International Journal of Applied Econometrics and Quantitative Studies Vol.1-4(2004)

THE EFFICIENCY EFFECTS OF BANK MERGERS AND ACQUISITIONS IN A DEVELOPING ECONOMY: EVIDENCE FROM MALAYSIA

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Abstract

This paper utilises the non-parametric frontier approach, Data Envelopment Analysis (DEA), to analyse the technical and scale efficiency of domestic incorporated Malaysian commercial banks during the merger year, pre-and post merger period. We found that Malaysian banks have exhibit a commendable overall efficiency level of 95.9% during 1998-2003 hence suggesting minimal input waste of 4.1%. Our results suggest that the merger programme was successful, particularly for the small and medium size banks, which have benefited the most from the merger and expansion via economies of scale. On the other hand our results suggest that the larger banks should shrink to benefit from scale advantages. Decision-makers hence ought to be more cautious in promoting mergers as a means to enjoying efficiency gains.

JEL Classification: C13; G21; D24; O31
Keywords: Finance and Banking, Mergers, Efficiency Change, Data Envelopment Analysis; Malaysia

1. Introduction

The purpose of the paper is to examine the effects of mergers and acquisitions on the efficiency of Malaysian banks. Has the merger results in better efficiency of Malaysian banks? The efficiency estimates was performed using the non-parametric Data Envelopment Analysis (DEA) methodology. The results of the study suggest that the merger programme was successful, particularly for

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the small and medium size banks, which have benefited the most from expansion via economies of scale, while on the other hand our results suggest that the larger banks should shrink to benefit from scale advantages. The study has important implications such as guiding the government policy regarding deregulation mergers. Decision-makers hence ought to be more cautious in promoting mergers as a means to enjoying efficiency gains.

The motivation for this paper comes firstly, from the fact that despite the substantial structural changes and importance of the Malaysian banking sector, the sector has remained underresearched compared to studies in other countries. To date, there has been only a few microeconomics studies conducted in this field of studies with respect to the Malaysian banking system.

Secondly, in order to appraise the success of the merger program among the domestic incorporated Malaysian commercial banks, it is essential to conduct a formal analysis. To our knowledge, there is no study in the literature that has examined this important issue. The present study thus addresses an important gap in the literature.

Thirdly, compared to earlier papers, this study has the following merits. Firstly, unlike Katib and Mathews (2000) and Okuda and Hashimoto (2004), which investigate Malaysian banks efficiency during the 1989-1995 and 1991-1997 period respectively, we investigates the efficiency of domestic incorporated Malaysian commercial banks on a more recent data during the period of 1998-2003. Although Krishnasamy et al. (2004), investigates Malaysian banks productivity changes during the 2000-2001 period, they have not examined the efficiency changes.

Lastly, the study has important public policy implications, particularly with respect to the principal aim of the Malaysia Financial Sector Master Plan (FSMP), to achieve a more competitive and efficient financial system. The study could help the regulatory authorities in determining the future course of action to be pursued to further strengthen the Malaysian banking sector in particular the domestic incorporated banks.

The paper is set out as follows: the next section gives an overview of the Malaysian banking system, section 3 reviews related studies in the main literature with respect to the study of bank efficiency, section 4 outlines the approaches to the measurement and estimation of efficiency change, section 5 discusses the results and finally, section 6 provides some concluding remarks.

2.Overview of Malaysian Banking

The Malaysian banking system has historically been characterised by its large number of small institutions. Although the Malaysian central bank, Bank Negara Malaysia (BNM) has always encouraged banks to merge in order to achieve economies of scale and higher level of efficiency, only a few mergers among the banking institutions have taken place.

The urgency to consolidate the banking sector was apparent during the Asian financial crisis that struck the region in 1997-1998, which has exposed the vulnerabilities of the small banking institutions and the need for these institutions to maintain a high level of capital. Furthermore, given the fact that much of the required financing in Malaysia was intermediated through the banking system, the risk associated with cyclical downturn in the economy would be much concentrated in the banking system.

In order to minimize the potential impact of systemic risks on the banking sector as a whole, following the deepening of the financial crisis, the Government took stronger measurers to promote (force) merging of banking institutions. Subsequently, ten banking groups were formed. The ten banking groups or anchor banks are: Malayan Banking Berhad, RHB Bank Berhad, Public Bank Berhad, Bumiputra-Commerce Bank Berhad, Multi-Purpose Bank Berhad, Hong Leong Bank Berhad, Perwira Affin Bank Berhad, Arab-Malaysian Bank Berhad, Southern Bank Berhad and EON Bank Berhad. Each bank had minimum shareholders' funds of RM2 billion and asset base of at least RM25 billion.

Table 1: Malaysian Banks Mergers and Acquisitions

Anchor Banks	Banks Acquired	Anchor's 30 June '00 Total Assets RMb	Post-Merger Assets RMb	% of Systems Assets
Maybank	The Pacific Bank Phileo Allied Bank	127	150	24.0
Bumiputra-Commerce Bank	N.A.	63	67	10.7
RHB Bank	N.A.	51	56	9.0
Public Bank	Hock Hua Bank	43	50	8.0
Arab-Malaysian Bank	N.A.	11	39	6.2
Hong Leong Bank	Wah Tat Bank	29	35	5.6
Multi-Purpose Bank	International Bank Malaysia Sabah Bank	9	14	2.2
Affin Bank	BSN Commercial Bank	15	30	4.8
Southern Bank	Ban Hin Lee Bank	24	25	4.0
EON Bank	Oriental Bank	14	25	4.0

Source: Bank Negara Malaysia

3. Related Studies

In the past few years, DEA has frequently been applied to banking industry studies. The first application analyzed efficiencies of different branches of a single bank. Sherman and Gold (1985) studied the overall efficiency of 14 branches of a U.S. savings bank. DEA results showed that six branches were operating inefficiently compared to the others. Similar study by Parkan (1987) suggested that eleven branches out of thirty-five were relatively inefficient.

Rangan et al. (1988) shifted the unit of assessment from branches to consolidated banking institutions. They applied DEA to a larger sample of 215 U.S. banks and attempted to break down inefficiency to that stemming from pure technical inefficiency and scale inefficiency. They employed the intermediation approach by using three inputs (labor, capital and purchased funds) and five outputs (three types of loans and two types of deposits). Their results indicated that banks could have produced the same level of output with only 70% of the inputs actually used, while scale inefficiencies of the banks were relatively small, suggesting that the sources of inefficiency to be pure technical rather than scale.

In addition to the heavy concentration on the US, DEA has fast become a popular method in assessing financial institutions efficiency among banking researchers in other nations. Fukuyama (1993 and 1995) was among the early researchers particularly among countries in Asia to employ DEA to investigate banking efficiency. Employing labor, capital, and funds from customers as inputs and revenue from loans and revenue from other business activities as outputs, Fukuyama (1993) considers the efficiency of 143 Japanese banks in 1990. He found that the pure technical efficiency to average around 0.86 and scale efficiency around 0.98 implying that the major source of overall technical inefficiency is pure technical inefficiency. The scale inefficiency is found to be mainly due to increasing returns to scale. He also found that banks of different organizational status perform differently with respect to all efficiency measures (overall, scale, pure technical). Scale efficiency is found to be positively but weakly associated with bank size.

3.1 *The effects of mergers and acquisitions on bank's efficiency*

Bank mergers and acquisitions may enable banking firms to benefit from new business opportunities that have been created by changes in the regulatory and technological environment. Berger et al. (1999, p 136) pointed the consequences of mergers and acquisitions, which may lead to changes in efficiency, market power, economies of scale and scope, availability of services to small customers and payments systems efficiency.

Besides improvement in cost and profit efficiency, mergers and acquisitions could also lead banks to earn higher profits through the banks market in leveraging loans and deposit interest rates. Prager and Hannan (1998) found that banks mergers and acquisitions has resulted in higher banks concentration, which in turn leads to significantly lower rates on deposits. Some evidence also suggested that U.S. banks that involved in M&As improved the quality of their outputs in the 1990s in ways that increased costs, but still improved profit productivity by increasing revenues than costs (Berger and Mester (2003, p 88)).

A note of caution however, encouraging or forcing banks to merge in times of severe banking crisis as a measure to reduce bank failure risk, would not only possibly create a weaker bank, but could also worsen the banking sector crisis. As shown by Shih (2003), merging a weaker bank into a healthier bank in many cases would result in a bank even more likely to fail than both the predecessors bank. On the other hand, he found that mergers between relatively healthy banks would create banks that are less likely to fail.

3.2 *Studies on Malaysian commercial banks efficiency and productivity*

Despite substantial studies performed on the U.S., Europe and other Asia-Pacific banking industry in regard to the efficiency and productivity of financial institutions in their countries, the Malaysian banking industry has not followed suite in that there has been no extensive study aimed at this area partly due to the lack of available

data sources and the small sample of banks compared to the countries mentioned above. As pointed by Kwan (2003), the reason for the lack of research on the efficiency of Asian banks is due to the lack of publicly available data for non-publicly traded Asian financial institutions.

The most notable research conducted on Malaysian banks was by Katib and Mathews (2000) which studied the characteristics of the management structure and technical efficiency of the banking industry in Malaysia by DEA from 1989 to 1995. Okuda and Hashimoto (2004) conducted a research on the production technology of Malaysian domestic commercial banks with Stochastic Cost Functions approach adjusted to non-performing loans from the year 1991 to 1997.

More recently, Krishnasamy et al. (2004) has investigated Malaysian banks post-merger productivity changes. Applying two inputs, namely labour and total assets and loans and advances and total deposits as outputs, they found that during the period of 2000-2001, post-merger Malaysian banks has achieved a total factor productivity growth of 5.1%. They found that during the period, eight banks posted positive total productivity growth ranging from 1.3% to 19.7%, one bank exhibit total factor productivity regress of 13.3% and a bank was stagnant. The merger has not resulted in better scale efficiency of Malaysian banks as all banks exhibits scale efficiency regress with exception of two banks. The results also suggest rapid technological change of post-merger Malaysian banks ranging from 5.0% to 16.8%. Two banks however experienced technological regress during the period of study.

4. Methodology and Data

For the empirical analysis, ten domestic incorporated Malaysian commercial banks that were engaged in the merger program from 1998-2003 would be used (see Table 2). Malaysian Islamic Banks, Development Banks, Investment Banks, Export-Import Banks and Cooperative Banks are excluded from the sample. Annual data were

taken from published balance sheet information in annual reports of each individual bank.

Following Berg et al. (1992), Fare et al. (1994) and Bhattacharya et al. (1997), among others, a non-parametric method, DEA, will be used in measuring the efficiency of the Malaysian banks. The methods allows for the decomposition of the efficiency and productivity differences into one representing the banks' efficiency and productivity levels relative to their peers best practice frontiers. The DEA is a linear (mathematical) programming technique which forms a non-parametric surface / frontier (more formally a piecewise-linear convex isoquant) over the data points to determine the efficiencies of each DMU relative to this frontier.

The main reason to choose the DEA is the expressed interest in the Malaysian banking industry of reducing costs in the recent years owing to the increased competition fostered by liberal policies. Furthermore, DEA allows the study to focus on the input saving (cost) efficiency, which can be detailed into technical and allocative efficiency components. It also permits one to further detail technical efficiency into its pure technical and scale efficiency components. Hence, through input-oriented DEA, we can dwell on the sources of input waste in Malaysian banking and draw some policy conclusions.

Nevertheless, DEA is less data demanding as it works fine with small sample size and does not require knowledge of the proper functional form of the frontier, error and inefficiency structures (Evanoff and Israelvich (1991), Grifell-Tatje and Lovell (1997), Bauer et al. (1998)). The stochastic models on the other hand, necessitate a large sample size to make reliable estimations. Although the sample includes the universe of Malaysian banks, the total number of banks in the sample is relatively small, motivating us to adopt DEA in this study.

The term Data Envelopment Analysis (DEA) was first introduced by Charnes et al. (1978), (CCR), to measure the efficiency of each Decision Making Units (DMUs), that is obtained as a maximum of a ratio of weighted outputs to weighted inputs. This denotes that the

more the output produced from given inputs, the more efficient is the production. The weights for the ratio are determined by a restriction that the similar ratios for every DMU have to be less than or equal to unity. This definition of efficiency measure allows multiple outputs and inputs without requiring pre-assigned weights. Multiple inputs and outputs are reduced to single 'virtual' input and single 'virtual' output by optimal weights. The efficiency measure is then a function of multipliers of the 'virtual' input-output combination.

The CCR model presupposes that there is no significant relationship between the scale of operations and efficiency by assuming constant returns to scale (CRS), and it delivers the overall technical efficiency (OTE). The CRS assumption is only justifiable when all DMUs are operating at an optimal scale. However, firms or DMUs in practice might face either economies or diseconomies of scale. Thus, if one makes the CRS assumption when not all DMUs are operating at the optimal scale, the computed measures of technical efficiency will be contaminated with scale efficiencies.

Banker et al. (1984) extended the CCR model by relaxing the CRS assumption. The resulting "BCC" model was used to assess the efficiency of DMUs characterized by variable returns to scale (VRS). The VRS assumption provides the measurement of purely technical efficiency (PTE), which is the measurement of technical efficiency devoid of the scale efficiency effects. If there appears to be a difference between the TE and PTE scores of a particular DMU, then it indicates the existence of scale inefficiency.

$$\min_{\lambda_0} \theta_0 \qquad (1)$$

$$\text{subject to } \sum_{j=1}^{n} \lambda_{0j} y_{rj} \geq y_{r0} \qquad (r = 1,\ldots..,s)$$

$$\theta_0 x_{i0} \geq \sum_{j=1}^{n} \lambda_{0j} x_{ij} \qquad (i = 1,\ldots..,n)$$

$$\sum_{j=1}^{n} \lambda_{0j} = 1$$

$$\lambda_{0j} \geq 0 \qquad (j = 1, \ldots..,n)$$

The first constraint states that output of the reference unit must be at least at the same level as the output of DMU 0. The second constraint tells that the efficiency corrected input usage of DMU 0 must be greater than or the same as the input use of the reference unit. Since the correction factor is same for all types of inputs, the reduction in observed inputs is proportional. The third constraint ensures convexity and thus introduces variable returns to scale. If convexity requirement is dropped, the frontier technology changes from VRS to CRS. The efficiency scores always have smaller or equal values in the case of CRS. Efficiency can also be measured into output direction in the case of VRS.

Although the scale efficiency measure will provide information concerning the degree of inefficiency resulting from the failure to operate with CRS, it does not provide information as to whether a DMU is operating in an area of increasing returns to scale (IRS) or decreasing returns to scale (DRS). Hence, in order to establish whether scale inefficient DMUs exhibit IRS or DRS, the technical efficiency problem (1) is solved under the assumption of non-increasing returns to scale (NIRS) rather than variable returns to scale (VRS) to provide

$$\min \lambda_0 \ \theta_0 \qquad (2)$$

$$\text{subject to } \sum_{j=1}^{n} \lambda_{0j} y_{rj} \geq y_{r0} \qquad (r = 1,\ldots..,s)$$

$$\theta_0 x_{i0} \geq \sum_{j=1}^{n} \lambda_{0j} x_{ij} \qquad (i = 1,\ldots..,n)$$

$$\sum_{j=1}^{n} \lambda_{0j} \leq 1$$

$$\lambda_{0j} \geq 0 \qquad (j = 1, \ldots..,n)$$

The nature of the scale inefficiencies, due to either IRS or DRS can be determined by the difference between the NIRS TE and VRS TE score. If these two measures of PTE differ, this indicates that the DMUs are operating in the region of IRS. Conversely, if the two measures coincide, then DRS apply. The type of scale inefficiencies (IRS or DRS) for a specific DMU can be summarized as follows:

If the VRS TE ≠ Non-IRS TE, then the DMU is operating at IRS
If the VRS TE = Non-IRS TE, then the DMU is operating at DRS

Table 2: Malaysian Ten Commercial Banks

Bank	Abbreviation Used
Affin Bank Bhd.	AFB
Alliance Bank Bhd.	ALB
AmBank Bhd.	AMB
Bumiputra-Commerce Bank Bhd.	BCB
EON Bank Bhd.	EON
Hong Leong Bank Bhd.	HLB
Maybank Bhd.	MBB
Public Bank Bhd.	PBB
RHB Bank Bhd.	RHB
Southern Bank Bhd.	SBB

Source: Bank Negara Malaysia

The approach of input and output definition used in this study is a variation of the intermediation approach, which was originally developed by Sealey and Lindley (1977). The intermediation approach posits total loans and securities as outputs, whereas deposits along with labor and physical capital are defined as inputs. According to Berger and Humphrey (1997), the intermediation

approach might be more suitable for studying efficiency of the entire financial institutions because interest expenses might indeed compose a large portion (as high as one-half to two-thirds) of bank total costs depending on the phase of the interest rate cycle.

Following Drake (2003), Sathye (2001) and Fukuyama (1993,1995) among others, the intermediation approach or asset approach to define bank inputs and outputs would be adopted. Accordingly, three inputs and two outputs would be used consisting of:

Y1: Total Loans
Y2: Investment and dealing securities
X1: Personnel expenses (Labor)
X2: Fixed assets (Capital)
X3: Retail and other financial institutions deposits (Deposits)

Table 3: Mean, Minimum Maximum and Standard Deviation Values of Inputs and Outputs

Outputs		1998 (RMm)	1999 (RMm)	2000 (RMm)	2001 (RMm)	2002 (RMm)	2003 (RMm)
Total Loans	Min	5,150.6	6,326.2	7,204.1	7,878.6	7,213.8	7,227
	Mean	16,828.9	19,796.9	24,072.0	28,435.8	30,003.1	33,330
	Max	56,277.2	57,489.4	79,177.6	92,654.0	95,453.2	102,488
	S.D	15,373.6	16,729.3	21,872.1	25,281.2	69,339.0	28,864
Investment and Dealing Securities	Min	855.4	1,448.7	1,606.6	1,363.1	615.8	1,026
	Mean	4,375.9	5,484.6	6,629.7	7,003.9	7,838.4	8,406
	Max	12,549.6	15,110.1	19,463.2	22,576.1	25,277.0	25,907
	S.D	3,951.2	4,890.3	5,896.0	6,579.0	7,378.9	7,567
Inputs							
Labour	Min	84.2	91.2	101.7	112.1	121.7	142
	Mean	367.6	351.5	560.0	685.1	718.1	757
	Max	1,117.1	996.1	1,593.7	2,118.0	2,180.8	2,336
	S.D	350.2	286.5	474.0	598.5	616.7	661

Fixed Assets	Min	39.9	34.0	26.1	22.4	36.1	33.5
	Mean	254.4	338.5	396.3	448.5	441.7	457.4
	Max	836.2	826.5	1,142.2	1,418.0	1,376.6	1,420.0
	S.D	279.4	300.3	361.2	432.8	422.1	435.7
Retail and Other Financial Institutions Deposits	Min	5,507.4	7,414.6	9,125.0	9,161.9	7,966.6	9,023.6
	Mean	20,855.4	26,593.9	31,977.4	35,075.4	37,172.6	39,735.(
	Max	67,249.8	69,004.5	101,957.1	115,573.4	116,647.1	123,065.
	S.D	18,726.2	21,392.2	28,486.5	31,740.6	32,157.9	33,936.7

5. Empirical Results

All computations were performed using the DEAP program (Coelli (1996). Efficiency estimates are computed using the multi-stage DEA. We compute efficiency levels for two years preceding the year of the merger and three years after the merger. As pointed by Rhoades (1998, p278), there has been unanimous agreement among the experts that about half of any efficiency gains should be apparent after one year and all gains should be realized within three years after the merger years. The whole period, (i.e. 1998-2003) is divided into three sub-periods: 1998-1999 refers to the pre-merger period, 2000 is considered as the merger year and 2001-2003 represents the post-merger period where the merger programme is expected to have some impact on the efficiency of banks.

In table 4 below, the overall efficiency estimates are presented, along with their decomposition into pure technical and scale efficiency estimates. It is apparent that, Malaysian banks have achieved a commendable mean overall efficiency level of 95.9% during 1998-2003 (see table 4). Similar studies performed on Italian banks by Resti (1997) has found that mean efficiencies of about 70% under both the DEA and econometric models. Pastor et al. (1997) has

reported efficiency score of 80% in their study of banks in the U.S. and seven Western European countries. While Lang and Welzel (1996) has found average efficiency scores of 54% and 61% for German banks.[1]

Hence, the results suggest the input waste among post-merger Malaysian banks is minimal at 2.7% in 2001, 3.0% in 2002 and 1.3% in 2003. The average x-inefficiency of 1.3% to 3.0% compares favorably with the 'just over 5 percent' reported in the study by Miller and Noulas (1996) on 201 large (defined as those with assets in excess of US$1b) US banks between 1984 and 1990. It is much lower than that found by Fukuyama (1993) study on Japanese banks (14%) and the 14-25% averages of Indian commercial banks (Bhattacharyya et al. (1997).

A more direct comparison would be the study by Chu and Lim (1998). In their study on Singaporean banks, which operates in a similar oligopolistic banking environment they reported average efficiency levels of 95.3%, hence suggesting inefficiencies of 4.7% during the period of 1992-1996 slightly higher compared to our findings of 4.1%.

Turning now to discuss the effects of mergers on the efficiency of Malaysian banks. From table 4 below it is clear that during the pre-merger years, Malaysian banks have been operating at an average overall efficiency level of 95.9% with only two banks operating at CRS. Although Malaysian banks exhibit lower mean pure technical efficiency compared to the mean scale efficiency during the pre-merger period, only two banks were operating at 100% scale efficient, whereas six banks were pure technically efficient during the pre-merger period. A possible cause is that, as Malaysian banks were still recovering from the financial crisis that struck the region in 1997, banks were more reluctant to assume higher risks by disbursing loans during the pre-merger period.

Table 4: Summary of Mean Efficiency Levels of Malaysian Banks

Bank	Pre-Merger*			During Merger**			Post-Merger***		
	OE	PTE	SE	OE	PTE	SE	OE	PTE	SE
Affin Bank	0.921	0.942	0.978	0.865	0.869	0.995	0.976	1.000	0.976
Alliance Bank	0.987	1.000	0.987	1.000	1.000	1.000	0.982	0.995	0.987
Arab-Malaysian Bank	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Bumiputra-Commerce Bank	0.989	1.000	0.989	0.857	1.000	0.857	1.000	1.000	1.000
EON Bank	0.924	0.931	0.992	0.915	1.000	0.915	0.982	1.000	0.982
Hong Leong Bank	0.862	0.877	0.983	0.799	1.000	0.799	0.999	1.000	0.999
Maybank	0.958	1.000	0.958	0.907	1.000	0.907	0.936	1.000	0.936
Public Bank	0.958	0.961	0.997	0.738	0.739	0.998	0.891	0.908	0.981
RHB Bank	0.993	1.000	0.993	1.000	1.000	1.000	1.000	1.000	1.000
Southern Bank	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Mean	0.959	0.971	0.988	0.910	0.961	0.947	0.976	0.990	0.986

1998-1999; ** 2000; *** 2001-2003

Notes:

[1] Berger et al. (1993) provides an excellent review of studies on U.S. banks efficiency. They found that the average mean efficiency scores to be in the range of 50% to more than 90% for the studies that employed DEA models while studies that employed econometric models reported mean efficiency scores of 75% to 80%.

Despite the number of banks being fully efficient during the merger year increased to four from two during the pre-merger period, the mean overall efficiency level slipped to 91.0% during the year of merger compared to 95.9% pre-merger. Further, as banks total assets grew, it is evidenced that scale inefficiency dominates the Malaysian banking with average efficiency level of 94.7% compared to 96.1% for pure technical efficiency. During the merger year, only four banks have been 100% scale efficient compared to only two banks

that were pure technically inefficient in the same period. Two banks, namely Arab-Malaysian Bank and RHB Bank, which did not engage in any merger activities during the merger year has been able to operate at unity. Southern Bank is an exceptional case, which has been fully efficient in all years pre-and-post merger. With the exception of Affin Bank and Public Bank, all other banks experienced lower scale efficiency during the merger year.

From table 4 it is also interesting to note that Public Bank mean overall efficiency level deteriorates significantly during the merger year compared to the mean overall efficiency level pre-merger. The bank's mean overall efficiency level declined from 95.8% pre-merger to 73.8% during the merger year largely caused by pure technical inefficiency. A possible explanation to the cause is that the bank has acquired Hock Hua Bank, which operations were mainly concentrated in the East Malaysia while Public Bank operational headquarters are located in Kuala Lumpur (Peninsular Malaysia). Hence, the bank may have to incur higher costs associated with systems integration and branch closures compared to the other banks that engaged in mergers during the year.

Consistent with Rhoades (1998) that all gains should be realized within three years after the merger year, our findings also suggest that Malaysian banks has benefited from the merger. Compared to pre-and during the merger year, model 1 suggest that post-merger Malaysian banks mean overall efficiency has considerably improved to 97.6% from 91.0% during the merger year and 95.9% pre-merger. The number of banks that operates at 100% overall efficiency level has remained the same as during the merger year. From table 4 it is clear that six banks has achieved higher overall efficiency level, two banks maintained to operate at unity while Alliance Bank and Maybank efficiency level deteriorates post-merger due to scale inefficiency compared to the pre-merger period.

With the exception of Arab-Malaysian Bank, RHB Bank and Southern Bank, which were fully efficient during all periods, Bumiputra-Commerce Bank was among the inefficient bank during the merger year that has been operating at CRS post-merger period.

During the merger year, the bank's overall efficiency level slipped to 85.7% from 98.9% efficiency level pre-merger, solely due to scale inefficiency. Despite that, the bank's efficiency level has considerably improved and it has been able to operate at CRS as early as the first year of the merger. Furthermore, the bank has also been able to maintain 100% efficiency level throughout the post-merger period covered in this study.

Almost all banks that answered the merger call have taken the step to close duplicated branches, which resulted in employees laid off. An exception is to Public Bank, which has taken a different strategy to retain all employees post-merger. The bank has taken the step to retrain its employees and redeployed to areas where the bank believed the employee could benefit the bank. Our results suggest that the bank has not significantly benefited from the move. The bank's post-merger average overall efficiency of 89.1% is still lower compared to pre-merger when the bank has been operating at about 95.8% average overall efficiency. The move is thus suggested to be costly to the group, as the merged entity is burdened with high overhead costs and excess employees. Overall, our findings are similar to US studies into x-efficiency of banks where the general conclusions was that smaller banks experienced increasing returns to scale (IRS) (Hunter et al. (1990), Noulas et al. (1990), Berger and Humphrey (1991)). Further, as suggested by McAllister and McManus (1993), the evidence on larger banks is at best constant returns to scale (CRS) and at worst declining returns to scale (DRS).

In contrast to the earlier findings by Chu and Lim (1998) (Singapore), Berger et al. (1993) and Miller and Noulas (1996) (U.S.) and Drake and Hall (2003) (Japan), which found that the large banks exhibited higher x-efficiency levels compared to the smaller peers, our results suggest that the merger has greater positive impact on small and medium size banks as the larger banks are still suffering from scale inefficiency after the third year of merger. The results thus have a very important policy implication as it suggests that the small and medium sized banks may reap significant cost savings from expansion and mergers via economies of scale. It could also be argued that, the small and medium sized banks has largely benefited

from the merger programme arising from less duplication of branches compared to the larger banks where prior to the merger has a wide and established branch networks across the country. On the other hand the larger banks greater cost savings are to be expected to achieved through reducing output size rather than improving x-efficiency. Hence, the results indicate an alternative policy prescription that the largest banks should shrink to benefit from scale advantages.

6.Conclusions

Applying a non-parametric frontier approach, Data Envelopment Analysis, this paper attempts to investigate the effects of merger to the efficiency of Malaysian banks. The sample period is divided into three sub-periods to compare the difference in Malaysian banks' efficiency. We further extended our studies to incorporate loan loss provisions in the definition of banks input variable to measure the effects of risk on the efficiency of Malaysian banks during all the periods.

Our results suggest that during the sample period, Malaysian banks have exhibit a commendable overall efficiency level of 95.9% suggesting minimal input waste of 4.1%. We found that during the merger year, Malaysian banks' overall efficiency level deteriorates significantly compared to the pre-merger period, which was mainly due to scale inefficiency. Despite that, post merger Malaysian banks' mean overall efficiency has not only recovered but is higher compared to the pre-merger period. We also found that scale inefficiencies dominates pure technical efficiency in Malaysian banking post merger. Although Malaysian banks' have exhibit higher mean overall efficiency level post merger hence suggesting that the merger programme was successful, our results suggest that the small and medium size banks have benefited the most from the merger programme while the large banks are still suffering from scale inefficiency post merger. This results thus have a very important policy implication as it suggest that while the small and medium sized banks may reap significant cost savings from expansion and mergers via economies of scale, the larger banks

should shrink to benefit from scale advantages. Decision-makers hence ought to be more cautious in promoting mergers as a means to enjoying efficiency gains.

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