

The Cost Efficiency Effects of Involuntary Bank Mergers: Empirical Evidence from Malaysia

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Abstract

Much of the merger and banking efficiency studies is centered on the market driven or voluntary merger. Thus, the uniqueness of Malaysian merger policy offers an interesting platform for this study to embark on. The merger in Malaysia is unique as all the domestic banks were enforced to merge by the government in year 1999 after years of persuasion with little success. This study attempts to quantify the impact of the involuntary merger on the cost efficiency gains over the 1990-2005 periods. Firstly, several tests have been performed to investigate whether it is best to envelope data with a common frontier of data envelopment analysis (DEA) or by separate frontiers. Secondly, this paper assesses the cost, allocative, technical, pure technical and scale efficiencies of Malaysian banking industry as the results of the merger. In general, the results suggest that the enforcement of the bank merger policy has resulted in an improvement of bank efficiency levels.

Keywords: involuntary mergers, efficiency, banking, Malaysia

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1. Introduction

Bank mergers are claimed to be the sources of efficiency gains from the realization of economies of scale and economies of scope, the removal of overlapping services and the increasing awareness of innovative banking tools; however, one needs to read over the assertions with caution. It is due to the fact that much of the prior research has focused on the market driven merger or the voluntary merger. At the one hand, the voluntary bank merger refers to the process by which two or more banks merged and become one new entity. The merger takes place without any objection from the shareholders and the board of both banks. The purchase is considered done once the acquirer purchased the shares of the target bank. On the other hand, involuntary merger refers to the merger of a firm that is insolvent or in danger of insolvency and it is initiated by the government or the authority.

In the Malaysian banking context, the involuntary merger term refers to a unique banking sector reform that was announced in 1999 as a result of the economic crisis. Initially, central bank of Malaysia introduced a rescue scheme; the scheme had been costly, yet the banks reluctance to merge.¹ Specifically, the government announced the unprecedented measure by forcing 58 financial institutions to merge into six anchor banks on 29 July 1999.² Theoretically, the policy was intended to create more robust banks to compete innovatively and to enhance their operational efficiency effectively (Oh, 2000). Due to the strong protests, the central banks of Malaysia revised the scheme by allowing banks to choose their own partners and leaders (Bank Negara Malaysia, October 1999). As at 14 February 2000, the central bank revealed the ten anchor

¹ The reluctance of the domestic banks to merge could be explained by the unique characteristics of the Asian corporations as highlighted in Claessens et al. (2000a; 2002b). The corporations' ownership is concentrated among families and due to that, self-recapitalization makes banks less willing to absorb losses thus, hinders corporate restructuring.

² Lang (2002) expresses the difficulty to ascertain whether the merger is voluntary or forced; government may force the merger without determining the partners or government may establish strong incentives to merge. Finally, government may stimulate the merger by giving hints that a merger would be approved on certain conditions or by signalling that a problematic institution will not be rescued by government intervention.

banks (by maintaining the initial six anchor banks selected) as part of the merger exercise and 13 foreign banks were left untouched. It has been a decade; thus, it seems timely to retrospect this issue.

As far as efficiency is concerned, efficiencies as the results of the bank mergers had been studied extensively, in the dominant manner of the voluntary bank merger circumstances. This study contributes to the involuntary bank merger context, the fact that the market with or without government interventions will result in the varying degrees of market performance. The significant changes in the market structure will result in the intense of competition and the increased of harmful risk is hardly can be denied. Eventually being efficient or inefficient will determine the competitiveness of the firms and in the long run, it will influence the contestability of the market. The efficiency measurement would give an indication whether current banks are ready to face the challenge of globalize and liberalized of the financial institutions.

This study can be seen as an importance step in gaining a better understanding of a phenomenon that is commonly observed but rarely investigated; namely, the implications of the involuntary merger policy. The involuntary merger offers a unique opportunity to investigate whether efficiency gains can be created from involuntary type of merger. The relationship between bank mergers and cost efficiencies (cost, pure technical, technical, scale and allocative efficiency) change is examined. Apart from that, the study embraces the environmental variables to see their impacts on the efficiency scores of Malaysian domestic banks. This paper contributes to government policy with an empirical evaluation of the impact of government initiated merger on the efficiency of a banking system given a market which is more national in scope and highly concentrated. This paper is structured as follows. Following the introduction, Section 2 presents the review of related literature while Section 3 provides the sample of banks with data on inputs and outputs as well as the DEA methodology are presented. Last but not least, the empirical results are presented in Section 4 whilst Section 5 concludes the paper.

2. Previous Studies

Theory suggests that merger have the potential to increase efficiency (Berger and Humphrey, 1992; Shaffer, 1993 and Rhoades, 1998); efficiency will motivate banks to consider operational improvements, substitute for inefficient management and implement new organizational structure. On the other hand, Berger (2003) adds that merger and acquisition can decrease bank efficiency due to increased costs (e.g. consultant fees, severance pay, legal expenses etc.) along with downsizing disruptions, the merging of organizational cultures and managerial turf battles. The existing studies continue the debate on the efficiency gains as the results of bank merger. The existing literature fails to provide convincing empirical evidence on the merger gain thus the questions on the merger and acquisition gains remain. Succinctly, there is no strong support for the hypothesis that mergers have a beneficial effect on merged banks and the banking industry as a whole.³ Cavallo and Rossi (2001) state that "...so far, the empirical literature based on the US experience does not support this common belief" (p. 516).

It is interesting to highlight that all the aforementioned studies are based on voluntary merger. Thus, the aim of this paper is to contribute to the above debate from a specific outlook. More precisely, this paper would like to examine the influence of merger on banking efficiency in a setting of involuntary merger within Malaysian banking sector. Despite the substantial structural changes and the pivotal role of the sector to the economy, research on the implication of merger policy on Malaysian banking efficiency appears to be limited. Most of the domestic banking literature concentrates on the efficiency and productivity of the banking sector (Okuda and Hashimoto, 2004; Batchelor et al., 2005; Sufian, 2005; Sufian and Ibrahim, 2005; Sufian, 2006; Sufian and Abdul Majid, 2006; Matthews and Mahadzir, 2006) whilst Guru et al. (2003) and Shanmugan (2003) focus on causes of the consolidation process. Last but not least, few studies focus on the effects of mergers and acquisitions as in Krishnasamy et al. (2003), Tan and Hooy

³ There is no consensus reached on the efficiency gains of bank mergers as concluded in a series of review (Berger and Humphrey, 1997; Piloff and Santomero, 1997; Rhoades, 1998; Berger et al., 1999; Amel et al., 2004; Nail and Parisi, 2005).

(2003), Batchelor et al. (2005), Sufian (2004), Sufian and Ibrahim (2005), Chong et al. (2006), Mohd. Said et al. (2008) and Abdul Majid and Sufian (2006).

In line with this study spirit, Sufian (2004) and Mohd. Said et al. (2008) investigate the impact of merger on the pure technical efficiency and scale efficiency while Chong et al. (2006) investigate the effects on the shareholder's wealth. The latter reveals that the involuntary merger scheme destroys economic value in aggregate and the acquiring banks tend to gain at the expense of the target banks study, a contrary results with the voluntary merger findings. While the referred paper employs the event study methodology in measuring the shareholders' wealth effect of the merging banks during the merger announcement, this study attempts to explore the issue of involuntary merger and the impact on the production efficiency of Malaysia's banking sector using frontier approach.

By employing the data envelopment analysis (DEA), Sufian (2004) and Mohd. Said et al. (2008) measure the implication of mergers on Malaysia banking efficiency. Sufian (2004) estimates the efficiency levels based on three sub-periods: 1998-1999 to refer to the pre merger period, 2000 is considered as the merger year and 2001-2003 to represent the post merger period. The results illustrate that Malaysian banks efficiency levels deteriorate significantly in the merger year but are higher during post merger as compared to the pre merger period. On the other hand, Mohd. Said et al. (2008) report that on average; the merger does not enhance the productive efficiency of the banks. The efficiency scores are estimated based on three years each to represent pre merger and post merger periods, from 1998 to 2003. It is worth mentioning that both studies measure efficiency by constructing a separate frontier pertains to respective periods and compare the scores for the respective periods in quantifying the effects of mergers on the efficiency. By enumerating the efficiency effects based on separate frontiers for sub periods, the aforementioned studies raise the methodological concern.

Methodologically speaking, DEA efficient frontier is generated by the input-output combination of the best practice decision making units (DMUs) with a unity efficiency score. In other words, DEA establishes a benchmark efficiency score of unity that no other firm can exceed; this benchmark constitutes the reference technological for the sample. Hence, if banks are

observed in two different periods and the efficiency scores are calculated with different samples of banks; the comparison of efficiency scores would only show changes in the relative efficiency of the bank with other banks in two different periods. Using DEA, this study will tackle the problem by constructing a common frontier enveloping the data sets for all banks in the sample throughout the study period. The common frontier approach is very popular amongst the cross-country studies as in Allen and Rai (1996), Dietsch and Lozano-Vivas (2000), Casu and Molyneux (2003), Lozano-Vivas et al. (2002).

3. Data and Methodology

3.1 Data

The study includes all the domestic banks in Malaysia and covers the period from 1995 to 2005; however, data on the target banks ranges from 1995 to 1999 only as they were absorbed into the anchor banks as the results of the merger. The input and output data are obtained from the Bank Scope database package produced by Bureau van Dijk electronic publishing (BVDep), supplemented with the published balance sheet and income statement as reported in annual reports of the domestic banks. All data is in MYR\$ Millions. The banks comprise ten anchor banks which are Affin Bank Ltd. (Affin), Alliance Bank Ltd. (Alliance), AMBank Ltd. (AM), CIMB Bank Ltd. (CIMB), EON Bank Ltd. (EON), Hong Leong Bank Ltd. (Hong Leong), Malayan Banking Ltd. (Maybank), Public Bank Ltd. (Public), RHB Bank Ltd. (RHB) and Southern Bank Ltd. (Southern).⁴ With respect to the total assets, Maybank dominates the market shares in 1995 and 2005; with 44.36 percent (%) and 27.74% respectively. The figures had placed Maybank to be the largest player in the market, followed by Public Bank and RHB Bank whilst the fourth largest bank is the CIMB Bank. The three smallest banks are Southern Bank, Affin Bank and Alliance Bank with the 2005 market shares are 4.73%, 3.61% and 3.41% respectively.

⁴ The merger process has reduced the number of domestic commercial banks from twenty-four to ten anchor banks; however, Southern Bank merges voluntarily with Bumiputra-Commerce Bank in 2006. As a result, the merged entity changes its name to CIMB Bank Berhad.

3.2 Variable

The definition and measurement of inputs and outputs in the banking function remain a contentious issue among researchers. There is longstanding dispute over what banks produce and what resources banks consume (Berger and Humphrey, 1992). With regard to this, there are two main approaches in the banking theory literature namely the production and intermediation approaches (Sealey and Lindley, 1977). Financial institution is defined as a producer of services for account holders under the production approach. Hence, the number of accounts (deposits) or its related transactions (loans) represents output, while the number of employees and physical capital is considered as inputs. The intermediation approach on the other hand assumes that financial firms act as an intermediary between savers and borrowers and posits total loans and securities as outputs, whereas deposits along with labor and physical capital are defined as inputs. On top of that, Berger and Humphrey (1992) introduce the value added approach whereby outputs consist of loans and deposits and labor, physical capital and purchased funds are classified as inputs.

This study employs intermediation approach in choosing the variables. Based on the list of inputs and outputs in the preceding studies as well as data availability; the input variables used are personnel expenses⁵, capital which is the book value of premises and fixed assets, deposits and short term funding (hereafter denoted as deposits) whereas the output variables are represented by total loans, total securities and off-balance sheet items. The input prices are calculated as price of labour (the total expenditures on employees such as salaries, employee benefits and reserves for retirement pay is divided by the total assets); price of capital (the book value of premises and fixed assets is divided by the total of fixed assets) and price of deposits (the total of interest expenses divided by the total deposits and short-term funding). With the identification and measurement of banking outputs and costs, the level of cost efficiency with respect to two types of frontiers (common and separate frontiers) is estimated. Data was analyzed using the DEA Excel Solver (Zhu, 2003).

⁵ Since information with respect to the number of employees is unavailable for most banks, data on personnel expenses is used.

3.3 Methodology

This study employs input-oriented DEA as it is believed that domestic commercial banks should dwell well on the sources of input waste (Isik and Hasan, 2003). The main advantage of DEA is that it does not require a priori assumption about the analytical form of the production function and it places less structure on the frontier (Serrano-Cinca et al., 2005). DEA aims to identify the firms that determine an envelopment surface against other firms that are not located on the frontier. An efficiency index of one or any firm that lie on the surface is considered efficient and identified as the best practice unit relatively to other units. Efficiency scores in DEA are relative, not absolute measures because the score depends heavily on the performance of other firms in the sample. DEA efficiency score is obtained by taking the maximum ratio of weighted outputs to weighted inputs. The envelopment form of the ‘virtual’ input-output combination is as below:

$$\begin{aligned}
 & \min_{\theta, \lambda} && \theta, \\
 & \text{s.t.} && -y_t + Y\lambda \geq 0, \\
 & && \theta x_t - X\lambda \geq 0 \\
 & && \lambda \geq 0,
 \end{aligned} \tag{1}$$

where θ is the efficiency score for the i th DMU and it should be solved n times. Under the assumption of variable returns to scale (Banker et al. 1984), the convexity constraint $N\mathbf{1}'\lambda = 1$ is applied to equation (1).

$$\begin{aligned}
 & \min_{\theta, \lambda} && \theta, \\
 & \text{s.t.} && -y_t + Y\lambda \geq 0, \\
 & && \theta x_t - X\lambda \geq 0 \\
 & && N\mathbf{1}'\lambda = 1 \\
 & && \lambda \geq 0,
 \end{aligned} \tag{2}$$

where $N\mathbf{1}$ is an $N \times 1$ vector of ones. To account for allocative efficiency, the vector of input prices w_i is inserted in equation (2), shown as below:

$$\begin{aligned}
 & \min_{\lambda, x_i^*} && w_i^T x_i^* \\
 \text{s.t.} & && -y_i + Y\lambda \geq 0, \\
 & && x_i^* - X\lambda \geq 0, \\
 & && N1^T \lambda = 1 \\
 & && \lambda \geq 0,
 \end{aligned} \tag{3}$$

where x_i^* is the cost minimizing vector of input quantities for the i th DMU, given the input prices w_i and the output levels y_i . The total cost efficiency or overall efficiency of the i th DMU is calculated as:

$$\text{OE} = \frac{w_i^T x_i^*}{w_i^T x_i}$$

thus, the allocative efficiency is calculated as $\text{AE} = \text{OE}/\text{TE}$.

4. Results and Discussions

This section begins with the presentation of the descriptive statistics of the input and output variables. All financial variables are reported in RM values (Ringgit Malaysia) and in order to facilitate a comparison over time, the consumer price index is used to deflate all variables to obtain their values in the 2000 constant price.⁶ Table 1 shows the summary statistics of the input and output variables, which consists of the mean, the minimum and maximum values and the standard deviations.

⁶ The consumer price index is the preferable deflator for studies in the banking sector (Kumbhakar et al. 2001; Dogan and Fausten 2003; Detragiache and Gupta 2004). Okuda and Hashimoto (2004) stated that when using panel data, it was necessary to use a deflator in order to keep outputs from various years comparable.

Table 1
Descriptive statistics of input and output variables (RM '000 million)

Variable Description	Mean	Median	Minimum	Maximum	Standard Deviation
1995: Number of banks (21)					
Personnel expenses	97.86	47.70	5.70	645.80	141.82
Fixed assets	148.50	73.70	6.50	834.00	229.52
Total deposits	2105.14	903.80	54.10	14386.00	3712.08
Securities portfolio	6407.56	3190.70	324.30	48939.50	10559.67
Loans and advances	1518.28	573.95	47.36	12020.20	2656.78
Off-balance sheet	6154.12	2527.90	59.90	42181.80	9604.31
Price of labour	0.0125	0.0085	0.0029	0.0626	0.0123
Price of capital	0.0089	0.0073	0.0010	0.0409	0.0083
Price of deposits	0.2832	0.2092	0.0105	0.6704	0.1869
2000: Number of banks (14)					
Personnel expenses	229.33	131.79	43.10	827.20	232.38
Fixed assets	340.52	246.55	25.00	1142.20	330.25
Total deposits	5106.81	2159.31	519.56	21849.70	6053.17
Securities portfolio	18947.02	10759.12	3476.06	79177.60	20317.02
Loans and advances	5205.94	3253.34	496.65	19641.66	5529.98
continuing...					
...continue					
Off-balance sheet	13843.51	6858.24	1593.79	62670.20	17349.90
Price of labour	0.0078	0.0076	0.0042	0.0121	0.0023
Price of capital	0.0073	0.0068	0.0051	0.0115	0.0019
Price of deposits	0.2486	0.1874	0.0992	0.8863	0.2034
2005: Number of banks (10)					
Personnel expenses	499.33	303.00	200.47	1356.80	364.79
Fixed assets	505.18	375.35	167.20	1341.60	378.58
Total deposits	11697.41	7956.83	2735.01	31921.20	10334.30
Securities portfolio	43099.22	30780.97	14644.05	119593.81	31964.30
Loans and advances	11456.21	8543.00	3133.20	28560.87	9076.72
Off-balance sheet	34405.15	26768.55	6977.30	109452.00	29839.39
Price of labour	0.0075	0.0076	0.0051	0.0096	0.0015
Price of capital	0.0077	0.0079	0.0049	0.0102	0.0019
Price of deposits	0.1511	0.1539	0.0787	0.2198	0.0525

Table 1 shows that during the study period, the scale of sample banks has increased in terms of deposits, even though the number of commercial banks operating in Malaysian banking is reduced from 21 banks in year 1995 to only 10 banks in 2005. The input and output variables also show the same pattern as total deposits. For instance, total loans and advances increases by 242% from RM151 billion (1995) to RM521 billion (2000) and increases further to RM1, 145 billions in year 2005. In addition, the increasing trend in input variables is reflected by more than two-fold increase in personnel expenses (409%), total fixed assets (240%) and total deposits (455%) from year 1995 to 2005. The input price variables, which are the price of labour (the ratio of total personnel expenses to total assets); the price of capital (the ratio of non-interest expenses to fixed assets); and finally, the price of deposits is calculated as the ratio of interest expenses to total deposits. All price variables show a decrease throughout the study period.

Next section presents the DEA efficiency scores, for the common and separate frontiers. The common frontier is estimated by pooling the datasets from all firms or decision-making units (DMUs) into the sample. The dataset is divided into three sub-periods, namely the pre-merger period (1995-1999), the transition period (2000-2001) and the post-merger period (2002-2005). Three separate frontiers are formed and each frontier generates efficiency scores with respect to these sub-periods.

4.1 Common and Separate Frontiers

Previous DEA studies have tended to estimate efficiencies by constructing separate frontiers approach based on at least two different periods. This has raised methodological concerns because based on different sample of banks, the comparison of efficiency scores would only show changes in efficiency of one bank against other banks in different periods. Pertaining to the matter, this study has constructed a common frontier to envelope all observations in the

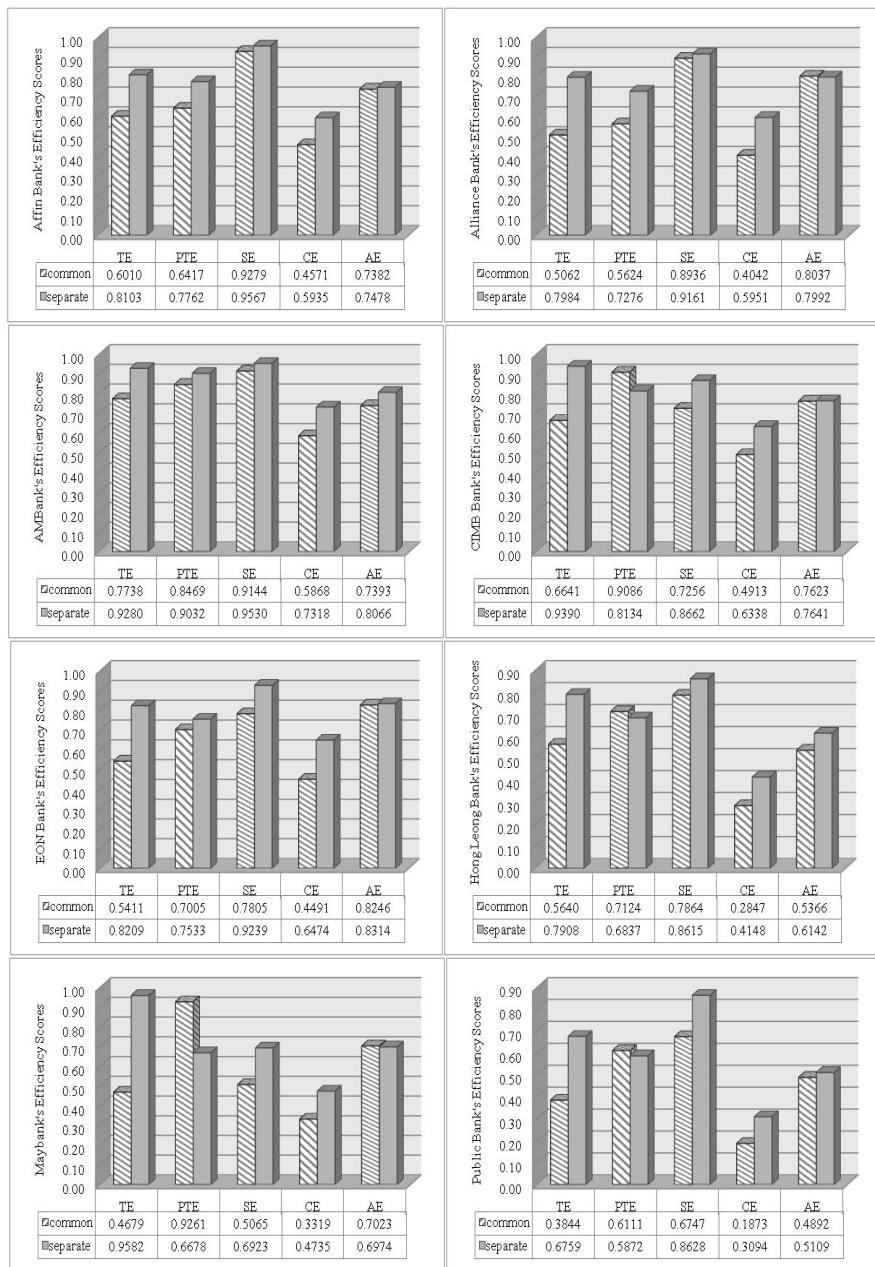
sample throughout the study period.⁷

Essentially, five types of efficiencies are generated. The overall cost efficiency (CE) and its decompositions (four), which are technical efficiency (TE), pure technical efficiency (PTE), scale efficiency (SE) and allocative efficiency (AE). The DEA constant returns to scale model yields technical efficiency scores, whilst pure technical efficiency is generated by the DEA variable returns to scale model. Additionally, scale efficiency is the ratio of technical efficiency to pure technical efficiency.

For simplicity of the results presentation, the efficiency scores of the common frontier are aggregated according to three sub-periods of the separate frontiers approach, which are the pre-merger, the transition and the post-merger periods. The efficiency results of individual banks with respect to common frontier and separate frontiers approaches are shown graphically in Figure 1.

⁷ Unlike the work by Hayami and Ruttan (1970) that estimates productivity differences by utilising frontier meta-production functions as the proxy for the common or cross country production function based on parametric method; this study estimates efficiency scores on common frontier approach based on non-parametric method. Technology gap ratio (TGR) is defined as the gap between the group's technology and the technology available for the industry. To estimate TGR, the 'meta production frontier' is built, in addition to 'common' (pooling) frontier and 'separate' (group) frontiers by employing stochastic frontier (SF) model, which is parametric method. In SF technique, the technology of production has to be specified; thus, 'common' and 'separate' frontier in SF refers to homogenous and heterogeneous production function respectively. In this study, by employing DEA which is non-parametric methods; two type frontiers were drawn, 'common' and 'separate' frontiers. However, unlike SF technique; there is no need to specify the technology of production in DEA. Thus, 'common' or 'separate' frontiers drawn in this study do not refer to production function of firms observed. Both frontiers represent the different approaches to pool or divide the data set. Thus, unlike SF; we are unable to estimate TGR from the 'common' and 'separate' frontiers in DEA. Different approaches of pooling or separating dataset in this study were employed in this study to highlight that, in comparing performance of firms with respect to different periods based on DEA method; we need to pool the dataset. Once efficiency results are estimated, then only we disaggregate the scores based on respective periods as compared to 'separate' frontier in which the dataset was divided prior to the DEA calculation.

Figure 1
Common and separate frontiers efficiency of individual banks



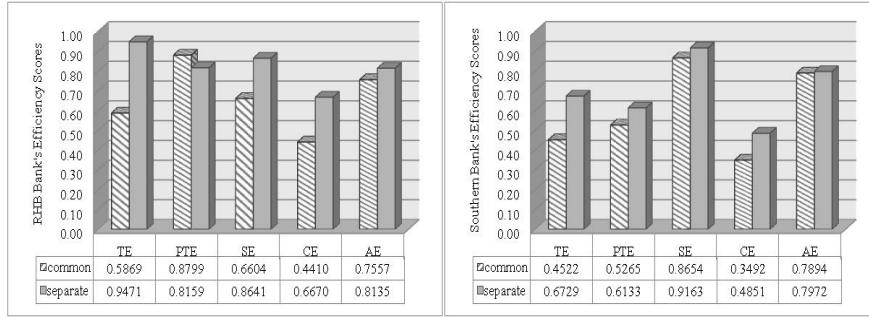


Figure 1 shows the average efficiency scores for five types of efficiency, in respect to the common and separate frontiers. It is shown that the separate approach yields higher efficiency scores, in particular the cases of cost and allocative efficiencies. The largest differences are recorded by Southern Bank, showing the difference of 67.79% in cost efficiency and 31.98% in allocative efficiency. On the other hand, the smallest differences (0.32%) are found in the Affin Bank scale efficiency. The results show that different approaches employed led to differences in efficiency scores of the individual banks. Table 2 shows details of the efficiency differences between common and separate frontier approaches.

Table 2**Summary of efficiency differences – common vs. separate frontiers (%)**

Bank	Pure				
	Technical Efficiency	Technical Efficiency	Scale Efficiency	Cost Efficiency	Allocative Efficiency
AFFIN	0.1089 (12.21%)	0.1077 (11.92%)	0.0031 (0.31%)	0.1347 (22.58%)	0.0707 (10.92%)
ALLIANCE	0.1136 (13.85%)	0.1228 (13.93%)	-0.0060 (-0.65%)	0.2118 (38.99%)	0.1702 (26.75%)
AMBANK	0.0821 (13.27%)	0.1148 (15.64%)	-0.0463 (-5.49%)	0.1157 (21.44%)	0.1326 (15.24%)
CIMB	0.1306 (13.71%)	0.0297 (3.06%)	0.1092 (11.12%)	0.1454 (35.57%)	0.0900 (21.25%)
HONG	0.0873	0.0768	0.0231	0.0534	0.0442
LEONG	0.0969 (11.64%)	0.0576 (9.80%)	0.0460 (2.40%)	0.1812 (29.55%)	0.1544 (18.06%)
EON	0.1695 (11.14%)	0.0205 (6.33%)	0.1558 (4.85%)	0.1201 (35.32%)	0.0742 (26.87%)
MAYBANK	0.1108 (22.35%)	0.0830 (2.13%)	0.0583 (19.87%)	0.0841 (38.38%)	0.0805 (18.59%)
PUBLIC	0.1681 (20.76%)	0.0481 (13.45%)	0.1334 (6.52%)	0.1776 (38.87%)	0.0884 (20.38%)
RHB	0.1332 (18.10%)	0.1421 (4.95%)	-0.0058 (13.96%)	0.2097 (30.47%)	0.1772 (14.34%)
SOUTHERN	0.1984 (19.84%)	0.1984 (19.84%)	-0.63% (-0.63%)	0.4041% (40.41%)	0.2422% (24.22%)

Figures in Table 2 indicate that almost all cases show that separate frontiers report higher efficiency scores than the common frontier. The largest differences in technical and scale efficiencies are recorded by Maybank (22% and 20%), whilst Southern Bank records the highest differences in pure technical efficiency (20%) and cost efficiency (40%). Additionally, the largest difference in allocative efficiency is recorded in the Alliance Bank case. Apart from the differences between efficiency scores attained due to the different approaches employed in estimating the efficient frontier as shown in Table 2, the differences can also be seen by looking at the rankings of individual banks. The results of the ranking of banks based on its common frontier and separate frontiers efficiency scores are presented in Table 3.

Table 3
Summary of ranking efficiency - common vs. separate frontiers

Approach/ Bank	Common frontier			Separate frontiers		
	Pre-Merger	Transition	Post- Merger	Pre-Merger	Transition	Post- Merger
Technical Efficiency:						
AFFIN	9	21	3	20	1	5
ALLIANCE	11	4	16	22	2	15
AMBANK	17	13	28	24	18	27
CIMB	1	22	6	10	11	3
HONG	10	5	8	21	7	6
LEONG						
EON	25	12	7	26	17	9
MAYBANK	23	20	19	25	8	14
PUBLIC	29	30	26	30	28	23
RHB	2	14	15	13	4	12
SOUTHERN	27	18	24	29	19	16
Pure Technical Efficiency:						
AFFIN	17	24	7	22	1	10
ALLIANCE	16	12	22	21	2	17
AMBANK	19	21	28	24	3	13
CIMB	5	14	1	15	4	25
HONG	15	11	8	20	5	7
LEONG						
EON	26	18	13	28	6	8
MAYBANK	9	3	2	16	9	12
PUBLIC	29	30	20	30	19	18
RHB	4	10	6	11	26	14
SOUTHERN	27	23	25	29	27	23
Scale Efficiency:						
AFFIN	9	7	1	11	1	6
ALLIANCE	22	6	8	24	2	14
AMBANK	24	13	19	26	17	29
CIMB	2	3	25	8	21	3
HONG	15	16	23	22	13	7
LEONG						
EON	4	5	14	9	28	5
MAYBANK	28	29	30	30	15	23
PUBLIC	17	18	26	27	19	20
RHB	10	11	27	16	4	12
SOUTHERN	20	21	12	25	18	10
Cost Efficiency:						
AFFIN	5	8	3	15	2	6
ALLIANCE	11	6	15	16	1	8
AMBANK	2	1	24	11	3	20
CIMB	18	12	17	24	13	12
HONG	7	20	16	19	17	7
LEONG						

continuing

EON	25	30	28	29	28	25
MAYBANK	21	23	22	26	22	18
PUBLIC	26	29	27	30	27	23
RHB	4	13	10	14	10	4
SOUTHERN	9	14	19	21	9	5
Allocative Efficiency:						
AFFIN	5	4	8	14	5	12
ALLIANCE	17	7	14	22	1	9
AMBANK	1	2	16	3	2	7
CIMB	26	11	21	27	15	16
HONG	9	25	20	17	20	10
LEONG						
EON	27	29	30	28	30	29
MAYBANK	19	22	23	26	23	19
PUBLIC	18	24	28	24	25	21
RHB	10	13	6	18	13	8
SOUTHERN	3	12	15	11	4	6

Based on Table 3, the ranking analysis is as follows. In respect of technical efficiency, in the case of the common frontier, CIMB ranks number one (No. 1) prior to the merger, drops to No. 22 during the transition, but the bank climbs back up to No. 6 after the merger. However, the results of CIMB efficiency scores appear to be contradicted in the separate frontiers context. Before the merger, CIMB ranks at No. 10, drops slightly to No. 11 during the transition, but climbs quickly to No. 3 during the post-merger period.

In the case of pure technical efficiency, according to separate frontiers, Affin Bank ranks No. 1 during the transition period, jumps to No. 22 prior to the merger, but its rank drops to No. 10 after the merger. It is interesting to highlight that during the post-merger period, CIMB ranks at No. 1 in the context of the common frontier approach. However, the bank sits at a ranking of No. 25 in the separate frontiers context. In respect of scale efficiency, Maybank as the largest industry player has been at the bottom three, in the context of the common frontier. The separate frontier results support these findings when the bank is ranked at No. 30 during the pre-merger period. However, their rank improves to No. 15 during the transition period.

In terms of the common frontier's cost efficiency, AmBank ranks No. 1 and No. 2 during the transition period and prior to the merger, respectively. However, it ranks at No. 24 after the merger. Another small sized bank, namely the Alliance Bank, attains the first rank during the

transition period, despite only achieving No. 16 before the merger took place. In addition, the case of allocative efficiency imitates the trend of cost-efficiency. In respect of the common frontier approach, AmBank has occupied the top two ranking positions prior to the merger and during the transition periods, whilst according to separate frontiers, Alliance bank ranks No. 1 during the transition period only.

Briefly, the ranking results show that there are banks positioned highly in the context of the common frontier approach, yet they are located at the bottom ranks in the case of separate frontiers approach. In other words, different approaches employed in estimating DEA efficient frontier led to different efficiency outcomes. Based on the results of several statistical tests, it is confirmed that a common frontier and separate frontiers do not come from the same population. The results of the t-test, the Wilcoxon rank-sum test, the Mann-Whitney test, the Kruskal-Wallis test and the Kolmogorov-Smirnov test are shown in Table 4.

Table 4
Summary of parametric and non-parametric tests

Test Statistics/ Type of Efficiency	Wilcoxon Rank-Sum (prob > z)	Mann- Whitney (prob > μ)	Kruskal- Wallis (prob > χ^2)	Kolmogorov- Smirnov (prob > D)	t-test (prob > t)
Technical	8.284	3.424	11.724	2.182	11.721
Efficiency	(0.000)*	(0.001)*	(0.001)*	(0.000)*	(0.001)*
Pure Technical	7.424	2.783	7.746	1.582	0.130
Efficiency	(0.000)*	(0.005)*	(0.005)*	(0.013)**	(0.719)
Scale	4.122	2.846	8.100	1.418	0.788
Efficiency	(0.000)*	(0.004)*	(0.004)*	(0.036)**	(0.375)
Cost	7.062	3.694	13.648	2.128	18.381
Efficiency	(0.000)*	(0.000)*	(0.000)*	(0.000)*	(0.000)*
Allocative	5.559	2.704	7.313	1.418	4.043
Efficiency	(0.000)*	(0.007)	(0.007)*	(0.036)**	(0.045)**

Note: * - significant at 1% level; ** - significant at 5% level; and *** - significant at 10% level

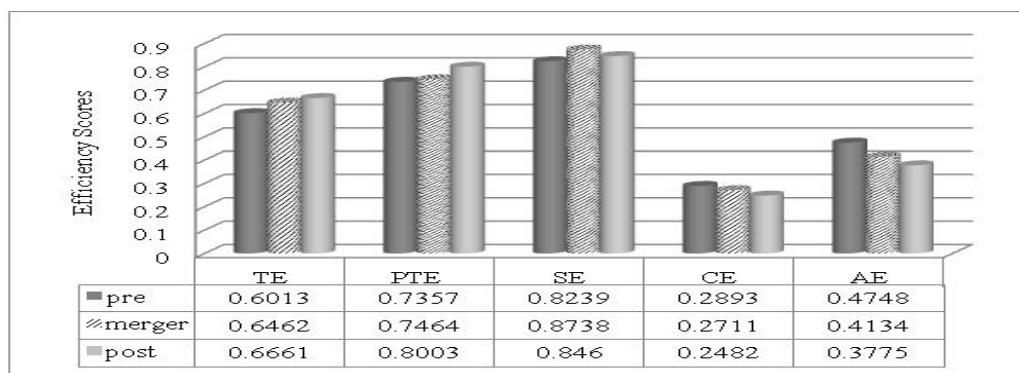
Based on Table 4 the Wilcoxon signed-rank test tests the differences between the efficiency scores of the common frontier and separate frontiers approaches.⁸ In order to investigate whether the efficiency scores are from the same population, other tests such as the t-test, Mann-Whitney, Kruskal-Wallis and Kolmogorov-Smirnov tests are also performed. (Havrylchyk, 2006; Isik and Hasan, 2002). Based on the results, the null hypothesis that the common and separate frontiers are coming from the same population is rejected at various significance levels. The DEA common frontier is employed in this study. The common frontier approach gathers all firms in the sample and establishes a benchmark of a single efficiency frontier - this benchmark becomes the technology reference for all firms in the sample.

4.2 Impacts of Bank Mergers of Cost Efficiency

To discuss the implications of involuntary mergers on the cost efficiency of domestic banks in Malaysia, the performance of banks are compared based on three sub-periods, namely: pre-merger period, merger period and post-merger period. The overall results are illustrated graphically in Figure 2.

Figure 2

Types of efficiency scores by sub-periods in respect of all banks



⁸ Under the null hypothesis, the common median of differences between data scores is expected to be zero. Scores equal to the central point are excluded, tight scores are assigned a mean score and the absolute value of the deviations from the median is ranked. Based on the rank-sum test, the test statistics reject the null hypothesis at the 1% significance level, in respect of each efficiency type.

Generally, the results suggest that on average commercial banks perform more technically efficient after the merger. Before the bank mergers, the scores for technical efficiency are 60%, while the scores for its decompositions are 83% for scale efficiency, follows by pure technical efficiency (74%). Commercial banks perform better during the post-merger period, the scores for technical efficiency, scale efficiency and pure technical efficiency increase to 67%, 80% and 85% respectively.

The results from the present study confirm the findings from previous studies, such as Sufian (2004). The author disclosed that Malaysian banks exhibited an outstanding performance of 96% (97%) in technical efficiency before the merger and improved further to 98% after the merger. The finding is supported in the study by Ismail and Abdul Rahim (2009), the study found that the pure technical efficiency scores for commercial banks in Malaysia were 68% prior to the merger and improved to 95% during the post-merger period. Other studies, such as that by Lim, Randhawa and Wee (2004) concluded that the merger policy yielded benefits of 5% to 14% in respect of scale, pure technical and technical efficiency scores. In addition, a study by Sufian and Habibullah (2009) found that the merger yielded benefits not only to domestic banks, but also to foreign banks. The improvement is evident in technical efficiency at 91%, pure technical at 98% and 93% in scale efficiency.

Interestingly, the findings of this study that technical efficiency of banks does improve after merging are consistent with the results of international literatures. Previous studies provide evidence of efficiency gains from bank mergers (see Akhvein, Berger and Humphrey, 1997; DeYoung, 1997; Resti, 1998; Cuesta and Orea, 2002; Focarelli and Panetta, 2003; Huizinga, Nellisen and Vander Vennet, 2001; Worthington, 2004; Humphrey and Vale, 2004). Akhvein, Berger and Humphrey (1997) found that mega-mergers of the U.S. commercial banks had resulted in improvements of post-merger profit efficiency by 16%. Employing stochastic frontier approach, Humphrey and Vale (2004) revealed that bank mergers yield efficiency gains in Norwegian banking sector. Nevertheless, it is worth noting that the results of this study are not consistent with those of Amel et al. (2004) and Havrylchyk (2004) which indicate that bank mergers yield efficiency gains to commercial banks in the U.S. and Polish banking market respectively. Based

on the aforementioned studies, results of the existing international literature show inconclusive evidence of merger impacts on the benefits of bank mergers; while studies on the impacts of bank mergers on Malaysian commercial banks offer consistent evidence of technical efficiency gains. The contradict findings could be explained by the nature of the merger, as all of the international literature are based on market-driven mergers but mergers in Malaysian banking are based on involuntary-driven, the direct result of a directive by the central bank of Malaysia

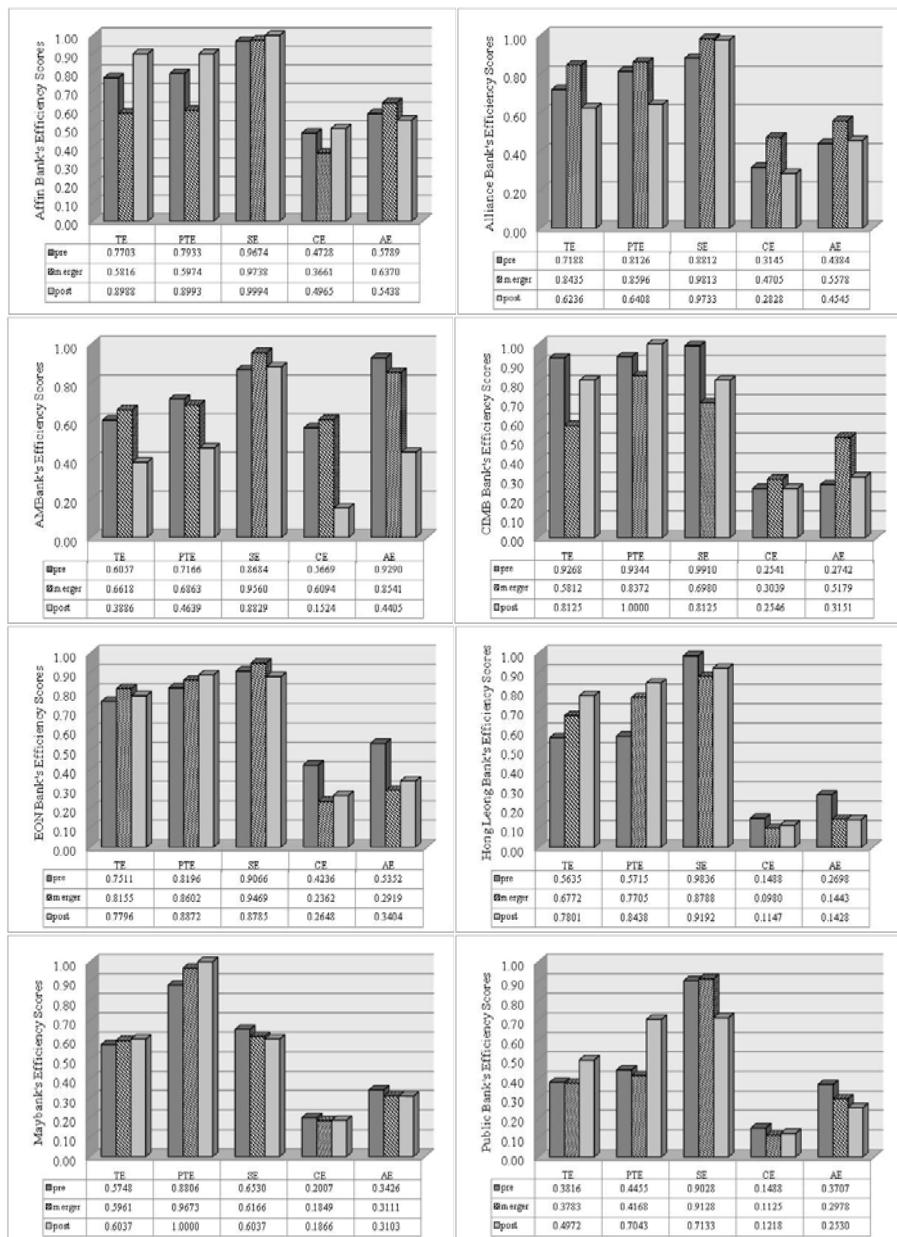
Nevertheless, this study detects another interesting finding. Even though bank mergers result in technical efficiency gains, the results are reversed in the context of cost efficiency. The scores of cost efficiency and allocative efficiency register a decline during the post-merger period. Prior to the merger, the cost efficiency (allocative efficiency) scores are 28% (48%), declines to 27% (41%) in the transition period and declines further to 24% (38%) in the post-merger period. The issue of minimizing domestic bank operating costs is crucial, given the fact that cost inefficiency is 245% prior to the merger, whilst allocative inefficiency accounts for 108%.⁹ As far as this study is concerned, there are no existing studies, which go far enough to measure the cost and allocative efficiencies. Therefore, this pattern could not be compared with its domestic studies counterparts.

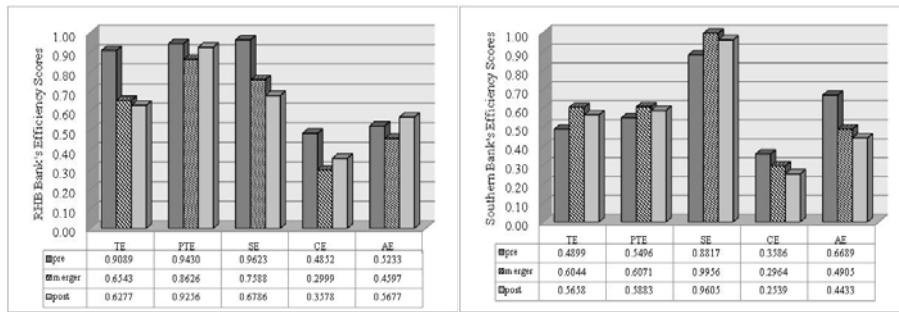
One possible explanation for the regress in cost efficiency is because banks had probably incurred additional costs dealing with mergers, while bank outputs were declining. At the same time, the process of mergers is strongly pursued by the central bank of Malaysia. Consequently, all banks had to rescale their operations, reduced their number of branches and even cut down the number of employees. Berger (2003) stated that bank mergers and acquisitions resulted in decreased efficiency, due to increasing costs, downsizing disruptions, clashes in organizational cultures, as well as the existence of managerial turf-battles.

⁹ The calculation of inefficiency (IE) is given as $IE = (1 - E)/ E$ (E stands for Efficiency). During the merger period, the cost efficiency is 27%, which means that the average bank could have reduced 270% of their resources to produce the same output.

Figure 3 illustrates the performance of each individual bank in respect of types of efficiencies across three sub-periods; namely pre-merger, merger and post-merger periods.

Figure 3
Types of efficiency scores in respect of individual banks





The results illustrated in Figure 3 clearly show that among the 10 banks involved in merger activities, average technical efficiency scores of six banks increased after the merger i.e. Affin Bank, EON Bank, Maybank, Hong Leong Bank, Public Bank and Southern Bank. It is worth stating that, the major source of the improvement in technical efficiency performance is contributed by pure technical efficiency rather than scale efficiency. Seven banks register an increase in pure technical efficiency as compared to only four banks that improve their scale efficiency performance after the merger. Surprisingly, two small banks namely, Affin Bank and Southern Bank outperform other large banks (Maybank, CIMB Bank, Public Bank and RHB Bank) in terms of technical efficiency and its counterparts. Thus, the result is consistent with existing studies results that size is not a necessary condition for efficient production (see Nguyen and Lee, 2001; Isik and Hasan, 2002; Darrat, Topuz and Yousef, 2002; Lin, 2005). This could be due to higher coordinating costs, complex organizational structure and moral hazard behaviour or because the large banks are experiencing the diseconomies of scale benefit.

Next, in the case of overall (cost) efficiency; the results reveal that out of ten commercial banks that involved in the merger exercise, there are only two banks that improve their cost efficiency scores after the merger which are Affin Bank and CIMB Bank. As for the former, technical efficiency contributes to the improvement in cost efficiency scores while allocative efficiency is the main source for cost efficiency of the latter bank. Overall, the decompositions of cost efficiency seem to be dominated by technical rather than allocative efficiency. Out of 10 banks, six banks perform technically efficient better after the merger; however, only two banks score higher allocative efficiency score during the post-merger period. Even though this pattern

could not be compared with the other domestic studies, international literature on the merger impacts of cost efficiency does offer support to the findings of this study. Existing studies report that cost efficiency scores are found to be lowered than its decomposition, technical efficiency (see Isik and Hasan, 2003; Darrat, Topuz and Yousef, 2002; Havrylchyk, 2006).

In a nutshell, the results of the present study indicate that during the post-merger period; Malaysian commercial banks are efficient in utilizing resources (technical efficiency) however; the banks need to be more selective in choosing the optimal mix of inputs (allocative efficiency) in order to stay on the efficient frontier. Due to the flexibilities over time, both efficiencies can be improved in longer timer period.

5. Conclusions

The present study employed a non-parametric approach, DEA to examine the cost efficiency and its decompositions, namely technical and allocative efficiency. This study further decomposed technical efficiency into its components which are pure technical and scale efficiency. Over the period of 1995 – 2005, this study utilized a DEA common frontier whereby all banks were observed based on single frontier. This study main attempt was to investigate the impacts of involuntary merger policy on the cost efficiency of domestic banks; the policy was enforced to all Malaysian domestic commercial banks to merge with each other.

The empirical results were reported based on three sub-periods, namely: pre-merger, transition and post-merger period. The findings of this study suggest that over the entire study period, average cost efficiency of domestic banks found to be 30%, while technical efficiency is at 66% and 44% for allocative efficiency. Overall, the results of this study suggest that the involuntary merger policy yields technical efficiency gains. However, the merger fails to support the contention that bank merger is the appropriate tool to address the issue of inefficient cost minimization practice amongst commercial banks.

From a policy perspective, the results are of interest to authorities which are seeking for assessment of the trade-off between the value enhancing effects of mergers and its impact on the banking efficiency and competition. As quoted in Bank Negara Malaysia's Governor Speech (12

April 2000), “The merger and consolidation program is a necessary pre-condition to create strong, efficient and competitive domestic banking institutions”. Both elements are desirable to policymaker’s point of view because a competitive banking environment allocates resources more efficient to the society and eventually, it enhances the financial stability of a nation. The findings of this study offer mixed evidences of the efficiency gains as the results from the merger policy.

The results of this study would serve as useful reference to the regulatory authorities in assessing the possible effects of policy changes on banking efficiency, with respect to promoting mergers and acquisitions of the banking industry. As Malaysia banking industry is moving towards liberalisation and globalisation, the move to consolidate the banking industry deserves to be given special attention as the results of this study show that the involuntary merger has yielded technical efficiency gains. Despite the critic with the enforcement of the mergers, the policy seems to benefit the industry players.

Generally, the results show that bank mergers have resulted in a relatively higher level of technical efficiency scores for the merged entities but it does not offer evidence of allocative efficiency gains. However, one should avoid making an early conclusion that the authorities should prevent bank mergers to take place. The results should be drilled down because the bank mergers consistently have yielded technical efficiency gains throughout the study period. Even though the allocative efficiency performance diminished, it indicates that more time might be needed to reap the potential benefits of the overall efficiency. Thus, the authorities should implement their policies based on continual basis. Due to the flexibility over time, both efficiencies can be improved in longer time period.

The directive policy of bank mergers by Bank Negara (on behalf of the government) to consolidate all domestic banks in Malaysian banking industry has been seen as a mean of bailing out of weak banks. However, the empirical evidence of this study suggests that strong (more efficient) banks should not be merged with weak (less efficient) banks as it will result in contrary effect upon the performance of the stronger banks. In this regard, any directive policies to merge banks in Malaysian banking industry should be based on a framework that consists of selection of merger partners, the size of banks, the strength and weakness of either the target or the acquirer

banks, the timeframe for completion of the mergers, asset valuation as well as the fate of small and medium-sized banks.

As this is the first empirical study that provides a systematic understanding of the impacts of involuntary mergers on Malaysian banking efficiency, the results should be interpreted with caution due to a number of limitations. First, this study only confines to domestic commercial banks to account for the involuntary merger impacts. Second, data on mergers and acquisitions is not detailed in the sense that the method of payments (cash deals, stock deals) and type of deals (mergers vs. acquisitions) are not reported. Similarly, data on qualitative variables such as service quality, human skills and technological advancements were not included in the analysis. Discussions on the limitations and conclusions drawn from the empirical results provide appealing avenues for future studies. First, in terms of methodology; this study would recommend for advanced method in measuring efficiency. Apart from that, as profit efficiency has becoming primary issue in efficiency measurement thus, it should also be measured in future studies. Next, given the mixed results of the present study, it is pertinent to continue empirical research with longer duration of study, from year 1995 - 2011 so as to deepen the understanding of the linkages to draw appropriate policy inferences. It also appears intriguing to empirically test whether efficiency is related to banking competition which is eventually, contributing to bank soundness and financial stability.

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