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Impact of Merger on Efficiency and Productivity: A Case Study of Commercial Banks in Malaysia

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ABSTRACT

The Financial Master Plan (2001-2010) aims to enhance the capacity of banking industry so that higher efficiency and productivity can be reaped in the future. This study seeks to determine the impact of merger on the efficiency and productivity of commercial banks in Malaysia for the period 1995 until 2005. The study uses a non-parametric approach, namely DEA (data envelopment analysis?) to estimate the efficiency scores and to construct the Malmquist productivity index. To enable this estimation, three bank inputs and outputs are used. Amongst the findings are those banks exhibit higher efficiency score after the merger and the foreign banks are more efficient than the local banks. Productivity of the banks is calculated in both periods, before and after the merger. The results show that, it is the local banks that have improved the most after the merger. The main source of productivity is technical change or innovation. The findings support the existing policy of having larger domestic banks in term of size.

Keywords: *efficiency, productivity, DEA, commercial banks*

Introduction

By the end of the 1970s, Bank Negara Malaysia believed that there are too many banks in the country compared to its real size. The creation of new banks was not allowed and the existing banks were encouraged to consolidate. However, the call for bank consolidation throughout the 80s was not received well by the bankers. Only a few consolidations took place after the economic decline in 1985-86. The Asian financial crisis in 1997-98 had exposed financial difficulties in several banks and this gave the much needed push for the banking institutions to consolidate. The government announced a major consolidation in 1999 that would reduce the number of domestic banking institutions to ten banking groups by 2000. This consolidation exercise was finally completed in 2001.

Background of the Study

One of the main reasons behind the major consolidation of domestic banks is the need to enhance the domestic capacity by building the capabilities of domestic banking institutions. Size is a matter. It is a premise that the larger the size of the bank, the greater the opportunity to reap the economic efficiency. In fact, one of the objectives of Financial Master Plan (2001-2010) is to enlarge the size of domestic banking in Malaysia so that greater efficiency can be obtained. This study seeks to measure and compare the technical efficiency of the commercial banks before and after the merger and to identify the sources of productivity growth of the commercial banks. The study is important for a few reasons.

It should be noted that one of the main reasons behind the merger exercise is to enhance the capacity of the domestic banks via greater efficiency. For this factor to materialize, one needs to know the level of efficiency of the banks before and after the merger. Without any empirical evidence, no parties should claim that the efficiency and productivity of the banks have improved. Secondly, the merger involved only domestic banks. Therefore, it is interesting to look into the performance of domestic banks as compared with foreign banks.

This study is organized as follows. Section 3 presents the review of relevant studies about efficiency and productivity. This is followed by discussing the current banking industry in Malaysia. In Section 4, the research methodology is presented. Relevant models used in this study are explained. Then, the study proceeds with empirical results and concludes with summaries and policy implications.

Literature Review

The efficiency issue was initiated and discussed by Farrel (1957). His idea was further developed by the works of Aigner et al. (1977) and Meeusen and van den Broeck (1977) using a parametric approach, and by the work of Charnes et al. (1978) using a non-parametric approach. Since then, thousands of studies have been undertaken to evaluate the efficiency of financial institutions all over the world as shown by Tavares (2002). He compiled more than 3,000 studies that solely used non-parametric approaches.

On the other hand, the issue of productivity emerges as the performance of the financial institutions is observed over time. The superior performance of financial institutions as compared to the previous years might be contributed by the technical improvement (better use of existing resources) and by technological improvement (better technology adopted). These two aspects should be identified by the decision makers so that better planning and managerial decisions are feasible. In relation to data envelopment analysis (DEA), it was the work of Fare et al. (1994) who developed the Malmquist productivity index by using DEA technique.

The review shows that there are three debatable issues that surround the studies of the efficiency and productivity of the financial institutions. The three aspects are bank input and output, the concept of efficiency and productivity and measurement of efficiency and productivity. A thorough discussion is provided by Berger and Humphrey (1997).

Issues of Bank Input and Output

Efficiency is about how best the firms use existing inputs to produce output given the same technology and homogenous economic environment. It is about how the firms transform existing resources to become products. This process requires the banks to identify what constitute their input and output. The literature suggests that the choice of bank input and output should consider the real functions of commercial banks in the economy, the focus of the study that is undertaken and the types of data available. For example, Siems and Barr (1998) outlined key considerations in choosing appropriate inputs and outputs of the bank. Both must reflect their importance and contribution in attracting deposits and making loans and advances. In their study, they used salary expense, fixed asset expense, interest expense, non-interest expense and the purchased fund as bank inputs. Bank outputs are earning assets, interest income and non-interest income. On the other hand, Chu and Lim (1998) used shareholders' funds, interest expenses and operating expenses (non-interest expense plus provision) as bank inputs. Bank outputs are annual increases in average total assets and income (from interest and non-interest activities).

Concept and Measurement Efficiency

Efficiency issues arise when we evaluate the performance of the firms in transforming multiple inputs into multiple outputs. To economists, this transformation can be explained by a production function. The function specifies the maximum possible output given a set input. This means that the maximum possible output establishes itself as a boundary or frontier. A best practice bank is the one whose observed output lies on the frontier. If the production of an observed output lies below or deviates from the frontier, it reflects production or technical inefficiency. Such deviations can be seen in two ways:

i.   in terms of output, i.e. the maximum possible output (Ymax) minus the observed output (Y), (Ymax – Y e" 0). A positive outcome indicates deviation or technical inefficiency.

ii. in term of cost, i.e. the observed cost (C) minus the minimum cost (Cmin), (C – Cmin e" 0). A positive outcome shows deviation or cost inefficiency. Studies on the performance of the DMUs can be broken down into two broad categories, parametric and non-parametric. Under parametric approach, production function or cost function is used to make the estimation under strict assumptions. On the other hand, under non-parametric approach, such assumptions are not required. In the case of Malaysia, few studies looked into this topic like Katib and Matthews (1999) and Ismail (2005). Most studies focus on the developed countries.

Concept and Measurement of Productivity

The productivity of commercial banks can be measured by employing the Malmquist productivity index (MPI). The Malmquist productivity index is a number that enables a firm's productivity to be compared over two different time periods. This idea was introduced by Malmquist (1953) who demonstrated the calculation of quantity indices as a ratio of distance function. Grosskopf (2003) recalled the emergence of the Malmquist productivity index by referring to the early work by Caves et al. (1982). They stated that the Malmquist productivity index can be constructed from a ratio of the value of input distance functions before and after a specific event or in different time periods where the earlier time period is taken as the base reference point. In addition, as productivity index is defined based on distance functions, activity analysis can be used to estimate the index directly (Grosskopf, 2003). It was Färe et al. (1994) who initially developed the Malmquist productivity index using DEA approach based on constant returns to scale.

Färe et al. (1994) analysed productivity growth in 17 OECD countries for the period 1979- 1988. The decomposition of productivity growth was done under the assumption of constant returns to scale. They further stated that this

decomposition provides an alternative way of testing for convergence of productivity growth, as well as allowing identification of innovation. They found that the average change in the Malmquist productivity index was less than one percent per year for the whole sample. On average, the growth was due to technical change (innovation) rather than improvement in efficiency. Other studies on the productivity of financial institutions include Canhoto and Dermine (2003) and Casu et al (2003). In the case of commercial banks in Malaysia, there are studies like Krishnasamy et al (2003) and Fadzlan (2004).

Banking Industry in Malaysia

The Malaysian banking system comprises monetary and non-monetary institutions. The monetary institutions are the Central Bank - Bank Negara Malaysia (BNM) and commercial banks including Islamic banks. The banking crisis in the mid-1980s causes a number of weak commercial banks and finance companies into insolvency and financial distress. These institutions were badly hit by the 1985-1986 recession, as they were burdened with huge levels of non-performing loans. These were due to over-lending to the property sector and imprudent exposure to share-based lending during the earlier boom years. From this crisis, the government realized that it was crucial for banking institutions to maintain high levels of capital in order to confront the economic turbulence. Therefore, banking institutions were strongly encouraged to build up their capital strength through mergers and acquisitions to attain critical mass.

However, the banking institutions did not exercise the call for consolidation. However, the financial crisis in 1997-1998 has again clearly highlighted the vulnerabilities of a fragmented domestic banking sector. Many of these banking institutions were small and survived mainly as niche players. Due to that, the performances of the finance company industry were deteriorating during the financial crisis. The Government had to initiate a merger program whereby these small finance companies were to be absorbed by larger institutions. Through the merger program for the finance company industry, the government managed to reduce the number of finance companies from 39 to 22. However, it was still behind the target of eight anchor finance companies due to the disagreement in terms of pricing by the smaller finance companies. In 1999 the Government has announced the merger program for domestic banking institutions comprising the commercial banks, finance companies and merchant banks. Through the program, ten domestic financial groups will be created, each with a minimum shareholder equity of RM2 billion and an asset base of RM25 billion (BNM, 1999).

After the merger, the number of domestic banking institutions reduced substantially to 32 banking institutions consisting of 10 commercial banks, 12

finance companies and 10 merchant banks. Further consolidation and merger, for instance between Southern Bank Berhad and Bumiputra Commerce Bank Berhad headed by Commerce International Merchant Bankers in 2006, reduce the banking group to nine.

Methodology

The study is about measuring the efficiency and productivity of commercial banks before and after the merger. In the literature, there are two broad methods used, parametric and nonparametric approach. This study uses the non-parametric approach namely DEA due to its simplicity and for comparative purposes. This study follows the approach taken by Ismail (2005). He measured the efficiency scores and the productivity index of the commercial banks before the merger.

However, this study extends his work by exploring the performance of the banks after the merger. He used the basic models of the DEA, the ones developed by Charnes, Cooper and Rhodes (1978) known as CCR model and Banker, Cooper and Rhodes (1984) as BCR model. These models differ in term of the basic assumptions made with regard to the returns to scale.

Efficiency Model

This study uses the BCR model. Its primal formulation is written as

$$\text{Maximise } E_o = \sum_{i=1}^{s} u_i y_{io} - c_o \tag{1}$$

subject to

$$\sum_{j=1}^{r} v_j x_{jo} = 1$$

$$\sum_{i=9}^{s} u_i y_{im} - \sum_{j=1}^{r} v_j x_{jm} - co < 0, \ m = 1, \ldots, N.$$

where

E_o = relative efficiency of the bank o
s = number of outputs produced by the bank o

r = number of inputs employed by the bank o

y_i = the i th output produced by the bank o

x_j = the j th input employed by the bank o

u_i = s x 1 vector of output weights and

v_j = r x 1 vector of input weights.

i runs from 1 to s and j runs from 1 to r.

u_i, $v_j > 0$; (small but positive). The parameter co is unconstrained in sign. It indicates the various possibilities of returns to scale. $C_o > 0$ indicates increasing returns to scale and $c_o = 0$ implies constant returns to scale. Finally, $c_o < 0$ implies decreasing returns to scale. This model forms a convex hull of intersecting planes, which envelop the data points more tightly than the CRS model. Therefore, it enables technical efficiency scores to be greater than or equal to those obtained under the CRS model.

Productivity Model

To measure the productivity of commercial banks before and after the merger, this study follows the works of Caves et al. (1982) and Zhu (2003). These studies employ the technology in period $t + 1$ as the reference technology (see Equation 2 below). Alternatively, the technology in period t (base period) can also be used as reference technology. This approach is taken by Casu et al. (2004), Canhoto and Dermine (2003), and Färe et al. (1994). The difference in the reference technology used affects the magnitude in interpreting the index. When the reference technology is based on period $t + 1$, then $M_o > 1$ implies deterioration in productivity over the period under study. On the other hand, when reference technology is based on period t, then $M_o > 1$ implies an improvement in productivity.

Our empirical Malmquist productivity index (M_o) is written as:

$$M_o = \frac{D_o^t (x_o^t, y_o^o)}{D_o^{t+1} (x_o^{t+1}, y_o^{t+1})} \left[\frac{D_o^{t+1} (x_o^{t+1}, y_o^{t+1}) * D_o^{t+1} (x_o^t, y_o^t)}{D_o^t (x_o^{t+1}, yo^{t+1}) \quad D_o^t (x_o^t, y_o^t)} \right]^{\frac{1}{2}} \quad (2)$$

or

$$M = E * T$$

where

$$E = \frac{D_o^t (x_o^t, y_o^o)}{D_o^{t+1} (x_o^{t+1}, y_o^{t+1})}$$

$$T = \left(\frac{D_o^{t+1} (x_o^{t+1}, yo^{t+1}) * D_o^{t+1} (x_o^t, y_o^t)}{D_o^t (x_o^{t+1}, y_o^{t+1}) \quad D_o^t (x_o^t, y_o^t)} \right)^{\frac{1}{2}}$$

where

M = the Malmquist productivity index

E = a change in efficiency over the period t and t+1 (the term outside the square bracket)

T = a measure of technical progress measured by shifts in the frontier over the period t and t = 1

(the two ratios in the square bracket).

Empirical Results

This study uses the BCR model under the assumption of variable returns to scale. To estimate the efficiency score, we use three inputs and three outputs. The process of estimating the individual efficiency of the commercial bank is carried out by using Excel Solver Software developed by Zhu (2003). For the construction of Malmquist productivity index, the estimation is done under the assumption of constant returns to scale. The bank inputs and outputs are the same.

Descriptive Statistics of the Data

This study focuses on the conventional commercial banks only and Islamic commercial banks are excluded. In 1995 and 1996, there were 37 commercial banks in Malaysia but only 32 banks were included in the sample. Out of 32 banks; 21 were local banks and 11 foreign banks. Until 2000, the number of foreign banks in the sample remains at 11. The number of local banks starts to fall in 1997 due to merger activity. The number was 31 in 1997, 30 in 1998, 28 in 1999 and only 9 in 2000. In 2000, data of some domestic banks were not available since the banks were about to merge. After 2000, total number of commercial banks excluding Islamic banks stood at 23, 10 local banks and 13 foreign banks. The number of local banks was further reduced to 9 when another two banks merged in 2006. The inputs used are labour, total deposit and fixed assets. The inputs are total loans, other earning assets and other operating income. The descriptive statistics of the data is shown in Table 1.

Overall Technical Efficiency

Table 2 shows the efficiency score of commercial banks for each year for the period 1995 until 2005. On average, the efficiency scores before the merger are lower than the efficiency scores after the merger. For the period 1995 to 2000, the average score is 67.57% compared with 95.20 for the period 2001-2005. We applied t-test to show that the mean difference between these two periods is significant.

Efficiency and Bank Ownership

We proceed further by comparing the performance of both domestic and foreign banks. This comparison is shown in Table 3. The results clearly show that the foreign banks are more efficient than the local banks. The efficiency scores for foreign banks are 0.9003 compared with 0.6914 of the domestic banks.

Table 1: Descriptive Statistics of Bank Inputs and Outputs (1995-2005)

	LAB	TD	FA	LOANS	OEA	OOY
1995-2000						
Mean	1922.17	7746.24	114.33	6946.64	4285.08	100.03
Std Deviation	2444.40	9998.41	157.61	9280.18	5945.13	135.94
Minimum	70.00	131.40	1.70	146.30	100.30	-4.60
Maximum	12200.00	60260.40	792.20	61003.90	32091.00	800.70
2001-2005						
Mean	3513.93	22992.04	300.95	18250.84	11102.83	460.97
Std Deviation	4001.61	25815.15	591.34	20442.63	12085.89	1424.83
Minimum	45.00	515.90	1.50	84.10	139.40	0.00
Maximum	19773.00	138149.90	4769.00	115481.60	59216.10	13917.00

Notes: a. LAB is the number of bank employees. TD is total deposits. FA is total fixed assets. LOANS are total loans issued by the banks (overdraft, term loans and others). OEA is other earning asset and OOY is other operating income. n is the number of commercial banks.

     b. LAB figures for 1995, 1997 and 1999 are replacement value. The method used is mean substitution for each of the bank involved as suggested by Hair et al. (1998).

     c. Figures are in thousands of ringgit Malaysia (RM) except for the number of bank employees.

Sources: ABM (1996, 1998 and 2000).

Table 2: Summary of Efficiency Score (1995-2005)

Pure technical efficiency	1995-2000 (%)	2001-2005 (%)
Mean	67.57*	95.20*
Standard Deviation	23.38	8.96
Minimum	23.14	68.18
Maximum	100	100

Note: * significant at 1% level

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Table 3: Efficiency Scores and Bank Ownership (1995-2005)

Efficiency	Domestic banks[a]	Foreign banks	t-statistics level	Significance
Mean PTE	0.6914	0.9003	8.1690	0.0000
Standard deviation	0.2497	0.1415		
No. of observations	160	118		

Note: a Local banks consist of both private banks and state-owned banks.
* significant at 1% level.
** significant at 5% level.

Productivity and its Sources

Using the same inputs and outputs, the Malmquist productivity index is constructed. Table 4 shows the Malmquist productivity index and the sources of productivity growth: efficiency change and technical change or catching-up effect and shifting-up effect. The table reports the changes in productivity during two consecutive years (taking the second year to construct the benchmark technology or reference technology) as well as changes between 1995 and 2000 and between 2001 and 2005. Recall that the Malmquist productivity index (Mo) measures the change in productivity between two periods. Since technology in the second period is used as reference technology, then if Mo is less than 1, there is productivity growth. If Mo greater than 1, productivity deteriorates and if equal to one, productivity remains unchanged.

On average, productivity has increased over the 1995-2000 and 2001-2005 period for the banks in our sample. In both periods, productivity increases by 9%. The productivity indexes stand at 0.91. The main source of productivity growth comes from technical change or innovation. The index for technical change is 0.98 before the merger and 0.78 after the merger. This implies that the frontier has shifted outward by only 2% before the merger and 22% after the merger.

Table 4: Malmquist Productivity Index and Sources of Productivity Growth

Periods	Average Productivity Index (Mo)[a, b]	Efficiency Change	Technical Change
Before merger: 1995/2000	0.91	1.02	0.98
After merger: 2001/2005	0.91	1.16	0.78

Note: a. The calculation of productivity index is done based on the assumption of constant returns to Scale and under input orientation.
    b. M > 1 means deterioration in productivity, M=1 means no change in productivity and M < 1 means improvement in productivity.

Productivity and Bank Ownership

We now turn to the comparison of productivity growth over two groups of banks. Table 5 shows the Malmquist productivity index and the sources of productivity growth for these two groups. For the period 1995-2000, both domestic and foreign banks experienced an increase in productivity (8% and 10% respectively). Table 6 shows that the sources of the productivity growth originate from both efficiency and technical change. For domestic banks, efficiency change improves by 10% but technical change deteriorates by 13%. On the other hand, the foreign banks experience 15% improvement in technical change whilst efficiency change gets worst by 12 %. It should be noted that the estimation of this productivity index is done under constant returns to scale assumption.

After the post merger period, the productivity of domestic banks has increased by 34 % while the productivity of foreign banks deteriorates by 23%. The improved productivity of domestic banks is contributed by technical change (35%) rather than efficiency change. For foreign banks, the deterioration in productivity is caused by the decline in efficiency (31%) although their technical change has improved by 9%.

Table 5: Malmquist Productivity Index and Sources of Productivity
Growth by Types of Bank

Banks	1995-2000	2001-05
Productivity index[a, b]		
Domestic banks	0.92	0.66
Foreign banks	0.90	1.23
Efficiency Change		
Domestic banks	0.90	1.01
Foreign banks	1.12	1.31
Technical change		
Domestic banks	1.13	0.65
Foreign banks	0.85	0.91

Note: a. The calculation of productivity index is done based on the assumption of constant returns to scale and under input orientation.
b. M > 1 means deterioration in productivity,
M = 1 means no change in productivity and
M < 1 means improvement in productivity.

Conclusion and Policy Implications

This study shows that on average that the commercial banks have improved in term of their technical efficiency. The scores were 67.57 % before the merger and 95.20 % after the merger. The difference in the scores has been proven to be statistically significant. Secondly, the foreign banks have higher efficiency scores than the local banks (90.03% compared with 69.14 %). This is in line with the findings of other studies. Thirdly, the productivity of all banks increases by 9% in both periods (before and after the merger). This is contributed by improvement in technology (technical change) rather than efficiency change. An interesting finding is that the local banks have improved their productivity greater than the foreign banks'. However, it should be noted that the productivity index is constructed under the assumption of constant returns to scale. Finally, the study wants to identify what factors that might influence the efficiency of the banks.

The study finds some justifications for the merger policy introduced by the government in the late 1990s and also some support for the implementation of Financial Master Plan (2001-2010). It can be stated that the merger has created more spaces for the banks to better utilize the resources and enhance their capacity in particular the local banks. It had been claimed that before the merger Malaysia has many but small banks relative to her economy. As a result of the merger, the local banks have been restructured. Bank branches were relocated so that the potential market is well captured.

The superior performance of the foreign banks should raise the eyes of the policy makers. The finding in this study is consistent with other studies that the foreign banks are better in term of utilizing the resources and producing the outputs. The local banks should review their current practice and do the benchmarking. It is already known that the local banks need to meet certain requirements set by the authority. This is due to the needs to perform social obligations by the private sector. For example, priority areas have been identified for loan disbursement. Unlike the foreign banks, they are not required to meet this requirement. However, such requirement should not be taken as an excuse for their relative poor performance compared to their foreign counterparts. Service quality must be improved and the red tapes in meeting customers must be removed. Professional attitude must be upheld when entertaining customer needs.

The policy of enhancing the capacity of the banks should continue. By increasing the capacity, the banks can operate on larger scale. The economic theory states that large scale operation enables lower costs and this can boost competitive edge. Easy access to banking services via latest technique like online transaction should be further pursued. By reducing face to face communication, transaction can be further improved. This can eventually place the banks on higher frontier and efficiency level.

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