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EFFECT OF MERGERS ON EFFICIENCY AND PRODUCTIVITY: SOME EVIDENCE FOR BANKS IN MALAYSIA

By

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Abstract

This study is undertaken to investigate the extent to which mergers lead to efficiency by which services are provided to the public and the productivity of Malaysia's banking institutions sector. The data cover the period 1993 to 2004, which includes the pre-merger years and the post-merger years. This study attempts to evaluate technical efficiency, efficiency change, technical change and productivity of commercial banks, finance companies and merchant banks using a non-parametric Data Envelopment Analysis (DEA) and Malmquist Index approach as the framework for the analyses. It is found that: (1) that on average, productivity across banking institutions increased at annual rate of 5.8% over the study period 1993 to 2004; (2) the results also indicated that almost all of the productivity growth comes from technical change (or innovations in banking technology) rather than improvement in efficiency change, which contributes for 6.1% of productivity growth, while the latter accounted for 0.2% decline; (3) the merger process led to productivity improvements whereby, it is observed that the productivity of Malaysia's banking sector has been improved (in terms of efficiency) after the implementation of merger program for domestic banking institutions in 1999. This might be due to the utilization of their scale economies to improve their efficiencies. However, the productivity of banking institutions has been affected by certain economic conditions in year 2001 and 2004 (such as the September 11 tragedy and the process of capital rationalization that merged entities have undergone).

Keywords: Banking sector, Mergers, DEA and Malmquist index, Malaysia

Introduction

Merger is a process whereby two or more companies/institution merge into one company in order to strengthen their market positions. Normally it is market driven and main economic pushes for this exercise are such as: (1) enhancing efficiency and boosting productivity and (2) increasing the market share and in turn, market power by eliminating competitors. However the

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Malaysian scenario is quite different and unique, whereby it was based on the request or instruction of the Central Bank or more precisely Bank Negara Malaysia (BNM).

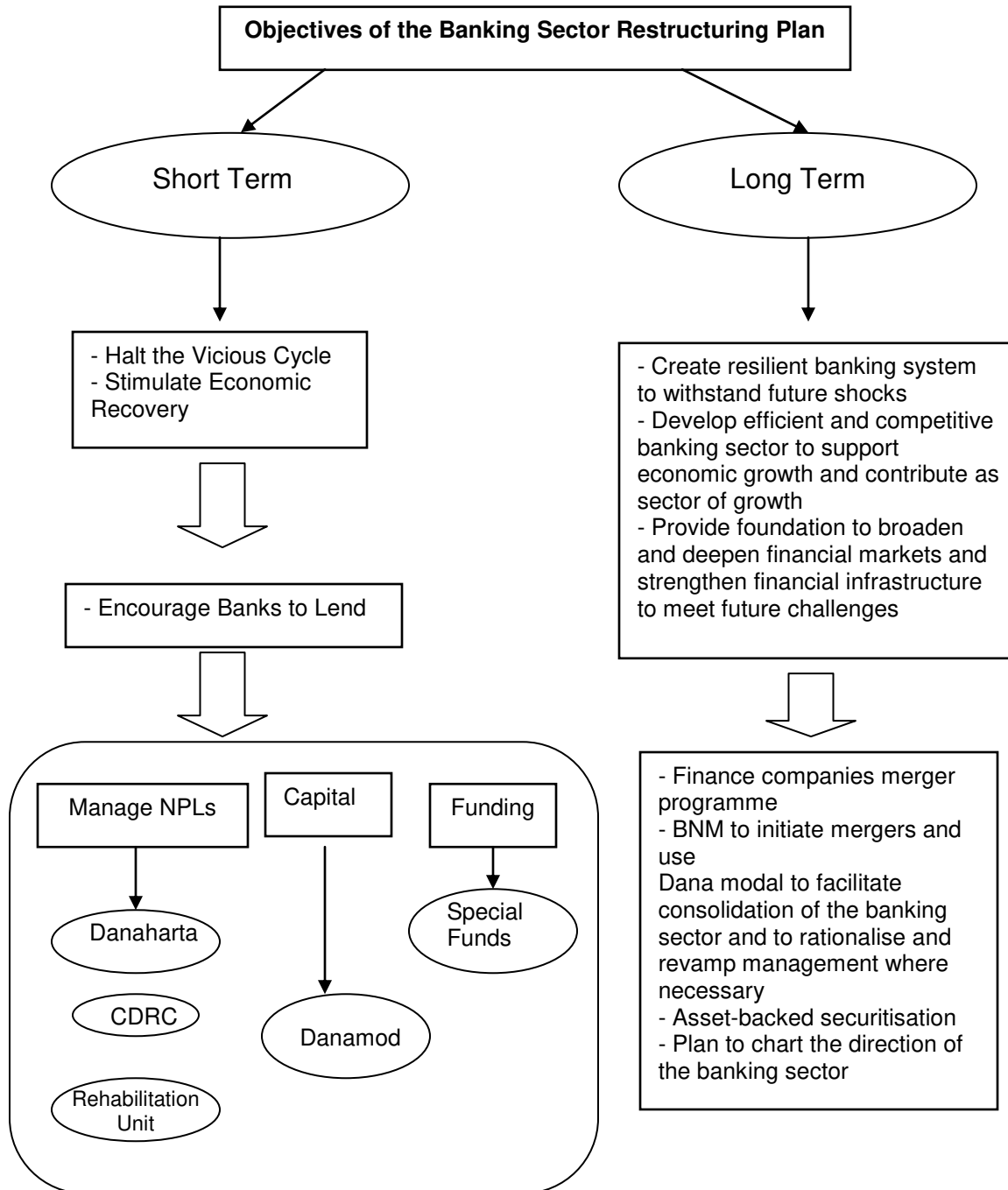
Looking from the hierarchy, Malaysian banking system consists of Bank Negara Malaysia (BNM) which functions as the central bank, banking institutions (commercial banks, merchant banks and finance companies) and other financial institutions (discount houses, foreign banks representative offices, and offshore bank in the International Offshore Financial Centre in Labuan). As of the end of 1997, the licensed banking system consists of 35 commercial banks, of which 22 are domestic banks and 13 are foreign-controlled. This contributes to 43.6% of total financial system assets, and whereby the rest of the financial system assets are made of 39 finance companies (13.6%), 12 merchant banks (4.0%), 7 discount houses (1.9%), and Bank Negara Malaysia (9.8 percent). On the other hand, non-bank financial intermediaries accounted for 27.1 percent of total assets of the financial system at the end of 1997 (Bank Negara Malaysia, 2001).

In 1999, the number of financial institution amounted to 58 which comprise, 21 domestic commercial bank, 25 finance companies and 12 merchant banks. These numbers clearly shows that Malaysia was over-banked, which will lead to inefficient use of resources and, duplication of resources and infrastructure of domestic market. Thru liberalization and globalization, Malaysian banking sector has undergone a lot of structural changes. In addition, South East Asian region, including Malaysia was severely affected by the financial crisis in 1997, which started with the descending of Thai Baht in July 1997, causing a sharp impact of recession on Malaysia (BNM, 1999).

Due to globalization, the banking industry is expected to be more dynamic and competitive in their operating environment. Hence, banking institutions are encouraged to increase their competitiveness in term of enhancing operational efficiency and become more innovative in developing competitively priced financial products. The task of serving the sophisticated needs of consumers and businesses became a priority. Before the financial crisis, though Malaysian banking sector was stable and performing satisfactorily, finance companies have been over exposed to broad property and consumption credit, besides that, banks have also overextended themselves to politically well-connected corporate entities backed by volatile assets in the form of shares and real estate. The value of non-performing loans (NPLs) for the financial institutions also increased tremendously, with the increase for finance companies and merchant banks substantially compared to commercial banks (Soo, 2006.).

Responding to the financial crisis, several policy measures were implemented to limit the amount of credit to the more volatile sectors of the economy, in order to reduce the high credit growth and to enhance financial disclosure by financial institutions. One of the policies that have been proposed by the government to promote economic recovery was the consolidation of banking system to resolve weaker bank institutions that had been badly affected during the financial crisis (Figure 1).

Figure 1: Objectives of the Banking Sector Restructuring Plan



(Source: Bank Negara Malaysia Annual Report, 1998)

The merger program for domestic banking institutions was announced by the Central Bank (Bank Negara Malaysia), on 29 July 1999. On 14 February 2000, Bank Negara Malaysia launched the consolidation program, whereby 58 institutions would be merged into ten anchor banking groups, comprising at least a commercial bank, a finance company and a merchant bank for each anchor bank group. In 2004, number of financial institution was 26 which comprises of 10 domestic commercial banks, 6 finance companies and 10 merchant banks. The 10 anchor banks which were identified were Maybank Bhd, Bumiputra-Commerce Bank Bhd, RHB Bank Bhd, Public Bank Bhd, Arab-Malaysian Bank Bhd, Hong Leong Bank Bhd, Perwira Affin Bank Bhd, Multi-Purpose Bank Bhd, Southern Bank Bhd and EON Bank Bhd (Table 1).

Table 1: The merging of local banks institution

Original Banking Group	Merged with	Entity after merging
1. Affin Bank Bhd		
Perwira Affin Bank Bhd	BSN Commercial Bank Bhd	Affin Bank Berhad
Affin Finance Bhd	BSN Finance Bhd	Affin ACF Finance Berhad
Perwira Affin Merchant Bankers Bhd	BSN Merchant Bank Bhd.	Affin Merchant Bank Bhd
2. Alliance Bank Bhd		
Multi-Purpose Bank Bhd	International Bank Malaysia Bhd	Alliance Bank Bhd
	Sabah Bank Berhad	Alliance Finance Bhd
	Bolton Finance Bhd	Alliance Merchant Bhd
	Sabah Finance Bhd	
	Bumiputra Merchant Bankers Bhd	
	Amanah Merchant Bank Bhd	
3. Arab Malaysian Bank Bhd		
Arab-Malaysian Bank Bhd	MBf Finance Bhd	Arab-Malaysian Bank Bhd
Arab-Malaysian Finance Bhd		Arab-Malaysian Finance Bhd
Arab-Malaysian Merchant Bank Bhd		Arab-Malaysian Merchant Bank Bhd
4. Bumiputra-Commerce Bank Bhd		
Bumiputra-Commerce Bank Bhd		Bumiputra-Commerce Bank Bhd
Bumiputra-Commerce Finance Bhd		Bumiputra-Commerce Finance Bhd
Commerce International Merchant Bankers Bhd.		Commerce International Merchant Bankers Bhd.

5. EON Bank Bhd EON Bank Bhd EON Finance Bhd	Oriental Bank Bhd, City Finance Bhd Perkasa Finance Bhd Malaysian International Merchant Bankers Bhd.	EON Bank Bhd EON Finance Bhd Malaysian International Merchant Bankers Bhd.
6. Hong Leong Bank Bhd Hong Leong Bank Bhd Hong Leong Finance Bhd	Wah Tat Bank Bhd Credit Corporation Malaysia Bhd.	Hong Leong Bank Bhd Hong Leong Finance Bhd
7. Malayan Banking Bhd Malayan Banking Bhd Mayban Finance Bhd Aseambankers Malaysia Bhd	PhileoAllied Bank Bhd Pacific Bank Bhd Sime Finance Bhd Kewangan Bersatu Bhd.	Malayan Banking Bhd Mayban Finance Bhd Aseambankers Malaysia Bhd
8. Public Bank Berhad Public Bank Bhd Public Finance Bhd	Hock Hua Bank Bhd Advance Finance Bhd Sime Merchant Bankers Bhd.	Public Bank Bhd Public Finance Bhd Public Merchant Bank Bhd
9. Utama Bank Bhd (now known as RHB Bank Bhd) RHB Bank Bhd RHB Sakura Merchant Bankers Bhd	Delta Finance Bhd Interfinance Bhd	RHB Bank Bhd RHB Delta Finance Bhd RHB Sakura Merchant Bankers Bhd
10. Southern Bank Bhd Southern Bank Bhd	Ban Hin Lee Bank Bhd Cempaka Finance Bhd United Merchant Finance Bhd Perdana Finance Bhd Perdana Merchant Bankers Bhd.	Southern Bank Bhd Southern Finance Bhd Southern Investment Bank Bhd

(Source: Bank Negara Malaysia Annual Report, 2001)

The objective of the present paper is to investigate the productivity of Malaysia's banking sector throughout the pre-merger years and post-merger years (1993-2004). In order to achieve our purpose, the study is organized as follows: The literature review is conducted in section 2. Section 3 will present the methodology and the data used in the analysis. This is followed by a discussion on the empirical results of this study and the last section contains our conclusion.

Literature Review

There are numerous studies on banking efficiency and productivity using the non-parametric Data Envelopment Analysis (DEA) as the framework for their analyses such as Kadir et al. (2002), Alias et al. (2002), Barr et al. (1999), Grigorian and Manole (2002), Grigorian and Manole (2002)

Alias et al. (2002) analyzed the efficiency and productivity of Indonesian commercial banks from year 1991 to 1999 using Data Envelopment Analysis (DEA) and the Malmquist productivity index. They explained that, although there was a decline in productivity in 1997, due largely to the financial crisis, the technical efficiency and productivity still grew at the frontier over the period. They also stated that the level of efficiency and productivity of the bank is not really reflected by the structure of the commercial banks (in terms of assets sizes and total loans). Regarding to technical efficiency results, respective banks need to manage their inputs and avoid wastage as the bank assets is identified as the main source of inefficiencies.

Khong and Habibullah (2002) studied the effects of bank mergers on productivity in 1990s using the multilateral productivity index and found that, for the period 1989 to 1999, the local banks was less productive compared to the foreign commercial banks. Acquiring banks have higher productivity level than targeted banks, due to the bank mergers. In other words, productivity as a whole should be improved as mergers have been seen as acquisition of less productive banks by more productive banks. Since 1989, banks have less incentive to operate efficiently due to government interventions. However, the Bank Negara Malaysia idea to strengthen the local financial institutions through consolidation is most welcomed. The steps are crucial since the new merger entity needs time to obtain the benefit from bank mergers.

Tan and Hooy (2002) examined the main aspects of the Malaysian bank merger program, and studied the effects of the consolidation on the volatility of Malaysian bank stock returns by using General Autoregressive Conditional Heteroskedasticity (GARCH) model. They found that the bank's stock prices and returns become more stable (after the initial consolidation announcement), based on the estimation of conditional variances. Before the announcement, there was a persistent positive risk returns tradeoff and asymmetrical news effects in the bank stock. However, bank stocks faced a huge reduction in the volatilities and the asymmetrical news effects, after the announcement.

Brewer et al. (1990) stated that the structure of the U.S banking industry was changed dramatically by the bank consolidation in the 1990s due to the mergers whereby the total number of banks has been reduced significantly. Mergers also led to the increased market share of large banks. They also found that the difference merger motivations affects merger bid premiums that the acquiring banks are willing to offer for the targets. They also suggested that the targeted banks more likely to offer a larger bid premium; by targeting higher profits through higher returns on assets and/or returns on equity. Besides, bid premiums and the announcement-period abnormal stock returns can be positively correlated with the long-term performance of the merged banks, if the market participants able to identify in advance the improved performance associated with bank acquisitions.

Pillof and Santomero (1996) stated that consolidation can reduce cost if economies of scale are achieved. If redundant facilities and staffs are eliminated during the post-merger organization, the larger institutions may become more efficient. In addition, cost can be reduced if bank offer several products at a lower price compare to when separate bank offer individual products. They also agreed that there is no significant gain in value or performance from the consolidation. Besides, as there is no correlation between changes in accounting-based performance measures and stock market returns around the merger announcement, thus the market is unable to accurately forecast the success of individual mergers.

Moreover, the consolidation in the United States indicates nothing to prove that bank merger have impacts towards improvement in the performance. They also suggest that misguided view of one's own managerial talent has lead to the restructuring of the world financial structure. People do not really understand what actually happened in a consolidation process. However, a specific and through assessment on management process in the agreement about a consolidation can avoid this problem.

Kadir et al. (2002), examined the total factor productivity (TFP) and technical efficiency of 32 finance companies in Malaysia from year 1988 to 1996 by using similar framework. They however concluded that the major source of overall economic growth and welfare improvements is productivity growth. It is thereby necessary to understand and examine the level of productivity of each decision-making unit. Their research also shows that average output of the finance companies grew at 20.77% per annum. They also found that the productivity of all finance company decreased by 1.3% per annum. Thus, to increase their technical efficiency, finance companies need to save and reallocate their existing resources.

Barr et al. (1999) evaluated the productive efficiency and performance of U.S. commercial banks over the period 1984 to 1998 using a constrained multiplier, input-oriented Data Envelopment Analysis (DEA) model. They found that the relationships between efficiency of inputs and outputs are strong and consistent, as well as independent measures of bank performance. They also discovered that the impact of varying economic conditions is mediated to some extent by the relative efficiencies of the banks that operate in these conditions. In recent years, changes in the regulatory environment, huge growth in off-balance sheet risk management financial instruments, the introduction of e-commerce and on-line banking, and significant financial industry consolidation have made the U.S. banking industry highly competitive. The bank examiner ratings determine that there is a close relationship between efficiency and soundness.

Grigorian and Manole (2002) applied Data Envelopment Analysis (DEA) to bank level-data from a wide range of transition countries to measure the commercial banks efficiency (by stressing profit maximization and provision of transaction services as banks' primary objectives). DEA results imply that banking sectors with few large and, well capitalized banks have more chance to generate better efficiency and higher rates of intermediation. They argued that it is necessary to model various types of functions performed by banks, and control for the inputs necessary to provide a certain level of utility to owners (profits) and depositors (services)

in order to fully assess the efficiency of commercial bank operations. They also implied that privatization of banks does not guarantee significant improvements in efficiency.

Methodology and Data

Data Envelopment Analysis (DEA) is a linear-programming methodology, which uses data on the input and output quantities of a group of countries to construct a piece-wise linear surface over the data points. This frontier surface is constructed by the solution of a sequence of linear programming problems – one for each firm/company in the sample. The degree of technical inefficiency of each firm/company (the distance between the observed data point and the frontier) is produced as a byproduct of the frontier construction method.

Data envelopment analysis (DEA), or known as frontier analysis, was first developed by Charnes et al. (1978), and extended by Banker et al. (1984) to include variable returns to scale. It is a performance measurement technique which can be used for evaluating the *relative efficiency* of *decision-making units (DMU's)* in organizations. DMU is a distinct unit within an organization that has flexibility with respect to some of the decisions it makes, but not necessarily completes freedom with respect to these decisions. In this study, DMU is represented by banking sector itself, which are commercial banks, merchant banks and finance companies.

Today, the DEA measure has been used to evaluate and compare educational departments (schools, colleges and universities), health care (hospitals, clinics) prisons, agricultural production, banking, armed forces, sports, market research, transportation (highway maintenance), courts, benchmarking, index number construction and many other applications. Thus, Data Envelopment Analysis (DEA) and (input-or-output based) Malmquist Index methods are used as the productivity measurements in this study.

In this study, productivity change in each of the banking sectors is calculated as the geometric mean of two Malmquist indexes. Introduced by Caves *et al.* (1982), the (output-based) Malmquist productivity index is defined as the ratio of two (output) distance functions. Distance functions are functional representations of multiple-output, multiple-input technology which requires data only on input and output quantities. This index, therefore, is a *primal* measure of productivity change that, in contrast to the Tornqvist or Fisher Index, does not require cost or revenue share for aggregation purposes and yet is capable of measuring total factor productivity growth in a multi-input, multi-output setting.

This paper follows the approach developed and implemented by, among others, Fare *et al.* (1985), Fare *et al.* (1994), and Fare and Grosskopf (1996) which explicitly recognizes that improvements in technical efficiency and technical progress are two important factors in productivity growth. The measurement of productivity change by the Malmquist index, as is done in this study, is based on the concept of output distance function.

The input-oriented Malmquist index is generally computed as geometric mean of adjacent year's index value (Fare et al., 1994 and Price and Weyman-Jone, 1999) as

$$M_0(x^{t+1}, y^{t+1}, x^t, y^t) = \left(\frac{D_0^t(x^{t+1}, y^{t+1})}{D_0^t(x^t, y^t)} \frac{D_0^{t+1}(x^{t+1}, y^{t+1})}{D_0^{t+1}(x^t, y^t)} \right)^{\frac{1}{2}} \quad (1)$$

The index thus employs distance functions from two different periods or technologies, $D_0^t(\dots)$ and $D_0^{t+1}(\dots)$, and two pairs of input-output vectors, (x^t, y^t) and (x^{t+1}, y^{t+1}) . Caves *et al.* (1982) assume that $D_0^t(x^t, y^t) = D_0^{t+1}(x^{t+1}, y^{t+1})$ implying at own-period observations are technically efficient in the sense of Farrell (1957). The approach used in this paper does not impose such restriction *a priori* and explicitly allows for technical inefficiency.

As has been demonstrated by Fare *et al.* (1989), the Malmquist index (1) can be decomposed into two components, namely technical efficiency change (EFFCH) and technical change (TECHCH), defined as:

$$M_0(x^{t+1}, y^{t+1}, x^t, y^t) = \frac{D_0^{t+1}(x^{t+1}, y^{t+1})}{D_0^t(x^t, y^t)} \times \left(\frac{D_0^t(x^{t+1}, y^{t+1})}{D_0^{t+1}(x^{t+1}, y^{t+1})} \frac{D_0^t(x^t, y^t)}{D_0^{t+1}(x^t, y^t)} \right)^{\frac{1}{2}} \quad (2)$$

Whereby the ratio outside the square bracket measures the change in relative efficiency (i.e., the change in how far observed production is from maximum potential production) between year t and $t+1$. The geometric mean of the two ratios inside the square bracket captures the shift in technology between the two periods evaluated at x^t , and x^{t+1} that is

$$\text{Efficiency Change} = \text{EFFCH} = \frac{D_0^{t+1}(x^{t+1}, y^{t+1})}{D_0^t(x^t, y^t)} \quad (3)$$

$$\text{Technical Change} = \text{TECHCH} = \left(\frac{D_0^t(x^{t+1}, y^{t+1})}{D_0^{t+1}(x^{t+1}, y^{t+1})} \frac{D_0^t(x^t, y^t)}{D_0^{t+1}(x^t, y^t)} \right)^{\frac{1}{2}} \quad (4)$$

Although, in principle, one may calculate Malmquist productivity index under different returns to scale assumptions, this study calculates the index relative to a constant returns to scale (CRS) technology which is decomposed into efficiency change and technical progress. Since under CRS, scale of operation is irrelevant, entire efficiency change is due to technical efficiency change. However, if variable returns to scale (VRS) is allowed (i.e., technology that exhibits first increasing, then constant, and finally decreasing returns) efficiency change could come from the use of inefficient scale of operation (identified as Scale Efficiency) as well as from pure technical inefficiency. An enhanced decomposition of the Malmquist index, as developed in Fare *et al.* (1994), that recognizes this issue is implemented in this study. In this decomposition, the efficiency-change component calculated relative to CRS technology is decomposed into a pure efficiency change (PECH) and a scale efficiency change (SECH) that reflects the use of sub-optimal scale of operation by firms.

We can include scale efficiency for period's t and $t+ 1$ in the measure of efficiency change as follows:

$$EFFCH = \frac{S_o^t(x^t, y^t)}{S_o^{t+1}(x^{t+1}, y^{t+1})} \frac{D_o^{t+1}(x^{t+1}, y^{t+1} | VRS)}{D_o^t(x^t, y^t | VRS)} \quad (5)$$

Whereby;

$$\text{Scale Efficiency Change} = SECH = \frac{S_o^t(x^t, y^t)}{S_o^{t+1}(x^{t+1}, y^{t+1})} \quad (6)$$

and

$$\text{Pure Efficiency Change} = PECH = \frac{D_o^{t+1}(x^{t+1}, y^{t+1} | VRS)}{D_o^t(x^t, y^t | VRS)} \quad (7)$$

So, the enhance decomposition of Malmquist Productivity Index (M_o) implemented in this study can be written as:

$$\begin{aligned}
\text{Malmquist Productivity Index} &= \text{EFFCH} \times \text{TECHCH} \\
&= \text{SECH} \times \text{PECH} \times \text{TECHCH} \quad (8)
\end{aligned}$$

In this study, secondary data from year 1990 to 2005 will be used to measure the productivity of banking sector for pre-merger years and post-merger years using the Data envelopment analysis (DEA)-like linear programs and a (input-output oriented) Malmquist TFP index are used to measure productivity change. In this study, the data set consist of a set of time series data for inflow of financial institution report cover the period 1993 to 2004. We adopt the Malmquist Index measures using three variables as output (net interest income, Non-interest income and Total loans) and five inputs, namely operating cost, interest expenses, number of institutions, office network and number of employees (which includes commercial bank, merchant bank and finance company).

Data for the analysis were extracted from both printed and electronic resources. Data for this study were also obtained from BNM website and Bank Negara Malaysia annual report published by Bank Negara from year 1993-2005. In addition, some data, article and online journal that are related to the study were extracted from internet. This BNM time series data explain the implication of merger to banking sector productivity.

Results and Discussion

Using the data envelopment analysis computer program written by Coelli (1996), the input oriented Malmquist Total Factor Productivity (TFP) change index has been calculated. A value of the index greater than one will indicate a positive growth of total productivity and a value less than one indicates decline in productivity from period t to period $t+1$.

Table 2 show an average annual rate of productivity and efficiency change in Malaysia banking institution, 1993-2004. From the last column, it can be clearly observed that on average, productivity across banking institutions (consists of commercial banks, finance companies and merchant banks) increased at annual rate of 5.8% over the study period 1993 to 2004. We can also observe that, overall financial institutions efficiency change is 0.2 % lower. On the other hand, average technology/technical efficiency change index (TECHCH) increased about 6.1% over the same time period. The scale efficiency results conclude that the financial institutions are efficient (SECH value equal to unity). From the results it can also be concluded that all the banks under the study are efficient, except for the merchant banks. Thus, in general, it shows that the financial sectors in Malaysia are generally efficient. However, in term of total factor productivity (TFP), both finance companies and merchant banks indicate that the TFP growth of 2.1% and 37.9% respectively. While TFP for commercial banks is -15.9% (TFPCH=0.841).

Table 2: . Average Annual Rate of Productivity and Efficiency Change in Malaysia Banking Institution, 1993-2004

	Efficiency Change (EFFCH)	Technical Efficiency Change (TECHCH)	Pure Efficiency Change (PECH)	Scale Efficiency Change (SECH)	TFP Change (TFPCH)
Commercial Banks	1.000	0.841	1.000	1.000	0.841
Finance Companies	1.000	1.021	1.000	1.000	1.021
Merchant Banks	0.994	1.388	0.994	1.000	1.379
Mean	0.998	1.061	0.998	1.000	1.058

The mean efficiency changes (EFFCH) for the financial institutions shows that they are efficient (index value equal or above unity) for all the years except for 1997, 1998, 2001 and 2004 (Table 3). The efficiency change (EFFCH) values for those years are 0.993, 0.996, 0.993 and 0.974 respectively. This could be due to economic conditions in those years. For example, in 1997, Malaysia experienced financial crisis, while in 2001, the banks are repositioning their operations and activity after the merger process. Besides that, we can also observe that the productivity of the financial institutions seem to improve in 2002 (especially after merger in 2001), though after that it deteriorates again due to another move by the central bank(BNM) to further consolidates the local banks. In addition, the value of pure efficiency change (PECH) are equal or above unity over the study periods except for 1998 and 2004 (where the value are 0.997 and 0.974 respectively).

Table 3: Summary of Annual Means of Malmquist Index for Malaysian Banking Institution, 1993-2004

Year	Efficiency Change (EFFCH)	Technical Efficiency Change (TECHCH)	Pure Efficiency Change (PECH)	Scale Efficiency Change (SECH)	TFP Change (TFPCH)
1993	1.000	1.364	1.000	1.000	1.364
1994	1.000	1.177	1.000	1.000	1.177
1995	1.000	1.112	1.000	1.000	1.112
1996	1.000	1.131	1.000	1.000	1.131
1997	0.993	0.669	1.000	0.993	0.664
1998	0.996	1.060	0.997	0.999	1.056
1999	1.008	1.706	1.003	1.005	1.719
2000	1.003	1.321	1.000	1.003	1.325
2001	0.993	0.542	1.000	0.993	0.539
2002	1.007	1.327	1.000	1.007	1.336
2003	1.000	1.179	1.000	1.000	1.179
2004	0.974	0.741	0.974	1.000	0.722
Mean	0.998	1.061	0.998	1.000	1.058

The similar trend can also be observed with the scale efficiency (SECH) and technical efficiency change (TECHCH). The scale efficiency change value are efficient (score unity value) except for 1997, 1998 and 2001. While the average technical efficiency change are positive throughout the years except for 1997, 2001 and 2004 (TECHCH index for year 1997 = -33.1%, 2001 = -45.8% and 2004 = -25.9%). Lastly, the average productivity growth for the financial institutions is 5.8% per annum. 1999 recorded the highest total factor productivity (TFP) growth of 71.9%. This might be due to 1999 being the year of recovery and consolidation for the banking system. At the same time, further industry consolidation through the merger process took place, resolving some of the problems associated with smaller and weaker banking institutions which became apparent during the financial crisis. On the contrast, 2001 shows deterioration in term of productivity growth which is -46.1%. The September 11th tragedy had brought in negative impact to world's (including Malaysia's) economic growth. Indirectly, this might also led to the decline in Malaysia's banking sector productivity.

Table 4 shows that, for the period 1993 to 1996, the efficiency change index (EFFCH) for commercial banks equal to unity. It declined 2.1% in 1997 (EFFCH=0.979). Meanwhile, the efficiency change index for 1998 and 1999 is 1.021 and 0.990, respectively. On the other hand, efficiency change index has improved 1.0% in 2000 and maintained the value of unity over the years from 2001 to 2004. This condition may be due to the efficient banks management. Meanwhile, the technical change index (TECHCH) is above unity from 1993 to 1996, means that the technical change of the commercial banks are efficient. However, commercial banks experienced negative technical change over the period 1997 to 2001, except in 1999, where it had experienced positive technical change (TECHCH=1.417). In 2002 and 2003, the technical change had increased. However, the technical change index once again shows deterioration in 2004 (TECHCH=0.647).

Table 4: Summary of Annual Means of Malmquist Index for Malaysian Commercial Banks, 1993-2004

	EFFCH	TECHCH	PECH	SECH	TFPCH
1993	1.000	1.292	1.000	1.000	1.292
1994	1.000	1.222	1.000	1.000	1.222
1995	1.000	1.071	1.000	1.000	1.071
1996	1.000	1.102	1.000	1.000	1.102
1997	0.979	0.207	1.000	0.979	0.203
1998	1.021	0.930	1.000	1.021	0.950
1999	0.990	1.417	1.000	0.990	1.403
2000	1.010	0.874	1.000	1.010	0.883
2001	1.000	0.311	1.000	1.000	0.311
2002	1.000	1.290	1.000	1.000	1.290
2003	1.000	1.091	1.000	1.000	1.091
2004	1.000	0.647	1.000	1.000	0.647

On the aspect of pure efficiency change (PECH), commercial banks score PECH index equal to one (which indicates efficiency) over the study period of 1993 to 2004. Furthermore, for the period of 1993 to 2004, commercial banks score positive scale efficiency change value (SECH index equal or above unity). Except for year 1997 and 1999, where the index decreased slightly (-2.1% and -1.0% respectively). The total factor productivity change (TFPCH) index for year 1993, 1994, 95 and 96 are 1.292, 1.222, 1.071 and 1.102 respectively. The results indicate that the banks experienced positive productivity growth from year 1993 to 1996. However, in year 1997 to 2001 (excludes year 1999) the banks experienced negative productivity growth (TFPCH below unity). The total factor productivity change (TFPCH) for year 1997, 1998, 2000 and 2001 are 0.203, 0.950, 0.883 and 0.311 respectively. In year 1999, the productivity had increased 40.3% (might be due to government policies that was implemented to promote economic recovery). In addition, in 2002 and 2003, commercial banks had also showed positive productivity growth (efficient). In 2004, the total factor productivity (TFP) has declined (TFPCH=0.647).

The declination in technical change and total factor productivity change in year 2004 was due to the completion of merger exercise between commercial banks and finance companies in the third quarter of 2004. In that year, five out of ten finance companies, accounting 55% of the total finance companies assets, successfully merged with their respective commercial bank. The new Bafin (Banking and financial) entities are Alliance Bank Berhad, EON Bank Berhad, Hong Leong Bank Berhad, Malayan Banking Berhad and Public Bank Berhad. The merged entities have undergone the process of capital rationalization, staff redeployment and reorganization, branch relocation and delivery channel consolidation to gain economies of scale and scope post-merger.

The finance companies experienced positive efficiency change (EFFCH equal to unity) from 1993 to 1997 (Table 5). However, the efficiency change index has decreased 3.3% (EFFCH=0.967) in 1998. Then, the value rose 3.4% in 1999 (EFFCH=1.034). Meanwhile, the finance companies score efficiency change index equal to unity in 2000. In year, 2001 and 2002, the efficiency change index is 0.979 and 1.022 respectively (indicates improvement in the efficiency for year 2002). The finance companies maintained the value of unity in 2003 and 2004.

Table 5: Summary of Annual Means of Malmquist Index for Malaysian Finance Companies, 1993-2004

	EFFCH	TECHCH	PECH	SECH	TFPCH
1993	1.000	1.361	1.000	1.000	1.361
1994	1.000	1.108	1.000	1.000	1.108
1995	1.000	1.155	1.000	1.000	1.155
1996	1.000	1.126	1.000	1.000	1.126
1997	1.000	1.189	1.000	1.000	1.189
1998	0.967	0.901	0.990	0.976	0.871
1999	1.034	1.837	1.010	1.025	1.900
2000	1.000	1.031	1.000	1.000	1.031
2001	0.979	0.309	1.000	0.979	0.303
2002	1.022	1.249	1.000	1.022	1.276
2003	1.000	1.232	1.000	1.000	1.232
2004	1.000	0.681	1.000	1.000	0.681

Meanwhile, the technical change index (TECHCH) is above unity from 1993 to 1997, except for 1998 whereby it declined 9.9% (TECHCH=0.901). For 1999 and 2000, the technical change index rose to 1.837 and 1.031 respectively. In 2001, the finance companies experienced the lowest technical change value (TECHCH=0.309). It is believed that the economic condition was affected by the September 11th tragedy, thus not allowing finance companies to invest more in technological innovation. For the consequent years 2002, 2003 and 2004 the observed value are 1.249, 1.232 and 0.681 respectively. In pure efficiency change (PECH), finance companies score positive pure efficiency change (PECH index equal or above unity), except for 1998. In 1998, the pure efficiency change index declined 0.1% (PECH=0.991). Furthermore, finance companies experienced highest scale efficiency change value (SECH) in 1999, which was 1.025. These conditions arise from the merger and other restructuring exercises undertaken in the industry, as well as the absorption of eight finance companies by the parent commercial banks. The second highest scale efficiency change value is in year 2002, where the value is 1.022. This may be due to recovery of the global economy (after September 11th tragedy). On the other hand, the finance companies scored the lowest scale efficiency change value in 2001, which was 0.979. While in 1993 to 1997, 2000, 2003 and 2004, the finance companies score efficiency value (equal to unity).

We can also observe that the total factor productivity change (TFPCH) index for these finance companies are efficient (TFP equal or above unity), except for 1998, 2001 and 2004. The total factor productivity change (TFPCH) for 1998, 2001 and 2004 are 0.871, 0.303 and 0.681 respectively. Finance companies achieved the highest level of productivity growth in year 1999 (TFPCH=1.900) and the lowest productivity growth rate in year 2001 (TFPCH=0.303). The merger that started in year 1999 has led to improvement in productivity growth. However, the world's politic conflicts (September 11 tragedy) had brought negative impact to banking sector's productivity.

Table 6 presents the summary of annual means of Malmquist Index for Malaysian merchant banks, 1993-2004. It shows that, Merchant banks experienced stagnation in efficiency change (EFFCH value equal to unity) over the period of 10 years (1993 to 2003). Only in 2004 the efficiency change decline slightly about 7.5% (EFFCH=0.925). Meanwhile, the technical change index (TECHCH) is above unity from 1993 to 2003, except in 2004 whereby it declined 7.7% (TECHCH=0.923). Merchant banks experienced the highest technical change value in 2000 (TECHCH=2.557) and the lowest was in 2004 (TECHCH=0.923). As for pure efficiency change (PECH) index, merchant banks score positive efficiency index (PECH index equal or above unity), except for 2004 whereby it declined 7.5% (PECH=0.925). In term of scale efficiency change value (SECH), merchant banks score efficiency value equal to unity throughout the study periods of 1993 to 2004, means that the merchant banks is efficient. We can also observe that the total factor productivity change (TFPCH) index for merchant banks are positive (TFPCH equal or above unity) throughout the study period, except in 2004 whereby the total factor productivity change (TFPCH) is 0.853. Merchant banks achieved the highest level of productivity growth in year 2000 (TFPCH=2.557) and the lowest productivity growth rate in year 2004 (TFPCH=0.853).

Table 6: Summary of Annual Means of Malmquist Index for Malaysian Merchant Banks, 1993-2004

	EFFCH	TECHCH	PECH	SECH	TFPCH
1993	1.000	1.444	1.000	1.000	1.444
1994	1.000	1.203	1.000	1.000	1.203
1995	1.000	1.111	1.000	1.000	1.111
1996	1.000	1.165	1.000	1.000	1.165
1997	1.000	1.214	1.000	1.000	1.214
1998	1.000	1.423	1.000	1.000	1.423
1999	1.000	1.907	1.000	1.000	1.907
2000	1.000	2.557	1.000	1.000	2.557
2001	1.000	1.658	1.000	1.000	1.658
2002	1.000	1.449	1.000	1.000	1.449
2003	1.000	1.218	1.000	1.000	1.218
2004	0.925	0.923	0.925	1.000	0.853

Conclusion

This study measures the total factor productivity (TFP) and its efficiency component of banking institutions (commercial banks, merchant banks and finance companies) in Malaysia from year 1993 to 2004 by using a non-parametric Data Envelopment Analysis (DEA) and (input-or-output based) Malmquist Index. It is necessary to understand and measure the level of productivity of each decision-making unit, due to the fact that productivity growth is the main source of overall economic growth.

The result of this study clearly shows that on average, productivity across banking institutions (consists of commercial banks, finance companies and merchant banks) increased at annual rate of 5.8% over the study period 1993 to 2004. In addition, it is found that almost all of the productivity growth comes from technical change (TECHCH) rather than improvement in efficiency change (EFFCH), which contributing for 6.1% of productivity growth, while the latter accounted for 0.2% decline. This finding is concurrent with the finding of Khong and Habibullah, (2006), Alias et al. (2002), Kadir et al. (2002)

Due to the financial crisis in 1997, government promotes economic recovery through the consolidation of banking system to resolve weaker bank institutions that had been badly affected. It has been noted that the productivity of Malaysia's banking sector (commercial banks, merchant banks and finance companies) had improved (efficient) after the implementation of merger program for domestic banking institutions in 1999. However, it should be realized that the productivity of banking institutions had also been affected by certain economic conditions in 2001 and 2004. The September 11th tragedy in 2001 had brought negative impact to global (including Malaysia's) economic growth and development. Meanwhile, the process that merged entities (commercial banks and finance companies) have undergone, such as the process of capital rationalization, staff reorganization and branch relocation in the third quarter of 2004 also affect their productivity growth. Thus, the result of this study supports the Government approach for the consolidation of banking system to resolve weaker bank institutions that had been badly affected during the financial crisis.

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