eISSN:2600-7920
INTI JOURNAL
Vol.1, 2018 (34)

Does Bank Size Matters? A Pre and Post-Merger Productivity Analysis in Malaysian Financial Institutions using DEA and Malmquist Index

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Abstract

The aim of this study is to investigate the productivity growth amongst the local commercial banks in Malaysia before and after 1999 mega bank merger. In this context, we attempt to evaluate the technical efficiency, efficiency change, technical change and productivity of finance companies using the Malmquist index approach and the Data Envelopment Analysis amongst the local commercial banks in Malaysia from 1990 to 2005. In this context, the study will highlight the performance of local commercial banks before and after the merger process.

Keywords

Productivity, Banking, Data Envelopment Analysis (DEA), Malmquist Index

Introduction

Productivity measures are indicators of success, by which the performance of any individual bank as well as the industry as a whole can be gauged. From the early 1970's to 1990's, we can see that there have been rapid changes in financial industry structure occurring around the world (Berger et. al 1993). In Asia, for instance, countries are restructuring banking regulations and encouraging financial liberalization, in an attempt to increase financial industry efficiency. The banking industry has also undergone multiple growth in new bank products and banking facilities in these recent years as a result of advances in technology and telecommunications. These developments would have an impact on the competitiveness and hence on their performances of any financial institutions, particularly in Malaysia.

When the structure and services of the financial institutions are changing rapidly, it is important to determine the cost and revenue aspects of the evolving financial institutions. If these institutions are becoming more efficient, then we might expect improved profitability, greater amounts of funds intermediated, better prices and service quality for customers, and greater safety and soundness if some of the efficiency savings are applied towards improving capital buffers that absorb risk (Berger et. al., 1993).

Powerful new entrants to the market, emergence of substitute products and competition for an overlapping customer base has affected the operations of banks by forces that serve as significant threats to bank profitability (Porter 1979). There is the need for banks to address the issue of scarce resource allocation in order to provide a competitively strategic response. In the end, this will have a crucial impact on future bank performance and viability. In addition, as the banking sector has become increasingly competitive, there is an urgent need for each banking institution to optimize on its strength. Each banking institution must exploit its competitive advantage to the fullest and focus on its strength to built greater efficiency.

In this regards Malaysia is no exception. Since the crisis, the monetary authority namely the Central Bank of Malaysia had initiated many reforms including consolidation of the domestic financial sector with an objective of to improve the efficiency and effectiveness as well as to increase competition among domestic banking institutions. The potential concern of these reforms particularly the consolidation process will rest heavily on the existence of scale and technical efficiency of these financial institutions. This is primarily to address the problem of performance gap between the domestic banking institutions and the incumbent foreign institutions in Malaysia, let alone international players.

In view of these changes, an understanding of the efficiency of financial institutions is imperative. This study aims to test for evidence of productivity and efficiency in the commercial banking sector in Malaysia. In this context, the study attempts to evaluate if there are any differences in the efficiencies amongst the domestic owned Malaysian banks using the Malmquist index approach the Data Envelopment Analysis (DEA).

The first part of this study investigates the productivity growth amongst the finance companies in Malaysia before the financial consolidation with 10 anchor banks. The second part of the study analyzes the productivity amongst the local commercial banks in Malaysia before and after 1999 mega bank merger. A comparison is made between pre-merger and post-merger result.

Review of Financial Institutions in Malaysia

Malaysian financial institutions can be broadly divided into the banking system and the non bank financial intermediaries. The banking system consists of the Central Bank of Malaysia (Bank Negara Malaysia (BNM)), commercial banks, finance companies, merchant banks and others which include the discount houses, the representative office of foreign banks and offshore banks in Labuan. The banking system is the largest component of the financial system. The non-bank financial intermediaries composed of the provident and pension funds, insurance companies, the development finance institutions, the savings institutions and a group of other non-bank financial intermediaries.

The commercial banks are the main players in the banking system in Malaysia. They are the largest and most significant providers of funds in the banking system, with total assets representing 44.1% of rm1, 908.5 billion total assets of financial system**.** As at end-2005, the total assets of the financial system was RM1.9 trillion which were equivalent to 386% of GDP (BNM, 2005). The banking industry in Malaysia remained resilient in 2014. Total loans grew to MYR 1.34 trillion, while total

deposits from customers increased to MYR 1.64 trillion in 2014. The loan-to-deposit ratio was above 85%. In 2015, the Islamic banking sector recorded a growth of 12.0% in 2014 to account for 25.6% of the total assets of the overall banking system. As for the recent update, in 2017, BNM reported that financing by banks was RM1.584 trillion. Total deposits in the banking system also recorded a higher annual growth rate of 4.0%, which grew by 7.9% in 2017(2016: -2.3%) (BNM, 2017).

Soon after the Independence, there were 20 banks in Malaysia (BNM, 1960). This figure grew to 38 banks until end of 1990 but decreased to 37 by 1991 with the merger of two banks: Bank of Commerce Berhad and United Asian Malaysia Berhad. In mid 1999, there were 34 commercial banks (excluding Bank Islam Malaysia Berhad) operating with a total of 1,735 branches nation wide and 63,889 staff employed. Of these 34 commercial banks, 13 were locally incorporated foreign banks (BNM, 1999). By December 31, 2001, there were 25 commercial banks in Malaysia. 11 were the local commercial banks and 14 were the foreign owned banks. 1,664 total branches network with 3,370 ATMs were installed throughout Malaysia. Meanwhile, the commercial banks employed 67,398 staffs with an estimation of 13,959 persons served per office. Following the consolidation of the 54 domestic banking institutions to ten banking groups, there was significant rationalisation of the wide range of common functions and operations across banking institutions in the group. Six banking groups have also leveraged on cross-selling of their products and services across institutions in the group.

The consolidation programme for the domestic banking sector was a necessary prerequisite to enhance the sector's capacity to compete. Size alone, however, is not a sufficient condition that will result in producing efficient and competitive banks and it does not offer guarantee of success. Being a large and strong bank is however, an important enabler to achieving enough scale to be able to invest in cutting-edge technology and management systems and to attract the talent required to compete with the best players in the market. Domestic banking institutions must be able to meet the range of products offered by foreign competitors. But the larger scale and the wider range of activities will demand stronger management teams. With the completion of the merger programme in December 2000, the Malaysian banking groups are at various stages in building up their management team and enhancing corporate governance.

The year 2005 continued to witness a changing structural landscape in the banking sector. Following the flexibility granted to domestic banking groups to rationalise their commercial banking and finance company businesses, the industry underwent a transformation which saw the consolidation of retail banking businesses into a single entity. All ten domestic banking groups have completed the rationalisation exercise on schedule The successful completion of the rationalization exercise allows for more efficient use of the banking groups' capital and resources, which in turn will strengthen the potential of the entities to meet the increasingly more differentiated expectations and sophisticated demands of their customers.

By end of 2005, following the completion of the merger exercises of five finance companies with their respective parent commercial banks, the assets of the commercial banks rose by 14.4% to account for a larger share of 44.1% share of total financial system assets (2004: 41.7%). During the course of the year, four additional Islamic banks were established as a result of measures taken

to liberalise and accelerate the growth of Islamic banking industry by allowing foreign Islamic banks to operate in Malaysia.

Table 1 highlights the list of Malaysian commercial banks as at 31 October 2006, before the merger.

Table 1 List of Banking Institutions (as at 31 October 2006)

1. ABN Amro Bank Berhad (F)
2. Affin Bank Berhad
3. Alliance Bank Malaysia Berhad
4. AmBank (M) Berhad
5. Bangkok Bank Berhad (F)
6. CIMB Bank Berhad
7. Bank of America Malaysia Berhad (F)
8. Bank of China (Malaysia) Berhad (F)
9. Bank of Tokyo-Mitsubishi UFJ (Malaysia) Berhad (F)
10. Citibank Berhad (F)
11. Deutsche Bank (Malaysia) Berhad (F)
12. EON Bank Berhad
13. Hong Leong Bank Berhad
14. HSBC Bank Malaysia Berhad (F)
15. J.P. Morgan Chase Bank Berhad (F)
16. Malayan Banking Berhad
17. OCBC Bank (Malaysia) Berhad (F)
18. Public Bank Berhad
19. RHB Bank Berhad
20. Southern Bank Berhad
21. Standard Chartered Bank Malaysia Berhad (F)
22. The Bank of Nova Scotia Berhad (F)
23. United Overseas Bank (Malaysia) Berhad (F)
24. Bank Islam Malaysia Berhad
25. Bank Muamalat Malaysia Berhad
26. RHB ISLAMIC Bank Berhad
27. CIMB Islamic Bank Berhad
28. Hong Leong Islamic Bank Berhad
29. Kuwait Finance House (Malaysia) Berhad (F)
30. Affin Islamic Bank Berhad
31. EONCAP Islamic Bank Berhad
32. AmIslamic Bank Berhad
33. Al Rajhi Banking & Investment Corporation (Malaysia) Berhad

See the latest list of Banking Institutions (2017) in Appendix.

Review of Related Literatures and Methodology

Many studies conducted in order to examine the efficiency of the banks. DeYoung (1993) employed a frontier analysis in order to find the cost efficiency of banks. Das (1997) employed two different models including cross-sectional as well as data envelopment model to find the efficiency of banks. Bhattcharyya et al. (1997) used data envelopment model in order to find out the productive efficiency of Indian banks. The result of their research represented that public banks in India are the most efficient compared to private and foreign banks. Akhavein et al (1997) used the price and efficiency effects on USA banking industry. He found that the banks that used consolidation program gain higher profit compared to those that do not employ the consolidation program. Another study has been done by Berger and Humphrey (1997) indicating that most of the bank efficiency examination have emphasis on USA or developed countries. Vennet (1996) tried to find the relationship between bank consolidation program and efficiency using financial ratios as well as stochastic frontier analysis. He found that bank consolidation improves the efficiency of financial sectors.

Meanwhile, Data Envelopment Analysis (DEA) has been used widely by researchers to measure efficiency in the financial institutions. Among them are Parkan (1987), Baeur *et al.* (1993), Berg *et al.* (1991), Aly *et al.* (1990), Ferrier and Lovell (1990), Drake and Howcroft (1994), Favero and Pappi (1995), Resti (`1997), Ayadi *et al.* (1998), Rangan *et al. (1998),* Avkiran *et al.* (1999) and Mukherjee (2001). Recent application of DEA method on the performance of banking institutions include Begoña *et al.(2007),*Maria *et. al (2007),* Hidenobu and Suvadee (2006), Kang and William (2006), Olena (2006), Leigh *et. al* (2006) and Simon (2006).

Recent articles using DEA in banking system include Akther, Fukuyama, and Weber (2013), Fukuyama and Weber, (2008, 2010), and Fujii et al. (2014), Emrouznejad et al. (2008), Sufian et al. (2008, 2014) and Chaudary et al (2016).

Methodology

This paper follows the approach developed and implemented by, among others, Fare *et al.* (1985), Fare (1988), Fare *et al.* (1994) and Fare and Grosskopf (1995) which explicitly recognizes that improvement in technical efficiency and technical progress are two important factors in productivity growth. The measurement of productivity change by the Malmquist index, done in this study, is based on the concept of output distance function.

In this study, productivity change in each of the 8 commercial banks is calculated as the geometric mean of two Malmquist indexes. Introduced by Caves *et al.* (1982), the (output-based) 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 Tornquist 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.

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

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

The index thus employs distance functions from two different periods or technologies, $D_o^t(.,.)$ and $D_o^{t+1}(.,.)$ and two pairs of input-output vectors, (x^t, y^t) and (x^{t+1}, y^{t+1}). Caves *et al.* (1982) assume that $D_o^t(x^t, y^t) = D_o^{t+1}(x^{t+1}, y^{t+1})$ 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.* (1982) the Malmquist index (1) can be decomposed into two components, namely technical efficiency change (EFFCH) and technical efficiency change (TECHCH), defined as:

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

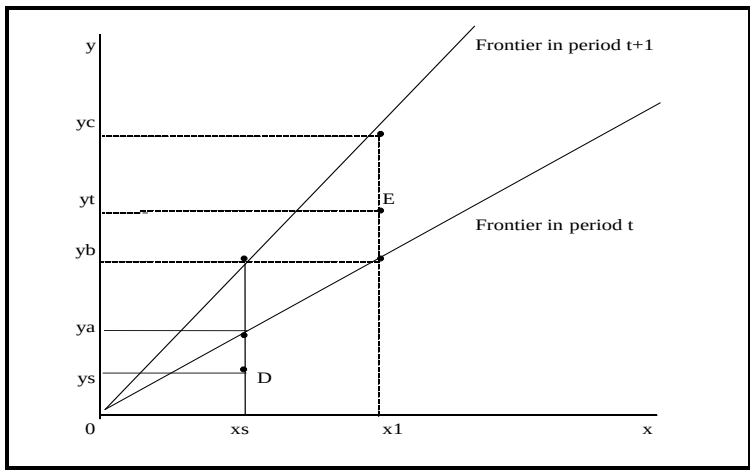
Where the ratio outside the square bracket measures the change in relative efficiency (i.e, the change in how far observed production is from maximum potential production) between years *t* and *t+1*. The geometric mean of the two rations inside the square bracket captures the shift in technology between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

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

$$\text{TECHCH} = \frac{\sqrt{D_0^{t+}(x^t, y^t) D_0^t(x^t, y^t)}}{\sqrt{D_0^{t+1}(x^{t+1}, y^{t+1}) D_0^{t+1}(x^t, y^t)}} \quad (4)$$

Figure 1: Malmquist Productivity Index

eISSN:2600-7920
INTI JOURNAL
Vol.1, 2018 (34)



This decomposition is illustrated in Figure 1 as firms at point D and E in periods 0 and 1, respectively. In each period the firm is operating below the technology for that period. Thus, there is technical inefficiency in both periods.

Efficiency Change = y_t / y_c

Technical Change = $\sqrt{\frac{y_t / y_b}{y_t / y_c} x \frac{y_s / y_a}{y_s / y_b}}$ (6)

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, developed by Fare *et al.* (1994), that recognizes this issue, is implemented in this study. In the decomposition of 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 sup-optimal scale of operations by firms.

We can include scale efficiency for periods *t* and *t+1* in the measure of efficiency change (i.e., (3)) as follows:

$$EFFCH = \frac{S_0^1 (x^t, y^t) D_0^{t+1} (x^{t+1}, y^{t+1}) | VRS}{S_0^{t+1} (x^{t+1}, y^{t+1}) D_0^t (x^t, y^t) | VARS} \quad (7)$$

Where

$$\text{Scale Efficiency Change} = \text{SECH} = \frac{S_0^1 (x^t, y^t)}{S_0^{t+1} (x^{t+1}, y^{t+1})} \quad (8)$$

And

$$\text{Pure Efficiency Change} = \text{PECH} = \frac{D_0^{t+1} (x^{t+1}, y^{t+1}) | \text{VRS}}{D_0^t (x^t, y^t) | \text{VARS}} \quad (9)$$

So, the enhance decomposition of Malmquist Productivity Index (M0) implemented in this study can be written as:

Malmquist Productivity Index = EFFCH x TECHCH = SECH X PECH x TECHCH

Data of 8 local commercial banks in Malaysia over the period 1990-2005 is used for the analysis which was extracted from various newspapers including the daily newspapers and the annual financial reports of individual banks. The inputs used are total deposits, total assets, interest expenses and operating costs (operating expenses). Meanwhile, the outputs employed are total loans and advances, interest income and non-interest income.

Results and Analysis

In this analysis, we used the Data Envelopment Analysis and Malmquist Index methods as the productivity measurements. As such, the methods construct a best-practice frontier from sample data and compared individual commercial banks with this frontier. The first analysis is based on the data of 32 finance companies in Malaysia from pre-merger period of 1988 to 1996.
The technical efficiency shows a 0.05% growth amongst the finance companies. The average technical efficiency of finance companies ranged from a minimum of 0.8653 to a maximum of 0.9308 as depicted in Table 1. The result indicates that on average, the finance companies were inefficient from 1988 to 1996, yet over time the efficiency has improved.

Meanwhile, Table 2 summarizes the average technical efficiency change, technical change and Malmquist productivity indices for Malaysian finance companies from 1988 to 1996. The technical efficiency change has grown 0.23%, while the technical change and productivity show a negative growth of 0.57% and 0.54%, respectively. These findings show that productivity index of finance companies was below one from 1988 to 1996 which indicates that productivity of finance companies are low yet improving every year. The major caused for the low total productivity was due to technical change rather than due to efficiency change. Sharp decreased of productivity was noted following the Malaysian recession that ended in 1986. Only when BAFIA was introduced and the Malaysian economy had improved, productivity started to increase.

The source of low productivity mainly due to technical change rather than efficiency change. Being a developing country and realizing the important of technology, Malaysian finance companies invested considerable large amount of capital in technology such as the increased use of

Automated Teller Machine and the use of computer in all banking activities. The result from this study suggests that return of investment in technology is not short term and given changes in technology, the finance companies in Malaysia will gain an increase in productivity a few years later. Depositors, in particular, may take some time to be confidence to use the newly introduced technology. Bank staffs, on the other hand, need to go for training or courses as to learn the new technology. This is showed in the study by the decreased technical change for three years compared to 1988 as the based year before it started to increase at an increasing rate. It is also crucial to realize that computerization is a two-edged instrument. If implemented in haste, its introduction can lead to loss of efficiency, include undue sacrifices in terms of the security of an institution's entire system, which can impair public confidence in that institutions (BNM, 1989).

Table 1- Technical Efficiency for Finance Companies

	MEAN	STD	MIN	MAX
1988	0.196	0.109	0.656	1.000
1989	0.865	0.130	0.534	1.000
1990	0.870	0.105	0.635	1.00
1991	0.900	0.082	0.730	1.000
1992	0.874	0.091	0.692	1.000
1993	0.931	0.066	0.776	1.000
1994	0.909	0.093	0.693	1.000
1995	0.916	0.082	0.718	1.000
1996	0.915	0.081	0.693	1.000
Growth	0.05%			

Source: Authors's self-calculation based on DEA Software

Table 2 - Average Productivity, Technical Change and Malmquist Index of Finance Companies in Malaysia

YEAR	TECHNICAL EFFIFCIENCY CHANGE	TECHNICAL CHANGE	MALMQUIST
1988	1.0000	1.0000	1.0000
1989	0.9458	1.0136	0.9514
1990	0.9549	0.8453	0.8112
1991	0.9924	0.6575	0.6535
1992	0.9645	0.7160	0.6767
1993	1.0296	0.7011	0.7137
1994	1.0022	0.7932	0.7877
1995	1.0115	0.8766	0.8886
1996	1.0134	0.8981	0.9114
Growth	0.23%	-0.57%	-0.54%

Source: Authors's self-calculation based on DEA Software

As at 1989, there were 47 finance companies in Malaysia. After a few merger and consolidation, the companies reduced to 40, 33, and 25 in 1996, 1998 and 1999, respectively. From the merger of the banking industry, finance companies is believed to reap the gains from economies of scale, reduce costs and excess capacity, as well as afford higher spending on their input resources (BNM, 1999).

The financial distress experienced by several finance companies following the worse recession in Malaysia's post-independence history in 1985-1986 had an impact on the efficiency of finance companies in late 1980's. Meanwhile, improved economy and improved ratio of non-performing loans to total loans contributed to an improvement in efficiency change, thereafter.

It was also noted that the structure of finance companies in terms of asset sizes does not seem to have much effect on the efficiency of the finance companies. This is evidenced from varies ranking of finance companies based on their assets size and efficiency. In certain years, it is quite surprising that some of the smaller finance companies performed better than the bigger one. Surveys in the U.S. have shown that the community banks have been out-performing the bigger multinational banks. Large finance companies may have an advantage over a smaller one in the range of services it can provide, but small finance companies may have an advantage in offering personalized services. In that case, small finance companies, by catering to its customers in a more personalized manner, may be able to match the profitability of larger finance companies despite the overall cost structure.

In the second part of analysis, where we analyze the productivity of commercial banks in Malaysia before and after the merger. Table 3 the estimated efficiency of the eight commercial banks over the last 16 years (1990 to 2005) in terms of constant returns to scale (CRS), variable returns to scale (VRS) and scale efficiency.

The reported efficiency index, EFFCH, measures efficiency relative to a Constant Return to Scale (CRS) technology. Since CRS technology is scale neutral, it is implicitly assumed that in all commercial banks are operating at optimal scale of operation. Efficiency measure under Variable Return to Scale (VRS) technology allows the possibility that inefficiency, as measured by EFFCH, may be due to deviation from respective optimum scale of operations (measured by SECH) as well as due to pure technical inefficiency (measured by PECH). Therefore, scale efficiency and pure technical efficiency isolate the two components that comprise the overall efficiency measure. The efficiency index values of unity (1) imply that the commercial bank is on the best-practice frontier or in other words, are efficient. Values below the unity imply that the firm is technically inefficient.

From Table 3 and Figure 2, it shows that technical efficiency has improved and increase over the years from 1990 to 2005 with the best achievement recorded in 2004, where our local commercial banks reach the best-practice frontier line of technical efficiency. In 1999 and 2005, technical efficiency of local commercial banks increase at an increase rate. This may be due to the effect of merger process that the banks have to go through. Changes in the management, operation and banking transactions may have jeopardize the efficiency of our banks.

Table 3: Technical Efficiency of Local Commercial Banks in Malaysia: 1990-2005

eISSN:2600-7920
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TECHNICAL EFFICIENCY

YEAR	Southern	Maybank	Public	Affin	EON	RHB	HongLeong	CIMB	MEAN
1990	1.000	0.800	0.922	1.000	0.922	1.000	1.000	0.978	0.956
1991	1.000	0.892	0.775	1.000	1.000	1.000	1.000	0.881	0.974
1992	1.000	1.000	0.952	1.000	0.959	1.000	1.000	0.979	0.988
1993	1.000	1.000	1.000	1.000	0.927	1.000	1.000	0.887	0.963
1994	1.000	1.000	1.000	1.000	0.815	1.000	1.000	0.924	0.964
1995	1.000	0.953	0.942	1.000	0.893	1.000	1.000	0.997	0.987
1996	1.000	1.000	0.942	1.000	0.959	1.000	1.000	1.000	0.971
1997	1.000	0.938	0.843	1.000	0.990	0.995	1.000	1.000	0.990
1998	1.000	1.000	1.000	1.000	0.923	1.000	1.000	1.000	0.992
1999	1.000	1.000	0.936	1.000	1.000	1.000	1.000	1.000	0.997
2000	1.000	1.000	1.000	1.000	0.977	1.000	1.000	0.994	0.972
2001	1.000	1.000	0.939	0.970	0.933	1.000	1.000	1.000	0.992
2002	1.000	1.000	0.956	0.943	0.879	1.000	1.000	1.000	0.998
2003	1.000	1.000	1.000	0.939	1.000	1.000	0.997	1.000	0.999
2004	1.000	1.000	1.000	0.986	1.000	1.000	1.000	1.000	1.000
2005	1.000	1.000	1.000	0.990	1.000	1.000	0.965	0.951	0.980

eISSN:2600-7920
INTI JOURNAL
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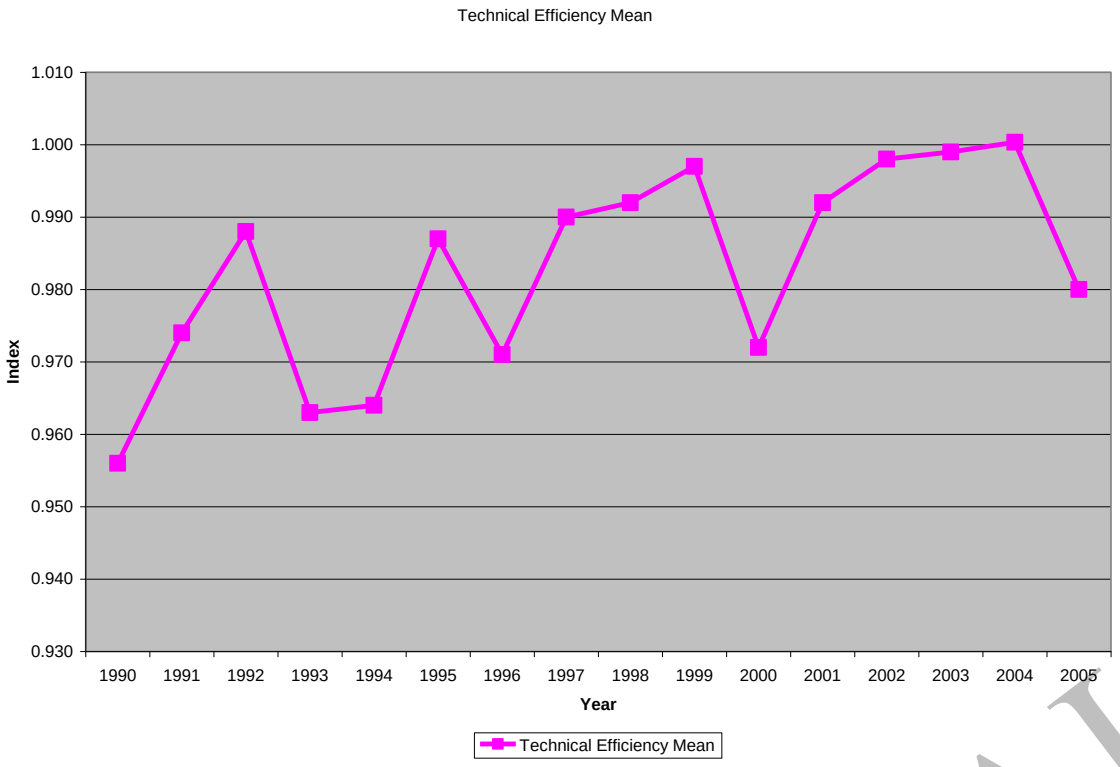

Figure 2: Average Technical Efficiency of Local Commercial Banks, 1990-2005

Comparing the result of technical change and pure efficiency change in Table 4, it shows that the local commercial banks are efficient in pure efficiency but lack of inefficiency mainly from technical change. For instance, there are five banks that score efficiency index equal or above unity in PECH which are Southern, Maybank, RHB, HongLeong and CIMB. Affin and EON do not score perfect index in pure efficiency change only in 2001 and 2000, respectively. From the mean score in each year, the same years has been notified to have inefficient index which are 1997 and 2001.

The cumulated productivity and its component are reported in Table 5. It may be observed from the table that the overall efficiency (average over all local commercial banks) was 0.3 percent higher. On the other hand, average technology index (over all industries) decrease over the same time period. Meanwhile technical change and Malmquist TFP index recorded the highest (2.308 and 2.267, respectively) after the merger took place. Again, from the Malmquist Index summary of firms means, it shows that the decreased of efficiency for AFFIN is further worsen with 4 percent decline in TECHCT which resulted in TFP loss of 4.1 percent.

Table 6 presented the average Malmquist Index summary of local commercial banks means from 1990 to 2005. From Table 6, it can be seen that all banks under the study are efficient, except for Affin which the inefficiency is very minimal, 1 percent. This shows that, in general, from 1990 to 2005, commercial banks in Malaysia are efficient. The source of efficiency comes from pure efficiency change rather than due to technical change. Yet, the result of total factor productivity shows do not reach the productivity level of unity except for Maybank, the leading anchor bank in Malaysia.

Southern Banks are efficient in all years while other banks, the result varies between years. Meanwhile, further analysis of the result shows the mean efficiency change of banks in 1994, 1997, 2001 and 2002 are below unity. This could be due to economic conditions in those years where in 1997 there is a financial crisis, while in 2001; the banks are re-positioning their operations and activities after the merger process.

Only 2 local commercial banks in Malaysia recorded TFP growth over the period of this study. RHB followed by MAYBANK witnessed maximum technological progress. The slowest technical progress took place in AFFIN and CIMB.

The result for the overall sluggish productivity growth in Malaysian local commercial banks can be supported by the fact that the financial crisis in 1997 caused a sharp reduction in productivity. Some local banks are facing with financial distress and then come the merger move instructed by the Central Bank to rescue and restore the stability as well as to prepare the banks towards financial globalization in the coming years. Productivity seems to improve, especially in 2001. Yet, after that, it deteriorates again, due to another move by the central banks to further consolidate the local banks.

Table 4: Efficiency, Technical, Pure Technical and TFP Change in Malaysian Local Commercial Banks: 1990-2005

4A. EFFICIENCY CHANGE (EFFCH)

YEAR	Southern	Maybank	Public	Affin	EON	RHB	HongLeong	CIMBB	MEAN
1991	1.000	1.115	0.841	1.000	1.084	1.000	1.000	1.014	1.004
1992	1.000	1.121	1.228	1.000	0.959	1.000	1.000	0.901	1.022
1993	1.000	1.000	1.050	1.000	0.966	1.000	1.000	1.110	1.015
1994	1.000	1.000	1.000	1.000	0.879	1.000	1.000	0.907	*0.972*
1995	1.000	0.953	0.942	1.000	1.095	1.000	1.000	1.042	1.003
1996	1.000	1.050	1.000	1.000	1.074	1.000	1.000	1.079	1.025
1997	1.000	0.938	0.895	1.000	1.032	0.995	1.000	1.003	*0.982*
1998	1.000	1.066	1.186	1.000	0.932	1.005	1.000	1.000	1.021
1999	1.000	1.000	0.936	1.000	1.084	1.000	1.000	1.000	1.002
2000	1.000	1.000	1.068	1.000	0.977	1.000	1.000	1.000	1.005
2001	1.000	1.000	0.939	0.970	0.956	1.000	1.000	0.994	*0.982*
2002	1.000	1.000	1.019	0.972	0.942	1.000	1.000	1.006	*0.992*
2003	1.000	1.000	1.046	0.996	1.138	1.000	1.000	1.000	1.021
2004	1.000	1.000	1.000	1.050	1.000	1.000	0.997	1.000	1.006
2005	1.000	1.000	1.000	1.004	1.000	1.000	1.003	1.000	1.001

4B. TECHNICAL CHANGE (TECHCH)

YEAR	Southern	Maybank	Public	Affin	EON	RHB	HongLeong	CIMBB	MEAN
1991	1.057	0.957	1.115	1.086	1.098	1.057	0.971	0.973	1.038
1992	1.033	0.984	0.891	0.861	0.749	1.02	0.832	0.925	0.907
1993	0.991	0.985	1.058	0.84	1.097	0.953	0.936	0.974	0.976
1994	1.038	0.944	0.839	0.973	1.249	1.046	1.027	1.035	1.013
1995	0.835	1.001	0.882	1.104	1.056	0.981	1.025	1.054	0.989
1996	0.905	1.198	1.058	1.007	0.962	1.098	0.933	1.012	1.018
1997	0.853	0.884	1.068	1.047	0.985	1.188	0.967	3.975	1.181
1998	0.873	0.888	0.877	0.881	0.959	1.18	0.883	0.373	0.829
1999	1.137	0.961	0.977	0.856	0.865	0.907	1.02	0.926	0.952
2000	1.035	0.877	0.877	0.819	0.921	0.957	0.955	0.74	0.893
2001	1.029	0.978	0.984	1.043	1.001	9.184	1.505	0.943	2.308
2002	1.014	0.963	1.004	0.968	0.965	0.002	0.64	0.947	0.422
2003	1.135	1.164	1.317	0.951	0.938	1.035	5.058	0.949	1.291
2004	1.017	0.992	1.074	0.988	1.119	1.08	0.302	1.037	0.893
2005	1.09	1.061	0.848	1.034	0.959	0.945	1.075	1.04	1.003

4C. PURE EFFICIENCY CHANGE (PECH)

YEAR	Southern	Maybank	Public	Affin	EON	RHB	HongLeong	CIMBB	MEAN
1991	1.000	1.000	0.866	1.000	1.000	1.000	1.000	1.000	0.982

1992	1.000	1.000	1.155	1.000	1.000	1.000	1.000	1.000	1.018
1993	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1994	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1995	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1996	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1997	1.000	1.000	0.902	1.000	1.000	1.000	1.000	1.000	0.987
1998	1.000	1.000	1.109	1.000	1.000	1.000	1.000	1.000	1.013
1999	1.000	1.000	0.937	1.000	1.000	1.000	1.000	1.000	0.992
2000	1.000	1.000	1.067	1.000	0.977	1.000	1.000	1.000	1.005
2001	1.000	1.000	0.943	0.974	1.024	1.000	1.000	1.000	0.992
2002	1.000	1.000	1.049	0.968	1.000	1.000	1.000	1.000	1.002
2003	1.000	1.000	1.011	1.060	1.000	1.000	1.000	1.000	1.009
2004	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
2005	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

4D. SCALE EFFICIENCY CHANGE (SECH)

YEAR	Southern	Maybank	Public	Affin	EON	RHB	HongLeong	CIMBB	MEAN
1991	1.000	1.115	0.971	1.000	1.084	1.000	1.000	1.014	1.022
1992	1.000	1.121	1.063	1.000	0.959	1.000	1.000	0.901	1.004
1993	1.000	1.000	1.050	1.000	0.966	1.000	1.000	1.110	1.015
1994	1.000	1.000	1.000	1.000	0.879	1.000	1.000	0.907	0.972

1995	1.000	0.953	0.942	1.000	1.095	1.000	1.000	1.042	1.003
1996	1.000	1.050	1.000	1.000	1.074	1.000	1.000	1.079	1.025
1997	1.000	0.938	0.993	1.000	1.032	0.995	1.000	1.003	0.995
1998	1.000	1.066	1.069	1.000	0.932	1.005	1.000	1.000	1.008
1999	1.000	1.000	0.999	1.000	1.084	1.000	1.000	1.000	1.010
2000	1.000	1.000	1.001	1.000	1.000	1.000	1.000	1.000	1.000
2001	1.000	1.000	0.995	0.995	0.933	1.000	1.000	0.994	0.990
2002	1.000	1.000	0.971	1.004	0.942	1.000	1.000	1.006	0.990
2003	1.000	1.000	1.035	0.939	1.138	1.000	1.000	1.000	1.013
2004	1.000	1.000	1.000	1.050	1.000	1.000	0.997	1.000	1.006
2005	1.000	1.000	1.000	1.004	1.000	1.000	1.003	1.000	1.001

4E. MALMQUIST TFP CHANGE (TFPCH)

YEAR	Southern	Maybank	Public	Affin	EON	RHB	HongLeong	CIMBB	MEAN
1991	1.057	1.067	0.938	1.086	1.190	1.057	0.971	0.987	1.042
1992	1.033	1.103	1.094	0.861	0.718	1.020	0.832	0.833	0.927
1993	0.991	0.985	1.111	0.840	1.060	0.953	0.936	1.081	0.991
1994	1.038	0.944	0.839	0.973	1.098	1.046	1.027	0.939	0.985
1995	0.835	0.954	0.831	1.104	1.157	0.981	1.025	1.099	0.991
1996	0.905	1.257	1.058	1.007	1.033	1.098	0.933	1.091	1.043
1997	0.853	0.828	0.957	1.047	1.017	1.182	0.967	3.987	1.160
1998	0.873	0.947	1.039	0.881	0.894	1.186	0.883	0.373	0.847

1999	1.137	0.961	0.915	0.856	0.938	0.907	1.020	0.926	0.954
2000	1.035	0.877	0.937	0.819	0.899	0.957	0.955	0.740	0.898
2001	1.029	0.978	0.923	1.012	0.956	9.184	1.505	0.938	2.267
2002	1.014	0.963	1.023	0.941	0.909	0.002	0.640	0.952	0.418
2003	1.135	1.164	1.377	0.947	1.068	1.035	5.058	0.949	1.319
2004	1.017	0.992	1.074	1.038	1.119	1.080	0.301	1.037	0.899
2005	1.090	1.061	0.848	1.038	0.959	0.945	1.079	1.040	1.004

Table 5: MALMQUIST INDEX SUMMARY OF ANNUAL MEANS

	EFFCH	TECHCT	PECH	SECH	TFPCH
1991	1.004	1.038	0.982	1.022	1.042
1992	1.022	0.907	1.018	1.004	0.927
1993	1.015	0.976	1.000	1.015	0.991
1994	0.972	1.013	1.000	0.972	0.985
1995	1.003	0.989	1.000	1.003	0.991
1996	1.025	1.018	1.000	1.025	1.043
1997	0.982	1.181	0.987	0.995	1.160
1998	1.021	0.829	1.013	1.008	0.847
1999	1.002	0.952	0.992	1.010	0.954
2000	1.005	0.893	1.005	1.000	0.898
2001	0.982	2.308	0.992	0.990	2.267
2002	0.992	0.422	1.002	0.990	0.418
2003	1.021	1.291	1.009	1.013	1.319
2004	1.006	0.893	1.000	1.006	0.899
2005	1.001	1.003	1.000	1.001	1.004
MEAN	**1.003**	**0.991**	**1.000**	**1.003**	**0.995**

EFFC = Efficiency Change
TECHTC = Technology Change
PECH = Pure Efficiency Change
SECH = Scale Efficiency Change
TFPCH = Total Factor Productivity Change

Table 6 MALMQUIST INDEX SUMMARY OF FIRM MEANS

FIRM	EFFCH	TECHCT	PECH	SECH	TFPCH
Southern	1.000	0.998	1.000	1.000	0.998
Maybank	1.015	0.985	1.000	1.015	1.000
Public	1.005	0.984	1.000	1.005	0.989

Affin	0.999	0.960	1.000	0.999	0.959
EON	1.005	0.988	1.000	1.005	0.994
RHB	1.000	1.026	1.000	1.000	1.026
HongLeong	1.000	0.999	1.000	1.000	0.999
CIMBB	1.002	0.993	1.000	1.002	0.995
MEAN	**1.003**	**0.991**	**1.000**	**1.003**	**0.995**

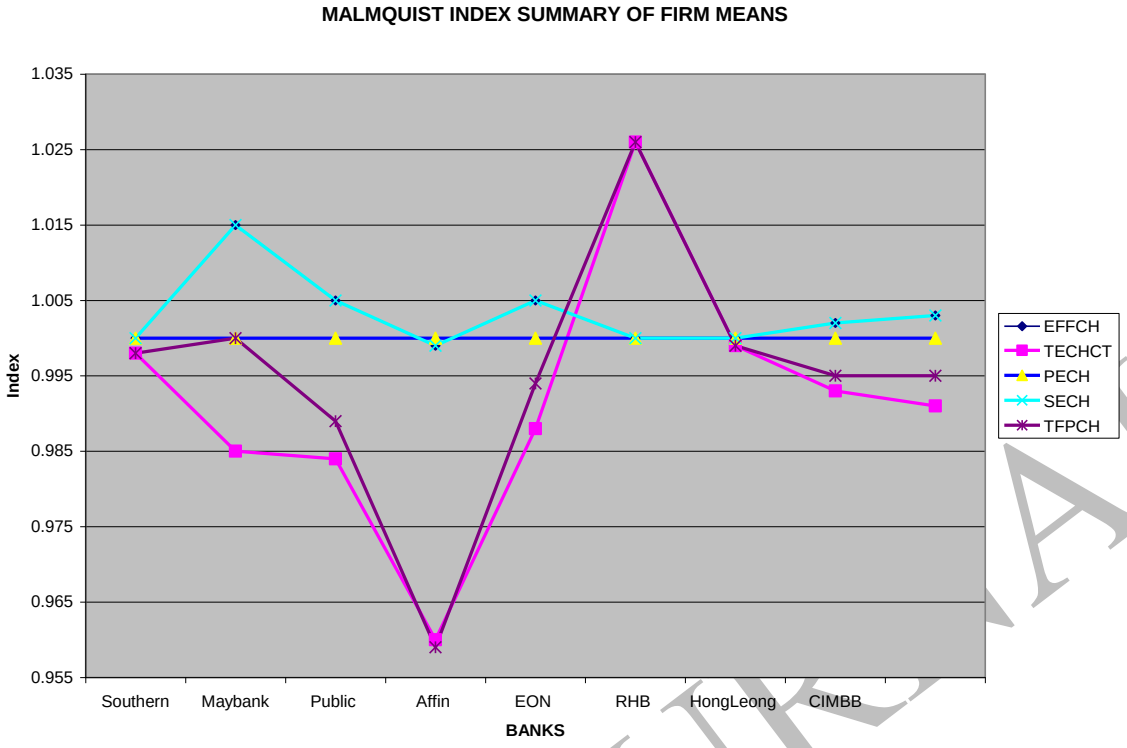

Figure 3: Productivity Growth Amongst Local Commercial Banks: Summary of firm Means

Conclusions

The consolidation program for the domestic banking sector was a necessary prerequisite to enhance the sector's capacity to compete. Size alone, however, is not a sufficient condition that will result in producing efficient and competitive banks and it does not offer guarantee of success. Being a large and strong bank is however, an important enabler to achieving enough scale to be able to invest in cutting-edge technology and management systems and to attract the talent required to compete with the best players in the market. Domestic banking institutions must be able to meet the range of products offered by foreign competitors. But the larger scale and the wider range of activities will demand stronger management teams. With the completion of the merger program in December 2000, the Malaysian banking groups are at various stages in building up their management team and enhancing corporate governance.

Using a non-parametric Data Envelopment Analysis (DEA), we measure the total factor productivity (TFP) and its efficiency component of eight local commercial banks in Malaysia from

1990 to 2006 at individual companies' level. The fact that productivity growth is a major source of overall economic growth and welfare improvement of both consumers and producers, it is important to understand and measure the level of productivity of each decision-making unit.
For the pre-merger analysis, the findings indicate that even though there were many finance companies, yet they have not yet achieved the critical size and not fully productive and efficient. Generally, the results support the Bank Negara calls for bank and finance companies consolidation to develop a sound and strong financial institutions driven by the desire to increase global presence as well as to maximize economies of scale and the scope of activities.

For the commercial banks analysis, we found that on average, across all local commercial banks and over the entire period of study, productivity decreased at an annual rate of 0.3 percent. In addition, almost all productivity deterioration came from technical efficiency rather than improvement in efficiency; the former decreased by 0.3 percent while the later maintained at unity level. The performance of individual local commercial banks varied from one or two outperformed the other mainly because they have larger total assets. local commercial banks are recommended to provide better services to stay competitive. Individual local commercial banks s needs to strive to reallocate their existing resources and avoid wastage in order to increase their technical efficiency. The result of this study thus supports for the Government call for the financial consolidation. Yet, regular changes in the management of the banks and transferring of banks ownership may jeopardize the productivity of our local banks.

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eISSN:2600-7920
INTI JOURNAL
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Appendix 1
List of Banking Institutions (July 2017)

Bank-Bank Perdagangan *Commercial Banks*	Bank-bank Islam *Islamic Banks*	Bank Pelaburan *Investment Banks*
1. Affin Bank Berhad	1. Affin Islamic Bank Berhad	1. Affin Hwang Investment Bank Berhad
2. Alliance Bank Malaysia Berhad	2. Al Rajhi Banking & Investment Corporation (Malaysia) Berhad	2. Alliance Investment Bank Berhad
3. AmBank (M) Berhad	3. Alliance Islamic Bank Berhad	3. AmInvestment Bank Berhad
4. Bangkok Bank Berhad	4. AmIslamic Bank Berhad	4. CIMB Investment Bank Berhad
5. Bank of America Malaysia Berhad	5. Bank Islam Malaysia Berhad	5. Hong Leong Investment Bank Berhad
6. Bank of China (Malaysia) Berhad	6. Bank Muamalat Malaysia Berhad	6. KAF Investment Bank Berhad
7. BNP Paribas Malaysia Berhad	7. CIMB Islamic Bank Berhad	7. Kenanga Investment Bank Berhad
8. China Construction Bank (Malaysia) Berhad	8. Hong Leong Islamic Bank Berhad	8. Maybank Investment Bank Berhad
9. CIMB Bank Berhad	9. HSBC Amanah Malaysia Berhad	9. MIDF Amanah Investment Bank Berhad
10. Citibank Berhad	10. Kuwait Finance House (Malaysia) Berhad	10. Public Investment Bank Berhad
11. Deutsche Bank (Malaysia) Berhad	11. Maybank Islamic Berhad	11. RHB Investment Bank Berhad
12. Hong Leong Bank Berhad	12. MBSB Bank Berhad	
13. HSBC Bank Malaysia Berhad	13. OCBC Al-Amin Bank Berhad	
14. India International Bank Malaysia Berhad	14. Public Islamic Bank Berhad	

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Industrial and Commercial Bank of China (Malaysia) Berhad	RHB Islamic Bank Berhad
J.P. Morgan Chase Bank Berhad	Standard Chartered Saadiq Berhad
Malayan Banking Berhad	
Mizuho Bank (Malaysia) Berhad	
MUFG Bank (Malaysia) Berhad	
National Bank of Abu Dhabi Malaysia Berhad	
OCBC Bank (Malaysia) Berhad	
Public Bank Berhad	
RHB Bank Berhad	
Standard Chartered Bank Malaysia Berhad	
Sumitomo Mitsui Banking Corporation Malaysia Berhad	
The Bank of Nova Scotia Berhad	
United Overseas Bank (Malaysia) Berhad	

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eISSN:2600-7920
INTI JOURNAL
Vol.1, 2018 (34)