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The Efficiency of Non-Bank Financial Institutions: Empirical Evidence from Malaysia

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Abstract

By applying the non-parametric Data Envelopment Analysis (DEA) method this paper attempts to investigate the efficiency of Malaysian Non-Bank Financial Institutions (NBFIs), during the period of 2000-2004. Our results suggest that the merchant banks have exhibited mean overall efficiency of 78.1% while the finance companies' mean overall efficiency was 91.3%. During the period of study, our results suggest that pure technical inefficiency rather than scale inefficiency has largely resulted in Malaysian NBFIs overall inefficiency. Examination of the sample of 80 observations over the five-year period revealed that while, on average, 28.75% of all Malaysian NBFIs were operating at CRS, the majority, 71.25%, was scale inefficient (operating at DRS or IRS). We have further employed the Spearman and Pearson correlation coefficients and found that PTE is more related to OE than SE, confirming the dominant effect of pure technical efficiency in determining the overall efficiency of Malaysian NBFIs. Our results from the Spearman and Pearson correlation coefficients also suggest that overall efficiency is positively and significantly associated with all other efficiency measures. We also found that size and market share have negative effects on Malaysian NBFIs overall and scale efficiency while it has positive relationship to pure technical efficiency though not statistically significant. We have also found positive and significant relationship between overall and pure technical efficiency and overhead expenses/total assets, which imply that there was expense preference behaviour among the more managerially efficient Malaysian NBFIs. Finally, our results suggest that the more efficient NBFIs tend to be more profitable.

Keywords: Non-Bank Financial Institutions, Data Envelopment Analysis (DEA), Malaysia
JEL Classification: G21; G28

1.0. Introduction

Given the substantial task of a non-bank financial sector, it is worth raising the issue of why it matters. In particular, since Gerschenkron (1962) classic study emphasised the role of the banking systems in the economic development of Germany, France and Italy in the nineteenth century, it may appear that the need for a non-bank financial sector is largely redundant in the specific circumstances of the developing economies. However, there are two main reasons why the existence of Non-Bank Financial Institutions (NBFIs) matters: one concerns economic development and the other relates to financial stability.

In the first place, banks offer assets (deposits) that claim to be capital certain. If this promise is to be honoured, then there must be limits to the range and nature of assets that a bank can reasonably take on to its balance sheets. Notwithstanding the existence of universal banking in many parts of the world, (that is, banks also engaged in securities market activities), this consideration implies that bank-based financial system will tend to have a smaller range of equity-type assets than those with a more broadly based structure including a wide range of NBFIs. More generally, NBFIs play a range of roles that are not suitable for banks and through their provision of liquidity, divisibility, informational efficiencies and risk pooling services they broaden the spectrum of risks available to investors. In this way, they encourage and improve the efficiency of investment and savings. Through the provision of a broader range of financial instruments, they are able to foster a risk management culture by attracting customers who are least able to bear risks and fill the gaps in financial services that otherwise occur in bank-based financial systems.

Secondly, from the view of financial stability, in a financial sector in which NBFIs are comparatively undeveloped, banks will inevitably be required to assume risks that otherwise might be borne by the stock market, collective investment schemes or insurance companies. However, there is basic incompatibility between the kinds of financial contracts offered by the banks and those offered by the financial institutions. Thus, banks are more likely to fail as a result. One way of minimising financial fragility in the developing economies may be to encourage a diversity of financial markets and institutions, where investors are able to assume a variety of risks outside the banking system itself. Without this diversity, there is a tendency for all risks to be bundled within the balance sheet of the banking system, which more likely may lead to severe financial crises. This point was widely noted by policymakers in their analysis of the lessons of the Asian currency crisis, for instance. As Greenspan (1999) pointed out, the impact of the currency crisis in Thailand might have been significantly less severe if some of the risks borne by the Thai banks had instead been borne by the capital markets. Thus, there are very good reasons to perform studies on the non-bank financial sector in parallel with the banking system with regards to their efficiency and productivity.

The importance of investigating the efficiency and productivity of Malaysian NBFIs could be best justified by the fact that in Malaysia, the NBFIs play an important role in complementing the facilities offered by the commercial banks. The existence of Banking Financial Institutions (BFIs) and NBFIs supported by efficient money and capital markets, keep the financial sector complete and enhance the overall growth of the economy.

Although Malaysia is moving towards a full market based economy, its capital markets are still at its infancy. As a sophisticated and well-developed capital market is considered as the hallmark for a market based economy worldwide, study of this nature is particularly important as the health and development of the capital market rely largely on the health of the NBFIs. The NBFIs are the key players in the development of the capital market in Malaysia. Hence, efficient and productive NBFIs are expected to enhance the Malaysian capital market in its pursuit to move towards a full market based economy.

By applying the non-parametric Data Envelopment Analysis (DEA) methodology, we attempt to investigate the efficiency of Malaysian non-bank financial institutions during the period of 2000-2004. The preferred non-parametric Data Envelopment Analysis (DEA) methodology has allowed us to distinguish between three different types of efficiency, such as technical, pure technical and scale efficiencies. Additionally we have performed a series of parametric and non-parametric tests to examine whether the merchant banks and finance companies were drawn from the same population. Finally, we have employed Spearman Rho Rank-Order and the parametric Pearson correlation coefficients to investigate the association between the efficiency scores derived from the DEA results with the traditional accounting ratios.

Our study is confined to the 20 NBFIs, which were issued licences by the central bank of Malaysia, Bank Negara Malaysia (BNM) up to 2004 under the Banking and Financial Institutions Act, 1989 (BAFIA). The NBFIs in Malaysia consist primarily the finance companies and merchant banks. This paper also aimed to fill a demanding gap in the literature on efficiency and productivity of

Malaysian financial institutions, by providing the most recent evidence on the productivity changes of Malaysian NBFIs.

During the period of study, our results suggest that, the Malaysian merchant banks have exhibited mean overall or technical efficiency of 78.1% while the finance companies have exhibited higher mean overall efficiency of 91.3%. In other words, during the period of study, the merchant banks could have produced the same amount of outputs by only using 78.1% of the inputs that they currently employ. Similarly, the finance companies could have reduced 8.7% of the amount of inputs they employ currently without affecting the amount of outputs that they currently produce. Overall, our results suggest that pure technical inefficiency dominates the scale inefficiency effects in determining Malaysian NBFIs overall or technical efficiency. Further, most of our results from the parametric and non-parametric tests rejected the null hypothesis that the merchant banks and the finance companies were drawn from the same population suggesting that it was appropriate to construct a separate frontier for both the merchant banks and finance companies.

To further complement the results of the efficiency measures, we have correlated various accounting measures of bank performance with the efficiency scores derived from the DEA. Our results from both the Spearman and the Pearson correlation coefficients suggest that overall efficiency is positively and significantly associated with other efficiency measures namely PTE and SE, while PTE was more related to OE than SE, confirming the dominant effect of pure technical inefficiency in determining the overall efficiency of Malaysian NBFIs. Our results from both the Spearman and the Pearson correlation coefficients suggest that size and market share have negative effects on Malaysian NBFIs overall and scale efficiency. On the other hand, we found that that both size and market share have positive relationship with pure technical efficiency though not statistically significant. Interestingly, we have also found positively and significant relationship between overall and pure technical efficiency with overhead expenses/total assets. The positive and significant relationship suggests that the more managerially efficient NBFIs tend to opt for the expense preference behaviour in that they tend to invest more in quality workforces and systems, which at most times command higher costs. During the period of study our results suggest that the more efficient NBFIs tend to be more profitable. Finally, We have also found positive and significant relationship between ownership with overall and pure technical efficiency. The results support our decision to construct different frontiers for the merchant banks and the finance companies.

This paper makes significant contributions on at least three fronts. Firstly, this will be the first study to investigate the efficiency of NBFIs in a developing economy. Despite the significance of the NBFI sector towards the economic developments of the developing economies, studies that attempt to investigate this issue is relatively scarce. Hence, to the best of our knowledge, the paper would be the first to address this issue. Secondly, the period chosen has witnessed the intensification of competition in the Malaysian banking sector, resulting from the Malaysian government's move to further liberalise the banking system ahead of the opening of the financial sector to foreign competitions. Thirdly, the period chosen has also witnessed the growing preference of Malaysian corporate sector in issuing more corporate debt securities in the capital markets instead of opting for the more traditional bank loan financing. This renders the importance of the NBFIs efficiency and productivity issues from both the policymakers and public point of views.

This paper is set out as follows: The second section will provide a brief overview of the Malaysian financial system. Section 3 reviews the main literature, while Section 4 outlines the approaches to the measurement and estimation of productivity change. Section 5 discusses the results and finally Section 6 concludes.

2.0. Brief Overview of the Malaysian Financial System

The Malaysian financial system can broadly be divided into the banking system and the non-bank financial intermediaries. These two banking institutions are different with respect to their activities. For a well functioning financial market along with the BFIs, NBFIs have an important role to uplift the

economic activity. These two financial sectors can simultaneously build up and strengthen the financial system of the country. The banking system is the largest component, accounting for approximately 70% of the total assets of the financial system. The banking system can be further divided into three main groups namely the commercial banks, finance companies and the merchant banks.

The commercial banks are the main players in the banking system. They are the largest and most significant providers of funds in the banking system. As at end-2003, there were 10 domestically incorporated and 13 locally incorporated foreign commercial banks in Malaysia. Legally, Malaysian commercial banks enjoy the widest scope of permissible activities and are able to engage in a full range of banking services. Traditionally, Malaysian commercial banks main functions include retail-banking services, trade financing facilities, treasury services, cross border payment services and custody services. Apart from the more traditional activities, Malaysian commercial banks are also allowed to engage in foreign exchange activities i.e. to buy, sell and lend foreign currencies and the only financial institutions allowed to provide current account facilities.

Finance companies formed the second largest group of deposit taking institutions in Malaysia. There were 10 domestically incorporated finance companies in Malaysia as at end-2003. Traditionally, finance companies specialise in consumption credit, comprising mainly of hire purchase financing, leasing, housing loans, block discounting and secured personal loans. The finance companies are allowed to accept savings and fixed deposits from the public, but are prohibited from providing current account facilities. They are also not allowed to engage in foreign exchange transactions compared to the commercial banks. During the later part of the last decade, the finance companies began to expand its traditional role in retail financing to include wholesale banking as well.

Merchant banks emerged in the Malaysian banking scene in the late 1970s, marking an important milestone in the development of the financial system alongside of the corporate development of the country. As the country's small businesses prospered and grew into large corporations, the banking needs of the nation became larger and more sophisticated, requiring more bulk financing and complex banking services.

Merchant banks filled the need for such services by complementing the facilities offered by commercial banks which were at times more focused on providing short-term credit for working capital and trade financing. They play a role in the short-term money market and capital raising activities such as financing, syndicating, corporate financing, providing management advisory services, arranging for the issue and listing of shares as well as managing investment portfolio. As at end-2003, there were 10 merchant banks in Malaysia and all were domestically controlled institutions.

Top the best of our knowledge, despite having undergone tremendous development over the past two decades, there has been no microeconomic study performed in the area of research on the Malaysian NBFIs. Hence, this study would be the first to provide important insights into the efficiency change among Malaysian NBFIs.

3.0. Related Studies

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

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

of the banks were relatively small, suggesting that the sources of inefficiency to be pure technical rather than scale.

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

Despite substantial studies performed on the developed economies banking industry with regard to the efficiency and productivity of financial institutions, there are only a handful of studies performed on the Malaysian banking industry partly due to the lack of available data sources and the small sample of banks. As pointed out by Kwan (2003), the lack of research on the efficiency of Asian banks was due to the lack of publicly available data for non-publicly traded Asian financial institutions. The most notable research conducted on Malaysian banks' productivity are by Krishnasamy *et al*. (2004) and Sufian and Ibrahim (2005).

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

More recently, Sufian and Ibrahim (2005) applied the Malmquist Productivity Index method to investigate the extent of off-balance sheet (OBS) items in explaining Malaysian banks total factor productivity changes. They found that the inclusion of OBS items resulted in an increase in the estimated productivity levels of all banks in the sample during the period of study. They also suggested that the impacts were more pronounced on Malaysian banks technological change rather than efficiency change.

4.0. Methodology

The term Data Envelopment Analysis (DEA) was first introduced by Charnes, Cooper and Rhodes (1978), (hereafter CCR), to measure the efficiency of each Decision Making Units (DMUs), that is obtained as a maximum of a ratio of weighted outputs to weighted inputs. This denotes that the more the output produced from given inputs, the more efficient is the production. The weights for the ratio are determined by a restriction that the similar ratios for every DMU have to be less than or equal to unity. This definition of efficiency measure allows multiple outputs and inputs without requiring pre-assigned weights. Multiple inputs and outputs are reduced to single 'virtual' input and single 'virtual' output by optimal weights. The efficiency measure is then a function of multipliers of the 'virtual' input-output combination.

The CCR model presupposes that there is no significant relationship between the scale of operations and efficiency by assuming constant returns to scale (CRS), and it delivers the overall technical efficiency (OTE). The CRS assumption is only justifiable when all DMUs are operating at an optimal scale. However, firms or DMUs in practice might face either economies or diseconomies of

scale. Thus, if one makes the CRS assumption when not all DMUs are operating at the optimal scale, the computed measures of technical efficiency will be contaminated with scale efficiencies.

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

$$min\lambda_0\ \theta_0 \qquad (1)$$

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

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

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

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

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

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

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

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

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

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

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

Amongst the strengths of the DEA is that, DEA is less data demanding as it works fine with small sample size. The small sample size is among other reasons, which leads us to DEA as the tool of choice for evaluating Malaysian NBFIs X-efficiency. Furthermore, DEA does not require a preconceived structure or specific functional form to be imposed on the data in identifying and determining the efficient frontier, error and inefficiency structures of the DMUs[1] (Evanoff and Israelvich, 1991, Grifell-Tatje and Lovell, 1997, Bauer *et al*., 1998). Hababou (2002) adds that it is better to adopt the DEA technique when it has been shown that a commonly agreed functional form

[1] Hababou (2002) and Avkiran (1999) provide a relatively thorough discussion of the merits and limits of the DEA.

relating inputs to outputs is difficult to prove or find. Such specific functional form is truly difficult to show for financial services entities. Avkiran (1999) acknowledges the edge of the DEA by stating that this technique allows the researchers to choose any kind of input and output of managerial interest, regardless of different measurement units. There is no need for standardisation[2].

Three useful features of DEA are first, each DMU is assigned a single efficiency score, hence allowing ranking amongst the DMUs in the sample. Second, it highlights the areas of improvement for each single DMU. For example, since a DMU is compared to a set of efficient DMUs with similar input-output configurations, the DMU in question is able to identify whether it has used input excessively or its output has been under-produced. Finally, there is possibility of making inferences on the DMUs general profile. We should be aware that the technique used here is a comparison between the production performances of each DMU to a set of efficiency DMUs. The set of efficiency DMUs is called the reference set. The owners of the DMUs may be interested to know which DMU frequently appears in this set. A DMU that appears more than others in this set is called the global leader. Clearly, this information gives huge benefits to the DMU owner, especially in positioning its entity in the market.

The main weakness of the DEA is that it assumes data are free from measurement errors. Furthermore, since efficiency is measured in a relative way, its analysis is confined to the sample set used. This means that an efficient DMU found in the analysis cannot be compared with other DMUs outside of the sample. The reason is simple. Each sample, separated, let us say, by year, represents a single frontier, which is constructed on the assumption of same technology. Therefore, comparing the efficiency measures of a DMU across time cannot be interpreted as technical progress but rather has to be taken as changes in efficiency (Canhoto and Dermine, 2003).

DEA can be use to derive measures of scale efficiency by using the variable returns to scale (VRS), or the BCC model, alongside the constant returns to scale (CRS), or the CCR model. Coelli *et al*. (1998) noted that the BCC model have been most commonly used since the beginning of the 1990s. A DEA model can be constructed either to minimise inputs or to maximise outputs. An input orientation aims at reducing the input amounts as much as possible while keeping at least the present output levels, while an output orientation aims at maximising output levels without increasing use of inputs (Cooper *et al*., 2000). The focus on costs in banking and the fact that outputs are inclined to be demand determined means that input-oriented models are most commonly used (Kumbhakar and Lozano Vivas, 2005).

As we are looking at relative efficiency, it is important for the DMUs to be sufficiently similar, so that comparisons are meaningful. This is particularly the case with DEA, where Dyson *et al*. (2001) have developed what they describe as a series of homogeneity assumptions. The first of these is that the DMUs the performance of which is being compared should be undertaking similar activities and producing comparable products and services so that a common set of outputs can be defined. The second homogeneity assumption is that a similar range of resources is available to all the units and they operate in a similar environment.

4.1. Data Sample, Inputs-Outputs Definition and the Choice of Variables

For the empirical analysis, *all* Malaysian Non-Bank Financial Institutions would be incorporated in the study. The annual balance sheets and income statements used to construct the variables for the empirical analysis were taken from published balance sheet information in annual reports of each individual NBFI. Four NBFIs have to be excluded from the study due to unavailability of data resulting from mergers and acquisitions.

The definition and measurement of inputs and outputs in the banking function remains a contentious issue among researchers. To determine what constitutes inputs and outputs of banks, one should first decide on the nature of banking technology. In the banking theory literature, there are two

[2] An additional advantage according to Canhoto and Dermine (2003) is that the DEA technique is preferred to parametric methods is when the sample size is small.

main approaches competing with each other in this regard: the production and intermediation approaches (Sealey and Lindley, 1977).

Under the production approach, a financial institution is defined as a producer of services for account holders, that is, they perform transactions on deposit accounts and process documents such as loans. Hence, according to this approach, the number of accounts or its related transactions is the best measure for output, while the number of employees and physical capital is considered as inputs. Previous studies that adopted this approach are among others by Sherman and Gold (1985), Ferrier and Lovell (1990) and Fried *et al*. (1993).

The intermediation approach on the other hand assumes that financial firms act as an intermediary between savers and borrowers and posits total loans and securities as outputs, whereas deposits along with labour and physical capital are defined as inputs. Previous banking efficiency studies that adopted this approach are among others Charnes *et al*. (1990), Bhattacharyya *et al*. (1997) and Sathye (2001).

For the purpose of this study, a variation of the intermediation approach or asset approach originally developed by Sealey and Lindley (1977) will be adopted in the definition of inputs and outputs used[3] . According to Berger and Humphrey (1997), the production approach might be more suitable for branch efficiency studies, as at most times bank branches basically process customer documents and bank funding, while investment decisions are mostly not under the control of branches.

The aim in the choice of variables for this study is to provide a parsimonious model and to avoid the use of unnecessary variables that may reduce the degree of freedom. All variables are measured in millions of Ringgit (RM). We model Malaysian NBFIs as a multi-product firms producing two outputs by employing three inputs. Accordingly, we assume Malaysian NBFIs produce Total Loans (*y1*) and Non-Interest Income (*y2*) by employing Total Deposits (*x1*) and Fixed Assets (*x2*).

Table 1: Descriptive Statistics for Inputs and Outputs

	2000 (RMb)	**2001(RMb)**	**2002 (RMb)**	**2003 (RMb)**	**2004 (RMb)**
Outputs					
Total Loans (y1)					
Min	172,048	179,370	136,731	89,774	136,552
Mean	4,089,029.44	4,195,137	4,952,955.06	5,122,363.75	5,259,250.63
Max	14,045,862	17,097,078	22,909,030	25,160,438	26,048,864
S.D	4,013,245.39	4,949,607.76	6,609,351.42	7,027,574.37	7,191,474.18
Other Income (y2)					
Min	1,080	799	939	534	3,730
Mean	60,217.69	63,605.25	57,418.13	69,020	71,603.63
Max	242,411	350,575	207,255	313,840	392,518
S.D	66,727.10	93,480.63	6,376,814	97,747.24	113,478.62
Inputs					
Total Deposits (x1)					
Min	58,302	88,858	113,195	63,782	108,898
Mean	4,123,328.44	4,291,041.44	5,039,194	5,032,300.94	5,237,107.88
Max	14,546,269	17,012,443	19,591,827	19,609,194	20,411,793
S.D	4,126,896.05	4,948,226.30	6,180,309.37	5,957,495.91	5,749,856.56
Fixed Assets (x2)					
Min		506,331	553,523	662,855	594,538
Mean		6,948,016.94	7,070,498.94	8,898,910.69	9,176,940.81
Max		20,186,180	23,625,038	32,529,566	33,618,318
S.D		6,354,506.67	6,717,443.03	9,076,978.74	8,936,914.42

[3] Humphrey (1985) presets an extended discussion of the alternative approaches over what a bank produces.

5.0. Results

The efficiency of Malaysian NBFIs was first examined by applying the DEA method for each year under investigation using a common frontier. We extend the analysis by examining the efficiency of merchant banks only, finance companies only and a pooled common frontier for all NBFIs, merchant banks and finance companies, for all years. Table 2 reports the sample statistics of the various efficiency scores of Malaysian NBFIs for the years 2000 (Panel A), 2001 (Panel B), 2002 (Panel C), 2003 (Panel D), 2004 (Panel E), Merchant Banks (Panel F), Finance Companies (Panel G) and All NBFIs All Years (Panel H). The results suggest that Malaysian NBFIs have exhibited mean overall efficiency score of 89.2% in year 2000 (Panel A), before recording the highest mean overall efficiency score of 89.9% in year 2001 (Panel B). The Malaysian NBFIs mean overall efficiency declined to 82.9% and 79.2% in years 2002 and 2003 (Panel C and Panel D) respectively, before improving to record overall efficiency of 81.3% in year 2004 (Panel E). The decomposition of overall efficiency into its pure technical and scale efficiency components suggest that pure technical inefficiency dominates scale inefficiency of Malaysian NBFIs during all the years under investigation. This implies that during the period of study, Malaysian NBFIs have been inefficient in controlling their costs rather than having been operating at the wrong scale of operations.

Table 2: Summary Statistics of Efficiency Measures

Efficiency Measures	Mean	Minimum	Maximum	Std. Dev.
Panel A: 2000				
Overall Efficiency	0.892	0.661	1.000	0.117
Pure Technical Efficiency	0.927	0.702	1.000	0.116
Scale Efficiency	0.963	0.882	1.000	0.041
Panel B: 2001				
Overall Efficiency	0.899	0.59	1.000	0.132
Pure Technical Efficiency	0.934	0.616	1.000	0.115
Scale Efficiency	0.955	0.82	1.000	0.050
Panel C: 2002				
Overall Efficiency	0.839	0.574	1.000	0.159
Pure Technical Efficiency	0.896	0.607	1.000	0.144
Scale Efficiency	0.935	0.825	1.000	0.061
Panel D: 2003				
Overall Efficiency	0.792	0.488	1.000	0.182
Pure Technical Efficiency	0.867	0.562	1.000	0.173
Scale Efficiency	0.911	0.769	1.000	0.077
Panel E: 2003				
Overall Efficiency	0.813	0.503	1.000	0.175
Pure Technical Efficiency	0.851	0.542	1.000	0.175
Scale Efficiency	0.955	0.819	1.000	0.054
Panel F: Merchant Banks Only				
Overall Efficiency	0.781	0.488	1.000	0.175
Pure Technical Efficiency	0.831	0.542	1.000	0.168
Scale Efficiency	0.937	0.769	1.000	0.063
Panel G: Finance Companies Only				
Overall Efficiency	0.913	0.590	1.000	0.101
Pure Technical Efficiency	0.959	0.616	1.000	0.086
Scale Efficiency	0.950	0.828	1.000	0.056
Panel H: All NBFIs All Years				
Overall Efficiency	0.847	0.488	1.000	0.157
Pure Technical Efficiency	0.895	0.542	1.000	0.147
Scale Efficiency	0.944	0.769	1.000	0.060

During the period of study, we have found that the Malaysian merchant banks (Panel E) have exhibited mean overall efficiency of 78.1%, suggesting mean input waste of 22.9%. In other words, the domestic banks could have produced the same amount of outputs by only using 78.1% of the amount of inputs they used. From Table 2 (Panel E) it is clear that pure technical inefficiency dominates scale inefficiency in determining the efficiency of Malaysian merchant banks during the period of study.

Our results from Table 2 (Panel F) suggest that Malaysian finance companies have exhibited higher mean overall efficiency of 91.3% compared to their merchant banks counterparts. In contrast to the merchant banks, our results suggest that the finance companies inefficiency were mainly attributed to scale rather than pure technical. Our findings suggest that the finance companies have exhibited higher pure technical and scale efficiency of 95.9% and 95.0% (merchant banks – 83.1% and 93.7%) respectively, suggesting that Malaysian finance companies were more managerially efficient in controlling their costs and have been operating at the right scale of operations compared to their merchant banks counterparts during the period of study.

The results for all NBFIs for all years (Table 3, Panel G) suggest that pure technical inefficiency was the dominant factor influencing Malaysian NBFIs efficiency. During the period 2000-2004, our results from Panel F suggest that, Malaysian NBFIs have exhibited mean overall (technical) efficiency of 84.7%. The decomposition of the overall efficiency into its pure technical and scale efficiency components suggest that the inefficiency could mainly be attributed to pure technical (10.5%) rather than scale (5.6%).

We now turn our discussion on the developments of the Malaysian NBFIs returns to scale. As Panel 1 of Table 3 shows, over the five-year period, the share of inefficient Malaysian NBFIs has witnessed an increasing trend, from 62.5% in year 2000 to 81.25% in year 2004. It is apparent from Panel 1 of Table 3 that, the number of Malaysian NBFIs experiencing economies of scale (IRS) has increased substantially from 2 (12.5%) in year 2000 to 5 (37.5%) in year 2004. The share of scale efficient banks (operating at CRS) has declined from 6 (35.7%) in year 2000, to only 3 (18.75%) in year 2004. On the other hand, the share of Malaysian NBFIs experiencing diseconomies of scale (DRS) has remained stable at 8 (50.0%) in years 2000 and 2001, declined to 5 (31.75%) in year 2002 before increasing again to 8 (50.0%) in years 2003 and 2004.

Table 3: Returns to Scale (RTS) in Malaysian Non-Bank Financial Institutions

Panel 1: Developments in RTS[a]										
RTS	**Years**									
	2000		**2002**		**2002**		**2003**		**2004**	
	No. of NBFIs	**% Share**	**No. of NBFIs**	**% Share**	**No. of NBFIs**	**% Share**	**No. of NBFIs**	**% Share**	**No. of NBFIs**	**% Share**
CRS	6	37.5	5	31.25	5	31.25	4	25.0	3	18.75
DRS	8	50.0	8	50.0	5	31.25	8	50.0	8	50.0
IRS	2	12.5	3	18.75	6	37.5	4	25.0	5	31.25
Total	**16**	**100.0**	**16**	**100.0**	**16**	**100.0**	**16**	**100.0**	**16**	**100.0**

Panel 2: RTS by Size[b]								
Size	**CRS**		**DRS**		**IRS**		**Total**	
	No. Of NBFIs	**% Share**	**No. Of NBFIs**	**% Share**	**No. Of NBFIs**	**% Share**	**No. Of NBFIs**	**% Share**
SML_NBFIs	13	16.25	9	11.25	19	23.75	41	51.25
MED_ NBFIs	6	7.5	7	8.75	0	0	13	16.25
LAR_ NBFIs	4	5.0	21	26.25	1	1.25	26	32.50
Total	**23**	**28.75**	**37**	**46.25**	**20**	**25.0**	**80**	**100.0**

[a] Panel 1 presents the trend in the RTS of Malaysian Non-Bank Financial Institutions by year. RTS are the increase in output that result from increasing all inputs by the same percentage. There are three possible cases. (1) Constant Returns to Scale (CRS), which arise when percentage change in outputs = percentage change in inputs; (2) Decreasing Returns to Scale (DRS), which occur when percentage change in outputs < percentage change in inputs; (3) Increasing Returns to Scale (IRS), which occurs when percentage change in outputs > percentage change in inputs. Over the years, 23 observations (28.75% of total 80 observations) belonged to the NBFIs that experienced CRS, 37 observations (46.25% of total 80 observations) belonged to the NBFIs that experienced DRS and 20 observations (25.0% of total 80 observations) belonged to the NBFIs that experienced IRS.

[b] Panel 2 provides the summary of overall RTS according to various size groups over the years 2000-2004. SML_NBFIs is defined as NBFIs with total assets < industry's Mean, MED_NBFIs is defined as NBFIs with total assets in the mean range, while LRG_NBFIs is defined as NBFIs with total assets > industry's mean. Over the years studied, 41 observations (51.25% of total 80 observations) belonged to SML_NBFIs of which 13 or 31.70% of 41 SML_NBFIs observations experienced CRS, 9 (21.95%) experienced DRS and 19 (46.35%) experienced IRS. 13 observations (16.25% of total 80 observations) belonged to MED_NBFIs, of which, 6 or 46.15% of 13 MED_NBFIs observations experienced CRS, 7 (53.85) experienced DRS and no MED_NBFI experienced IRS. 26 observations or 32.50% of total 80 observations belonged to LAR_NBFIs, of which 4 or 15.38% of 26 LAR_NBFIs observations experienced CRS, 21 (80.77%) experienced DRS and 1 (3.85%) experienced IRS

Panel 2 of Table 3 displays the returns to scale by size measured in billions of RM. Panel 2 of Table 3 presents the overall summary results from the sample of the 80 observations over the five-year period. Examination of Panel 2 of Table 3 revealed that while, on average, 23 or 28.75% of all Malaysian NBFIs were operating at CRS, the majority, 71.25%, were scale inefficient (operating at DRS or IRS). Of the scale inefficient NBFIs, 28 or 35.0% were small NBFIs, 7 or 8.75% were medium NBFIs and 22 or 27.5% were large NBFIs. Of the NBFIs experiencing DRS, 9 or 11.25% were small NBFIs and the majority, 28 or 35.0% were medium and large NBFIs (8.75% due to medium NBFIs and 26.25% due to large NBFIs). Whereas, of the NBFIs experiencing IRS, the majority 19 (23.75%) were small NBFIs and only 1 (1.25%) was large NBFI. As observed, the convexity of the frontier assures that NBFIs experiencing IRS were more frequently the smaller NBFIs. Our results thus congregate with earlier findings by among others Miller and Noulas (1996) and McAllister and McManus (1993). McAllister and McManus (1993) suggest that while small banks have generally exhibited IRS, the large banks on the other hand tend to exhibit DRS and at best CRS.

After examining the efficiency results, the issue of interest now is whether the two samples were drawn from the same population and whether the merchant banks and finance companies possessed the same technology. The null hypothesis tested would be that the merchant banks and the finance companies were drawn from the same population or environment. We tested the null hypothesis that merchant banks and finance companies were drawn from the same population and have identical technologies by using a series of parametric (ANOVA and t-test) and non-parametric (Kolmogorov-Smirnov and Mann-Whitney [Wilcoxon Rank-Sum]) tests. Based on most of the results presented in Table 4, we could reject the null hypothesis at the 0.05 levels of significance that the merchant banks and finance companies came from the same population and have identical technologies. This implies that, there is significant difference between the merchant banks and finance companies technologies (frontiers) and that it is appropriate to construct a combined frontier. Furthermore, the results from the Levene's test for equality of variances rejected the null hypothesis

that the variances among the merchant banks and finance companies were equal, implying that we could not assume the variances among merchant banks and finance companies to be equal.

Table 4: Summary of Parametric and Non-Parametric Tests for the Null Hypothesis that Merchant Bank (*mb*) and Finance Companies (*fc*) Possessed Identical Technologies (Frontiers)

	Test Groups			
	Parametric Test		**Non-Parametric Test**	
Individual Tests	Analysis of Variance (ANOVA) test	*t*-test	Kolmogorov-Smirnov [K-S] test	Mann-Whitney [Wilcoxon Rank-Sum] test
Hypotheses	$Mean_{mb} = Mean_{fc}$		$Distribution_{mb} = Distribution_{fc}$	$Median_{mb} = Median_{fc}$
Test Statistics	*F* (Prb > *F*)	*t* (Prb > *t*)	K-S (Prb > K-S)	z (Prb > z)
Overall Efficiency	8.809 (0.005)***	-2.968 (0.005)***	1.588 (0.013)**	-1.999(0.046)**
Pure Technical Efficiency	8.715 (0.005)***	-2.952 (0.005)***	1.299 (0.068)*	-2.451 (0.014)**
Scale Efficiency	0.570 (0.454)	-0.755 (0.454)	0.577 (0.893)	-0.417 (0.677)

Note: Test methodology follows among others, Aly *et al.* (1990), Elyasiani and Mehdian (1992) and Isik and Hassan (2002). Parametric (ANOVA and t-test) and Non-Parametric (Kolmogorov-Smirnov and Mann-Whitney) tests test the null hypothesis that domestic and foreign banks are drawn from the same efficiency population (environment).
The numbers in parentheses are the p-values associated with the relative test.
*** indicate significant at the 0.01 level
** indicates significant at the 0.05 level
* indicates significant at the 0.10 level

5.1. Consistency of the DEA Efficiency Scores

As suggested by Bauer *et al*. (1998), for the frontier based efficiency scores to be useful, the estimated scores should be positively correlated with the traditional non-frontier based measures of performance used by regulators, managers and industry consultants. Bauer *et al*. (1998) stated that positive rank-order correlations with these measures would give assurance that the frontier measures are not simply artificial products of the assumptions made regarding the underlying optimisation concept. In the spirit of Bauer *et al*. (1998), in order to complement the results of the efficiency measures, we have further correlated various accounting measures of financial institutions performance with the efficiency scores derived from the DEA model. We have used ROA (Net Income/Total Assets) and ROE (Net Income/Shareholders Equity) as proxy measures of NBFIs profitability, while OE/TA (Overhead Expenses/Total Assets) was entered into the equation as a proxy measure of expense preference behaviour among Malaysian NBFIs. LOGASS (Log of Total Assets) was used as a proxy measure of size and LOGLOANS (Log of Total Loans) was used as a proxy measure of market share. We have also entered an ownership dummy variable, OWN, to examine the relationship between ownership and the efficiency scores as well as the various proxy measures. Following among others, Isik and Hassan (2002), we have calculated both the rank-order Spearman and the parametric Pearson correlation coefficients to examine the possible relationship among the X-efficiency measures and accounting measures of performance. Both the Spearman and Pearson correlation coefficients are presented in Table 5. The null hypothesis is that the correlation coefficient between two variables is zero.

Table 5: Spearman Rho Rank Order [*s*] and Parametric Pearson [*p*] Correlation Coefficients among Efficiency Estimates and Proxy-Measures of Performance

Variables	Overall Efficiency	Pure Technical Efficiency	Scale Efficiency	OWN	ROA	ROE	OE/TA	LOGASS	LOGDEP
Overall Efficiency									
[*s*]	1.000	0.908***	0.690***	0.331***	0.034	0.129	0.326***	-0.012	-0.225*
[*p*]	1.000	0.937***	0.474***	0.429***	0.106	0.163	0.299**	-0.059	-0.229*
Pure Technical Efficiency									
[*s*]	0.600***	1.000	0.294**	0.416***	0.110	0.211*	0.400***	0.108	-0.057
[*p*]	0.595***	1.000	0.165	0.453***	0.058	0.085	0.330***	0.007	-0.141
Scale Efficiency									
[*s*]	0.903***	0.294**	1.000	0.047	0.039	0.061	0.092	-0.112	-0.222*
[*p*]	0.881***	0.165	1.000	0.079	0.168	0.251**	0.036	-0.174	-0.255**
OWN									
[*s*]	0.331***	0.416***	0.047	1.000	0.139	0.443***	0.376***	0.299**	0.373***
[*p*]	0.429***	0.453***	0.079	1.000	0.152	0.315**	0.242*	0.314**	0.383***
ROA									
[*s*]	0.034	0.110	0.039	0.139	1.000	0.769***	0.232*	0.069	0.239*
[*p*]	0.106	0.058	0.168	0.152	1.000	0.717***	0.234*	0.033	0.238*
ROE									
[*s*]	0.129	0.211*	0.061	0.443***	0.769***	1.000	0.259**	0.414***	0.495***
[*p*]	0.163	0.085	0.251**	0.315**	0.717***	1.000	0.322***	0.236*	0.310*
OE/TA									
[*s*]	0.326***	0.400***	0.092	0.376***	0.232*	0.259**	1.000	-0.003	0.043
[*p*]	0.299**	0.330***	0.036	0.242*	0.234*	0.322***	1.000	-0.052	0.015
LOGASS									
[*s*]	-0.012	0.108	-0.112	0.299**	0.069	0.414***	-0.003	1.000	0.718***
[*p*]	-0.059	0.007	-0.174	0.314**	0.033	0.236*	-0.052	1.000	0.674***
LOGDEP									
[*s*]	-0.225*	-0.057	-0.222*	0.373***	0.239*	0.495***	0.043	0.718***	1.000
[*p*]	-0.229*	-0.141	-0.255**	0.383***	0.238*	0.310**	0.015	0.674***	1.000

Note: OWN is a dummy variable for ownership. ROA is return on assets as a proxy measure for profitability (Net Income/Total Assets); ROE is return on shareholders equity as a proxy measure for profitability (Net Income/Shareholders Equity). OE/TA is proxy measure for expense preference (Overhead Expenses/Total Assets); LOGASS is a proxy measure for size (Log of Total Assets); LOGDEP is a proxy measure for market share (Log of Total Deposits).

Spearman [s] correlation coefficient – first row of each cell

Parametric Pearson [p] correlation coefficient – second row of each cell

*** indicates significant at the 0.01% level (2-tailed)

** indicates significant at the 0.05% level (2-tailed)

* indicates significant at the 0.10% level (2-tailed)

As the results indicate the Spearman correlation coefficients shows that overall efficiency is highly positively and statistically significantly associated with other X-efficiency measures, namely, PTE and SE (ρ OE – PTE = 0.908, ρ OE – SE = 0.690). The results also suggest that PTE is more related to OE than SE, confirming the dominant effect of pure technical efficiency in determining the overall efficiency of Malaysian NBFIs. Our results from the Pearson correlation coefficients have also confirmed the relationship and its significance. Further, most of the Spearman [s] correlation coefficients were significantly different from zero, indicating that there is a strong association among the X-efficiency measures and accounting measures of performance. Generally, all the relationships found with the Spearman correlation coefficient results in the direction (positive or negative) and the significance levels have been confirmed by the Pearson [*p*] correlation coefficient results[4] .

The results from the Spearman correlation coefficients suggest that LOGASS as a proxy for size to be negatively related to OE and SE though not statistically significant at any conventional levels

[4] In the case that the relationship found significant with the Spearman rank correlation and is not supported by the Pearson correlation, the results obtained by the Spearman correlation should be used, as the results obtained by Spearman correlation coefficients are more credible due to the less stringent assumptions required (Isik and Hassan, 2002). The difference could be attributed to the assumptions underlying each method.

implying that the large NBFIs inefficiency was mainly scale related. In contrast, the results suggest that LOGASS has a positive relationship with pure technical efficiency suggesting that the larger NBFIs tend to exhibit higher pure technical efficiency compared to its smaller counterparts. The results thus confirmed our earlier finding and corroborate with earlier findings on banks efficiency studies in that large banks tend to exhibit higher pure technical efficiency compared to its smaller counterparts[5] . In contrast to Sathye (2001), who found that market share has significantly positive effects on Australian banks efficiency, our results suggest that market share was negatively and significantly related to Malaysian NBFIs overall and scale efficiency (ρ LOGDEP – OE = -0.225, ρ LOGDEP – SE = -0.222). The results are further confirmed by the results from the Pearson correlation coefficients in the direction and significance.

Interestingly, we have also found positive and significant relationship between overall and pure technical efficiency with overhead expenses/total assets. The positive and significant relationship suggests that the more managerially efficient NBFIs tend to opt for the expense preference behaviour i.e. they tend to invest more in quality workforces and systems, which at most of the time command higher costs. Despite that, the higher quality workforces and systems have resulted in higher pure technical efficiency.

From Table 5 it is apparent that there were positive correlations between both profitability ratios namely, ROA and ROE and efficiency measures though not statistically significant. The results from the Spearman correlation coefficients suggest that ROA was positively correlated with OE, PTE and SE (ρ ROA – OE = 0.034, ρ ROA – PTE = 0.110, ρ ROA – SE = 0.039). Similarly, the results suggest that ROE was positively correlated to all efficiency measures (ρ ROE – OE = 0.129, ρ ROE – PTE = 0.211, ρ ROE – SE = 0.061) although not statistically significant in most cases[6]. Again, the results from the Spearman correlation coefficients were confirmed by the Pearson correlation coefficients. These findings support among others, Miller and Noulas (1996), Hasan and Marton (2000) and Isik and Hassan (2002) in that the most profitable banks were also the most efficient.

It is also interesting to note that the dummy variable, OWN, a proxy measure for ownership was positively and significantly correlated to overall and pure technical efficiency measures. The results confirmed our earlier findings in that there was a significant difference between the merchant banks and the finance companies, thus supporting our decision to construct different frontiers for the two.

In sum, the statistically significantly different from zero correlation coefficients suggest that our X-efficiency measures were strongly associated with conventional proxy measures of performance, i.e. they were robust and were not 'meaningless' of the technique used.

6.0. Conclusions

This paper attempts to investigate the efficiency of Malaysian Non-Bank Financial Institutions (NBFIs) during the period of 2000-2004. The preferred non-parametric Data Envelopment Analysis (DEA) methodology has allowed us to distinguish between three different types of efficiency, such as technical, pure technical and scale efficiencies. Additionally we have performed a series of parametric and non-parametric tests to examine whether the merchant banks and finance companies were drawn from the same population. Finally, we have employed Spearman Rho Rank-Order and the Parametric Pearson correlation coefficients to investigate the association between the efficiency scores derived from the DEA results with the traditional accounting ratios.

During the period of study, our results suggest that, the Malaysian merchant banks have exhibited mean overall or technical efficiency of 78.1% while the finance companies have exhibited higher mean overall efficiency of 91.3%. In other words, during the period of study, the merchant banks could have produced the same amount of outputs by only using 78.1% of the inputs that they

[5] See for example McAllister and McManus (1993) and Miller and Noulas (1996).
[6] ROE is statistically significant to PTE at the 10% level of significance.

currently employed. Similarly, the finance companies could have reduced 8.7% of the amount of inputs they employed currently without affecting the amount of outputs that they currently produce. Overall, our results suggest that pure technical inefficiency dominates the scale inefficiency effects in determining Malaysian NBFIs overall or technical efficiency. Further, most of our results from the parametric and non-parametric tests rejected the null hypothesis that the merchant banks and the finance companies were drawn from the same population suggesting that it was appropriate to construct a separate frontier for both the merchant banks and finance companies.

Our results suggest that the number of Malaysian NBFIs experiencing economies of scale (IRS) has increased dramatically from 12.5% in year 2000 to 31.25% in year 2004. The share of scale efficient NBFIS (operating at CRS), declined from 37.5% in year 2000 to 18.5% in year 2004, while Malaysian NBFIs experiencing diseconomies of scale (DRS) remained stable at 50.0% during the five-year study period. Examination of the sample of 80 observations over the five-year period revealed that while, on average, 28.75% of all Malaysian NBFIs were operating at CRS, the majority, 71.25%, were scale inefficient (operating at DRS or IRS). Of the scale inefficient NBFIs, 35.0% were small NBFIs, 8.75% were medium NBFIs and 27.5% were large NBFIs. Our results thus suggest that the convexity of the frontier has assured that NBFIs experiencing IRS are more frequently the smaller NBFIs.

To further complement the results of the efficiency measures, we have further correlated various accounting measures of financial institutions performance with the efficiency scores derived from the DEA model. The results from both the Spearman and the Pearson correlation coefficients suggest that overall efficiency is positively and significantly associated with all the efficiency measures. Our results from both the Spearman and the Pearson correlation coefficients suggest that size and market share have negative effects on Malaysian NBFIs overall and scale efficiency. On the other hand, we found that that both size and market share have positive relationship with pure technical efficiency though not statistically significant. Interestingly, we have also found positively and significant relationship between overall and pure technical efficiency with overhead expenses/total assets. The positive and significant relationship suggests that the more managerially efficient NBFIs tend to opt for the expense preference behaviour in that they tend to invest more in quality workforces and systems, which at most time command higher costs. We have also found positively and significantly relationship between ownership and overall and pure technical efficiency. The results support our decision to construct separate frontiers for the merchant banks and the finance companies. Finally, our results suggest that the more efficient NBFIs tend to be more profitable.

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