THE EFFICIENCY OF MERCHANT BANKS AND FINANCE COMPANIES IN AN EMERGING MARKET: DETERMINANTS AND POLICY ISSUES

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ABSTRACT

This paper attempts to investigate efficiency changes of Malaysian Non-Bank Financial Institutions (NBFIs), during the period of 2000-2004, by applying the non-parametric Data Envelopment Analysis (DEA) method which allows us to distinguish between three different types of efficiency, such as technical, pure technical and scale efficiencies. We have found that the mean overall or technical efficiency has been 78.1% and 91.3% for merchant banks and the finance companies respectively. It was found that pure technical efficiency is more related to overall efficiency than scale efficiency, confirming the dominant effect of pure technical efficiency in determining the overall efficiency of Malaysian NBFIs. Examination of the sample of 80 observations over the five-year period reveals that while, on average, 28.75% of all Malaysian NBFIs were operating at CRS, the majority, 71.25%, are scale inefficient (operating at DRS or IRS). Our results from the Tobit regression analysis suggest that the level of equity capital is positively related to the level of efficiency gain. This finding is consistent with the results of the previous research that usually reported higher efficiency levels for well capitalized financial institutions. Additionally, NBFIs with higher ratio of loans to assets are related to higher levels of efficiency. This might reflect the higher market power that exists in the loan market compared to the other product markets in which NBFIs operate, as well as control for the strategic niche of the NBFIs.

JEL Classification: G21; G28

Keywords: Non-Bank Financial Institutions, Data Envelopment Analysis (DEA), Malaysia, Tobit.

1.0 Introduction

Given the substantial task of a non-bank financial sector, it is worth raising the issue of why it matters. 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 record 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 systems will tend to have a smaller range of equity-type assets than those with a more broad-based structure; including a wide range of NBFIs. More generally, NBFIs play a range of roles that are not suitable for commercial 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 point of view of financial stability, in a financial sector in which NBFIs are comparatively underdeveloped, 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 these financial institutions. Thus, banks are more likely to fail as a result. One way of minimising financial fragility in 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 may likely lead to severe financial crises. This point was widely noted by policymakers in their analysis of the lessons of the Asian currency crisis. 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 of Malaysian NBFIs could best be 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 commercial banks and NBFIs supported by efficient money and capital markets keeps the financial sector complete and enhances the overall growth of the economy. Although Malaysia is moving towards a full market based economy, its capital markets are still in their infancy. As a sophisticated and well-developed capital market is considered the hallmark of a market based economy worldwide, a 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 NBFIs during the period of 2000-2004. The preferred non-parametric 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 the Tobit regression model to investigate the association between the efficiency scores derived from the DEA results with a set of specific determinants of the NBFIs' behaviour.

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 of the finance companies and merchant banks. This paper also aims to fill a demanding gap in the literature on the efficiency of Malaysian financial institutions,

by providing the most recent evidence on the efficiency changes of Malaysian NBFIs.

We have found that the mean overall or technical efficiency has been 78.1% and 91.3% for merchant banks and the finance companies, respectively. 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 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 efficiency dominates the scale efficiency effects in determining Malaysian NBFIs overall or technical efficiency. Further, most of our results from the parametric and non-parametric tests reject the null hypotheses that the merchant banks and the finance companies were drawn from the same population, suggesting that it is appropriate to construct a combined frontier for both the merchant banks and finance companies.

To complement the results of the efficiency measures, we have carried out regression analysis to correlate various NBFI determinants with the efficiency scores derived from the DEA. Our results from Tobit regression model suggest that overall efficiency is positively and significantly associated with NBFIs' capitalization and market share. This finding is consistent with the results of the previous research that usually reported higher efficiency levels for well-capitalized financial institutions and the existence of market power in the loan market. On the other hand, we found that both size and economic environment have negative relationships with NBFI efficiency, though not statistically significant. Interestingly, we have also found a positive, but insignificant relationship between overall efficiency and overhead expenses.

This paper makes significant contributions on at least three fronts. Firstly, this will be among the first study to investigate the efficiency of NBFIs in a developing economy. Despite the significance of the NBFI sector towards developing economies' economic development, studies that attempt to investigate this issue are relatively scarce (Worthington, 2000). To the best of our knowledge, despite the fact that they have 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. 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 competition. Thirdly, the period chosen has also witnessed the growing preference of the Malaysian corporate sector for 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 issues from both the policymakers' and public's point of view.

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. Section 4 outlines the approaches to the measurement and estimation of efficiency 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 be broadly divided into the commercial 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 commercial banks, NBFIs have an important role in uplifting 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 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-2004, 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 are the only financial institutions allowed to provide current account facilities.

As at end 2004, there were 10 domestically incorporated finance companies in Malaysia. 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 as do the commercial banks. During the latter part of the last decade, the finance companies began to expand their traditional role in retail financing to include wholesale banking as well.

Merchant banks emerged in the Malaysian banking scene in 1970, 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 2004, there were 10 merchant banks in Malaysia and all were domestically controlled institutions.

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. A 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 were pure technical rather than in of 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) considered the efficiency of 143 Japanese banks in 1990. He found the pure technical efficiency to average around 86% and scale efficiency around 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 extensive 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 and efficiency 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,

with loans and advances and total deposits as outputs, they found that during the period 2000-2001, post-merger Malaysian banks had achieved a total factor productivity growth of 5.1%. They found that during the period, eight banks had posted positive total productivity growth ranging from 1.3% to 19.7%, one bank had exhibited total factor productivity regress of 13.3%, while another was stagnant. Mergers did not result in better scale efficiency of Malaysian banks as all banks 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 Unit (DMU), 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.

To arrive at the basic specification of a linear-programming model underlying the DEA, assume that there are data on K inputs and M outputs for each N NBFI. For *i*th NBFI, these are represented by the vectors x_i and y_i respectively. Let us call the *K* x *N* input matrix – *X* and the $M \; x \; N$ output matrix – *Y*. To measure the efficiency for each NBFI we calculate a ratio of all inputs, such as $(u'y_i/v'x_i)$ where *u* is an $M \; x \; 1$ vector of output weights and v is a $K \; x \; 1$ vector of input weights. To select optimal weights we specify the following mathematical programming problem:

$$\begin{aligned} &\min_{u,v} (u'y_i/v'x_i), \qquad (1)\\ &u,y_i/v'x_i \le 1, \quad j = 1,2,..., N,\\ &u,\, v \ge 0 \end{aligned}$$

The above formulation has a problem of infinite solutions and therefore we impose the constraint $v'x_i = 1$, which leads to:

$$
\begin{aligned}
&\textit{min}\ (u'y_i) && (2)\\
&u,\ \varphi\\
&\varphi' x_i = 1\\
&u\ 'y_i - \varphi' x_j\ \text{d}\ \text{“}0 = 1, 2, \ldots, N,\\
&u,\ \varphi\ e\text{”}\ 0
\end{aligned}
$$

where we change notation from u and v to μ and φ, respectively, in order to reflect transformations. Using the duality in linear programming, an equivalent envelopment form of this problem can be derived:

$$
\begin{aligned}
&\textit{min}\ \theta, && (3)\\
&\theta, \lambda\\
&y_i + Y\lambda \geq 0\\
&\theta x_i - X\Upsilon \geq 0\\
&\lambda \geq 0
\end{aligned}
$$

where θ is a scalar representing the value of the efficiency score for the ith NBFI which will range between 0 and 1. λ is a vector of $N\ x\ 1$ constants. The linear programming has to be solved N times, once for each NBFI in the sample. In order to calculate efficiency under the assumption of VRS, the convexity constraint *(N1'λ= 1)* will be added to ensure that an inefficient NBFI is only compared against NBFIs of similar size, and therefore provides the basis for measuring economies of scale within the DEA concept. The convexity constraint determines how closely the production frontier envelops the observed input-output combinations and is not imposed in the constant returns to scale case.

Amongst the strengths of the DEA is that DEA is less data demanding as it works fine with small sample size (Canhoto and Dermine, 2003). The small sample size is, among other reasons, what 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 relating inputs to outputs is difficult to prove or find. Such a specific functional form is difficult to show for financial services entities. Avkiran (1999) acknowledges superiority 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. Hence, there is no need for standardisation.

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 inputs excessively or its output has been under-produced. Finally, there is the 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 efficient DMUs. The set of efficient DMUs is called the reference set. The owners of the DMUs may be interested in knowing 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 the 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).

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

DEA can be used 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 has 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 the 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 that the DMUs should 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 which are 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.

It is also of considerable interest to explain the determinants of technical efficiency scores derived from the DEA models. As defined in equations (1) to (3) the DEA score falls between the interval 0 and 1 $(0 < h^* \leq 1)$,[2] making the dependent variable a limited dependent variable. A commonly held view in previous studies is that the use of the Tobit model can handle the characteristics of the distribution of efficiency measures and thus provide results that can guide policies to improve performance. DEA efficiency measures obtained in the first stage are the dependent variables in the second stage of the Tobit model.

The Tobit model was first introduced in the econometrics literature by Tobin (1958). These models are also known as truncated or censored

2 h^* refers to the dependent variable. In this case is the efficiency index derived from the DEA.

regression models where expected errors are not equal to zero. Therefore, estimation with an Ordinary Least Squares (OLS) regression of h^* would lead to a biased parameter estimate since OLS assume a normal and homoscedastic distribution of the disturbance and the dependent variable (Maddala, 1983).

In recent years, many DEA applications employ a two-stage procedure involving both DEA and Tobit. Among others, Luoma *et. al.,* (1996) and Chilingerian (1995) conduct both DEA and Tobit analyses in health sector applications to estimate both inefficiency and the determinants of inefficiencies. Another study by Kirjavainen and Loikkanen (1998) applies both DEA and Tobit for the Finnish senior secondary schools and Finnish municipalities respectively. Jackson and Fethi (2000) apply DEA with Tobit to evaluate technical efficiency in Turkish banks.

The standard Tobit model can be defined as follows for observation (NBFI) *i*:

$$\begin{aligned} y_i^* &= \beta x_i + \varepsilon_i \\ y_i &= y_i^* \; if \quad y_i^* \; if \quad y_i^* \geq 0 \quad and \\ y_i &= 0, \quad otherwise \end{aligned} \tag{4}$$

where $\varepsilon_i \sim N\,(0,\ \sigma^2)$, X_i and β are vectors of explanatory variables and unknown parameters, respectively. The is a latent variable and y_i is the DEA score.

The likelihood function *(L)* is maximized to solve β and σ based on 63 observations (NBFIs) of y_i and x_i is

$$L = \prod_{y_i=0}(1-F)\prod_{y_i>0}\frac{1}{(2\Pi\sigma^2)^{1/2}} \times e^{-[1/(2\sigma^2)](y^i-\beta x_i)^2} \tag{5}$$

where

$$F_i = \int_{-\infty}^{\beta' x_i / \sigma} \frac{1}{(2\Pi)^{1/2}} e^{-t^2/2} dt \qquad (6)$$

The first product is over the observations for which the NBFIs are 100 percent efficient $(y = 0)$ and the second product is over the observations for which NBFIs are inefficient $(y > 0)$. F_i is the distribution function of the standard normal evaluated at $\beta' x_i / \sigma$.

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

For the empirical analysis, *all* Malaysian NBFIs will 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 due to mergers and acquisitions.

The definition and measurement of inputs and outputs in the banking function remain a contentious issue among researchers. In the banking theory literature, there are two main approaches competing with each other in this regard: the production and the 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 are 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 intermediaries 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 research that adopted this approach are among others by 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 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 $(x2)$.

Several NBFI and industry-specific factors may influence the level of efficiency of a particular NBFI. Some of these factors may be neither inputs nor outputs in the production process, but rather circumstances faced by a particular NBFI. The variables consist of two groups - the first representing NBFI-specific attributes, and the second encompassing the market conditions in effect over the period examined. The NBFI-specific variables included in the regressions are: size (LNTA= log of total assets measured in millions of Malaysian Ringgit); capitalization (EQTY = book value of stockholders' equity as a fraction of total assets); market share (LOANS/TA = total loans over total assets); and overhead cost (OE = total overhead expenses over total assets). The LNTA and EQTY variables are included in the model to examine the effect of NBFI size and capitalization on efficiency.

Strong capital structure is essential for financial institutions in emerging economies since it provides additional strength to withstand financial crises and increased safety for depositors during unstable macroeconomic conditions. Furthermore, lower capital ratios in banking imply higher leverage and risk, and therefore greater borrowing costs.

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

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	279,167	506,331	553,523	662,855	594,538
Mean	6,840,386.88	6,948,016.94	7,070,498.94	8,898,910.69	9,176,940.81
Max	21,371,114	20,186,180	23,625,038	32,529,566	33,618,318
S.D	6,224,024.14	6,354,506.67	6,717,443.03	9,076,978.74	8,936,914.42

Thus, the efficiency level should be higher for better-capitalized NBFIs. However, we do not have any *a priori* expectation on the signs of the coefficients of other NBFI-specific variables.

The GDP variable represents the growth rate of country's gross domestic product and is used as a proxy for economic conditions. Favourable economic conditions will affect positively the demand and supply of banking services, but will either impact positively or negatively on NBFI efficiency. To distinguish between merchant banks and finance companies, we included SPEC variable which accounts for the effect of NBFIs' specialization.

5.0 Results

The efficiency of Malaysian NBFIs was first examined by applying the DEA method for each year under investigation by 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 a 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 suggests that pure technical inefficiency dominates scale inefficiency of Malaysian NBFIs during all years under investigation. This implies that during the period of study, Malaysian NBFIs have been inefficient in controlling their costs rather than operating at the wrong scale of operations.

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 merchant banks could have produced the same amount of outputs by

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

Table 2: Summary Statistics of Efficiency Measures - Concluded

Efficiency Measures	Mean	Minimum	Maximum	Std. Dev.
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

only using 78.1% of the amount of inputs it 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 bank counterparts. In contrast to the merchant banks, our results suggest that the finance companies' inefficiency was mainly attributable to scale rather than pure technical inefficiency. Our findings suggest that the finance companies have exhibited higher pure technical and scale efficiency of 95.9% and 95.0% while merchant banks exhibited 83.1% and 93.7%, respectively. These results imply 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 bank 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 components suggests that the inefficiency could be attributed mainly to pure technical (10.5%) rather than scale inefficiency (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 exhibited 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) increased substantially from 2 (12.5%) in year 2000 to 5 (37.5%) in year 2004. The share of scale-efficient NBFIs (operating at CRS) 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) 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

RTS	Panel 1: Developments in RTS[a]									
	Years									
	2000		2001		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**

Size	Panel 2: RTS by Size[b]							
	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 results 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 a total of 80 observations) belonged to the NBFIs that experienced CRS, 37 observations (46.25% of a total of 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 a total of 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 a total of 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 a total of 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 and presents the overall summary results from the sample of the 80 observations over the five-year period. Examination of Panel 2 of Table 3 reveals 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 smaller NBFIs. Our results 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 are drawn from the same population and whether the merchant banks and finance companies possessed the same technology. The null hypothesis tested is that the merchant banks and 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 the difference between the merchant banks' and finance companies' technologies (frontiers) is not significant 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 merchant banks and finance companies were equal, implying that we could 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
** indicate significant at the 0.05 level
* indicate significant at the 0.10 level

The second stage regressions were estimated to further investigate the determinants of efficiency over time by using the Tobit regression model. Unlike the conventional Ordinary Least Square (OLS) estimation, in cases with limited dependent variables, Tobit models are known to generate consistent estimates of regression coefficients.[4] The results of the estimation are presented in Table 5. A positive coefficient implies increase in efficiency whereas a negative coefficient reflects the deterioration in efficiency.

The coefficient on the size variable is negative for the efficiency index. This might imply that as NBFIs grow larger and venture into different banking businesses, they are not able to control cost and it becomes more difficult for them to efficiently create revenues. This is consistent with conventional wisdom and historical fact that small NBFIs typically have higher profitability ratios. The level of equity capital is positively related to the level of efficiency gain. This finding is consistent with the results of the previous research that usually report higher efficiency levels for well-capitalized financial institutions. Financial institutions with higher ratio of loans to assets are related to higher levels of efficiency. This might reflect higher market power that exists in the loan market compared to the other product markets in which NBFIs operate as well as the control for the strategic niche of the NBFIs. Finally, the dummy variable representing NBFIs' specialization is significant, indicating that the finance companies are more efficient relative to the merchant banks. On the other hand, the level of overhead expenditure is found to be insignificant with respect to NBFIs' efficiency. The GDP variable is negatively linked to efficiency growth but insignificant at conventional levels.

4 See among others (Maddala, 1983) and Coelli *et. al.,* (1998).

Table 5: Results of Tobit Regression Analysis

Variable	Efficiency Score					
	1	2	3	4	5	6
CONSTANT	1.068** (0.288)	0.766** (0.336)	0.609** (0.264)	0.598** (0.259)	0.592** (0.262)	0.651** (0.292)
LNTA	-0.014 (0.014)	-0.051 (0.018)	-0.001 (0.014)	-0.002 (0.014)	-0.0029 (0.014)	-0.002 (0.015)
EQTY	-	0.127* (0.052)	0.308** (0.059)	0.313** (0.059)	0.312** (0.055)	0.353** (0.051)
LOANS/TA	-	-	0.322** (0.079)	0.315** (0.077)	0.312** (0.075)	0.126** (0.061)
GDP	-	-	-	-0.009 (0.006)	-0.009 (0.006)	-0.008 (0.006)
OE/TA	-	-	-	-	0.374 (2.665)	1.342 (2.506)
SPEC	-	-	-	-	-	0.167** (0.045)
No. of Observations	63	63	63	63	63	63
Log-likelihood	28.29	29.59	45.06	46.24	46.25	52.04

Note: * and ** represent significance at the 5% and 1% levels respectively, standard error in parentheses.

6.0 Conclusion

The paper attempts to investigate the efficiency of Malaysian NBFIs during the period 2000-2004. The preferred non-parametric DEA methodology allowed us to distinguish between three different types of efficiency such as technical, pure technical and scale efficiencies. Additionally, we 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 employed the Tobit regression model to investigate the association between the efficiency scores derived from the DEA results with a set of specific determinants of NBFI's behaviour.

We found that the mean overall or technical efficiency was 78.1% and 91.3% for merchant banks and the finance companies respectively. 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 it currently employs. Similarly, the finance companies could have reduced 8.7% of the amount of inputs it employs currently without affecting the amount of outputs that it currently produces. The results from the parametric and non-parametric tests reject the null hypotheses that the merchant banks and the finance companies were drawn from the same population suggesting that it is appropriate to construct a combined 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 reveals that while, on average, 28.75% of all Malaysian NBFIs were operating at CRS, the majority, 71.25%, are scale-inefficient (operating at DRS or IRS). Of the scale inefficient NBFIs, 35.0% are small NBFIs, 8.75% are medium NBFIs and 27.5% are 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 examined the relationship of various NBFI specific determinants with

the efficiency scores derived from the DEA. Our results from Tobit regression model suggest that efficiency is positively and significantly associated with NBFIs capitalization and market share. We have also found positive and significant relationship between the degree of specialisation and NBFI efficiency.

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