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On the Operating Efficiency of the Commercial Banking Sector in Malaysia : Empirical Evidence

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ABSTRAK

Di dalam tulisan tentang pembangunan ekonomi, telahpun diperkatakan dan diakui bahawa kewangan perlu untuk pertumbuhan ekonomi. Kebolehan dan keupayaan institusi kewangan untuk melaksanakan peranan asasnya sebagai orang tengah di antara penabung dan pelabur dalam sesuatu sistem kewangan akan memberi kesan terhadap prestasi sesebuah negara. Oleh itu, tidak hairanlah jika kajian terhadap kecekapan pasaran kewangan, terutamanya di sektor bank, merupakan topik yang paling hangat dikaji, khususnya di negara maju seperti Amerika Syarikat, Canada dan Britain. Kajian ini bertujuan melengkapkan kajian terhadap kecekapan bank, dengan tumpuan terhadap sebuah negara sedang membangun, iaitu Malaysia. Dalam kajian ini, tiga pendekatan, iaitu pendekatan fungsi kos bank satu-output, fungsi kos bank pelbagai-keluaran, dan analisis keuntungan, digunakan untuk mengenalpasti sama ada sektor bank di Malaysia menggambarkan ekonomi ikut skel.

Kajian ini menggunakan data keratan rentas, dan tempoh masa kajian adalah 1984-1986. Hasil kajian mengikut kaedah fungsi kos bank pelbagai-keluaran menunjukkan bahawa sektor bank, secara amnya, menggambarkan pancaran kos purata yang menurun atau mengalami ekonomi ikut skel. Seterusnya, hasil kajian menyarankan bahawa sektor bank di Malaysia menggambarkan ekonomi ikut skop atau kesalinggenapan antara-keluaran di kalangan beberapa output. Walau bagaimanapun, didapati bank milik asing di Malaysia tidak mengalami ekonomi ikut skel. Keadaan ini berlaku mungkin disebabkan oleh peraturan di negara ini yang melarang bank milik asing menubuhkan cawangan, dan justeru itu menghalang bank milik asing menikmati peluang untuk mengagihkan kos operasi secara lebih sempurna seperti bank milik tempatan.

ABSTRACT

It has been argued and recognised in the literature on economic development that finance is inevitable for economic growth. The ability of financial institutions to perform their basic role as an intermediary between savers and investors in the financial system affects the performance of the economy as a whole. Thus, it is not surprising that the efficiency of the financial markets, particularly the banking sector, must by now be one of the most intensively researched topics in economics, especially in developed countries such as the United States, Canada and the United Kingdom. The purpose of this study is to complement the literature on banking efficiency, with respect to a developing country, namely, Malaysia. In this study, we used three approaches — single-output bank cost function, multiproduct bank cost function and profitability analysis — to identify whether the banking sector in Malaysia exhibits scale economies.

The study used cross-sectional data for the 1984-1986 period. Results of our multiproduct bank cost function approach show that, as a whole, the banking sector in Malaysia exhibits decreasing ray average cost or economies of scale. Further, our results indicate that banks exhibit economies of scope or interproduct complementarity among various outputs. However, it was also revealed that foreign banks in Malaysia do not experience scale economies. This is probably due to the fact that current regulations do not permit foreign banks to establish their branches in the country. As such, the banks do not have the opportunity to spread their operating costs more 'evenly' compared to domestic banks.

INTRODUCTION

A review of the development economics literature would indicate that financial development has received very little attention as an important instrument in promoting economic development. This is due to the belief that finance is only a supporting mechanism of an accomodative nature. Finance would presumably follow when the demand for it arises in the real sectors of the economy. Hence, no special attention needs be paid to financial development. This is the essence of the view that finance is merely a demand following phenomenon.

Gurley and Shaw (1960), Patrick (1966), Cameron and Patrick (1967) and Cameron (1972) have challenged this view. They suggest that finance can be a supply-leading finance; it not only accomodates the demands of existing businesses, but also supplies finance to new investments that would otherwise not be contemplated. By encouraging increased saving and investment specialization, finance can lead economic growth and development. Whether finance leads development or otherwise is a matter of empirical evidence. However, finance is inevitable for economic development. Thus, a prerequisite for economic development is the maturity of the financial system of an economy.

The quality of the services provided by the financial system affects the performance of the economy as a whole. It raises the levels of saving and investment and provides incentives for the allocation of the available resources to those uses where they are likely to give the highest returns.

Thus, the financial system helps production, capital-accumulation, and growth by (i) encouraging savings, (ii) mobilizing them, and (iii) allocating them among alternative uses and users. Each of these functions is important and the efficiency of a given financial system depends on how well it performs these functions.

The efficiency of the financial markets must by now be one of the most intensively researched topics in economics. In Malaysia, the majority of the work on efficiency has focused on the stock market (see Anuar, Shamser and Mohd. Ariff, 1991a, 1991b), and relatively little research effort has been directed at examining the evidence of efficiency in the banking sector. Therefore, it is imperative that a similar study be conducted to determine whether the banking sector in Malaysia exhibits operating efficiency or scale economies.

Role of Commercial Banks in the Monetization Process in Malaysia

The development in the Malaysian financial markets has been noted by several authors. Vilksnin (1980) pointed out that among the ASEAN countries, Malaysia experienced considerably greater monetization during the 1965-1978 period. M2 holdings per capita had been at about US$500, and the two velocity (M1 and M2) statistics were low and fell substantially during the 1970s. The ratio of GNP to M2 declined from 3.5 in 1965 to 2.0 in 1978, indicating a rise in liquid asset holdings. Yeoh and Lim (1984), Lin (1986) and Shulze (1986) concluded that besides Singapore, Malaysia experienced greater financial deepening compared to other ASEAN countries. In addition, Gupta (1984) found that besides Korea, Taiwan, Singapore, Panama and Venezuela, Malaysia demonstrated spectacular growth in financial development in the 1961 - 1977 period.

The Malaysian financial system comprises the banking system and the system of non-bank financial intermediaries. The banking system includes the Central Bank, commercial banks and also several important non-bank financial institutions which are closely linked to the monetary institutions (i.e., Central Bank and commercial banks), and whose liabilities are generally accepted as near-money. These institutions are the finance companies, merchant banks, discount houses and the money and foreign exchange brokers. On the other hand, the non-bank financial institutions, apart from the above, include development finance institutions, saving institutions, provident and pension funds, insurance companies, building societies, unit trusts and other special investment agencies (*Quarterly Economic Bulletin*, 1985).

The commercial banks form the largest and most important group of financial institutions in Malaysia. As at 30th December

1986, Malaysia is served by a network of 38 commercial banks, of which 21 are locally incorporated. The foreign banks include five banks incorporated in Singapore, three in the United States, two in Hong Kong and one each in the United Kingdom, Japan, Canada, Thailand, the Netherlands and West Germany.

In the early 1960s, foreign banks dominated the banking system, which accounted for 74 per cent of the banking system's total assets. However, the dominance of foreign banks was eroded by the rapid deposit growth and expanded activities of the domestic banks by the 1980s. As at 30th December 1986, domestic banks accounted for 73 per cent of the banking system's total assets. The banks' ownership and size in terms of total assets at the end of 1986 is shown in Table 1.

Expansion in the domestic banks has also been in terms of increasing numbers of bank branches. By the end of 1986, the domestic banks had a total of 704 branches, concentrated among the three major banks - Malayan Banking Berhad (182), Bank Bumiputra Malaysia Berhad (111) and United Malayan Banking Corporation (59). While the relative importance of foreign banks in Malaysia declined, they continued to play an important role in the economy. At the end of 1986, there were 146 foreign banking offices, dominated by two British banks: the Standard Chartered Bank, having 35 branches, and the Hong Kong and Shanghai Banking Corporation (incorporated in Hong Kong), having 36 branches.

Although the growth of financial institutions (in terms of banking offices and total assets) has been rapid, the operational efficiency of banks can still be questioned. The evidence of efficiency in Malaysian commercial banks is rather vague, probably due to the non-existence of empirical studies in this country. However, more recently, a general study on the efficiency of commercial banks in Malaysia was carried out by Lin (1985). Lin used productivity measures for efficiency. The measures include assets per employee, staff cost per employee, assets per ringgit of staff cost, revenue per employee, expenditure per employee and value of bank transactions per employee as proxy for efficiency in Malaysian commercial banks. Table 2 presents the efficiency measures for the years 1979 and 1983, the results as a whole pointing to operating efficiency in commercial banks in Malaysia, at least with respect to labour usage. However, the results of a more recent study regarding the efficiency of the banking system (Lin 1988) contradict his earlier findings. The results of the study for the years 1984 and 1986 are presented in Table 3. The findings indicate that Malaysian financial institutions (which include commercial banks, finance companies and merchant banks) were cost inefficient during 1984 and 1986. However Lin correctly stated that the results were rather robust and might not apply to all at the micro-individual institutional level. As a matter of fact, some institutions did exhibit efficiency in their operations.

OPERATING EFFICIENCY IN THE MALAYSIAN BANKING SECTOR : EMPIRICAL EVIDENCE

A firm's average cost reflects the value of the resources it uses in production per unit of output. The average cost of each firm can be divided into two components: the minimum average cost at which firms of the same size can operate and the firm's excess cost per unit of output over this minimum average cost. The technical efficiency of a firm equals the first component of its average cost, and a firm's operational efficiency equals the second component.

Technical and operational efficiency of firms are illustrated in Figure 1. The curve labelled LAC is a hypothetical long-run average cost curve for firms of a given size. The long-run average cost curve shows the minimum average cost at each level of output at which firms can operate. The firms producing at minimum average cost are run with maximum efficiency and have the plant size and technology best suited for their levels of output.

Firms that produce at combinations of average cost and output on the long-run average cost curve, such as firms A and B in Figure 1, have maximum operational efficiency. In the range of output in which the long-run

TABLE 1 : Malaysian Commercial Banks as at End of December 1986

Banks	Years of Commencement in Malaysia	Total Assets in Malaysia ($ million)	No. of Offices	
Domestic Banks:				
Ban Hin Lee Bank Berhad	1935	853	14	
Bank Bumiputra Malaysia Berhad	1966	16700	111	
Bank Buruh (Malaysia) Berhad	1975	244	1	
Bank of Commerce Berhad	1956	751	7	
Bank Utama (Malaysia) Berhad	1977	860	8	
Development and Commercial Bank Berhad	1966	3215	28	
Hock Hua Bank Berhad	1951	751	14	
Hock Hua Bank (Sabah) Berhad	1961	280	4	
Kong Ming Bank Berhad	1964	250	11	
Kwong Yik Bank Berhad	1913	1323	35	
Malayan Banking Berhad	1960	20775	182	
Malayan United Bank Berhad	1923	1991	32	
Malaysian French Bank Berhad	1982	717	16	
Oriental Bank Berhad	1936	855	14	
The Pacific Bank Berhad	1963	858	14	
Perwira Habib Bank Malaysia Berhad	1976	1428	25	
Public Bank Berhad	1966	4898	64	
Sabah Bank Berhad*	1979	739	4	
Southern Banking Berhad	1965	1333	26	
United Asian Bank Berhad**	1973	2820	30	
United Malayan Banking Corporation Berhad	1960	6658	59	
Wah Tat Bank Berhad	1965	156	5	
				Country of Incorporation
Foreign Banks:				
Algemene Bank Nederland	1988	230	2	Holland
Bangkok Bank Ltd.	1959	386	1	Thailand
Bank of America NT and SA	1959	612	1	USA
The Bank of Canton Ltd.	1957	211	1	Hong Kong
The Bank of Nova Scotia	1973	289	1	Canada
The Bank of Tokyo Ltd.	1959	826	1	Japan
The Chase Manhattan Bank N.A.	1964	873	1	USA
Chung Khiaw Ltd.	1951	1278	16	Singapore
Citibank N.A.	1959	2616	3	USA
Deutsche Bank (Asia)	1968	256	1	Germany
The Hong Kong and Shanghai Banking Corporation	1964	4939	36	Hong Kong
Lee Wah Bank Ltd.	1956	740	9	Singapore
Overseas-Chinese Banking Corporation	1932	2388	25	Singapore
Overseas Union Bank Ltd.	1958	825	12	Singapore
Standard Chartered Bank	1975	4340	35	UK
United Overseas Bank	1966	75	1	Singapore

Note: * Figure as at end of 1984
** Figure as at end of 1985

TABLE 2: Results of Lin's (1985) Study

	Indicators	1979	1983
1.	Assets per Employee (RMM)	1.17	1.69
2.	Staff Cost per Employee (RM' 000)	13	17
3.	Assets per Ringgit of Staff Cost (RMM)	89	111
4.	Revenue (excluding interest) per Employee (RM' 000)	14	15
5.	Total Expenditure (excluding interest) per Employee (RM' 000)	29	40
6.	Pre-Tax Profit per Employee (RM' 000)	16	21
7.	Value of Bank Transactions per Employee (RMM)	1.1	1.6

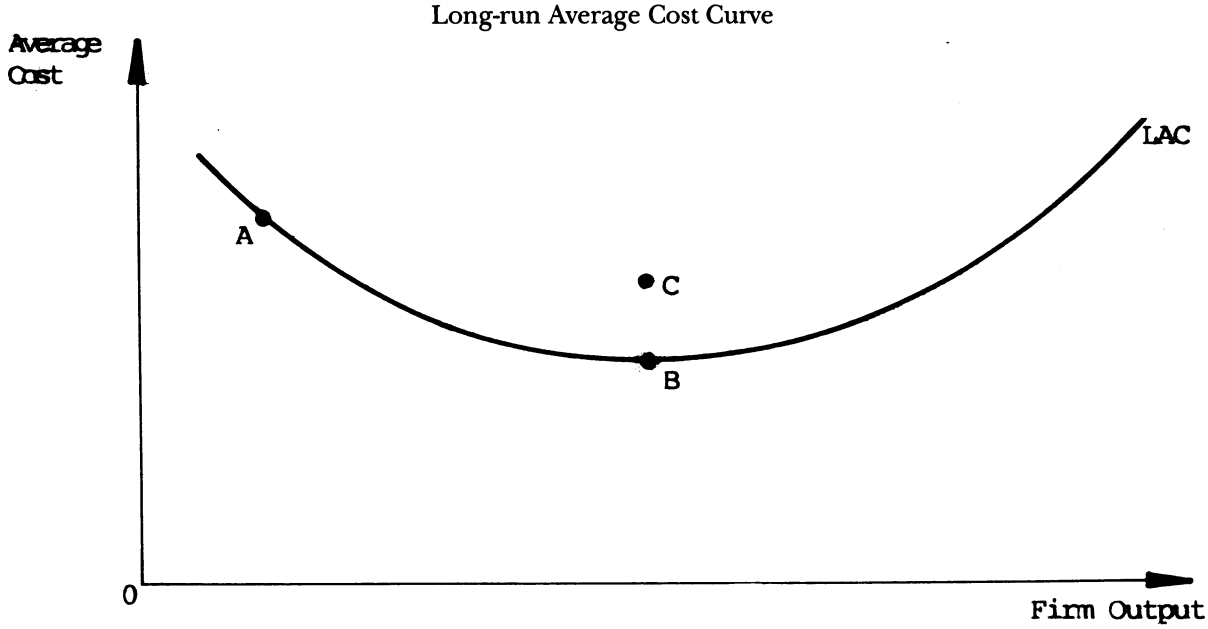
Source: Lin (1985)

TABLE 3: Results of Lin's (1988) Study

	Indicators	1984	1986
1.	Assets per Employee (RMM)	1.98	2.10
2.	Staff Cost per Employee (RM' 000)	18.2	21.1
3.	Assets per Ringgit of Staff Cost (RMM)	109	99
4.	Revenue (excluding interest) per Employee (RM'000)	26	26
5.	Total Expenditure (excluding interest) per Employee (RM'000)	52	75
6.	Pre-Tax Profit per Employee (RM' 000)	22	(5)
7.	Value of Bank Transactions per Employee (RMM)	1.7	1.5

Source: Lin (1988)

FIGURE 1
Long-run Average Cost Curve



average cost curve has a negative slope, larger firms are technically more efficient than smaller firms, and conversely, in the range of output in which the long-run average cost curve has a positive slope, smaller firms are technically more efficient than larger firms. Thus, in Figure 1, firm B is technically more efficient than firm A. Firm C is operationally inefficient because it produces the same level of output as firm B but at a higher cost. However, firm C is technically more efficient than firm A since firm C is capable of producing at a lower average cost if operated efficiently.

From the above discussion, it is apparent that size or scale is an important factor in determining the operational efficiency or the cost economies of a firm. Our question is: Is there an advantage, in terms of cost, to being large? This advantage to largeness is what economists call economies of scale or scale economies.

If the banking industry is characterised by significant and continuous economies of large scale operations, eventually only one bank would survive under free competition. The ultimate formation of a monopoly is undesirable to consumers because they will not participate fully in the economies of scale and, perhaps more importantly, they will have few alternatives to the services provided by the monopoly bank. On the other hand, if banking is characterised by diseconomies of scale, a large number of smaller banks could operate side by side. In this event, the authorities might view attempts by banks to merge as organisational changes motivated more by a desire to eliminate competition than by a desire to achieve operating economies.

Therefore, an examination of the economic efficiency, or cost economies of banking is important for at least three reasons. First, managers of banks would be interested in knowing how to improve cost efficiency in order to achieve higher profits and further to improve the chances of survival, especially in the present competitive financial environment, in light of the recent deregulation and its potential effects on market competition. Second, customers would be interested in knowing the effects of deregulation on costs and, consequently, on the prices and quality of bank services, and in the likely effect on the number of new services that may be offered. Finally, it would be useful for monetary authorities to have information on bank costs and competition under the present deregulatory regime to help them formulate policies affecting the banking industry as a whole.

Estimating Economies of Scale in the Banking Sector

The simplest way of estimating the economies of scale of a firm, is to estimate its long-run cost function. The cost function is derived by relating the total, average and/or marginal costs of a firm to its output. The long-run cost function can be estimated for a single firm using cross-section data, assuming that each firm is operating on its short-run efficiency border. Economies of scale appear when total costs are proportionally increasing less than output or, in other terms, when average costs are decreasing.

This approach has been widely used by Johnston (1960) and surveyed by Walters (1963). Although this approach has been criticised, it has survived to date due to its simplicity and low data requirements compared with other complicated models (e.g., the translog cost model). This cost function approach has been widely used in studying scale economies in the agricultural and manufacturing sectors.

However, the application of this approach in the banking sector is due to Benston (1972) and Benston, Hanweck and Humphrey (1982). The specification of the average cost function used in this study is as follows :

$$AC(t) = \alpha(0) + \alpha(1)Q(t) + \alpha(2)Q^2(t) + \mu(t) \qquad (1)$$

where AC is average total cost, Q is the total output produced, α's are parameters to be estimated, and μ is the disturbance term. It is expected that $\alpha(1)<0$ and $\alpha(2)>0$ in order to arrive at the U-shaped average cost curves. The optimal scale Q*, can be obtained by the

following relation :

$$Q^* = -[\alpha(1)/2\alpha(2)]$$

By 'optimal scale', we mean a firm operating at that scale at which, in existing conditions of techniques and organizing capacity, it has the lowest average cost of production per unit output, when all those costs which must be covered in the long-run are included.

The log-linear average cost equation can be estimated by the following relation :

$$\log AC(t) = \beta(0) + \beta(1)\log Q(t) + v(t) \qquad (2)$$

It is expected that $\beta(1)<1$ would exhibit economies of scale; otherwise, there are diseconomies of scale. The advantage of this specification is that one can derive the importance of the diseconomies or economies of scale immediately from the scale factor as $[1 - \beta(1)]$ which is a percentage. This percentage is, however, constant over the whole range of output.

In this study, bank output Q, is measured as the sum of loans and deposits. However, data on costs are not available. To obtain total cost TC, we have subtracted net profit (pre-tax) from total revenue (that is total loans multiplied by the rate of interest on loans). Average cost AC, is derived by dividing total cost by output. We also employed dummy variables to take into account the effect of organizational structural differences between small and large, and foreign and domestic banks. All equations were estimated using ordinary least squares.

This study is based on cross-sectional data on Malaysian commercial banks for the period 1984 - 86. Data compiled were based on balance sheet structures reported in the Bankers Directory of Malaysia 1986/87 and 1987/88, published by the Association of Banks in Malaysia. In this directory, seven items on financial data were reported, i.e., total assets, total loans and advances, total deposits, capital and reserves, net profit (pre-tax and after - tax), and number of banking offices. A total of 108 number of observations were used in the analysis. Financial data on prices of loans and advances, and deposits were compiled from various issues of the Quarterly Economic Bulletin published by Bank Negara Malaysia.

Table 4 presents the regression results of cost functions for all banks in Malaysia. In the final estimation we have considered several forms of organizational structure differences in the banking sector. We first consider the results for all banks. The average cost function as estimated in equation (4.1) shows that output variable Q is significant at the ten per cent level, but Q^2 is not significant. The average cost functions estimated suggest that banks in Malaysia would reach an optimal scale of RM16 billion. By dropping Q^2, the estimated average cost function of equation (4.2) shows that output variable is significantly different from zero at the one per cent level and has the expected sign.

Similar results are derived when equation (4.3) is estimated. The log-linear average cost function implies a constant elasticity of average cost to scale and a decline. Equation (4.3) indicates that when the scale increases by one per cent, total costs at the banks grow by about 0.95 per cent, therefore pointing to economies of scale. However, the R^2 for equations (4.1), (4.2) and (4.3) are low. We suspect that the low R^2 value is due to the organizational structure differences among the banks. To differentiate between foreign and domestic banks, we have included dummy variable Dummy, where one equals foreign banks and zero otherwise. The results show improvement in terms of R^2, standard error and significance of the variables, compared to earlier estimates for all banks. Equation (4.4) indicates that banks in Malaysia reach an optimal scale of RM13 billion, the estimated equations (4.5) and (4.6) further pointing to economies of scale in Malaysian foreign banks. Equation (4.6) indicates that with a one per cent increase in scale, total cost increases by 0.97 per cent.

To differentiate further on the effect of different organizational structures, we estimated equations (4.7), (4.8) and (4.9) by excluding the two largest banks in terms of total assets, that is, Malayan Banking Berhad (MBB) and Bank Bumiputra Malaysia Berhad (BBMB); and

TABLE 4: Regression Results of Cost Functions for Banks in Malaysia, 1984 - 1986[a]

A. All banks

4.1) $AC = 0.58438 - 0.1878 \times 10^{-4} Q + 0.5937 \times 10^{-9} Q^2$
$(33.467)^{***} \quad (-2.3682)^{**} \quad (1.5702)$

$R^2 = 0.0919 \quad SE = 0.1207 \quad Q^* = M\$16$ billion

4.2) $AC = 0.56748 - 0.6925 \times 10^{-5} Q$
$(40.989)^{***} \quad (-2.8383)^{***}$

$R^2 = 0.0706 \quad SE = 0.1215$

4.3) $\text{Log } AC = -0.27326 - 0.04914 \log Q$
$(-2.4388)^{**} \quad (-3.2089)^{***}$

$R^2 = 0.0885 \quad SE = 0.2014 \quad E_{TC} = 0.95$

B. All banks except domestic banks

4.4) $AC = 0.50210 - 0.1479 \times 10^{-4} Q + 0.5869 \times 10^{-9} Q^2 + 0.16516 \overline{\text{DDummy}}$
$(31.696)^{***} \quad (-2.4873)^{**} \quad (2.0769)^{**} \quad (9.1632)^{***}$

$R^2 = 0.4975 \quad SE = 0.0902 \quad Q^* = M\$13$ billion

4.5) $AC = 0.48534 - 0.3059 \times 10^{-5} Q + 0.16526 \text{ DDummy}$
$(35.052)^{***} \quad (-1.6199) \quad (9.0273)^{***}$

$R^2 = 0.4767 \quad SE = 0.0916$

4.6) $\text{Log } AC = -0.56607 - 0.02533 \log Q + 0.28461 \text{ DDummy}$
$(-6.5083)^{***} \quad (-2.2182)^{**} \quad (9.7364)^{***}$

$R^2 = 0.5210 \quad SE = 0.1467 \quad E_{TC} = 0.97$

C. All banks except two largest banks (BBMB and MBB)[a]

4.7) $AC = 0.72009 - 0.1703 \times 10^{-4} Q + 0.2144 \times 10^{-9} Q^2 - 0.13641 \text{ L2B Dummy}$
$(3.5933)^{***} \quad (-2.0360)^{**} \quad (0.31778) \quad (-0.67981)$

$R^2 = 0.0959 \quad SE = 0.1210 \quad Q^* = M\$40$ billion

4.8) $AC = 0.77064 - 0.1703 \times 10^{-4} Q - 0.18916 \text{ L2B Dummy}$
$(6.3496)^{***} \quad (-2.7944)^{***} \quad (-1.6847)^{*}$

$R^2 = 0.0950 \quad SE = 0.1204$

4.9) $\text{Log } AC = -0.32263 - 0.04627 \log Q + 0.30464 \text{ L2B Dummy}$
$(-1.6352) \quad (-2.5650)^{**} \quad (0.30464)$

$R^2 = 0.0893 \quad SE = 0.2023 \quad E_{TC} = 0.95$

D. All banks except foreign banks and two largest banks (BBMB and MBB)

4.10) $AC = 0.84475 - 0.1247 \times 10^{-4} Q + 0.9173 \times 10^{-10} Q^2 - 0.16581 \text{ FDummy} - 0.17807 \text{ L2B Dummy}$
$(5.6427)^{***} \quad (-1.9988)^{*} \quad (0.18271) \quad (-9.2136)^{***} \quad (-1.1922)$

$R^2 = 0.5044 \quad SE = 0.0900 \quad Q^* = M\$68$ billion

4.11) $AC = 0.86643 - 0.1160 \times 10^{-4} Q - 0.16590 \text{ FDummy} - 0.20065 \text{ L2B Dummy}$
$(9.5368)^{***} \quad (-2.8956)^{***} \quad (-9.2649)^{***} \quad (-2.4026)^{**}$

$R^2 = 0.5042 \quad SE = 0.0896$

4.12) $\text{Log } AC = -0.19645 - 0.03007 \log Q - 0.28707 \text{ FDummy} - 0.05232 \text{ L2B Dummy}$
$(-1.3641) \quad (-2.2751)^{**} \quad (-9.7312)^{***} \quad (-0.71718)$

$R^2 = 0.5233 \quad SE = 0.1470 \quad E_{TC} = 0.97$

Notes: ***Statistically significant at the one per cent level
**Statistically significant at the five per cent level
*Statistically significant at the ten per cent level
Figures within brackets are t-statistics
a - As at end of 1986, the total assets of Malayan Banking Berhad and Bank Bumiputra Malaysia Berhad registered a figure of M$21 billion and M$17 billion respectively.
b - DDummy equals 1 for foreign banks and 0 otherwise. L2BDummy equals 1 for banks other than BBMB and MBB and 0 otherwise. FDummy equals 1 for domestic banks and 0 otherwise.

we also estimated equations (4.10), (4.11) and (4.12) to determine the scale economies of domestic banks but excluding the effect of the two largest domestic banks (MBB and BBMB). Overall results suggest that the Malaysian banking sector exhibits scale economies in their operation.

In Table 5, we estimate separate cost functions for domestic banks and foreign banks. Initially we tested the quadratic average

TABLE 5 : Regression Results of Cost Functions for Subsamples of Banks in Malaysia, 1984-1986[a]

A. Domestic Banks

5.1) Log AC = - 0.75505 + 0.5816 x 10^{-4} log Q
(- 8.1155)*** (0.00478)

R^2 = 0.401 x 10^{-6} SE = 0.1162 E_{TC} = 1.6

5.2) Log AC = -0.60986 - 0.01572 log Q - 0.04961 SDummy
(-3.5328)*** (-0.78844) (-0.99853)

R^2 = 0.0174 SE = 0.1162 E_{TC} = 0.98

5.3) Log AC = - 0.70838 - 0.00743 log Q - 0.04072 SDummy + 0.03486 L2BDummy
(-2.6908)*** (-0.28535) (-0.76683) (0.49823)

R^2 = 0.0219 SE = 0.1170 E_{TC} = 0.99

5.4) AC = 0.47717 - 0.9338 x 10^{-6} Q
(54.461)*** (-0.77895)

R^2 = 0.0105 SE = 0.0552

5.5) AC = 0.49292 - 0.1975 x 10^{-5} Q - 0.02172 SDummy
(31.931)*** (-1.3524) (-1.2366)

R^2 = 0.0368 SE = 0.0550

5.6) AC = 0.61270 - 0.7356 x 10^{-5} Q - 0.03782 SDummy - 0.09897 L2BDummy
(6.5588)*** (-1.6770)* (-1.7670)* (-1.2999)

R^2 = 0.0655 SE = 0.0547

B. Foreign banks

5.7) Log AC = - 0.18574 - 0.04247 log Q
(-1.1454) (-1.8047)*

R^2 = 0.0648 SE = 0.1915 E_{TC} = 0.96

5.8) AC = 0.67435 - 0.2372 x 10^{-4} Q
(29.239)*** (-2.6530)***

R^2 = 0.1302 SE = 0.1226

Notes : ***Statistically significant at the one per cent level
**Statistically significant at the five per cent level
*Statistically significant at the ten per cent level
Figures within brackets are t-statistics
a - SDummy equals 1 for banks with total assets of more than M$1 billion and 0 otherwise

cost functions but the results were discouraging since all variables were insignificant for both domestic and foreign banks. Therefore, we have estimated the log-linear and linear average cost functions. For domestic banks, only estimated equation (5.6) is worth commenting upon. In equation (5.6), we have taken into account the effect of the two largest banks, and also the different organizational structures of small (total assets of less than RM1 billion) and large (total assets of more than RM1 billion) banks. Besides dummy variable L2BDummy, we have included SDummy to capture the different structures of small and large banks (one equals large, and zero otherwise). As can be seen, domestic banks exhibit scale economies in their operations. On the other hand, equations (5.7) and (5.8) clearly indicate that the average cost curve for foreign banks decline, showing that they are operationally efficient.

Banks as Multiproduct Firms : Further Evidence on Scale Economies

Although banks have been recognised as multiproduct firms, it was not until the eighties that researchers explicitly took into account the effect of joint production of the multiple services on bank costs. Studies in the 1960s and 1970s considered different bank outputs as separable from one another. The outputs of financial institutions which have been used in previous studies, particularly in commercial banks, are total assets, earning assets, total deposits, demand deposits, the number of deposits and loans accounts, gross operating income and also the combination of these measures (Benston, 1972; Mackara, 1975).

For a single output bank, the measurement of output is straight-forward; the researcher chooses any measure of output as long as the measure is consistent with the researcher's goal. However, for a multiproduct firm, the measurement of output is quite complicated. One way out is to devise some aggregate output index for multiproduct banks (Goldschmidt, 1983; Kim, 1986). However, Baumol (1977) has proposed an alternative solution based on the behaviour of total costs as each firm's output is increased by the same proportion. This relationship is referred to as ray average cost. Baumol has shown that the concept of declining ray average costs describes average costs for the multiproduct firm without recourse to arbitrary aggregation.

A declining ray average cost for a multiproduct firm corresponds to scale economies in a single product firm. In the multiproduct case, average costs decline as outputs increase proportionately along a ray in output space.

To illustrate this point, consider Figure 2. In Figure 2, the cost surface OAE is strictly concave with respect to the output plane, e.g., loans and deposits. Along any ray through the origin (Ray1, Ray2, Ray3), the cost function exhibits decreasing ray average costs. But, the cross section ABCDE taken across the rays reaches its lowest points at the loans and deposits axes, although the cost function exhibits economies of scale. This would imply that the cost surface OAE favours production of loans and deposits separately, since joint production would increase costs, such as at B, C or D. Therefore, in order to obtain cost savings by producing joint products in a multiproduct firm, it is necessary that the cost function exhibit decreasing ray average costs, and a cost savings with a joint production process which is characterized by interproduct complementarity, as the scale of production increases.

Such a situation is illustrated in Figure 3. In Figure 3, the cost surface OA*E* exhibits strict decreasing ray average costs along Ray1*, Ray2*, Ray3*. However, the cost surface also exhibits interproduct complementarity in the production process in that the cross section A*B*C*D*E*, indicating that minimum ray average cost is obtained by joint production of outputs-loans and deposits, at point C*.

The interproduct complementarity in joint production has been termed economies of scope. Since banks are multiproduct firms with a desire to expand their product offerings, the possibility of scope economies is real. Scope economies exist when joint production costs are less than stand-alone production costs. Consider two products, say loans and deposits, and their stand-alone costs functions, C (loans) and C (deposits). If the joint cost of producing the two products is represented by C (loans,deposits), then economies of scope exist when {C(loans,deposits)< [C(loans) +

C(deposits)]}. Referring to Figure 3, such a point is at C*.

To test for decreasing ray average costs and interproduct complementarity, we estimate the following cost function (see Goldschmidt, 1983),

$$C(t) = [\,[C1(t) + C2(t)] = a(0) + a(1)Q1^2(t) + a(2)Q2^2(t) + a(3)\,(Q1.Q2)\,(t) \quad (3)$$

where C is total cost of production, categorised into interest expense C1, and other production costs C2, Q1 and Q2 are the respective output measures.

To counter the simultaneity bias in C1, the following system was used,

$$C1(t) = b(0) + b(1)Q1(t) + b(2)Q2(t) \quad (4a)$$

$$Q1(t) = c(0) + c(1)C1(t) + c(2)Q1(t\text{-}1) + c(3)w(t\text{-}1) \quad (4b)$$

$$Q2(t) = d(0) + d(1)C1(t) + d(2)Q2(t\text{-}1) + d(3)w(t\text{-}1) \quad (4c)$$

where the exogenous variables are Qi(t-1), i = 1,2, the output measures and the wage bill per worker as a proxy for w(t-1), the annual wage rate.

Equations (4a), (4b) and (4c) were used to generate estimates by the two-stage least square technique. These estimates were then substituted into equation (3) to yield the following estimating equation,

$$[\hat{C}1(t) + \hat{C}2(t)] = \hat{\alpha}(0) + \hat{\alpha}(1)Q1^2(t) + \hat{\alpha}(2)Q2^2(t) + \hat{\alpha}(3)(Q1.Q2)(t) + U(t) \quad (5)$$

For the cost surface [equation (5)] to exhibit decreasing ray average cost, the following condition (6) must be satisfied,

$$-\alpha(0) + \alpha(1)Q1^2(t) + \alpha(2)Q2^2(t) + \alpha(3)(Q1.Q2)(t) < 0 \quad (6)$$

A sufficient condition for surface [equation (5)] to exhibit interproduct complementarity is $\alpha(1) > 0$, $\alpha(2) > 0$, and $\alpha(3) < 0$, while the necessary and sufficient condition is $\{2 \min [\alpha(1), \alpha(2)] > \alpha(3)\}$.

In this study, we defined outputs as total loans Q1, and total deposits Q2. These output definitions were used by Goldschmidt (1983), Gilligan, Smirlock and Marshall (1984), Lawrence and Shay (1986), Kim (1986), Berger, Hanweck and Humphrey (1987) and others. In the final estimating model, we incorporated three other variables; A(t), and A(t-1) to represent vertical integration/ expansion in the institution, and B, the number of branches, to represent horizontal expansion.

Results of the regression analysis are presented in Tables 6 to 8. In Table 6, in the equations estimated, we have included A(t) and A(t-1) as additional regressors to take into account vertical expansion in the banking sector, and it will also show interbank differences in balance-sheet composition, account size, turnover etc., which was suggested by Goldschmidt (1983). All variables are significantly different from zero at least at the five per cent level and all variables show expected signs.

Our results suggest that for the equations estimated for all banks and domestic banks, as shown by the solution (calculated at their average) of equation (6), the ray average cost (RAC) shows a negative value signifying that the banks in Malaysia as a whole experienced economies of scale in their operations. This is also true for domestic banks, but not for foreign banks, as shown by the positive value of RAC. Similar results are arrived at for the decreasing ray average cost when we take into account the horizontal expansion as shown in Table 7, and also for both vertical and horizontal expansions as shown in Table 8.

One explanation for this behaviour is that the domestic banks were unable to grab the opportunity to expand horizontally by branching out, and thereby spread the cost more 'evenly'. As for foreign banks, they are prohibited from expanding their branches. However, since this is an average result for all foreign banks, we believe that foreign banks

FIGURE 2 : Cost Surface Concave to Output Plane

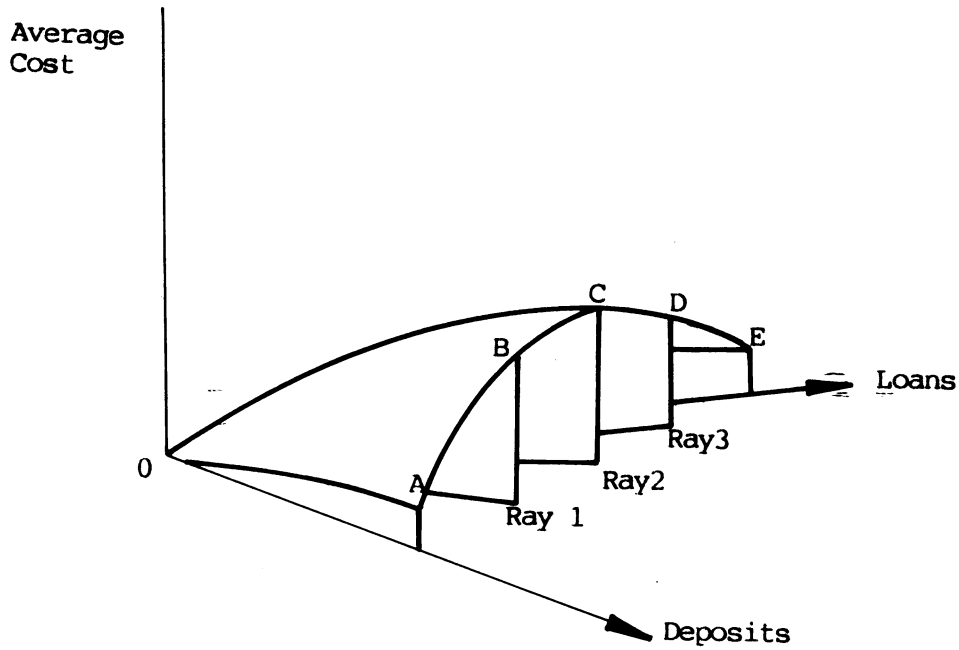


FIGURE 3 : Cost Surface Exhibits Strict Decreasing Ray Average Cost
Source : Adapted from Baumol (1977)

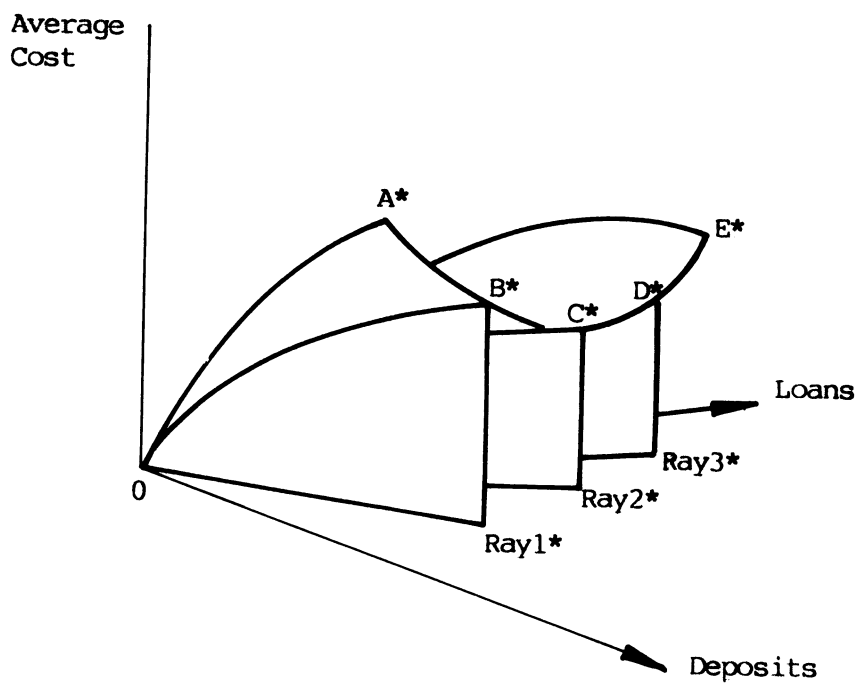


TABLE 6 : OLS Estimates of Equation (3) taking into account the effect of Asset Composition

$$\hat{C}1(t) + C2(t) = \alpha(0) + \alpha(1)\hat{Q}1^2(t) + \alpha(2)\hat{Q}2^2(t) + \alpha(3)(\hat{Q}1.\hat{Q}2)(t) + \alpha(4)A(t) + \alpha(5)A(t-1) + e(t)$$

	All Banks	Domestic Banks	Foreign Banks
$\alpha(0)$	121.44	221.79	59.178
	(2.3184)**	(2.6187)**	(2.1957)**
$\alpha(1)$	1.1764×10^{-3}	1.2242×10^{-3}	7.418×10^{-4}
	(5.2412)***	(3.2292)***	(3.7507)***
$\alpha(2)$	5.63×10^{-4}	5.896×10^{-4}	5.362×10^{-4}
	(4.9486)***	(3.0824)***	(3.1301)***
$\alpha(3)$	-1.6557×10^{-3}	-1.7173×10^{-3}	-1.192×10^{-3}
	(-5.1147)***	(-3.1355)***	(-3.3213)***
$\alpha(4)$	0.32574	0. 33755	0.37011
	(3.8233)***	(2.9683)***	(3.2888)****
$\alpha(5)$	0.35180	0.25636	0.29767
	(3.47756)***	(2.0155)**	(2.3653)**
R^2	0.9745	0.9781	0.9919
SE	360.4	427.1	100.5
Sample	108	59	49
RAC	-155.04	-293.98	6.39

Note : *** Statistically significant at the one per cent level
** Statistically significant at the five per cent level
* Statistically significant at the ten per cent level

TABLE 7 : OLS Estimates of Equation (3) taking into account the effect of Branching

$$\hat{C}1(t) + C2(t) = \beta(0) + \beta(1)\hat{Q}1^{2}(t) + \beta(2)\hat{Q}2^{2}(t) + \beta(3)(\hat{Q}1.\hat{Q}2)(t) + \beta(4)B(t) + v(t)$$

	All Banks	**Domestic Banks**	**Foreign Banks**
$\beta(0)$	330.78	407.93	169.86
	(4.3917)***	(3.7058)***	(4.6568)***
$\beta(1)$	1.1116×10^{-3}	1.431×10^{-4}	2.4426×10^{-3}
	(3.4464)***	(0.34981)	(8.4911)***
$\beta(2)$	4.935×10^{-4}	1.613×10^{-5}	1.2841×10^{-3}
	(3.0001)***	(0.07802)	(4.9250)***
$\beta(3)$	-1.4635×10^{-3}	-7.438×10^{-5}	-3.3657×10^{-3}
	(-3.1283)***	(-0.12618)	(-6.1516)***
$\beta(4)$	41.569	30.199	35.341
	(10.313)***	(6.0010)***	(7.6647)***
R^2	0.9405	0.9593	0.9789
SE	548.6	578.1	160.5
Sample	108	59	49
RAC	-244.38	-195.49	110.09

Note: *** Statistically significant at the one per cent level
** Statistically significant at the five per cent level
* Statistically significant at the ten per cent level

TABLE 8: OLS Estimates of Equation (3), taking into account the effects of both Asset Composition and Branching

$$\hat{C}1(t) + C2(t) = \theta(0) + \theta(1)\hat{Q}1^2(t) + \theta(2)\hat{Q}2^2(t) + \theta(3)(\hat{Q}1.\hat{Q}2) + \theta(4)A(t) + \theta(5)A(t-1) + \theta(6)B(t) + u(t)$$

	All Banks	Domestic Banks	Foreign Banks
$\theta(0)$	114.89	226.83	58.227
	(2.1677)**	(2.6087)**	(2.2925)**
$\theta(1)$	1.196×10^{-3}	1.2687×10^{-3}	1.0877×10^{-3}
	(5.2941)***	(3.0918)***	(4.7096)***
$\theta(2)$	5.702×10^{-4}	6.134×10^{-4}	6.981×10^{-4}
	(4.9919)***	(2.9386)***	(4.7096)***
$\theta(3)$	-1.6792×10^{-3}	1.7842×10^{-3}	-1.6654×10^{-3}
	(-5.1619)***	(-2.9933)***	(-4.3112)***
$\theta(4)$	0.28247	0.37113	0.30710
	(2.8483)***	(2.3121)**	(2.8197)***
$\theta(5)$	0.36119	0.24476	0.25109
	(3.5449)***	(1.8261)*	(2.0924)**
$\theta(6)$	3.8054	-2.0962	9.8476
	(0.85567)	(-0.29910)	(2.5355)**
R^2	0.9747	0.9782	0.9930
SE	360.9	430.8	94.7
Sample	108	59	49
RAC	-146.08	-306.55	35.30

Note: *** Statistically significant at the one per cent level
** Statistically significant at the five per cent level
* Statistically significant at the ten per cent level

with more branches would probably experience scale economies.

Further, our results indicate that all banks, both domestic and foreign, exhibit economies of scope or interproduct complementarity among various outputs. The existence of interproduct complementarity indicates that the more efficient way of production is to produce the whole output vector rather than only part of it.

Further Analysis Using Profitability Approach

Another approach to avoid the problem which arises in measuring bank output is to employ a simpler direct method using the balance sheet structures of the banks to determine the operating efficiency in banks. This approach was taken by Hester and Zoellner (1966), Haslem (1968), Bond (1971), and more recently, Kwast and Rose (1982).

Accordingly, the following relationships are in order,

$$Y(t) = \alpha(0) + \beta(1)A(t) + \theta(1)L(t) + \phi(1)S(t)+z(t) \quad (7)$$

where Y is a measure of income, A is the asset side of the balance sheet, L is the liability side of the balance sheet, S is a measure of efficiency, and z is the disturbance term. The coefficients β and θ are estimated (marginal) rates of return on the given asset and liability categories (if there are i th assets and j th liabilities). The asset coefficients should approximate rates of return net of operating costs, and the liability coefficients may be interpreted as the marginal cost of a particular liability (Kwast and Rose, 1982). The expected sign of β should be positive and θ should be negative. On the other hand, the expected sign on ϕ may be either positive or negative. A positive sign should reflect economies of scale, and a negative sign should show diseconomies of scale. The variable ϕ should be our main concern in this analysis.

In order to estimate equation (7), three measures of income were used as the dependent variables; Y1 (net profit before taxation), Y2 ({{Loans[1 + (rB/100)]} - [Deposits(rD/100)] + Y1}), and Y3 ({{Loans[1 + (rB/100)]} - [Deposits(rD/100)]}). rB and rD are rates of interest on loans and deposits, respectively. The average lending rate and 12-month fixed deposit rate were used to proxy for rB and rD, respectively. Independent variables A and L are proxied by total loans and total deposits respectively. Total assets are used to proxy a measure of scale economies.

Results of the regression equations based on equation (7) for the three measures of income are presented in Table 9. In Table 9, we have differentiated between all banks, domestic and foreign. Out of the three measures of income, only Y2 and Y3 gave the desired results, and Y1 failed to give any significant result. The undesired results shown by Y1 are expected as the value of profit before taxation reported in the financial statement of banks is subjected to what is commonly called 'window dressing'.

Therefore, results shown by Y2 and Y3 are worth mentioning. We observe from Table 9 that all estimated regression equations show satisfactory goodness of fit. All variables are significant at the one per cent level, except for S for foreign banks for income Y3, which is significant at the ten per cent level. Nevertheless, all variables show the expected sign.

Our main interest in this analysis is to determine the important relationship shown by variable S. Our results as indicated by S suggest that there are economies of scale in Malaysian commercial banking, both for domestic and foreign banks.

SUMMARY AND CONCLUSIONS

An examination of the economic efficiency or cost economies of banking is important for three reasons. First, managers of banks would be interested in knowing how cost efficiency could be improved further, in order to achieve higher profits and to improve the chances of survival, especially in the stiff competition faced by the banking sector against competing non-bank financial intermediaries. Second, customers would be interested in knowing the effects of deregulations on costs and, consequently, on the prices and quality of bank services and the likely effect on the number of new services that might be offered. Finally, monetary authorities would be interested in

TABLE 9: Regression Results for Profitability Analysis

	All Banks	Domestic Banks	Foreign Banks
A. Y1 as Dependent Variable			
Constant	7.1349 (7.3784)	4.5582 (12.849)	0.09508 (2.4784)
A	-0.00930 (0.01468)	-0.03421 (0.02301)	-0.011831 (0.01606)
L	-0.01787 (0.00988)*	-0.00862 (0.01438)	-0.01327 (0.00748)*
S	0.01675 (0.00766)**	0.021910 (0.01057)**	0.03279 (0.01262)**
R^2	0.0564	0.0835	0.5857
B. Y2 as Dependent Variable			
Constant	13.521 (7.9417)	8.0657 (12.890)	-0.77823 (2.6317)
A	1.0664 (0.01580)***	1.0219 (0.02308)***	1.0710 (0.01706)***
L	-0.08283 (0.01063)***	-0.06460 (0.01443)***	-0.10018 (0.00794)***
S	0.02916 (0.00824)***	0.03728 (0.01061)***	0.06129 (0.01340)***
R^2	0.9989	0.9990	0.9998
C. Y3 as Dependent Variable			
Constant	6.3865 (4.2625)	3.5075 (6.9125)	-0.87332 (3.2610)
A	1.0758 (0.00848)***	1.0561 (0.01238)***	1.0893 (0.02114)***
L	-0.06496 (0.00570)***	-0.05598 (0.00773)***	-0.08691 (0.00984)***
S	0.01241 (0.00442)***	0.01537 (0.00569)***	0.02849 (0.01660)*
R^2	0.9997	0.9997	0.9997

Notes: *** Statistically significant at the one per cent level
** Statistically significant at the five per cent level
* Statistically significant at the ten per cent level
Figures within brackets are standard errors.

having information on bank costs and competition under the present deregulatory regime to help them formulate policies affecting the banking industry as a whole.

In this study three types of analysis were done on the Malaysian banking data for the 1984-1986 period. The single-output bank cost function, the multiproduct bank cost function and bank profitability analysis were used to determine the status of operating efficiency in the banking sector in Malaysia.

The results from the single-output bank cost function estimations and bank profitability analysis indicate that scale economies are present in all banks in Malaysia, whether domestic or foreign. On the other hand, the results from estimating the multiproduct bank cost function, which is more appropriate for this study, suggest that estimated equations for 'all' banks and domestic banks exhibit economies of scale. However, on every occasion, the results tend to indicate that foreign banks in Malaysia experience operating inefficiency. Nevertheless, the results show that the Malaysian banking sector, including both domestic and foreign banks, exhibits economies of scope or interproduct complementarity among various outputs.

This study is important for at least four reasons. First, it adds to the literature on banking efficiency, particularly among the developing countries, which have not been given enough attention previously. Second, the results on multiproduct bank cost functions, substantiate Adar, Agmon and Orgler (1975) argument on the importance of interdependent cost consequences on bank output decisions. Third, the findings that foreign banks do not exhibit economies of scale imply that foreign banks should therefore take the opportunity to 'Malaysianise' their local operations, and thereby enjoy the benefits given to domestic banks, particularly, in being able to establish branches all over the country. As a matter of fact, under the Banking and Financial Institutions Act (BAFIA) 1989, foreign banks are required to be incorporated locally in order to operate their banking business in this country. Finally, the existence of interproduct complementarity in the Malaysian banking sector is consistent with other studies conducted in the developed countries mentioned earlier.

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