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An exploration into the home field, global advantage and liability of unfamiliarness hypotheses in multinational banking

Fadzlan Sufian [a,b,*]

[a] Khazanah Research and Investment Strategy, Khazanah Nasional Berhad, Level 35, Tower 2, Petronas Twin Towers, Kuala Lumpur City Centre, 50088 Kuala Lumpur, Malaysia
[b] Department of Economics, Faculty of Economics and Management, Universiti Putra, Malaysia

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Abstract This paper seeks to expand the efficiency paradigm of the eclectic theory in multinational banking within the context of a developing country banking sector. We employ the Data Envelopment Analysis (DEA) method to examine the efficiency of multinational banks operating in the Malaysian banking sector from 1995 to 2007. We then employ the panel regression analysis to examine the impact of origins on bank efficiency. We find foreign banks from North America to be the most efficient banking group, providing support to the 'limited form' of the *global advantage* hypothesis. On the other hand, we do not find evidence on both the *liability of unfamiliarness* and *home field advantage* hypotheses.

Introduction

The empirical works concerning multinational banking have mainly concentrated on the why, when, and how questions. The focus of these studies has been the determinants and methods of multinational banks' entry into foreign markets (see among others Cerutti, Ariccia, & Peria, 2005; Seth, Nolle, & Mohanty, 1998; Williams, 2002). On the other hand, studies concerning the efficiency of multinational banks as a subset of the literature on the eclectic theory are relatively scanty (see among others Williams, 1996). Furthermore, these studies are confined to the banking sectors of the developed and western world, while empirical evidence on the developing countries' banking sectors is completely missing in the literature.

The literature examining the efficiency of foreign owned banks has expanded rapidly in recent times. Banks expand internationally to gain from economies of scale, reduce risks, and increase profitability. However, in order to survive in foreign markets, multinational banks should possess some

* Corresponding author. Khazanah Research and Investment Strategy, Khazanah Nasional Berhad, Level 35, Tower 2, Petronas Twin Towers, Kuala Lumpur City Centre, 50088 Kuala Lumpur, Malaysia. Tel.: +603 2034 0197; fax: +603 2034 0035.
E-mail addresses: fadzlan.sufian@khazanah.com/fsufian@gmail.com.
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firm specific advantages which they can exploit in foreign markets (Casson, 1990). When these advantages can be transferred at little cost, or utilised at lower marginal cost, foreign owned multinational banks may enjoy some competitive advantages compared with the local and multinational banks (Lewis & Davis, 1987).

Generally, the empirical evidence suggests that foreign owned banks in developing and transition countries have succeeded in capitalising on their advantages and they exhibit a higher level of efficiency compared to their domestic bank peers (e.g. Ataullah, Cockerill, & Le, 2004; Havrylchyk, 2006; Isik & Hassan, 2002; Leightner & Lovell, 1998; Sathye, 2003; Shanmugam & Das, 2004). However, due to the different market environment, language, culture, supervisory, and/or regulatory structure, the weight of proximity could be greater and the 'liability of unfamiliarness' is more difficult to overcome for foreign banks headquartered in distant countries. Therefore, it is safe to suggest that foreign banks headquartered in distant countries with a very different market environment, language, culture, and supervisory and/or regulatory structure could be at greater disadvantage compared to those located within the same region.

However, the previous studies examining the efficiency of multinational banks have not properly distinguished between the *home field* and *global advantage* hypotheses (Berger, DeYoung, Genay, & Udell, 2000). Berger et al. (2000) suggest that any specific advantages the foreign banks are likely to have over their domestic bank peers are likely to accrue to the foreign banks headquartered in the same region or locality because of the shorter distances from the home country, similarity in languages, cultures, etc.

In the light of Berger et al.'s (2000) arguments, we build an empirical model that allows the efficiency of the multinational banks to depend on internal (bank specific characteristics) and external (macroeconomic and industry specific) factors. Moreover, unlike the previous studies on bank efficiency, we follow the procedures set in Berger et al. (2000) to take into account the origins of the multinational banks in order to test for the 'limited form' of the *global advantage* hypothesis and the *home field* and *liability of unfamiliarness* hypotheses. By doing so, the present paper builds on the earlier empirical studies and expands on the efficiency paradigm of the eclectic theory in multinational banking.

This paper is set out as follows: In the next section we provide theoretical background on multinational banking operations. In the third section we outline the approaches to the measurement of efficiency change as well as the method for the estimation of the determinants of bank efficiency. The fourth section discusses the results, and we conclude in the fifth section.

Internationalisation of banking operations: theories and empirical evidence

The empirical literature as to why banks expand their operations abroad expound on two major theories, namely the internationalisation and eclectic theories. The internationalisation theory of multinational banking takes its root from Coase's (1937) theory of the firm.[1] Also known as the defensive approach (Grubel, 1977) and follow the customer approach (Walter, 1988), the theory postulates that banks follow their customers and serve them in foreign markets. This implies that banks expand in countries where their corporate clients choose to invest, in order to offer their clients the services they need (Ball & Tschoegl, 1982). Moreover, banks may have a clear interest in keeping other financial institutions away from developing a relationship with its corporate clients. In other words, a bank's expansion abroad can sometimes be a defensive reaction to avoid losing important corporate clients at home (Williams, 2002).

The eclectic theory was first introduced by Dunning (1973, 1981, and 1993). Based on the OLI paradigm, the theory postulates that firms rely on three important factors namely ownership (O), location (L), and internationalisation (I) before making the decision to invest abroad. Similar to the other types of investments, banks face uncertainties about the expected costs and returns. Therefore, the empirical studies on all the three paradigms have mainly concentrated on the benefits and costs of multinational firms operating in foreign countries. Hymer (1976) suggests that foreign banks could face significant cost disadvantage compared to their domestic bank peers arising from differences in language, culture, legal barriers, managing from a distance, etc. To mitigate these costs, foreign banks must therefore be able to capitalise on their strengths and realise gains stemming from their competitive advantage, efficiency, and risk diversification.

Among the competitive advantages most frequently cited by both the eclectic and the internationalisation theories are innovative products, better technologies, and superior management quality.[2] However, these factors may not be germane to the banking sector, since banks have intangible assets which cannot be emulated (Dufey & Giddy, 1981). Furthermore, banks may also find it difficult to retain skilled staff when operating in a foreign country (Merret, 1990). Other comparative advantages, such as soft and hard information, may be crucial as well for banks to operate abroad. Furthermore, banks could be argued to have the competitive advantage, since firms normally prefer to do business with banks with which they have established a relationship (Casson, 1990).

In regard to efficiency, size, degree of internationalisation and product and distribution channels are the main factors mentioned in the literature. A large size may enable banks to translate their scale efficiency to foreign markets at a relatively low cost (Sabi, 1988). The importance of size depends heavily on the kind of activity developed by the foreign banks in the host market. If the business model implies a duplication of costs, scale efficiency will be

[1] As a departure from the eclectic theory, the internalisation theory argument stresses on the advantages of multinational firms stemming from the possibility of their limiting the cost of market failures by carrying out a share of their transactions within the boundaries of the firm. Williams (1997) presents a recent review of this paradigm and argues that most of the theoretical approaches to multinational banking can be encompassed as subsets of the internalisation theory.

[2] See Dunning (1977) for an early application to multinational banking.

difficult to attain. That is the reason why some authors argue that subsidiaries focussing on the retail business are unlikely to benefit from large gains in efficiency compared to a branch model with wholesale or investment banking markets focus (see among others Casson, 1990). The degree of internationalisation is also essential since banks with a large and geographically diversified customer base will be able to reduce transaction costs (Ursacki & Vertinsky, 1992). The use of their own distribution channels may imply large efficiency gains, particularly in developing countries where the supply of certain banking services is generally poor and sometimes non-existent. In this case, subsidiaries oriented towards retail banking can certainly profit from product efficiency. Furthermore, if the bank shares the same culture and language with the host country, the same financial products and services can be offered without requiring substantial changes.

Finally, risk diversification has also been widely quoted as an important motive for banks to have international operations. Banks may benefit from the diversification of their risk–return profile by expanding their operations in foreign countries (Berger & DeYoung, 2001). Other macro-economic factors, such as the business cycle, interest rate structure, and exchange rate could also have considerable influence in determining the intensity of banks' diversification in a foreign country. In this vein, Repullo (2000) suggests that banks prefer to open branches in relatively riskier countries, but with generous deposit guarantee schemes.

The efficiency of multinational banks: empirical evidence to date

The earlier studies on the efficiency of foreign owned banks in the U.S. have generally found that they were relatively inefficient compared to their domestically owned bank peers (e.g. Miller & Parkhe, 2002). According to these studies, the foreign owned banks had to trade efficiency, both cost and profit, for rapid expansion of market share as they financed their rapid growth by relying on purchased funds, which are relatively more expensive than core deposits.

Despite the poor performance of the foreign owned banks in developed countries, a growing body of empirical evidence has shown the superiority in performance of the foreign owned banks in developing countries. Foreign owned banks in India were found to be relatively efficient compared to the domestically owned banks (e.g. Ataullah et al., 2004). Similarly, Sathye (2003) and Shanmugam and Das (2004) also suggest that the public and foreign owned banks in India have exhibited a higher level of technical efficiency compared to their private owned bank peers. Leightner and Lovell (1998) find that the average Thai bank experienced falling total factor productivity growth (TFP), while the average foreign banks have exhibited increasing TFP.

Berger, Clarke, Cull, Klapper, and Udell (2005) suggest that foreign owned banks from developed nations in developing countries may have access to superior technologies, particularly information technologies for collecting and assessing 'hard' quantitative information. However, in less developed countries or regions the weight of proximity is greater, thus the *liability of unfamiliarness* is more difficult to overcome. Local communities differ in terms of the economic, institutional, social, and cultural characteristics from regions where out-of-region bank holding companies are headquartered. The risk of being isolated from strategic banking functions requiring staff that is more qualified is therefore higher. On the other hand, foreign banks with a common origin, either historical, linguistic, or both, can significantly reduce the costs of operating abroad while facilitating the exploitation of efficiencies or competitive advantages. A common origin may lead to advantages in product differentiation (Swoboda, 1990), knowledge transfer (Guillen & Tschoegl, 1999), and reduction in the cost of capital. This could be the case if local funds are easily obtained because of the cultural proximity Fig. 1.

Methodology and the choice of variables

Data envelopment analysis

The non-parametric Data Envelopment Analysis (DEA) method is employed with variable returns to scale (VRS) assumption, to measure input oriented cost efficiency of the Malaysian banking sector. The DEA method involves constructing a non-parametric production frontier based on the actual input–output observations in the sample relative to which efficiency of each bank in the sample is measured (Coelli, Prasada-Rao, & Battese, 1998). To discuss DEA in more technical terms, let us assume that there is data on K inputs and M outputs for each N bank. For the ith bank, these are represented by the vectors x_i and y_i respectively. According to Charnes, Cooper, and Rhodes (1978) the input oriented measure of a particular bank is calculated as:

$$\begin{aligned} &\min_{\lambda,\theta}\theta \\ &\text{subject to } -y_i + Y\lambda \geq 0 \\ &\theta x_i - X\lambda \geq 0 \\ &\lambda \geq 0 \end{aligned} \tag{1}$$

where θ is a scalar representing the value of the efficiency score for the ith bank which will range between 0 and 1. λ is a vector of $N \times 1$ constants. The linear programming has to be solved N times, once for each bank in the sample. In order to calculate efficiency under the assumption of VRS, the convexity constraint $(N1\lambda = 1)$ will be added. 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 (CRS) case.

Next, in order to estimate cost efficiency, the objective function of the program is altered to capture total bank costs (Fare, Grosskopf, & Lovell, 1985). The linear program is specified as

$$\begin{aligned} &\min_{w_i,x_i} \\ &x_i\lambda_i \\ &\text{subject to } y_i, \leq Y\lambda_i \\ &x_i \leq X\lambda_i \\ &\text{and } \lambda_i \geq 0 \end{aligned} \tag{2}$$

Letting x^*_i be the cost minimising vector of input for bank i, cost efficiency (CE) is given by $CE_i = w_i'x*_i / w_i'x_i$. Given estimates of CE and technical efficiency (TE),

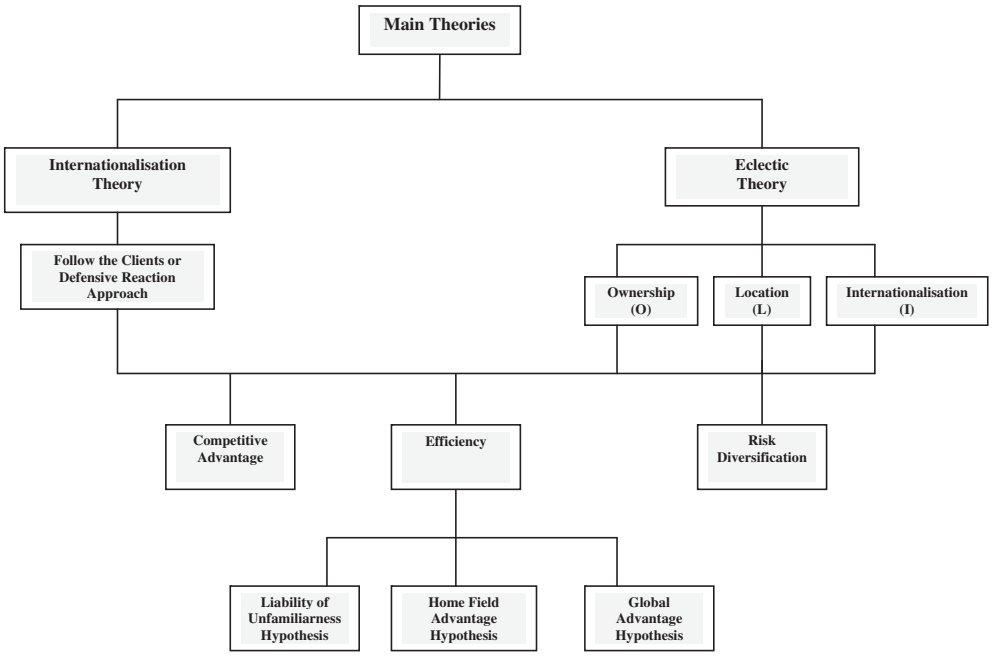

Fig. 1 Theory of Internationalisation.

allocative efficiency (AE) is estimated by the ratio $AE_i = CE_i/TE_i$. The solution of the cost efficiency program provides the cost minimising input vector conditional on the observed technology in the sample. If the ratio $x_{ik} = x*_{ik} < 1$, the bank is under utilising input k; and if $x_{ik} = x*_{ik} > 1$, the bank is over utilising input k.

Allocative efficiency represents how optimally input factors are mixed to minimise total input costs given output quantity and input prices. Firms achieve cost efficiency by adopting the best practice technology (becoming technically efficient) and choosing the optimal mix of input (becoming allocatively efficient), conditional on output and input prices. Technical efficiency for a given bank is defined as the ratio of the input usage of a fully efficient bank producing the same output vector to the input usage of the bank under consideration (Fare et al., 1985).

Multivariate panel regression analysis

It is of considerable interest to explain the determinants of the cost and technical efficiency scores derived from the DEA model. Coelli et al. (1998) indicate several ways in which environmental variables can be accommodated in a DEA analysis. The term 'environmental variables' is usually used to describe factors which could influence the efficiency of a firm. In this case, such factors are not traditional inputs and are assumed to be outside the control of the manager. Hence, the two-stage method used in this study involves the solution of the DEA problem in the first stage analysis, which comprises mainly the traditional outputs and inputs. In the second stage, the efficiency scores obtained from the first stage analysis are regressed on a set of internal (bank specific characteristics) and external (macroeconomic and industry specific) variables.

In an influential development, Banker and Natarajan (2008) provide statistical proof that the use of a two-stage procedure involving DEA followed by an Ordinary Least Square (OLS) regression yields consistent estimators of the regression coefficients. Furthermore, in an important development, McDonald (2009) provides statistical foundation that the use of DEA and OLS is a consistent estimator, and if White's (1980) heteroskedastic consistent standard errors are calculated, large sample tests can be performed which are robust to heteroskedasticity and the distribution of the disturbances.[3]

Thus, following Banker and Natarajan (2008) among others, eq. (3) is also estimated by using the OLS method. Furthermore, as suggested by McDonald (2009) we estimate eq. (3) by using White's (1980) transformation which is robust to heteroskedasticity, and the distribution of the disturbances in the second stage regression analysis involving DEA scores as the dependent variable. In order to check for the robustness of the results, eq. (3) is also estimated by using the 2L Tobit regression model to allow for the restricted [0, 1] range of the efficiency values. Saxonhouse (1976) pointed out that heteroskedasticity can emerge when estimated parameters are used as dependent variables in the second stage analysis. Therefore, following Sufian (2009) among others, the 2L Tobit regression model is estimated by using the QML (Huber/White) standard errors and covariates.

[3] The findings by McDonald (2009) are further supported by Estelle, Johnson, and Ruggiero (2010) who suggest that regression models involving DEA in the first stage are robust with respect to the selection of OLS, flogit, or non-parametric regression models in the second stage analysis. Furthermore, Hoff (2007) also suggests that Tobit regression is adequate to represent the second stage regression models, while the OLS regression models may sufficiently replace Tobit regression analysis as a second stage DEA model.

Table 1 Descriptive statistics for inputs, outputs, and input prices.

	Y1	Y2	Y3	X1	X2	X3	P1	P2	P3
Min	53,411.00	205.00	14.00	131,352.00	1248.00	1898.00	0.005	0.002	0.009
Mean	12,335.73	3,767,524.55	180,873.30	888,037.68	184,255.20	152,612.30	0.056	0.008	0.252
Max	109,070.50	36,423.40	1,800,718.00	137,864.10	1,417,961.00	1,419,973.00	1.461	0.019	7.340
S.D	5790.82	2,346,414.05	80,638.77	6551.73	61,636.41	78,243.08	0.084	0.001	0.411

Notes: Y1: Loans (includes loans to customers and other banks), Y2: Investments (includes dealing and investment securities), Y3: Non-Interest Income (defined as fee income and other non-interest income, which among others consist of commission, service charges and fees, guarantee fees, and foreign exchange profits), X1: Total Deposits (includes deposits from customers and other banks), X2: Capital (measured by the book value of property, plant, and equipment), X3: Personnel Expenses (inclusive of total expenditures on employees such as salaries, employee benefits and reserve for retirement pay)[a], P: Price of Deposits (interest expense divided by total deposits), P2: Price of Labour (personnel expenses divided by total assets), P3: Price of Capital (capital cost and depreciation divided by fixed assets).

Source: Annual reports of banks and authors own calculations.

[a] As data on the number of employees are not readily made available, personnel expenses have been used as a proxy measure.

By using the cost and technical efficiency scores as the dependent variable, the following baseline regression model is estimated:

$$\theta_{jt} = \delta_0 + \beta_1 \mathrm{LNDEPO}_{jt} + \beta_2 \mathrm{LOANS/TA}_{jt} + \beta_3 \mathrm{LNTA}_{jt} + \beta_4 \mathrm{LLP/TL}_{jt} + \beta_5 \mathrm{NII/TA}_{jt} + \beta_6 \mathrm{NIE/TA}_{jt} + \beta_7 \mathrm{EQASS}_{jt} + \beta_8 \mathrm{ROA}_{jt} + \zeta_1 \mathrm{LNGDP}_{t} + \zeta_2 \mathrm{INFL}_{t} + \zeta_3 \mathrm{CR3}_{t} + \zeta_4 \mathrm{MKTCAP/GDP}_{t} + \epsilon_{jt} \quad (3)$$

where '*j*' denotes the bank, '*t*' the examined time period, and ϵ is the disturbance term.

Data and construction of variables

We use annual bank level data of all Malaysian commercial banks over the period 1995—2007. The variables are obtained from published balance sheet information in annual reports of each individual bank. The macroeconomic variables are retrieved from IMF Financial Statistics (IFS) and the World Bank World Development Indicator (WDI) databases. The total number of commercial banks operating in Malaysia varied from 36 banks in 1995 to 23 banks in 2007 due to entry and exit of banks during the past decade. This gives us a total of 353 bank year observations. The sample represents the whole gamut of the industry's total assets.

As in the most recent studies, (e.g. Sufian, 2009), we adopt the intermediation approach. Elyasiani and Mehdian (1990) suggest three advantages of the intermediation approach over other approaches. They suggest that (i) it is more inclusive of the total banking cost as it does not exclude interest expense on deposits and other liabilities; (ii) it appropriately categorises the deposits as inputs; and (iii) it has an edge over other definitions for data quality considerations. Therefore, as in the majority of the empirical literature, we adopted a modified version of the intermediation approach as opposed to the production approach for selecting input and output variables for computing CE, TE, and AE scores for individual banks in the sample.

Accordingly, three input and three output variables are chosen. The input vectors used are (X1) Total Deposits, (X2) Capital, and (X3) Labour, while, (Y1) Total Loans, (Y2) Investments, and (Y3) Non-Interest Income are the output vectors. To measure cost and allocative efficiencies the input prices are (P1) Price of Deposits, (P2) Price of Labour, and (P3) Price of Capital. Table 1 presents the summary of data used to construct the efficiency frontiers.

The independent variables used to explain bank efficiency are grouped under two main characteristics. The first represents bank specific attributes, while the second encompasses economic and market conditions during the period of examination. The bank specific variables included in the second stage multivariate regression models are LNDEPO (log of total deposits), LOANS/TA (total loans divided by total assets), LNTA (log of total assets), LLP/TL (loans loss provisions divided by total loans), NII/TA (non-interest income divided by total assets), NIE/TA (total overhead expenses divided by total assets), EQASS (book value of stockholders' equity as a fraction of total assets), and ROA (profit after tax divided by total assets).

The variable LNDEPO is included in the regression model as a proxy variable for branch networks. It would be reasonable to assume that banks with wide branch networks are able to attract more deposits, which is a cheaper source of funds. Earlier studies by Chu and Lim (1998) among others point out that the large banks may attract more deposits and loan transactions and in the process command larger interest rate spreads. On the other hand, the smaller banking groups with smaller depositor base might have to resort to purchasing funds in the inter-bank market, which is costlier (Randhawa & Lim, 2005). Therefore, we do not have a priori expectation on the impact of network embededdness on the efficiency of banks in Malaysia.

Liquidity risk, arising from the possible inability of banks to accommodate decreases in liabilities, or to fund increases on the assets side of the balance sheet, is considered an important determinant of bank efficiency. The loans market, especially credit to households and firms, is risky and has a greater expected return than other bank assets, such as government securities. Thus, one would expect a positive relationship between liquidity (LOANS/TA) and efficiency. On the other hand, Eichengreen and Gibson (2001) point out that the fewer the funds tied up in liquid investments the higher the efficiency.

The LNTA variable is included in the regression models as a proxy of size to capture the possible cost advantages

associated with size (economies of scale). In the literature, mixed relationships are found between size and efficiency, while in some cases a U-shaped relationship is observed. LNTA is also used to control for cost differences related to bank size and for the greater ability of larger banks to diversify. In essence, LNTA may lead to positive effects on bank efficiency if there are significant economies of scale. On the other hand, if increased diversification leads to higher risks, the variable may exhibit negative effect.

The ratio of loan loss provisions to total loans (LLP/TL) is incorporated as an independent variable in the regression analysis as a proxy of credit risk. The coefficient of LLP/TL is expected to be negative. In this direction, Miller and Noulas (1997) suggest that the greater the exposure of the banks to high risk loans, the higher would be the accumulation of unpaid loans and profitability would be lower. Miller and Noulas (1997) suggest that decline in loan loss provisions is in many instances the primary catalyst for increases in profit margins. Furthermore, Thakor (1987) also suggests that the level of loan loss provisions is an indication of the bank's asset quality and signals changes in the future performance.

To recognise that banks in recent years have increasingly been generating income from 'off-balance sheet' business and fee income generally, the ratio of non-interest income over total assets (NII/TA) is entered in the regression analysis as a proxy measure of bank diversification into non-traditional activities. Non-interest income consists of commission, service charges, fees, net profit from sale of investment securities, and foreign exchange profit. The variable is expected to exhibit positive relationship with bank efficiency.

The ratio of overhead expenses to total assets, NIE/TA, is used to provide information on the variations of bank operating costs. The variable represents total amount of wages and salaries, as well as the costs of running branch office facilities. The relationship between the NIE/TA variable and bank efficiency levels may be negative, because the more efficient banks would keep their operating costs low. Furthermore, the usage of new electronic technology, like ATMs and other automated means of delivering services, may have caused expenses on wages to fall (as capital is substituted for labour).

EQASS variable is included in the regression models to examine the relationship between efficiency and bank capitalisation. Strong capital structure is essential for banks in developing 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. Thus, the efficiency level should be higher for the better capitalised bank.

The ROA (Return on Assets) ratio is defined as profit after tax divided by total assets and is a financial ratio used to measure the relationship between bank efficiency and profitability. The variable is expected to take a positive sign as banks reporting higher profitability are usually preferred by clients and therefore attract the biggest share of deposits as well as the best potential creditworthy borrowers. Such conditions create a favourable environment for the profitable banks to be more efficient from the point of view of intermediation activities.

Bank efficiency is sensitive to macroeconomic conditions despite the trend in the industry towards greater geographic diversification and wider use of financial engineering techniques to manage risk associated with business cycle forecasting. Generally, higher economic growth encourages banks to lend more and permits them to charge higher margins, as well as improving the quality of their assets. As GDP growth slows down and in particular during recessions, credit quality tends to deteriorate and the default rate rises. We use the log of gross domestic product (GDP) to control for cyclical output effects, which we expect will have a positive influence on bank efficiency.

We also account for macroeconomic risk by controlling for the rate of inflation (INFL). The extent to which inflation affects bank efficiency depends on whether future movements in inflation are fully anticipated, which in turn depends on the ability of banks to accurately forecast its future movements. An inflation rate that is fully anticipated raises profits as banks can appropriately adjust interest rates in order to increase revenues, while an unanticipated change could raise costs due to imperfect interest rate adjustment (Perry, 1992). We do not have a priori expectations on the relationship between bank cost and technical efficiency and INFL.

The CR3 variable measured as the concentration ratio of the three largest banks in terms of assets is entered in the regression models as a proxy variable for the banking sector concentration. According to the industrial organisation literature, a positive impact is expected under both collusion and efficiency views (Goddard et al. 2004). Following Demirguc-Kunt and Huizinga (1999) among others MKTCAP/GDP is introduced in the regression model to reflect the complementarity or substitutability between bank and stock market financing. Demirguc-Kunt and Huizinga (1999) found that stock market capitalisation to bank assets is negatively related to bank margins and suggested that the relatively well developed stock markets can substitute for bank finance. We therefore expect the variable to be negatively related to bank efficiency.

To explore Berger et al.'s (2000) *global advantage* hypothesis, we differentiate between the home countries of the foreign banks. We assign DUMAMER (dummy variable that takes a value of 1 for banks originating from North America, 0 otherwise), DUMEURO (dummy variable that takes a value of 1 for banks originating from European countries, 0 otherwise), and DUMASIA (dummy variable that takes a value of 1 for banks originating from the Asian countries, 0 otherwise).

The explanatory variables and their hypothesised relationship with bank efficiency are detailed in Table 2.

Results

Efficiency of the Malaysian banking sector

As suggested by Isik and Hassan (2002), we estimate separate annual efficiency frontiers rather than a common frontier across time. Isik and Hassan (2002) pointed out the following two advantages of this approach. First, it is more flexible and thus more appropriate than estimating a single

Table 2 Descriptive of the variables used in the regression models.

Variable	Description	Hypothesised Relationship with Efficiency
Dependent		
CE	Cost efficiency measure derived from the DEA method	N.A.
TE	Technical efficiency measure derived from the DEA method	N.A.
Independent		
Bank characteristics		
ROA	Return on assets	+
LNDEPO	Natural logarithm of total deposits	+/−
LOANS/TA	Total loans over total assets	+/−
LNTA	Natural logarithm of total assets	+/−
LLP/TL	Loan loss provisions over total loans	−
NII/TA	Non-interest income over total assets	+
NIE/TA	Non-interest expense over total assets	−
EQASS	Total book value of shareholders divided by total assets	+
Economic and market conditions		
LNGDP	Natural logarithm of gross domestic products	+
INFL	The annual inflation rate.	+/−
MKTCAP/GDP	The ratio of stock market capitalisation. The variable serves as a proxy of financial development.	−
CR3	The three largest banks asset concentration ratio.	+/−
Bank Origins		
DUMAMER	Dummy variable that takes a value of 1 for American banks, 0 otherwise	+/−
DUMEURO	Dummy variable that takes a value of 1 for European banks, 0 otherwise	+/−
DUMASIA	Dummy variable that takes a value of 1 for Asian banks, 0 otherwise	+/−

multiyear frontier for the banks in the sample. Second, it alleviates, at least to an extent, the problems related to the lack of random error in DEA by allowing an efficient bank in one year to be inefficient in another, under the assumption that the errors owing to luck or data problems are not consistent over time.

Panels A–M of Table 3 present the summary statistics of the efficiency scores by year. The results suggest that the mean cost efficiency of the Malaysian banking sector ranges from a low of 73.8% (Panel A: 1995) to a high of 92.1% (Panel L: 2006) with an average efficiency of 84.3% during the period under study. The results imply that Malaysian banks could have improved their cost efficiency by 18.7% on average, or in other words, banks could have used only 84.3% of the resources actually employed to produce the same level of outputs.[4] It is observed from Table 3 that the average allocative efficiency has been higher than technical efficiency, implying that the dominant source of cost inefficiency of Malaysian banks is technical rather than allocative. On average, Malaysian banks could improve technical efficiency by 20.6% and allocative efficiency by 6.3%. The results imply that the managers of Malaysian banks have been relatively efficient in choosing the proper input mix given the prices, but were relatively inefficient at utilising all factor inputs. Hence, the overall cost inefficiency in the Malaysian banking sector could be due largely to the underutilisation or wasting of resources rather than choosing the incorrect input mix.

We will now turn to examining the efficiency of the domestic banks.[5] The results are presented in Panel N of Table 3. The empirical findings suggest that the domestic banks have exhibited mean cost efficiency (inefficiency) of 81.8% (22.2%). It is also clear that the domestic banks have exhibited mean technical efficiency (inefficiency) of 68.1% (31.9%). A closer look at the results indicates that technical inefficiency outweighs allocative inefficiency in determining the domestic banks' total cost inefficiency. The findings indicate that although the domestic banks

[4] The relationship between efficiency (E) and inefficiency (IE) is IE = (1-E)/E. Thus, the 84.3% efficiency implies 18.7% inefficiency and not 15.7% (Isik & Hassan, 2002).

[5] It may be questionable to construct common frontiers for both the domestic and foreign banks (Isik & Hassan, 2002). Following the procedures outlined in Isik and Hassan (2002) among others, the null hypothesis of identical frontiers between the foreign and domestic banks' efficiency is tested by using a series of parametric (ANOVA and ^{t}–test) and non–parametric (Kolmogorov–Smirnov, Mann–Whitney [Wilcoxon Rank–Sum], and Kruskal–Wallis) tests. In general, both the parametric and non–parametric test statistics failed to reject the null hypothesis at the 5% levels of significance that the domestic and foreign banks are drawn from the same population and have identical technologies, implying that there is no significant difference between the domestic and foreign banks' technologies (frontiers). The results imply that we could assume the variances among the domestic and foreign banks to be equal and it is appropriate to construct common frontiers by pooling data on both the domestic and foreign banks. For purposes of brevity, the results are not reported in the paper, but are available upon request from the authors.

Table 3 Summary statistics of efficiency measures.

	No. of Banks	CE	AE	TE
Panel A: 1995	36			
Mean		0.738	0.875	0.645
Std. dev.		0.254	0.224	0.239
Panel B: 1996	36			
Mean		0.838	0.927	0.679
Std. dev.		0.181	0.136	0.223
Panel C: 1997	33			
Mean		0.867	0.956	0.628
Std. dev.		0.176	0.097	0.201
Panel D: 1998	33			
Mean		0.849	0.968	0.607
Std. dev.		0.140	0.043	0.206
Panel E: 1999	33			
Mean		0.787	0.928	0.481
Std. dev.		0.236	0.136	0.223
Panel F: 2000	24			
Mean		0.818	0.928	0.883
Std. dev.		0.148	0.095	0.112
Panel G: 2001	24			
Mean		0.899	0.968	0.928
Std. dev.		0.119	0.037	0.110
Panel H: 2002	24			
Mean		0.872	0.950	0.919
Std. dev.		0.082	0.049	0.076
Panel I: 2003	22			
Mean		0.820	0.942	0.846
Std. dev.		0.148	0.067	0.145
Panel J: 2004	23			
Mean		0.753	0.923	0.817
Std. dev.		0.157	0.105	0.148
Panel K: 2005	23			
Mean		0.915	0.952	0.961
Std. dev.		0.112	0.098	0.062
Panel L: 2006	22			
Mean		0.921	0.943	0.977
Std. dev.		0.094	0.087	0.048
Panel M: 2007	22			
Mean		0.880	0.918	0.956
Std. dev.		0.160	0.120	0.113
Panel N: domestic banks				
Mean		0.818	0.946	0.681
Std. dev.		0.175	0.105	0.239
Panel O: foreign banks				
Mean		0.859	0.924	0.857
Std. dev.		0.174	0.130	0.190

The table presents the Malaysian banking sector's cost efficiency (CE) scores and its mutually exhaustive components of allocative efficiency (AE) and technical efficiency (TE) mean and standard deviation. Panel A to M shows the mean and standard deviation of the Malaysian banking sector's CE, AE, and TE derived from a common frontier for the years 1995—2007. The CE, AE, and TE scores are bounded between 0 and 1. Detailed results are available from the authors upon request.

have been efficient in choosing the correct input mix, they have been relatively inefficient in utilising their resources.

The results for the foreign banks are presented in Panel O of Table 3. The empirical findings suggest that during the period under study, the foreign banks have exhibited a higher (lower) mean cost efficiency (inefficiency) of 85.9% (16.4%) compared to their domestic bank peers. It is also apparent that the foreign banks have exhibited a higher (lower) mean technical efficiency (inefficiency) of 85.7% (14.3%). Similar to their domestic bank counterparts, the empirical findings seem to suggest that technical inefficiency outweighs allocative inefficiency in determining the foreign banks' total cost inefficiency.

In general, during the period under study the results seem to suggest that the foreign banks have been relatively more cost efficient compared to their domestic bank counterparts and this can be attributed to higher technical efficiency levels. Interestingly the empirical findings seem to suggest that the domestic banks have been relatively more allocatively efficient compared to their foreign bank counterparts. It is worth noting that regulation is typically given as a major source of allocative inefficiency, poor management is usually associated with technical inefficiency. The results imply that although the domestic banks have been efficient in choosing the correct input mix, they have been relatively inefficient in utilising their resources.

Factors influencing the efficiency of Malaysian banks

The computation of the efficiency scores is important in that it leads to the attribution of variations in efficiency change to bank specific characteristics and the environment in which banks operate. Therefore, the following section proceeds with the discussion of the results derived from the panel regression analysis framework. The regression results focussing on the relationship between bank efficiency and the explanatory variables are presented in Table 4. The regression models are based on 353 bank year observations. Several general comments regarding the test results are warranted. The model performs reasonably well in at least two respects. For one, results for most variables remain stable across the various regressions tested. Secondly, the empirical findings suggest that all the explanatory variables have the expected signs and in most cases are statistically different from zero. The explanatory power of the models is also reasonably high and in the case of the OLS regression models, the *F*-statistics are also statistically significant at the 1% level.

During the period under study, the empirical findings seem to suggest that the impact of network embeddedness (LNDEPO) is negative and statistically significant in the technical efficiency regression models. The result is in consonance with the earlier findings by Randhawa and Lim (2005) among others. To recap, Randhawa and Lim (2005) suggest that the small banks with their small depositor base have attained higher efficiency levels because of the lower amount of deposits at their disposal to transform into loans. In the case of the Malaysian banking sector, the domestic banks have the most extensive branch networks and are present throughout Malaysia, while the foreign banks are active in large commercial urban centres. Therefore, it is not surprising to find a negative impact of network embeddedness (LNDEPO) on the efficiency of Malaysian banks.

The proxy measure of bank liquidity, LOANS/TA exhibits positive relationship with bank cost efficiency and is statistically significant at the 1% level. Likewise, it is apparent from columns 6 and 8 of Table 4 that the coefficient of the variable is positive and statistically significantly related to Malaysian banks' technical efficiency when we control for macroeconomic and market condition variables. The results clearly indicate negative relationship between bank efficiency and the level of liquid assets held by the bank. As higher figures of the ratio denote lower liquidity, the results imply that the relatively efficient (inefficient) banks tend to be less (more) liquid.

Concerning the impact of bank size, the coefficient of LNTA is always positive, a fact that supports the results of Kosmidou (2008) among others. Hauner (2005) offers two potential explanations for which size could have a positive impact on bank efficiency. First, if it relates to market power, large banks should pay less for their inputs. Second, there may be increasing returns to scale through the allocation of fixed costs (e.g. research or risk management) over a higher volume of services, or efficiency gains from a specialised workforce. However, it is worth noting that the variable loses its explanatory power when we control for macroeconomic and market conditions under the technical efficiency regression models.

Referring to the impact of credit risk, LLP/TL entered both the cost and technical efficiency regression models with the expected negative sign. The results indicate that Malaysian banks with high credit risks tend to exhibit low cost and technical efficiency levels. The empirical findings clearly suggest that Malaysian banks should focus more on credit risk management, which has proven to be problematic in the recent past. Serious banking problems have arisen from the failure of banks to recognise impaired assets and create reserves for writing off these assets. These anomalies would be vastly smoothened by improving the transparency of the banking system, which in turn will assist banks to evaluate credit risk more effectively and avoid problems associated with hazardous exposure.

During the period under study, the empirical findings seem to suggest that NII/TA consistently exhibits strong positive and significant relationship with Malaysian banks' cost and technical efficiency. Furthermore, the elasticity of cost and technical efficiency and NII/TA are quite high and statistically significant at the 1% level. The results imply that banks which derived a higher proportion of their income from non-interest sources such as fee based services tend to report higher efficiency levels. The empirical findings provide support to an earlier study by Canals (1993), among others. To recap, Canals (1993) suggests that revenues generated from new business units have contributed significantly to the improvement in bank performance.

Turning to the impact of overhead costs, the coefficient of NIE/TA has consistently exhibited negative and significant impact on both cost and technical efficiency estimates. The results imply that an increase (decrease) in these expenses reduces (increases) the efficiency of banks operating in the Malaysian banking sector. Clearly, efficient cost management is a prerequisite to improve the efficiency of the Malaysian banking sector i.e. the high elasticity of efficiency to this variable denotes that banks have much to gain if they improve their managerial practices. Furthermore, the Malaysian banking sector has not reached the maturity level required to link quality effects from increased spending to higher bank efficiency.

The level of capitalisation (EQASS) is positively related to Malaysian banks' cost and technical efficiency. The empirical finding provides support to the argument that well capitalised banks face lower costs of going bankrupt,

Table 4 Panel regression analysis.

	Cost efficiency				Technical efficiency			
	OLS		Tobit		OLS		Tobit	
Constant	−0.101	−0.796***	−0.133	−1.396***	0.195	0.316	0.423*	−0.111
	(−0.625)	(−3.048)	(-0.648)	(-3.824)	(1.155)	(1.121)	(1.831)	(-0.263)
Bank characteristics								
LNDEPO	−0.020	−0.015	−0.034	−0.024	−0.022	−0.031	−0.048*	−0.049**
	(-1.002)	(-0.776)	(-1.360)	(-1.018)	(-1.070)	(-1.596)	(-1.755)	(-1.970)
LOANS/TA	0.286***	0.323***	0.333***	0.404***	−0.018	0.210***	−0.065	0.270**
	(3.651)	(3.897)	(3.315)	(3.826)	(-0.245)	(2.881)	(-0.561)	(2.395)
LNTA	0.064***	0.060***	0.078***	0.073***	0.058***	0.022	0.073**	0.018
	(2.846)	(2.676)	(2.871)	(2.769)	(2.647)	(0.996)	(2.511)	(0.662)
LLP/TL	−0.233	−0.290	−0.179	−0.273	−0.761**	−0.247	−0.629	−0.068
	(-0.768)	(-1.058)	(-0.529)	(-0.959)	(-2.385)	(-1.251)	(-1.509)	(-0.266)
NII/TA	10.004***	10.985***	14.733***	17.001***	12.870***	11.234***	22.839***	19.569***
	(6.726)	(7.690)	(6.465)	(7.774)	(7.112)	(6.160)	(7.735)	(7.191)
NIE/TA	−6.527***	−7.065***	−8.726***	−9.838***	−14.634***	−10.717***	−20.728***	−15.975***
	(-3.703)	(-4.042)	(-3.842)	(-4.531)	(-7.026)	(-5.132)	(-7.183)	(-5.961)
EQASS	0.590***	0.670***	0.625***	0.823***	0.670***	0.138	0.740***	0.174
	(3.356)	(3.496)	(2.854)	(3.536)	(3.554)	(0.636)	(2.690)	(0.599)
ROA	−0.008	−0.011	0.000	−0.006	−0.003	0.009	0.011	0.023
	(-1.190)	(-1.631)	(0.027)	(-0.721)	(-0.267)	(0.965)	(0.937)	(2.118)
Economic and market conditions								
LNGDP		0.021*		0.034**		0.121***		0.180***
		(1.877)		(2.180)		(10.810)		(9.804)
INFL		0.024***		0.040***		−0.053***		−0.051***
		(2.802)		(3.487)		(-5.693)		(-3.758)
MKTCAP/GDP		0.021		0.043		−0.064***		−0.078***
		(0.965)		(1.546)		(-2.645)		(-2.825)
CR3		0.747**		1.314***		−1.444***		−1.183**
		(1.953)		(2.638)		(-3.358)		(-1.924)
R^2	0.270	0.305	0.307	0.333	0.313	0.484	0.360	0.550
Adj. R^2	0.253	0.281	0.288	0.308	0.297	0.466	0.343	0.533
F-statistics	15.868***	12.453***			19.560***	26.591***		
Log likelihood	168.664	177.525	−23.109	−9.058	79.091	129.746	−80.199	−22.108
No. of observations	353	353	353	353	353	353	353	353

$$\theta_{jt} = \alpha + \beta_1 \text{LNDEPO} + \beta_2 \text{LOANS/TA} + \beta_3 \text{LNTA} + \beta_4 \text{LLP/TL} + \beta_5 \text{NII/TA} + \beta_6 \text{NIE/TA} + \beta_7 \text{EQASS} + \beta_8 \text{ROA} + \zeta_1 \text{LNGDP} + \zeta_2 \text{INFL} + \zeta_3 \text{MKTCAP/GDP} + \zeta_4 \text{CR3} + \epsilon_j$$

The dependent variables are bank's cost and technical efficiency scores derived from the DEA. LNDEPO is a measure of bank's market share calculated as a natural logarithm of total bank deposits; LOANS/TA is a measure of bank's loans intensity calculated as the ratio of total loans to bank total assets; LNTA is the size of the bank's total asset measured as the natural logarithm of total bank assets; LLP/TL is a measure of banks risk calculated as the ratio of total loan loss provisions divided by total loans; NIE/TA is a measure of bank management quality calculated as total non-interest expenses divided by total assets; NII/TA is a measure of bank's diversification towards non-interest income, calculated as total non-interest income divided by total assets; EQASS is a measure of banks capitalisation measured by banks total shareholders equity divided by total assets; LNGDP is natural logarithm of gross domestic product; INFL is the rate of inflation; MKTCAP/GDP is the ratio of stock market capitalisation divided by GDP; CR3 is the three bank concentration ratio, Values in parentheses are *t*-statistics and *z*-statistics for the OLS and Tobit regressions respectively.
***, **, and * indicate significance at 1, 5 and 10% levels.

thus reducing their cost of funding. Furthermore, a strong capital structure is essential for banks in developing economies, since it provides additional strength to withstand financial crises and increased safety for depositors during unstable macroeconomic conditions (Sufian, 2009). Moreover, lower capital ratios in banking imply higher leverage and risk, and therefore greater borrowing costs. Thus, it is reasonable to expect the better capitalised banks to exhibit higher efficiency levels.

The results about LNGDP seem to support the argument of the association between economic growth and the performance of the banking sector. The high economic growth could have encouraged Malaysian banks to lend more and permits them to charge higher margins, as well as

improving the quality of their assets. On the other hand, the empirical findings seem to suggest mixed impact of the indicators of macroeconomic risk on bank cost and technical efficiency. During the period under study, the empirical findings seem to suggest that the rate of inflation (INFL) has positive impact on Malaysian banks' cost efficiency. On the other hand, the coefficient of INFL entered the technical efficiency regression models with a negative sign.

The empirical findings seem to suggest mixed impact of the banking sector's concentration on Malaysian banks' cost and technical efficiency. It is observed from columns 2 and 4 of Table 4 that the coefficient of the three bank concentration ratio (CR_3) exhibits a positive sign in the cost efficiency regression model. On the other hand, the impact of banking sector concentration is negative on Malaysian banks' technical efficiency. During the period under study, the impact of stock market capitalisation (MKTCAP/GDP) is negative on Malaysian banks' technical efficiency. The findings seem to suggest that during the period under study, the Malaysian stock market serves as a complement rather than a substitute to borrowers in Malaysia.

Bank origins and efficiency

Berger et al. (2000) pointed out that previous studies which examine the efficiency of the banking sector have not properly distinguished the *home field* and the *global advantage* hypotheses. To address this concern and unlike the previous studies on bank efficiency, we follow the procedures set in Berger et al. (2000) to take into account the home country of the foreign owned banks in order to test for the 'limited form' of the *global advantage* hypothesis. Accordingly, we repeat eq. (3) to further classify foreign banks operating in Malaysia into three major groups. In each regression model, these regressions are performed by considering the origin of each foreign bank at a time. It is again worth noting that when we add the other group of variables to the baseline specification that includes the bank specific attribute variables, the coefficients of the baseline variables continue to remain robust in terms of directions and significance levels. Therefore, we will only discuss the results of the new variables added to the baseline specification. The regression results are presented in Table 5.

It is observed from Table 5 that both cost and technical efficiency measures are positively related to the foreign banks from North America and are statistically significant at the 1% level. Likewise, the empirical findings seem to suggest that the coefficient of DUMEURO is positive in the technical efficiency regression models. However, the coefficient of the variable is only statistically significant at the 10% level and loses its explanatory power when we control for the macroeconomic and market condition variables. On the other hand, DUMASIA entered both the cost and technical efficiency regression models with a negative sign, implying that the estimates of cost and technical efficiency are negatively related to foreign banks from the Asian countries. However, the coefficient of the variable is weak and is not significant at any conventional levels in any of the regression models estimated.

In essence, the findings, which suggest that banks from North America are relatively more efficient compared to other foreign banks and their domestic bank peers, seem to reject the *home field advantage* hypothesis, but lend support to the'limited form' of the *global advantage* hypothesis. Berger et al. (2000) suggest that under the 'limited form' of the *global advantage* hypothesis, only efficient institutions in one nation or a limited number of nations with specific favourable markets or regulatory conditions in their home countries can operate more efficiently than domestic banks in other nations. In a recent study, Havrylchyk (2006) suggests that the Dutch banks have been the most efficient banking group operating in Poland, thus supporting the 'limited form' of the *global advantage* hypothesis. On the other hand, the empirical findings clearly indicate that there is no such advantage accruing to the foreign banks from the Asian region, thus rejecting the *liability of unfamiliarness* hypothesis.

Robustness checks

In order to check for the robustness of the results, we perform a number of sensitivity analyses. First, we restrict our sample to banks with more than three years of observations. All in all, the results remain qualitatively similar in terms of directions and significance levels. Secondly, we address the effects of outliers in the sample by removing the top and bottom 1% of the sample. Again, the results continue to remain robust in terms of directions and significance levels. Finally, the Malaysian banking sector could have been affected adversely by the Asian financial crisis in 1997—1998. To address this concern, we remove the observations for the years 1997 and 1998 from the regression models and repeat eq. (3). All in all, the results continue to remain robust in terms of directions and significance levels. To conserve space, we choose not to report the full regression results in the paper, but are available upon request.

Conclusions, policy implications and directions for future research

The banking sector has increasingly become more globalised during the past few decades on account of deregulation, advances in communications and technology, and greater economic integration among countries. There are numerous reasons why banks expand their activities abroad. In general, banks venture into new markets outside their countries of origin to expand their activities and to diversify their sources of income. Banks also extend their operations abroad as a strategy to follow and sustain their large exporting clients. In addition, restrictions on the activities that banks can undertake in their home country may also be the reason why banks expand their operations abroad. Consequently, the impact of internationalisation on the performance of multinational banks has attracted interest among policymakers, bank managers and researchers alike.

To date, empirical evidence concerning multinational banking has mainly concentrated on the why, when, and

Table 5 Multivariate tobit regression analysis.

	Cost efficiency						Technical efficiency					
	OLS	Tobit	OLS	Tobit	OLS	Tobit	OLS	Tobit	OLS	Tobit	OLS	Tobit
Constant	−0.991***	−1.718***	−0.809***	−1.391***	−0.798***	−1.404***	0.096	−0.398	0.268	−0.125	0.321	−0.110
	(-3.571)	(-4.477)	(-3.088)	(-3.789)	(-3.047)	(-3.836)	(0.326)	(-0.923)	(0.939)	(-0.293)	(1.142)	(-0.261)
Bank characteristics												
LNDEPO	−0.002	−0.006	−0.016	−0.024	−0.015	−0.022	−0.017	−0.032	−0.034*	−0.049**	−0.033*	−0.049**
	(-0.122)	(-0.291)	(-0.808)	(-1.007)	(-0.742)	(-0.954)	(-0.970)	(-1.461)	(-1.710)	(-2.002)	(-1.626)	(-1.963)
LOANS/TA	0.380***	0.497***	0.331***	0.401***	0.330***	0.427***	0.275***	0.359***	0.239***	0.280**	0.194**	0.265**
	(4.337)	(4.471)	(3.994)	(3.784)	(3.831)	(3.890)	(3.735)	(3.152)	(3.256)	(2.478)	(2.529)	(2.289)
LNTA	0.054**	0.067***	0.061***	0.073***	0.059***	0.070***	0.016	0.012	0.026	0.019	0.025	0.019
	(2.549)	(2.787)	(2.720)	(2.736)	(2.603)	(2.649)	(0.781)	(0.507)	(1.159)	(0.709)	(1.065)	(0.668)
LLP/TL	−0.250	−0.202	−0.263	−0.283	−0.282	−0.245	−0.202	0.018	−0.147	−0.037	−0.264	−0.074
	(-0.982)	(-0.779)	(-0.929)	(-0.983)	(-1.028)	(-0.863)	(-1.002)	(0.071)	(-0.696)	(-0.140)	(-1.352)	(-0.295)
NII/TA	10.854***	16.924***	10.799***	17.138***	11.041***	17.267***	11.086***	18.844***	10.552***	19.013***	11.113***	19.510***
	(7.741)	(7.866)	(7.656)	(7.508)	(7.681)	(7.767)	(6.238)	(6.838)	(5.936)	(6.693)	(6.106)	(7.095)
NIE/TA	−6.315***	−8.448***	−7.368***	−9.727***	−7.228***	−10.377***	−9.868***	−14.750***	−11.827***	−16.303***	−10.366***	−15.854***
	(-3.777)	(-4.078)	(-3.956)	(-4.316)	(-3.859)	(-4.386)	(-4.766)	(-5.576)	(-5.416)	(-5.938)	(-4.694)	(-5.406)
EQASS	0.689***	0.851***	0.698***	0.811***	0.684***	0.865***	0.159	0.188	0.239	0.214	0.110	0.166
	(3.645)	(3.790)	(3.503)	(3.324)	(3.489)	(3.638)	(0.710)	(0.646)	(1.059)	(0.713)	(0.504)	(0.573)
ROA	−0.014**	−0.012*	−0.010	−0.006	−0.010	−0.005	0.005	0.017	0.011	0.023**	0.009	0.023**
	(-2.323)	(-1.649)	(-1.558)	(-0.741)	(-1.609)	(-0.663)	(0.525)	(1.561)	(1.169)	(2.152)	(0.914)	(2.089)
Economic and market conditions												
LNGDP	0.022**	0.036**	0.020*	0.034**	0.021*	0.035**	0.122***	0.181***	0.119***	0.179***	0.120***	0.180***
	(1.954)	(2.311)	(1.817)	(2.177)	(1.917)	(2.269)	(10.938)	(10.072)	(10.533)	(9.775)	(10.721)	(9.884)
INFL	0.023***	0.039***	0.024***	0.040***	0.023***	0.040***	−0.053***	−0.052***	−0.052***	−0.050***	−0.053***	−0.051***
	(2.769)	(3.401)	(2.838)	(3.465)	(2.786)	(3.460)	(-5.764)	(-3.893)	(-5.504)	(-3.735)	(-5.679)	(-3.764)
MKTCAP/GDP	0.030	0.060**	0.021	0.043	0.021	0.043	−0.054**	−0.063**	−0.062**	−0.078***	−0.064***	−0.078***
	(1.440)	(2.231)	(0.983)	(1.529)	(0.960)	(1.541)	(-2.250)	(-2.257)	(-2.566)	(-2.800)	(-2.634)	(-2.818)
CR3	0.764**	1.330***	0.761**	1.310***	0.752**	1.336***	−1.424***	−1.178**	−1.389***	−1.174*	−1.457***	−1.188**
	(1.989)	(2.677)	(1.988)	(2.617)	(1.959)	(2.675)	(-3.322)	(-1.950)	(-3.200)	(-1.905)	(-3.400)	(-1.941)
Bank origins												
DUMAMER	0.098***	0.159***					0.111***	0.161***				
	(3.452)	(3.692)					(4.103)	(3.592)				
DUMEURO			0.016	−0.007					0.058*	0.023		
			(0.556)	(-0.180)					(1.930)	(0.594)		
DUMASIA					−0.007	−0.023					0.016	0.005
					(-0.348)	(-0.768)					(0.599)	(0.123)
R^2	0.334	0.359	0.306	0.333	0.306	0.334	0.505	0.565	0.489	0.551	0.485	0.550
Adj. R^2	0.308	0.332	0.279	0.306	0.279	0.306	0.486	0.547	0.470	0.532	0.465	0.532
Log likelihood	184.855	0.949	177.699	−9.040	177.573	−8.801	136.899	−14.736	131.539	−21.955	129.913	−22.100
F-statistics	13.053***		11.498***		11.471***		26.564***		24.990***		24.522***	
No. of Observations	353	353	353	353	353	353	353	353	353	353	353	353

$\theta_{jt} = \alpha + \beta_1 \text{LNDEPO} + \beta_2 \text{LOANS/TA} + \beta_3 \text{LNTA} + \beta_4 \text{LLP/TL} + \beta_5 \text{NII/TA} + \beta_6 \text{NIE/TA} + \beta_7 \text{EQASS} + \beta_8 \text{ROA} + \zeta_1 \text{LNGDP} + \zeta_2 \text{INFL} + \zeta_3 \text{MKTCAP/GDP} + \zeta_4 \text{CR3} + \gamma_1 \text{DUMAMER} + \gamma_2 \text{DUMEURO} + \gamma_3 \text{DUMASIA} + \epsilon_j$

The dependent variables are bank's cost and technical efficiency scores derived from the DEA. LNDEPO is a measure of bank's market share calculated as a natural logarithm of total bank deposits; LOANS/TA is a measure of bank's loans intensity calculated as the ratio of total loans to bank total assets; LNTA is the size of the bank's total asset measured as the natural logarithm of total bank assets; LLP/TL is a measure of bank's risk calculated as the ratio of total loan loss provisions divided by total loans; NIE/TA is a measure of bank management quality calculated as total non-interest expenses divided by total assets; NII/TA is a measure of bank's diversification towards non-interest income, calculated as total non-interest income divided by total assets; EQASS is a measure of bank's capitalisation measured by banks total shareholders' equity divided by total assets; LNGDP is natural logarithm of gross domestic product; INFL is the rate of inflation; MKTCAP/GDP is the ratio of stock market capitalisation divided by GDP; CR3 is the three bank concentration ratio; DUMAMER, DUMEURO, and DUMASIA are dummy variables that take a value of 1 for foreign banks of which parent companies are headquartered in the North America, Europe, and Asia respectively, 0 otherwise, Values in parentheses are *t*-statistics and *z*-statistics for the OLS and Tobit regressions respectively. ***, **, and * indicate significance at 1, 5 and 10% levels.

how questions. On the other hand, studies examining the efficiency of multinational banks as a subset of the literature on the eclectic theory are scarce and concentrated on the banking sectors of the western and developed countries. The present paper contributes to this line of literature by expanding the efficiency paradigm of the eclectic theory in multinational banking within the context of a developing country banking sector. We employ the Data Envelopment Analysis (DEA) method to examine the efficiency of multinational banks operating in the Malaysian banking sector during 1995—2007. We then employ panel regression analysis to examine the impact of origins on bank efficiency, while controlling for other internal and external factors. During the period under study we find foreign banks from North America to be the most efficient banking group, providing support to the 'limited form' of the *global advantage* hypothesis. On the other hand, we do not find evidence on both the *liability of unfamiliarness* and *home field advantage* hypotheses.

The ability to overcome the disadvantages of being foreign and to compete successfully in foreign markets varies between firms. Resources, capabilities, and managerial know-how are firm specific. Caves (1971) points out that multinational firms expanding abroad must cultivate their unique mix of strategic assets to compensate for their foreigner status. Consequently, international market success depends on the ability of a firm to understand the chances and challenges of the new environment, adapt resources, structures, and processes to leverage internal assets for host country competitive advantage (Luo, Shenkar, & Nyaw, 2002). Therefore, the concept of liability of foreignness does not imply that foreign firms are automatically doomed abroad, but that they should be prepared for an uphill battle.

Domestic firms have an advantage over their foreign counterparts because of the intensive accumulation of tacit knowledge in economic, social, legal, and cultural conditions in their home country market. In contrast, foreign firms have problems in developing a deep understanding of the host country's cultural and social regulations and their impact (Jensen & Szulanski, 2004). Given these social and cultural roots of liability of foreignness, moving operations abroad is typically more of a marathon than a sprint i.e. it takes time to compete on the same level as local enterprises. In this regard, Zaheer and Mosakowski (1997) suggest that it takes more than 15 years for foreign firms to overcome the disadvantage of being foreign in the currency trading industry, while DeYoung and Hasan (1998) suggest that de novo banks require nine years to catch-up with established banks in terms of efficiency.

The paper could be extended in a variety of ways by future research. Firstly, future research could include more variables such as taxation and regulation indicators, exchange rates as well as indicators of the quality of the offered services. Secondly, in terms of methodology, the non-parametric Malmquist Productivity Index (MPI) method could be employed to investigate changes in productivity over time as a result of technical change; technological progress or regress could yet be another extension to the present paper. Finally, future research into the efficiency of the multinational banks sector could also consider the production function along with the intermediation function.

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