

Paper for New Zealand Finance colloquium 2009

# **Determinants of Foreign-owned Banks Efficiency in New Zealand**

Ying Fang LU

Lincoln University  
Email: [luy4@lincoln.ac.nz](mailto:luy4@lincoln.ac.nz)

Dr. Christopher Gan  
Faculty of Commerce  
Lincoln University

Dr. Bai Ding HU  
Faculty of Commerce  
Lincoln University

|

# **Determinants of Foreign-Owned Banks' Efficiency in New Zealand**

## **Abstract:**

Foreign-owned banks have dominated New Zealand banking sector for decades but it remains relatively under-researched. This study employs Battese and Coelli (1995) Stochastic Frontier Approach (SFA), using both cost and profit function to investigate the efficiency of 20 registered banks in New Zealand from 2002 to 2007. Following Naaborg's (2007) study, our study aims to test the ownership hypothesis supported by the limited global advantage hypothesis (Berger and Mester, 1997), where foreign-owned banks are more presumed to be more efficient than domestic banks, and Australian-owned banks are more efficient than other foreign banks in New Zealand. The main objective of our study is to investigate the findings from the limited global advantage hypothesis and how bank specific characteristics, such as organizational form, bank size and risk management and country specific characteristics, such as economic and legal conditions significantly influence foreign owned banks' efficiency in New Zealand.

## **Key words:**

Foreign bank efficiency, New Zealand, Stochastic Frontier Approach

## 1. Introduction:

Over the past few decades, the increase in international trade flows, foreign investment activities and the globalization of capital markets, financial integration has stimulated cross-border banking activities in many countries. Regulatory changes have also fostered cross-border consolidation and other activities. Large banks are most likely to operate outside their national market (Berger et al 1993). Those banks generally operate beyond their national borders by establishing foreign subsidiaries or branches or incorporating the existing banks in the host market.

In New Zealand, foreign-owned banks have gradually come to control more than 80% of the total banks' assets over the past two decades. The registrations for foreign banks peaked at 24 in mid-1990<sup>1</sup>. According KPMG (1996, 2007), by the end of 2006, the total assets of 14 foreign-owned banks in New Zealand has increased to over \$233.23 billions compared to \$121.56 billions at the end of 1997 with 16 foreign-owned banks and 3 domestic banks (see **Table 1**). Overseas mergers and acquisitions, particularly in Australia have resulted in four large banks (ANZ National Bank, Bank of New Zealand, ASB Bank and Westpac Bank Corporation) in New Zealand and they are Australian-owned banks. There are also several other foreign banks from Netherlands, Germany, the United Kingdom, the United States, Korea and Japan registered in New Zealand market at the wholesale level.

Bollard (2004) reveals that foreign banks entries are associated with diffusion of new technologies, better resource allocation, which suggests that foreign banks are more efficient than their domestic counterparts and their greater efficiency should transferred (through competition and/or imitation) to the whole banking sector. However, empirical evidences in the U.S banking system show that foreign banks are generally less efficient than domestic counterparts. Berger et al. (2000) studies the efficiency of cross-border banks in France, Germany, Spain,

---

<sup>1</sup> Because of NZ policy of limited entry into the banking market prior to 1984, deregulation led to an increase in the number of banks entering into NZ. Since 1996, CIBC, Security Pacific, Elderbank, NZI Bank, State Bank of South Australia, Countrywide and Superbank, have registered and relinquished. However, the total number of foreign-owned banks has remained unchanged, Walsh & Cruz (1988) suggest that the regulatory should attempt to remove regulatory barriers to entry and exit and the number of foreign banks remaining large or small is not an important issue.

the United Kingdom, and the United States during the 1990s, and their results show that domestic banks in these countries on average have both higher cost and higher profit efficiencies than foreign banks operating in host country. Miller and Parkhe (2002) examine the alternative profit efficiency for fourteen different host nations and discovered domestic banks are more efficient than foreign banks. However, recent studies including Sturm & Williams (2004, 2005) in Australia; Kosmido et al (2004) in the United Kingdom; and Havrylchuk (2006) in Poland have shown that foreign banks are more efficient than their domestic counterparts.

In New Zealand, there are limited studies examining the efficiency measurements of foreign-owned banks. Most of the studies employed non-parametric technique such as Data Environmental Analysis (DEA) to estimate X-efficiency and generating similar findings. For example, Liu & Tripe (2001) examine all registered banks' efficiency over the period 1989 to 1998 showed that large international banks are more efficient than standalone New Zealand banks. Tripe (2004) reports that large major foreign banks have become more efficient due to mergers and acquisitions. Tripe (2003) investigated the trend of banks in NZ from 1996 to 2003 and reported that there is an overall efficiency improvement for most of current banks over the study period.

In addition to employing DEA in efficiency analysis, financial ratios are also favoured by researchers and managers. For example, KPMG applies financial ratios<sup>2</sup> in its annual survey of the performance of New Zealand financial institutions for 21 years since 1987. KPMG (1998-2007) report shows foreign banks have achieved significant reductions in their cost ratios over the past ten years. However, it has been argued that one cannot ignore the limitation of these two methods. A number of studies suggested that DEA, a linear mathematic program is compromised by the problem of data heterogeneity and variable measurement error (Berger & Mester 1997, Bauer et al 1998, Ruggiero 2006). Tripe (2002) study on bank efficiency in New Zealand agrees that the major difficulty with the non-parametric approaches such as DEA is that they cannot

---

<sup>2</sup> The types of financial ratios used in KPMG surveys measuring bank efficiency include operating income/average employees, operating expenses/ average total assets, operating expenses/ operating income.

distinguish random error arising from either measurement error or extraordinary financial performance (arising from accounting practice or some other source). The drawback of using financial ratios to measure efficiency is the manipulation through changing accounting practice and they do not account for the differences between the pattern and structure of businesses studied (Tripe, 2004). Financial ratios may also be misleading indicators of efficiency because they do not control for product mix or input prices (Berger, et al, 2000).

This study applies the parametric method---Stochastic Frontier Approach (SFA) to examine and extend the findings from previous studies by Liu & Tripe (2001), Tripe (2002, 2004), Tripe & Prasad (2004), and KPMG's study with the primary focuses on the determinants of foreign bank efficiency. The consistency between the parametric (SFA) and non-parametric measurements (DEA) is also examined.

As there is relatively little empirical research devoted to developing an understanding what determines the foreign-owned banks' efficiency, the objective of this study is to examine foreign banks' efficiency in New Zealand focusing on how factors, such as foreign ownership, organizational form, bank size, loan quality, and regulatory and economic conditions affect foreign-owned banks' efficiency. Similar to Battese and Coelli (1995) model, this study uses the cost and profit equations to examine efficiency for all the registered banks in NZ market from 1997 to 2007. The analyses are based on multiple inputs and outputs measuring both inefficiency and other random effects (Naaborg, 2007).

This study will test the following hypotheses:

- Ownership Hypothesis: Foreign banks are more efficient than domestic banks.
- Global limited hypothesis:
  - Banks from Australia in NZ are more efficient than banks owned by other nations (due to the similarity and institutional distance between host and home countries)
- Bank-specific Hypothesis:
  - Foreign banks characteristics (such as institutional form, size, risk management, etc) have significant influences on foreign bank efficiency.
- Country-specific Hypothesis:

- Environmental factors in host country have significant impacts on foreign bank efficiency.

This is the first study using SFA to examine foreign bank efficiency in New Zealand. We employ a stochastic frontier approach with a specified cost and alternative profit function to investigate the factors influencing the efficiency of foreign banks in New Zealand. It is hypothesized that foreign banks exhibit higher efficiency than domestic banks; Australian owned banks are more efficient than those banks owned by other nations; and foreign banks operating as incorporated subsidiaries are more efficient than branch banks. Other possible findings include, for example, the big four banks act as entry barrier for new foreign bank entrants; mergers and acquisitions can improve the foreign banks efficiency; and foreign banks which have been operating for many years in New Zealand are more efficient than new foreign entrants.

The SFA ranks the efficiencies of the firms in the same order as their cost function residuals, regardless of which specific distributional assumptions are imposed. This property of SFA has intuitive appeal for performance measure for regulatory purposes. According to the ranking order in efficiency, regulators and supervisors will be given valuable insights to the performance of individual foreign banks, hence to the overall efficiency of New Zealand banking system (Berger & Mester, 1997). The results of this study will benefit managers in multinational banks who consider strategic objectives for offshore expansion, in particular the determinants of the appropriate host nations. For researchers, it can be a valuable reference to study further on foreign banks' performance in a small and open economy.

The rest of the paper is organised as follows: Section 2 reviews the literature on foreign bank efficiency in international markets and New Zealand. Section 3 discusses in detail the foreign-owned banks in New Zealand. Section 4 describes the methodology and data collection. Section 5 presents the possible contribution and limitation of this study.

## **2. Literature Review**

### **2.1. The concept of efficiency.**

The idea of efficiency was formally introduced in the early 1950s by the studies such as Shephard (1953). Most of the studies in banking efficiency focused on scale and scope efficiency in the 1990s, Berger et al (1993) and Berger & Mester (1997) argue that the uniform assumption used in the measurement of scale and scope efficiency is not reasonable. According to Chantapong (2005), the technique of scale and scope efficiency studies assumes that there is no X-inefficiency and banks use the same production technology. Under this assumption, banks fail to operate at the efficient scale or scope can raise inefficiently high costs, which is not consistent with the reality. Farrell (1957) is the first researcher who presented the basic framework for studying and measuring X-efficiency using the concept of frontier analysis with the frontier comprising benchmark level of optimum performance. Leibenstein (1966) popularised the concept of frontier efficiency or X-efficiency as the peculiar form of inefficiency that arises for organisational reasons rather than technological reasons when the interests of managers and worker are not perfectly in line with those of owners. Bauer et al (1998) defined X-efficiency measures as deviations in the firms' performance from that of "best practice" firms on the efficient frontier with holding other factors unchanged.

The concept of efficiency can be broken down into technical efficiency or technological efficiency and economic efficiency. Technical efficiency (TE) focuses on the degree of friction and waste in the production process. To be technical efficient, a firm must minimize its inputs given a certain level of outputs or maximize its outputs with given inputs. To be economic X-efficiency, a firm has to optimally choose their inputs and/or outputs based on their reaction to the markets to meet the goal of cost minimization or profit maximization. Thus efficiency is a measure of how well management aligns technology, human resources management, and other resources to produce given levels of output (Frei et al, 2000). Previous studies show that the use of the two different efficiency concepts may significantly affect the result of ranking of firms. (Bauer et al, 1998). Berger and Humphrey (1997) suggest that frontier efficiency is essentially a sophisticated way to benchmark the relative performance of production and help managers to identify the target practices to improve

performance, and to help regulators to identify the performance of firms in the studied area.

Berger and Mester (1997) emphasize that the concept of “efficiency” used in the measurement of financial institution efficiency is fundamental. They suggest that the cost and profit efficiency concepts are the most important economic efficiency concepts and have the best economic foundation for analyzing the efficiency of financial institutions. Berger et al (1993) also suggests that profit efficiency concept is superior to the cost efficiency concept for evaluating the overall performance of the firm. Profit efficiency accounts for errors on the output side as well as those on the input side. Further details about the concept of cost efficiency and profit efficiency will be discussed in Section 4.

## **2.2. Approaches to Frontier Estimation.**

A number of papers have studied bank efficiency using frontier analysis across countries over the past decades. However, there is no consensus on the best method for estimating bank efficiency, or on the average level of bank efficiency. It is generally accepted that there are two broad approaches---the econometric approach (parametric) and the mathematical programming approach (nonparametric). According to Fried, Lovell and Schmidt (2008), there are two essential differences from these approaches. First, the econometric approach is stochastic and attempts to distinguish the effects of noise from the effects of inefficiency, whereas the programming approach is non-stochastic with the consideration of combining noise and inefficiency. Second, the econometric approach confounds the effects of misspecification of the functional form whereas the nonparametric approach is less prone to the type of specification error.

Berger and Humphrey (1997) survey 130 previous studies on efficiency and identified five most common estimation techniques: data envelopment analysis (DEA) and free disposable hull analysis (FDH) which are nonparametric techniques; the stochastic frontier approach (SFA), the thick frontier approach (TFA), and the distribution-free approach (DFA) which are parametric methods. The finding from Bauer et al (1998) suggests that the parametric and



nonparametric methods measuring bank efficiency generally consist of either: they tend to yield higher efficiencies for the vast majority of firms in the banking competitive market, or they rank the banks' efficiency in roughly the same order and identify the "best" and "worst" banking practices as similar. However, they are not mutually consistent with each other: nonparametric methods generally yield lower average efficiencies possibly due to the measurement without the concern of the random error. Berger and Humphrey (1997) and Bauer et al (1998) emphasize that parametric methods appeared to be more generally consistent with the reality.

Data Envelopment Analysis (DEA) is a linear programming model introduced by Charnes et al (1978) and extended by Banker et al (1984). The technique envelopes observed production possibilities to obtain an empirical frontier and measure efficiency as the distance to the frontier. The primary advantages of this approach are the nonparametric nature and the ability to handle multiple outputs and inputs (Ruggiero, 2006). However, the DEA approach generally assumes that there are no random fluctuations, so that all deviations from the estimated frontier represent inefficiency (Rangan et al, 1988). Ruggiero (2004) argues that the two factors which result in the biases from using nonparametric methods are: the unit under analysis is biased relative to the frontier and the frontier is biased upward because of the measurement error. Moreover, the nonparametric methods generally ignore prices which only accounts for technological efficiency but not for allocative efficiency. They only focus on technological optimization rather than economic optimization, and do not correspond to the cost and profits efficiency concepts.

Parametric efficiency analysis methods dated back to Aigner *et al.* (1977) and Meeusen and Broeck (1977) who independently proposed a stochastic frontier approach (SFA). Different from DEA and other nonparametric approaches, SFA assumes two unobserved error terms representing efficiency and statistical noise, which allows estimation via maximum likelihood. This approach has a purported advantage of having the ability to measure efficiency in the presence of statistical noise.

SFA usually specify a functional form for the cost profit relationship between inputs, outputs and environmental factors. The ongoing arguments on whether or not the specified functional form result in some biases have forced researchers to seek alternative solutions, with the result of having Fourier-Flexible (FF) form. However, the complexity of such FF forms has not influenced on the popularity of SFA.

SFA model was originally developed for cross-sectional data, and included an error term with two components: a normally distributed random effects component and a half-normally distributed technical inefficiency component. Ruggiero (1999), Gong and Sickles (1992) and Sickles (2005) show that the panel data version of the stochastic frontier model works well in achieving relatively high rank correlations between estimated and true inefficiency compared to cross-sectional models. This is because the panel data model incorporates additional information from the times series nature of the data. In addition, the distributional assumptions allow estimation via maximum likelihood, while the panel models incorporate either random or fixed effects. Several recent studies have used the maximum-likelihood approach to estimate stochastic frontiers in panel data, possibly with missing data (Ruggiero, 2006).

### **2.3. Cross Country Studies of foreign bank efficiency.**

Frontier studies excluding New Zealand in foreign banks efficiency are summarized in Table 2 and 3, which suggests that there are no consensus agreements on whether foreign banks are more efficient than domestic banks.

#### **2.3.1. Results on the differences in foreign bank efficiency.**

The final column of **Table 2 and 3** presents the findings of previous studies in other countries. In the U.S studies, Hasan and Hunter (1998) and Mahajan *et al* (1996) found that foreign banks are less efficient than the host nation financial institutions while De Young and Nolle (1996) study showed positive profit efficiency.

Similar results were also found in the European banking market. For example, Berger, DeYoung, Genay and Udell (2000) measure foreign banks efficiency in France, Germany, Spain, the United Kingdom and the United States and conclude foreign banks on average are profit efficient and less costly than domestic banks. However, Yildirim and Philippato (2003) estimate 12 European transition countries and report that foreign banks are less profit efficient but more cost efficient than domestically owned banks.

Sturm and Williams (2004) study show that foreign banks in Australia are more efficient than domestic banks particularly due to superior scale efficiency. Similarly Sathye (2001) investigates 29 banks operating in Australia in 1996 concludes that there are no significant differences between domestic and foreign banks efficiency.

### ***2.3.2. The determinant of the differences in foreign bank efficiency.***

The determinants of the foreign-owned bank efficiency are still under-researched, and the following factors have been studied by previous researches.

Berger et al (2000) estimates separate cost and profit frontiers from domestic and foreign banks to test their home field advantage and global advantage hypothesis in France, Germany, Spain, the United Kingdom and the United States. Both of hypothesises are based on the authors' concern on the affects of origins of foreign banks and the capacities to manage and overcome some cross-border disadvantages.

Under home field advantage hypothesis, domestic firms are generally more efficient than foreign firms. Berger et al (2000) explains that the distance between firms' home and host country possibly cause organizational diseconomies, which could affect operating cost and the quality of management for foreign firms. The foreign firms may provide the same quality service but with higher cost or lower revenues. Moreover, the differences in language, culture, currency, regulatory and supervisory structure, and local market features can bring explicit or implicit barriers to foreign institutions' performance. Mian (2006) develops a theoretical model to support the idea that *institutional distance*

between the home country and the host country may cause higher informational, agency, or enforcement costs for foreign banks operating abroad.

In contrast to home field advantage hypothesis, Berger et al (2000) designs the global advantage hypothesis assuming some efficiently managed foreign institutions are likely to be more efficient than domestic banks because they are able to overcome some cross-border disadvantages, such as the distance and barriers discussed previously. Berger et al (2000) considers two forms of the global advantage hypothesis. Under the general form, efficient managed foreign-owned banks are able to operate more efficiently than domestic banks regardless the home country nations. Under the limited global advantage hypothesis, the efficient institutions which enter the specific nations with specific favourable market, regulatory, or supervisory conditions can operate more efficiently than domestic institutions in other nations. Strum and Williams (2005) apply parametric distance functions to estimate the efficiency of foreign banks in Australian. Their result is supported by the limited global advantage hypothesis of Berger et al (2000): banks from the UK are more efficient than other foreign banks within the study period. They also found that the acquisition of a domestic bank can ease the foreign bank entry to the host country market.

The findings from Berger et al (2000) shows that domestic banks generally have higher cost and profit efficiency than foreign banks on average, which supports the home field advantage hypothesis. However, they also show that banks from the United States in 3 considered nations are on average more efficient than the nations' domestic banks which support the limited global advantage hypothesis.

A recent study by Naaborg (2007) showed that the smaller the *institutional distance* between the host and the home country, the lower is foreign bank efficiency. The author also found similarity of host and home country's character can significantly affect the difference in foreign bank efficiency. Sturm and William (2005) apply parametric distance functions to estimate the efficiency of foreign banks in Australia and discovered banks from the United Kingdom in particular are more efficient than other foreign banks (Berger *et al*, 2000).

Dietsch, Lozano-Vivas (2000) and Beccalli (2004) studies show that differences in efficiency of cross broader banking can also be affected by differences in country's specific characters, such as regulation, economic condition, local market conditions, and effects of mergers and acquisition. Harle (2005) found the results of past European cross-border banking mergers had not improved the merged banks' efficiency compared with domestic bank mergers. The author explained that cultural differences, political and regulatory obstacles created the efficiency barriers. Studies of U.S banks' in mergers and acquisitions showed that the improvement of profit efficiency could be linked to an increased diversification of risks and an improved risk-expected return trade off (Berger and Mester, 1997).

Sturm and Williams (2004) studied Australian banks during the deregulation period and found that foreign banks were more efficient than domestic banks. The authors also found that the diversity in the types of banks participating in the banking system was an important source of competitive improvements in productivity, which implies that the establishment of new banks provided an important contribution toward efficiency gains during deregulation. Furthermore, they reported that recession and the accompanying increases in bad debts can result in a shift in the nature of ongoing changes in efficiency, with post-recession periods showing some lower efficiency. Naaborg (2007) suggests that market concentration or home GDP growth can affect the profitability of foreign banks to some extent than domestic banks. Williams (2003) employs competitor market share to measure the degree of host market competition confronting foreign banks in the host market, and concludes that the market share of competitor banks, particularly the incumbent Big Four banks in Australia, acts as a barrier to entry to the retail market resulting in reduced efficiency.

Bank specific characters are also examined by some researchers as significant factors influencing foreign bank efficiency. For example, Fuentes and Vergara (2003) estimated cross-border banks' efficiency in Chile and found that banks that are established as open corporations tend to show higher level of efficiency compared to offices of international banks. Claessens *et al.*, (2001) conclude that higher foreign bank share in the host market is associated with lower overhead

costs, which indicates higher efficiency. Detragiache and Gupta (2004) examine the experience of Malaysian banks during the 1997 Asian crisis and conclude that foreign banks have relatively low non-performing loans, and their profitability and capitalisation even improved during the crisis. However, Sturm and William (2004) in their study show that the major banks in Australia did display superior pure technical efficiency which did not necessarily result in higher profits during the investigating period.

#### **2.4. Previous studies in New Zealand<sup>3</sup>**

Studies by Hull (2002) and Mortlock (2003) suggest that the high level of foreign-bank ownership has enhanced the efficiency and stability of the New Zealand financial system for decades. They agree that foreign-owned banks have taken advantage of the accessibility to international capital markets compared to domestic banks.

Liu & Tripe (2001) employ accounting ratios and DEA to measure the six bank mergers from 1989 to 1998, and show evidence of improvements of bank efficiency in majority of the merger cases. They explain that interest rates and technical progress and management efforts partly contribute to the changes in efficiency. They also suggest that the deregulation over the last 20 years in New Zealand has caused significant changes in the environment where the foreign-owned banks are able to efficiently operate under the New Zealand financial system. The above findings are supported by Tripe & Prasad (2004) study. Tripe (2002) employs different approaches to investigate the trend of banks' efficiency in New Zealand from 1996 to 2002, and conclude that NZ banks have become more efficient during the period. Apart from the effect of interest rate, the major contribution is the improvement of managerial practice in X-efficiency. Tripe & Prasad (2004) use 14 different DEA models examining efficiency gains for six major banks in NZ over the period from 2000 to 2002, and conclude that New Zealand banking industry are fairly competitive which partly drives the banks efficiency and hence bank performance.

### **3. Foreign-owned Banks in New Zealand**

---

<sup>3</sup> Details see **Table 4**

The banking system in New Zealand is unique by world standard. There are two unique features in NZ banking system. One is that foreign owned banks dominate the banking system (see **Table 5 and 6**). In 2006, there are 16 registered banks in New Zealand and 14 are foreign owned banks. The two domestic banks include TSB Bank and Kiwi Bank which are relatively small compared to the major foreign banks. TSB bank is a regional bank and Kiwi Bank is a state-owned bank established in 2003. In addition, the banking system in New Zealand is highly concentrated in ownership by nationality of bank. The four big banks (ANZ National Bank, ASB Bank, Bank of New Zealand and Westpac Banking Corporation New Zealand Division) in New Zealand are Australian owned banks holding over 85 per cent of banking assets.

Prior to 1984, the financial market in New Zealand was the most heavily regulated Western economies. Regulations include direct controls on interest rates, lending activities, and foreign exchange activities on financial institutions, segmentation of domestic financial markets, and limited entry into the financial industry (Walsh & Cruz, 1988). Grimes (1998) reported that entry to the banking was permitted through an Act of Parliament, which virtually ruled out new bank entrants. As a result, there was no new entry over the 30 years since 1951.

Reforms in the financial markets took place in 1984 including removal of all capital (and current) account restrictions, floating of the New Zealand dollar, removal of all liquidity ratios on all financial institutions, removal of all interest rate controls, and directed lending criteria. These reforms were predominantly at a macroeconomic level, which paved the way for New Zealand to become a more open economy and to some extent attracted international financial institutions into NZ market. The Reserve Bank of New Zealand regulatory regime relatively is less interventionist than the regimes of other developed economies. They expect foreign banks to rely on a combination of self, market and regulatory discipline (Grimes, 1998)

Foreign banks can operate in New Zealand in several ways. The two general forms are subsidiaries and branches. In November 1997, out of the eighteen foreign-owned banks, eight were locally incorporated subsidiaries with six purchasing the assets of former registered banks either foreign owned or

domestic owned. Since 1988, there were eight mergers between banks which led to an overall improvement of bank efficiency. (Liu & Tripe, 2001)

Over the past two decades, most of the foreign-owned banks have taken advantages of a growing economy and deregulation in New Zealand to improve their performances. According to the KMPG (1996-2007) surveys, net profit after tax of foreign banks in New Zealand increased from \$11.5 billion in 1997 to \$28.8 billion in 2006. The cost performance in the banking industry has improved dramatically over the period from 1997 to 2007.<sup>4</sup>

## **4. Methodology and Data**

### **4.1 Concept of Efficiency used in this study**

Berger and Mester (1997) emphasize that the concept of “efficiency” used in the measurement of financial institution efficiency is fundamental. They suggest that the cost and profit efficiency concepts are the most important economic efficiency concepts and have the best economic foundation for analyzing the efficiency of financial institutions.

This study follows Berger and Mester (1997) framework to estimate cost and alternative profit efficiency. According to Berger and Mester (1997), cost efficiency measures how close a bank’s cost is to what a best practice bank’s cost would be for producing the same output bundle under the same conditions. It is derived from a cost function in which the variable costs depend on the prices of variable inputs, the quantities of variable outputs and any fixed inputs or outputs, environmental factors, and random error, as well as efficiency.

Since cost efficiency assumes that the observed level of output (input use) is profit maximizing, which may or may not be the case in practice. Besides, there may be differences in the financial service quality that are not captured in the output measures, which may not transfer the high quality service to cost efficient as a result of the extra expenses associated with producing the higher quality output. By estimating profit efficiency, such problem may be ameliorated

---

<sup>4</sup> For more details, see Matthews, C & Tripe D (2006) Banking in New Zealand (4<sup>th</sup> edition) published by New Zealand Bankers’ Association



because high quality should be rewarded in the marketplace by extra revenues that offset the extra expenses (Berger and Mester, 1997).

This study employs a recent developed efficiency concept -- alternative profit efficiency to measure how close a bank comes to earning maximum profits given its output levels rather than its output prices. The alternative profit function employs the same exogenous variables as the cost function in which the output variable is held constant in the cost function and output prices are free to vary and affect profits (Berger & Mester, 1997).

## **4.2. Intermediation Approach**

There are two approaches which explain bank behaviour: intermediation and production approach. Berger et al (1993) suggests that the intermediation approach is best suited to analyse firm level efficiency, whereas the production approach is best for measuring branch level efficiency. At the firm level, management will aim to reduce total costs and not just non-interest expenses, while at branch level a large number of customer service processing takes place and employees have little influence over funding and investment decisions. Our study adopts the intermediation approach to estimate foreign banks' efficiency in New Zealand. Under the intermediation approach a bank is viewed as employing inputs such as deposits, staff and equity to produce outputs such as loans and off balance sheet items (Berger et al, 2000). Avkiran (2006) suggests that the funds raised and the expenses incurred in the intermediation process are normally treated as inputs, whereas the funds loaned and income generated are regarded as outputs. Sealey and Lindley (1977) explain the objective of banks is implementing this transfer process efficiently where outputs are maximised and/or inputs minimised. Wheelock & Wilson (1995) argue that the intermediation approach effectively takes into account both operating and interest expenses, therefore, it is often considered as more appropriate for investigating economic viability.

## **4.3 Techniques of Efficiency Measurement.**

### **4.3.1 The Stochastic Frontier Approach (SFA)**

SFA is one of the well-established parametric methods measuring efficiency. According to Aigner, Lovell, and Schmidt (1977) who originally introduced this method, SFA employs a composed error model where inefficiencies are assumed to follow an asymmetric distribution, usually the half-normal, while random errors are assumed to follow a symmetric distribution, usually the standard normal. An advantage of the parametric method is that it allows for random error, thus, less likely to misidentify measurement error, transitory differences in cost, or specification error as inefficiency (Berger et al, 2000). Berger et al (1997) emphasize the one positive aspect of the SFA is that it will always rank the efficiencies of the firms as the same order as their cost function residuals, no matter which specific distributional assumptions are imposed. This means firms with lower costs for a given set of input prices, output quantities, and any other cost function regressors will always be ranked as more efficient. In addition, firms with higher profits generating from same inputs and outputs, and profit function regressors will be ranked as more efficient too.

The Battese and Coelli (1995) model (BC) is employed in the SFA. Similar to Naaborg (2007) comments, the first advantage of the BC model over the standard two-step SFA approach of Aigner, Lovell and Schmidt (1977) and Meeusen and van den Broeck (1977) is that the BC model estimates the cost-frontier and the coefficients of the efficiency variables simultaneously. Wang and Schmidt (2002) show that the standard two-step approach suffers from the assumption that the efficiency term is independently identical half-normally distributed in the first step, while in the second step the efficiency terms are assumed normally distributed and dependent on the explanatory variables. This contradicts the assumption of identically distributed efficiency effects in the stochastic frontier. The BC model can overcome this problem by estimating the frontier and the coefficients of the efficiency variables simultaneously (Koetter, 2006). A second advantage of the BC model is that it has the ability of estimating with an unbalanced panel dataset. Using an unbalanced panel dataset leads to an increase of observations.

The general BC model specifies a stochastic cost frontier with the following properties:

$$\ln C_{i,t} = C(y_{i,t}, w_{i,t}, c, b, \beta) + \mu_{i,t} + v_{i,t} \quad (1)$$

Where  $C_{i,t}$  is the total cost bank  $i$  faces at time  $t$ ,  $C(y_{i,t}, w_{i,t}, c, b, \beta)$  is the cost frontier,  $y_{i,t}$  represents the logarithm of output of bank  $i$  at time  $t$ ,  $w_{i,t}$  is a vector of logarithm of input prices of bank  $i$  at time  $t$ ,  $c$  is a vector of country specific variables is a vector of bank specific variables and  $\beta$  is a vector of all parameters to be estimated. The term  $\mu_{i,t}$  captures cost inefficiency and is independently identically distributed with a truncated normal distribution.  $v_{i,t}$  captures the measurement error and random effects, and is distributed as a standard normal variable. Both  $\mu_{i,t}$  and  $v_{i,t}$  is time and bank specific and represented as follows:

$$u_{i,t} \sim N^+(m_{i,t}, \sigma_u^2) \text{ and } v_{i,t} \sim \text{iidN}(0, \sigma_v^2) \quad (2)$$

$$m_{i,t} = \delta_0 + \sum_n \delta_{n,i,t} z_{n,i,t} \quad (3)$$

Equation (2) models inefficiency ( $m$ ) and its explanatory variables. The  $z$  in equation (3) represents the vectors of  $n$  variables that drive the inefficiency ( $m$ ) of bank  $i$  at time  $t$ . The deltas represent the coefficients. Equations (1) and (3) are solved in one step using maximum likelihood.(Naaborg ,2007)

#### 4.3.2 Model specification for cost efficiency.

In line with the general BC model<sup>5</sup>, following Naaborg (2007) suggestion, a transcendental logarithmic form is selected for the cost function adding a time trend, which allows for changes in technology over time<sup>6</sup>. The cost function is specified as follows:

---

<sup>5</sup> Coelli (1996) implemented the BC model into a statistical software package FRONTIER Version

<sup>6</sup> Since a translog function is a second order approximation, a trend is included with a  $t$  and  $t^2$  term (Coelli, Rao, and Battese, 1998).

$$\begin{aligned}
\ln\left(\frac{TC}{PL}\right) &= \beta_0 + \beta_1 \ln\left(\frac{PF}{PL}\right) + \beta_2 \ln(loans) + \beta_3 \ln(securities) \\
&+ \beta_4 \frac{1}{2} \left[ \ln\left(\frac{PF}{PL}\right) \right]^2 + \beta_5 \frac{1}{2} \ln[(loans)]^2 + \beta_6 \frac{1}{2} [(securities)]^2 \\
&+ \beta_7 \ln\left(\frac{PF}{PL}\right) \ln(loans) + \beta_8 \ln\left(\frac{PF}{PL}\right) \ln(securities) \\
&+ \beta_9 \ln\left(\frac{PF}{PL}\right) T + \beta_{10} \ln(loans)(securities) + \beta_{11} \ln(loans)T \\
&+ \beta_{12} \ln(securities)T + \beta_{13} T + \frac{1}{2} \beta_{14} T^2 + \beta_{15} GDPG + \beta_{16} NR \\
&+ \beta_{17} UNEMP + \beta_{18} IFR + \beta_{19} MKTC + \beta_{20} IM + \beta_{21} LLR \\
&+ \mu_{i,t} + v_{i,t}
\end{aligned} \tag{4}$$

$$\text{Where } u_{i,t} \sim N^+(m_{i,t}, \sigma_u^2) \text{ and } v_{i,t} \sim \text{iidN}(0, \sigma_v^2) \tag{5}$$

$$m_{i,t} = \delta_0 + \sum_n \delta_{n,i,t} z_{n,i,t} \tag{6}$$

The dependent variable of the cost function is total costs (*TC*) and includes labour, interest, and other costs. This specification assumes two input prices and two output quantities. The first input price is the price of funds (*PF*). This price is defined as the ratio of a bank's interest costs, scaled by the sum of deposits and other interest bearing funding such as borrowing from other banks. The second input price is the price of labour (*PL*) and is the ratio of personnel expenses, divided by total employees. According to Naaborg (2007) suggestion, in order to guarantee linear homogeneity in input prices of the cost function, *TC* and *PC* are divided by *PL*. This scaling implies an estimation of coefficients for *PF* as well as *PL* with the restriction that the sum of these coefficients is equal to one (Kuenzle, 2005). The output quantities used are total loans (*Loans*) and total securities (*Securities*).

Country specific and bank specific factors are also controlled in the cost function, economic conditions measured by GDP per capita growth (*GDPG*); changes in interest expenses and labour price are measured by nominal interest rate (*NR*) and unemployment rate (*UNEMP*) respectively. The market condition is indicated by the Herfindahl index of market concentration (*MKTC*). The impact of

inflation is measured by inflation rate (IFR). Consistent with previous studies, the bank loan quality is reflected by the volume of impaired assets (IM), and loan loss provision (LLR) to total loan.

### 4.3.3 Model specification for alternative profit efficiency

The techniques for estimating profit efficiency are essentially the same as cost efficiency. Alternative profit efficiency measurement employs same exogenous variables similar in cost efficiency measurement, where the variable output is held constant in measuring cost efficiency while output prices are free to vary and affect profits (Berger & Mester, 1997). Independent variables used in the profit efficiency function remain the same as those in cost equation (4). The only change in the profit function is the dependent variable profit efficiency (PC) which is measured by net profit after tax.

The modified profit efficiency equation is given as follows:

$$\begin{aligned}
\ln\left(\frac{PC}{PL}\right) &= \beta_0 + \beta_1 \ln\left(\frac{PF}{PL}\right) + \beta_2 \ln(loans) + \beta_3 \ln(securities) \\
&+ \beta_4 \frac{1}{2} \left[ \ln\left(\frac{PF}{PL}\right) \right]^2 + \beta_5 \frac{1}{2} \ln[(loans)]^2 + \beta_6 \frac{1}{2} [(securities)]^2 \\
&+ \beta_7 \ln\left(\frac{PF}{PL}\right) \ln(loans) + \beta_8 \ln\left(\frac{PF}{PL}\right) \ln(securities) \\
&+ \beta_9 \ln\left(\frac{PF}{PL}\right) T + \beta_{10} \ln(loans)(securities) + \beta_{11} \ln(loans)T \\
&+ \beta_{12} \ln(securities)T + \beta_{13} T + \frac{1}{2} \beta_{14} T^2 + \beta_{15} GDPG + \beta_{16} NR \\
&+ \beta_{17} UNEMP + \beta_{18} IFR + \beta_{19} MKTC + \beta_{20} IM + \beta_{21} LLR \\
&+ \phi_{i,t} + \varphi_{i,t}
\end{aligned} \tag{7}$$

$$\text{Where } \phi_{i,t} \sim N^+ (n_{i,t}, \sigma_v^2) \text{ and } v_{i,t} \sim \text{iidN}(0, \sigma_v^2) \tag{8}$$

$$n_{i,t} = \delta_0 + \sum_n \delta_{n,i,t} z_{n,i,t} \tag{9}$$

### 4.3.4 Cost and Profit inefficiency equations

The cost and profit inefficiency equations are designed as follows:

$$m_{i,t} = \delta_0 + \delta_1 \textit{ownership} + \delta_2 \textit{size} + \varepsilon_{i,t} \quad (10)$$

$$n_{i,t} = \delta_0 + \delta_1 \textit{ownership} + \delta_2 \textit{size} + \pi_{i,t} \quad (11)$$

Where  $m_{i,t}$  and  $n_{i,t}$  are the inefficiency in equations (4) and (7) respectively, ownership is a dummy variable, 1 if foreign-owned banks, 0 otherwise. The ownership variable is used to test the hypothesis that foreign owned banks are more efficient than domestic banks. Bank size is based on the ratio of equity to total asset of individual banks. Equations (10) and (11) are used to estimate all the registered banks in New Zealand during 2002 and 2007.

This study uses a sample of foreign banks to estimate the determinants of foreign bank inefficiency. The following equations are employed:

$$m_{i,t} = \delta_0 + \delta_1 \textit{similarity} + \delta_2 \textit{institutionalform} + \delta_2 \textit{size} + \xi_{i,t} \quad (12)$$

$$n_{i,t} = \delta_0 + \delta_1 \textit{similarity} + \delta_2 \textit{institutionalform} + \delta_1 \textit{size} + \phi_{i,t} \quad (13)$$

where  $m_{i,t}$  and  $n_{i,t}$  denote the same value of inefficiency as those in equations (10) and (11). Similarity measures institutional distance between the home and host country (Naaborg, 2007). It is expected that the higher value of similarity of home and host country create lower cost inefficiency. Considering the special relations and integrated markets between New Zealand and Australia, similarity is designated to test the hypothesis that foreign banks from some nations (in this study from Australia) are more efficient than banks from other nations. The dummy variable for similarity in equations (12) and (13) equals to 1 for Australian-owned banks, 0 otherwise Institutional form explains whether or not banks operating as incorporated subsidiaries are more efficient than branches. Institutional form is also a dummy variable, 1 if the bank is incorporated subsidiary, 0 if the bank operated as branch. Different from equations (10) and (11), size is a dummy variable, 1 if the foreign bank is in the Big Four group, 0 otherwise.  $\xi_{i,t}$  and  $\phi_{i,t}$  are random errors for the two regression models.

#### 4.4. Data

A total of 20 past and present registered banks in New Zealand from 2002 to 2007 are examined by the cost and alternative profit functions in our study. The study period extends the previous studies in the literature. In 2003, Australia and New Zealand Banking Group Ltd purchased the National Bank of New Zealand Ltd from Lloyds TSB Group plc and subsequently changed its name to ANZ National Bank Limited. This merger can raise some issues and concerns to our study. In addition, the establishing of Kiwibank in the early 2002 with the initially large amount of government funding provided New Zealanders more accessible and cheaper services, which also raise a concern on the difference in foreign bank and domestic efficiency. There are several other foreign banks registered in this period such as St. George Bank Limited in 2003 which relinquished in 2006, Westpac New Zealand Limited in 2006<sup>7</sup> which registered after the Reserve Bank of New Zealand introduced a local incorporation policy for systemically important banks. For the best use of SFA, all those banks are grouped into four different categories for further inefficiency breakdown investigation using panel data: from foreign banks to domestic bank, Australian-owned banks to non-Australian owned banks; incorporated to branch bank, Big four (ANZ National, BNZ, ASB, Westpac) to small foreign banks.

Since all registered banks are required by law to publish quarterly disclosure statements including Key Information Summary, General Disclosure Statement and Supplemental Disclosure Statement from 1996, data at bank level can be obtained from those disclosure statements in Knowledge Centre of RBNZ and the National library; Statistics on RBNZ website, KPMG financial institutions performance surveys and individual banks' annual reports from their respective website. Country specific factors such as the growth of GDP per capita (GDPG), the nominal interest rate (NR) and unemployment rate (UNEMP) and inflation rate (IFR) can be obtained from the Statistic of RBNZ ([www.rbnz.co.nz](http://www.rbnz.co.nz)). Market concentration rate (MKTR) can be measured by the Herfindahl index.

There are some issues involved in terms of the variable selection due to the data availability and accessibility. For example, deposits have input characteristics

---

<sup>7</sup> Since the bank has only existed in the NZ market for more than one year, analysis on its performance may be only as a reference.

because they are paid for in part by interest payments and the funds raised provide the institution with the raw material of investment funds. However, deposits also have output characteristics because they are associated with a substantial amount of liquidity, safekeeping, and payments services provided to depositors. Some studies resolve this issue by counting the interest paid on deposits as part of costs and the rate paid as an input price, both consistent with the input of the raw material of investment funds (Berger and Humphrey, 1997; Bauer, Berger, and Humphrey, 1993). Since the value of deposit at the end of each year during the study period for individual banks can be obtained from KMPG (1996-2007), our study use deposits as one of the inputs.

Tripe (2002) explains that the effect of inflation can be ignored if the inflation rate throughout the studied period (1996-2002) is relatively low. Ignoring this issue is unlikely to have a major impact on results. Different from Tripe (2002, 2004), our study adjust for the effects of inflation since the inflation rate has increased significantly recently, which would have a strong influence on foreign bank efficiency over the study period.

The ANZ Bank acquired the National Bank in December 2003. Following the suggestion of Berger and Mester (1997), if the two banks have existed but merged before the end of the sample period, they are aggregated over the period they existed separately and recorded in the data set as a single composite bank based on the two types of SFA method design – SFA-A & SFA-P. This method is applied in this study to estimate the efficiency of related banks involved in the acquisitions.

## **5. Conclusion (Possible finding and limitation of this study)**

This study employs a stochastic frontier approach with a specified cost and alternative profit function to investigate the factors influencing the efficiency of foreign-owned banks in New Zealand. It hypothesized that foreign-owned banks exhibit higher efficiency than domestic banks due to deregulation and strong economic growth during the study period; Australian-owned banks are more efficient than those banks owned by other nations; foreign banks operating as incorporated subsidiaries are more efficient than branch banks. In terms of



determinants of foreign-owned banks efficiency in New Zealand, all the possible factors investigated in this study are expected to contribute to some extent to the expecting findings discussed above. Other possible results include, for example, the big four banks act as entry barrier for new foreign bank entrants; mergers and acquisitions can improve the foreign banks efficiency; foreign banks survival longer years in New Zealand are more efficient than new foreign entrants.

The SFA always *rank* the efficiencies of the firms in the same order as their cost function residuals, regardless of which specific distributional assumptions are imposed (Berger & Mester, 1997). This property of SFA has intuitive appeal for a measure of performance for regulatory purposes. According to the ranking order in efficiency, regulators and supervisors will be given valuable insights to the performance of individual foreign banks, hence to the overall efficiency of New Zealand banking system (Berger & Mester, 1997). The results of this study will also benefit managers in multinational banks who consider strategic objectives for offshore expansion, in particular determination of the appropriate host nations. For researchers, it can be a valuable reference to study further on foreign banks' performance in a small and open economy.

However, this study is not designed to address the issues arising from the integrated New Zealand and Australia market, thus, further researchers can either use the same SFA or other parametric approaches but with more factors concerning the foreign banks home countries characters in particular in Australia.

In the present environment, similar to many other countries, New Zealand economic and financial system is undergoing a very challenge period of adjustments. The ongoing changes in regulatory policy such as Deposit Guarantee Scheme, treatment of foreign banks branches and other insurance prudential requirements should all be taken account as they are crucial to the future studies in foreign-owned banks efficiency study.

## References:

Arthur Grimes (1998), Liberalisation of financial markets in New Zealand, Reserve Bank of New, *Bulletin Vol. 61 No. 4*  
[http://www.rbnz.govt.nz/research/bulletin/1997\\_2001/1998dec61\\_4grimes.pdf](http://www.rbnz.govt.nz/research/bulletin/1997_2001/1998dec61_4grimes.pdf)

Avkiran N. K (2006), Developing foreign bank efficiency models for DEA grounded in finance theory, *Socio-Economic Planning Sciences* 40

Berger, A.N, and L. Mester (1997). Inside the black box: what explains differences in the efficiencies of financial institutions? *Journal of Banking and Finance*.

Berger, A, N. DeYoung, H. Genay and G. Udell (2000). Globalisation of financial institutions: evidence from cross-border banking performance, *Brookings-Wharton Papers on Financial Service*,

Berger, A.N (1993), Distribution-free' estimates of efficiency in the U.S. banking industry and tests of the standard distributional assumptions, *Journal of Productivity Analysis*

Bauer, P.W., Berger A.N.and Humphrey D.B (1993). Efficiency and productivity growth in U.S. banking, pp. 386-413, in H.O. Fried, C.A.K. Lovell, and S.S. Schmidt, eds., *The measurement of productive efficiency: Techniques and applications*. New York: Oxford University Press

Bauer.P.W, Berger A.N, Ferrier.G.D. Humphrey D.B (1998), Consistency Conditions for Regulatory Analysis of Financial Institutions: A comparison of Frontier Efficiency Methods, *Journal of Economics and Business*

Berger, A.N., Hancock, D. and D.B. Humphrey (1993). Bank efficiency derived from the profit function, *Journal of Banking & Finance*, 17, 317-347.

Battese, G. E., and T.J. Coelli (1995). A model for technical inefficiency effects in a stochastic frontier production function for panel data, *Empirical Economics*

Banker,R.D.,A.Charnes and W.W.Cooper. (1984).Some models for estimating technical and scale inefficiencies in Data Development Analysis,*Management Science*.

Beccalli, E.(2004), Cross-country comparisons of efficiency: Evidence from the UK and Italian investment firms, *Journal of Banking and Finance*, 28, 1363-1383.

Bollard, A. (2004). Being a responsible host: Supervising foreign-owned banks  
Resource available on: <http://www.rbnz.govt.nz/speeches/0158779.html>

- Coelli, T.; Prasada Rao, D. S. & Battese, G. E. (1998). *An Introduction to Efficiency and Productivity Analysis*. Boston: Kluwer Academic Publishers
- Coelli, T. (1996). A Guide to FRONTIER Version 4.1: A Computer program for stochastic frontier production and cost function estimation, *CEPA Working Paper 96/07*, Centre for Efficiency and Productivity Analysis
- Charnes, A., Cooper, W.W., Rhodes, E., (1978) Measuring the efficiency of decision making units. *European Journal of Operational Research*
- Chang, C.E., Hasian, I. and W.C. Hunter (1998). Efficiency of multinational banks: An empirical investigation, *Applied Financial Economics*
- Claessens S, Demirguc-Kunt A, Huizinga H (2001). how does foreign entry affect domestic banking markets? *Journal of Banking and Finance*
- Chantapong Saovane (2005), Cost efficiency of domestic and foreign banks in Thailand, *paper presented at the Xth Spring Meeting of Young Economists at HEI, Geneva, Switzerland*
- Dietsch, M. and A. Lozano-Vivas (2000). How the environment determines bank efficiency: A comparison between French and Spanish industries, *Journal of Banking and Finance*, 24, 185 – 200.
- DeYoung R, Nolle DE (1996). Foreign-owned banks in the United States: Earning market share or buying it? *Journal of Money Credit and Banking* 28(4): 622–636
- Detragiache, Enrica and Poonam Gupta, (2004). Foreign Banks in Emerging Market Crises: Evidence from Malaysia, IMF Working Paper WP/04/129, July.
- Frei F, Harker P, Hunter L (2000). Inside the black box: what makes a bank efficient? *Cambridge University Press*
- Fries, S, A Taci (2005). Cost efficiency of banks in Transition : Evidence from 289 banks in 15 post-communist countries, *Journal of Banking and Finance*.
- Fried H.O, Knox Lovell C.A. and Schmidt S.S. (2008). The measurement of the productive efficiency and productivity changes, Published by Oxford University Press U.S. ISBN 019518325 9780195183528
- Farrell, M.j(1957), The measurement of productive efficiency, *Journal of the Royal Statistical Society Series*.
- Gong, B., Sickles, R., 1992. Finite sample evidence on the performance of stochastic frontiers and data envelopment analysis using panel data. *Journal of Econometrics*
- Hasan I. and W. Hunter (1998). Efficiency of multinational banks: an empirical investigation, *Applied Financial Economics*

- Havrylchyk, O. (2006). Efficiency of the Polish banking industry: Foreign versus Domestic banks, *Journal of Banking & Finance*
- Harle Philipp (2005). Negotiating better cross-border banking mergers in Europe, *The Mckinsey Quarterly*
- Hull, L (2002). Foreign-owned banks: implications for New Zealand's financial Stability, Reserve Bank of New Zealand Discussion Paper No. DP2002/05
- Kuenzle, M. (2005). Cost efficiency in network industries: Application of Stochastic frontier analysis, Universität Zürich
- Kosmidou I.K. Pasiouras,F, Doumpos,M., Zopounidis,C (2004). Foreign versus domestic banks' performance in the UK: a multicriteria approach, *Computational Management Science*
- KPMG (1998-2007), Financial Institutions Performance Survey, Wellington
- Lovell, A.D., and Schmidt.P. (1977). Formulation and estimation of stochastic frontier production function models, *Journal of Econometrics*
- Leibenstein,H,(1966),Allocative efficiency vs. X-efficiency, *American Economic Review*
- Liu, B. and Tripe, D. (2001), New Zealand bank mergers and efficiency gains, A paper presented to the 14th annual Australasian Finance and Banking Conference, Sydney
- Mattew,C and Tripe,D.(2006). Banking in New Zealand, (4 editions)
- Mahajan, Arvind, Nanda Rangan, and Asghar Zardkoohi (1996), Cost Structures in Multinational and Domestic Banking, *Journal of Banking and Finance*
- Meeusen, W. and J. van den Broeck (1977), Efficiency estimation from Cobb-Douglas production functions with composed error, *International Economic Review*
- Miller, S. and Parkhe, A.(2002). Is there a liability of foreignness in global banking? An empirical test of banks' x-efficiency, *Strategic Management Journal*
- Michael Koetter (2006), Measurement Matters—Alternative Input Price Proxies for Bank Efficiency Analyse, *J Financial Service Research (Springer Science + Business Media)*
- Mian, A. (2006). Distance constraints: The limits of foreign lending in poor economies.*The Journal of Finance*
- Mortlock, G (2003). New Zealand's financial sector regulation, *Reserve bank of New Zealand Bulletin 66*

- Naaborg I.(2007). Foreign Bank Entry and Performance: with a focus on Central and Eastern Europe
- Ondrich, J. and Ruggiero, J., 2001. Efficiency measurement in the stochastic frontier model. *European Journal of Operational Research*
- Rodrigo Fuentes and Marcos Vergara (2003).Explaining Bank Efficiency: Bank Size or Ownership  
Structure [http://www.cemla.org/pdf/redviii/chile\\_fuentes\\_vergara.pdf](http://www.cemla.org/pdf/redviii/chile_fuentes_vergara.pdf)
- Rangan, N.R., Grabowski, H.Y.Aly and C.pasurka (1988). The technical efficiency of US banks, *Economics Letters* 28
- Ruggiero, J.,(1999) Efficiency estimation and error decomposition in the stochastic frontier model: a Monte Carlo analysis. *European Journal of Operational Research*
- Ruggiero, J., (2004). Data envelopment analysis with stochastic data. *Journal of the OR Society*.
- Ruggiero,J.,(2006). A comparison of DEA and the Stochastic Frontier Model using Panel data, *International Transactions Inoperational Research*
- Reserve bank of New Zealand, website source: [www.rbnz.co.nz](http://www.rbnz.co.nz)
- Sickles, R., (2005), Panel estimators and the identification of firm-specific efficiency levels in parametric, semiparametric and nonparametric settings. *Journal of Econometrics*
- Sathye, M. (2001).X-efficiency of Australian banking: an empirical investigation, *Journal of Banking and Finance*
- Sealey J CW, Lindley JT (1977). Inputs, outputs, and a theory of production and cost at depository financial institutions. *Journal of banking and Finance*
- Sturm, J.E., and B. Williams (2004), Foreign bank entry, deregulation and bank efficiency: Lessons from the Australian experience, *Journal of Banking and Finance*,
- Sturm, J.E., and B. Williams (2005). What determines the difference in foreign bank efficiency: Australian Evidence, *Research Paper Series, Thurgauer Wirtschaftsinstitut*.
- Shephard, R.W. (1953), Cost and production functions, *Princeton University Press, Princeton*
- Tripe, D.(2002). *Have New Zealand banks really become more efficient?* Paper presented at the New Zealand Finance Colloquium, Massey University, Albany.

Tripe, D.(2003). Trends in New Zealand bank efficiency over time. *Applied Econometrics and International Development*

Tripe, D.(2004).Efficiency in Integrated Banking Markets-Australian and New Zealand, *Asia-Pacific Productivity Conference*

Tripe,D & Prasad,V. (2004) The efficiency of New Zealand Retail Banks 2002-2003 *Paper for 8<sup>th</sup> New Zealand Finance Colloquium, Hamilton*

Wheelock DC & Wilson PW (1995). Evaluating the efficiency of commercial banks: does our view of what banks do matter? *Federal Reserve Bank of St. Louis Review*

Williams, B.(2003), Domestic and international determinants of bank profits: Foreign banks in Australia, *Journal of Banking and Finance*.

Walsh, Carl E. & Cruz, Santa (1988). Deregulation in New Zealand, *FRBSF (Federal Reserve Bank of San Francisco) Weekly Letter*.

Wang, H. and P. Schmidt (2002) ‘One-Step and Two-Step Estimation of the effects of Exogenous variables on Technical Efficiency Levels’, *Journal of Productivity Analysis*

Weill,L.(2003). Banking efficiency in transition economies: the role of foreign ownership, *The Economics of Transition*

Yildirim, H.S., & Philippatos, G.C. (2003). Efficiency of banks: Recent evidence from the transition economies of Europe – 1993-2000, *University of Saskatchewan*

[www.yorku.ca/yildirim/CEEefficiency.pdf](http://www.yorku.ca/yildirim/CEEefficiency.pdf)

Zajc,P.(2006). A comparative study of banking efficiency in Central and Eastern Europe: The role of foreign ownership, *International Finance Review*

**Table 1: *Development of Foreign banks in New Zealand: (1997-2006)***

	No. of registered banks	No. of Foreign banks	Total banking asset (billion)	Total foreign bank asset (billion)	No. of employees
1997	19	16	123.36	121,56	24993
1998	17	15	139.03	138.24	23408
1999	17	16	150.36	149.26	22493
2000	17	16	175.18	173.96	21872
2001	17	15	186.76	185.34	22417
2002	17	15	194.06	192.26	21867
2003	18	16	205.39	202.79	22707
2004	16	14	220.54	218.21	23548
2005	16	14	239.63	236.92	24535
2006	16	14	275.68	233.23	24508

Sources: KMPG (1996-2007)

**Table 2: Some Selected Findings of Foreign Bank Efficiency in the US**

Author	Concept of efficiency used	Methodology	Main findings
DeYong & Nolle (1996)	Profit efficiency	DEA	Foreign owned banks are less profit than U.S.-owned banks, but there is a rapid growth of profitability for foreign banks.
Hasan & Hunter( 1996)	Cost efficiency Profit efficiency	SFA	Japanese multinational banks in the U.S. operating less cost and profit efficiency than U.S banks.
Chang,Hasan& Hunter(1998)	Cost efficiency	SFA	Foreign owned banks are less cost efficient than domestic banks.
Berger <i>et al</i> (2000)	Cost and profit efficiency	DEA	On average, domestic banks in France, Germany, Spain, the UK and the US have both higher cost efficiency and higher profit efficiency than foreign banks operating in the country.
Mahajan <i>et al</i> (1996)	Cost efficiency	TF	Foreign banks are able to fully exploit economies of scale, and face lesser diseconomies from joint production and lower inefficiencies than domestic banks,



**Table 3: Some Selected Findings of Foreign Bank Efficiency in other Countries**

Author	Country/Region	Methods	findings or suggestions
Zajc (2006)	6CEE nations	SFA	Foreign banks are less cost efficient than domestic banks
Havrylchyk (2006)	Poland	DEA	Foreign bank are more efficient than domestic owned banks.
Sturm & Williams(2005)	Australia	parametric distance functions and bounds analysis	Parent profits do not improve efficiency in the host market; Following clients is found to reduce the efficiency of the profit creation process; banks from the United Kingdom in particular being found to be more efficient than other foreign banks
Fries & Taci (2005)	15 European Transition nations	SFA	Foreign owned banks are more efficient than other private banks.
Sturm & Williams (2004)	Australia	DEA	New foreign banks are more input efficient than domestic banks, mainly due to their scale efficiency.
Green, Murinde& Nikolov(2004)	9 European Transition nations	Equations.	Foreign banks are more efficient than domestic banks, ownership does not significant reducing bank cost.
Matouseck & Taci (2004)	Czech Republic	DFA	Foreign banks are cost efficient than other banks.
K. Kosmidou <sup>1</sup> , F. Pasiouras <sup>2</sup> , M. Doumpos <sup>1</sup> , C. Zopounidis <sup>1</sup> (2004)	The UK	UTADIS	Domestic banks have higher mean profit efficiency than all of the foreign nations operating in the UK.
Chantapong & Menkhoff (2005),	Thailand	Cost and profit equations	Foreign banks seemed to be more efficient than domestic banks in terms of better capitalisation and lower levels of nonperforming loans. Foreign banks did not outperform domestic banks in term of cost efficiency.
Miller and Parkhe (2002)	14 nations	Alternative profit equations	Domestic banks to be more efficient than foreign banks.
Naaborg (2007).	Central and Eastern European	SFA	Higher quality of the institutions in the home country and higher similarity between home and host country institutional quality reduces foreign bank inefficiency.
Weil (2003)	Czech Poland	SFA	Foreign banks are more efficient than domestic banks. No significant influence in scale of operation or the bank activities structure.

**Table 4: Summary Findings of Foreign Bank Efficiency in New Zealand**

Author	Concept of efficiency used	Methodology	Main findings and suggestion
Tripe (2004)	X-efficiency	DEA	Average efficiency score 0.922 No significant difference is found between the efficiency of New Zealand banks and the major Australian banks,.
Tripe & Prasad (2004)	X-efficiency	DEA	Overall average efficiency in NZ banks is high in 2002-2003, findings are consist with the previous finding by Liu & Tripe(2002)
Tripe (2002)	X-efficiency	DEA	Negative relationship between the reported efficiency and interest rates. Improved efficiency positively correlated with improved banks' managerial practice.
Liu & Tripe (2002)	X-efficiency	DEA	The <b>mergers</b> led to an increase in efficiency in NZ banking industry.

**Table 5: Past Registered Banks in New Zealand between 1997 and 2007** (Banks in this table highlighted in Bold and Italic existing in the study period from 2002 to 2007)

Bank Name	Details
<b><i>AMP Bank Limited</i></b>	<b><i>Registered 12 October 1988, Relinquished 27 September 2004</i></b>
<b><i>Bank of Tokyo-Mitsubishi (Australia) Limited</i></b>	<b><i>Registered 18 September 1996, Relinquished 1 March 2004</i></b>
Crédit Agricole Indosuez	Registered as Banque Indosuez 28 March 1991 Amended 22 May 1997 Relinquished 20 August 1998
Banque Nationale de Paris(amended to BNP Paribas in 2000)	Registered 14 March 1997 Amended 13 June 2000 Relinquished 30 March 2001
Barclays Bank PLC	Registered 7 December 1988 Relinquished 27 March 1998
Bankers Trust New Zealand Limited	Registered as BT New Zealand (Holdings) Limited 21 June 1988 Amended 22 August 1988 Relinquished 21 June 1999
BNZ Finance Limited	Registered 23 January 1991 Relinquished 30 June 2001
Countrywide Banking Corporation Limited	Registered 3 December 1987 Relinquished 27 November 1998
<b><i>The National Bank of New Zealand Limited</i></b>	<b><i>Deemed to be registered on 1 April 1987 Relinquished 26 June 2004</i></b>
Primary Industry Bank of Australia Limited	Registered 11 May 1989 Relinquished 30 June 1999
<b><i>St George Bank New Zealand Limited</i></b>	<b><i>Registered as Leviathan Limited 3 February 2003 St George Bank New Zealand Limited Amended 7 February 2003 Relinquished 12 December 2006</i></b>

**Table 6: Registered Banks in New Zealand (in 2007)**

Bank	Owned by (Ultimate shareholding, %)	Country	Registered Date
<a href="#">ABN AMRO Bank NV (B)</a>	ABN AMRO Holdings N.V. (100)	Netherlands	2 March 1998
<a href="#">ANZ National Bank Limited</a>	Australia and New Zealand Banking Group Limited (100)	Australia	1 April 1987
<a href="#">ASB Bank Limited</a>	Commonwealth Bank of Australia(100)	Australia	11 May 1989
<a href="#">Bank of New Zealand Limited</a>	National Australian Bank Limited (100)	Australia	1 April 1987
<a href="#">Citibank N A (B)</a>	Citigroup Inc.(100)	The U.S	22 July 1987
<a href="#">Commonwealth Bank of Australia (B)</a>	Commonwealth Bank of Australia(100)	Australia	23 June 2000
<a href="#">Deutsche Bank A G (B)</a>	Deutsche Bank AG (100)	Germany	8 November 1996
<a href="#">Kiwibank Limited</a>	New Zealand Post Limited (100)	New Zealand	29 November 2001
<a href="#">Kookmin Bank (B)</a>	Kookmin Bank (100)	Korea	14 July 1997
<a href="#">Rabobank New Zealand Limited</a>	Cooperatieve Centrale Raiffeisen-Boerenleenbank B.A(100)	Netherlands	7 July 1999
<a href="#">Rabobank Nederland (B)</a>	Cooperatieve Centrale Raiffeisen-Boerenleenbank B.A(100)	Netherlands	1 April 1996
<a href="#">The Bank of Tokyo-Mitsubishi UFJ (B)</a>	Mitsubishi UFJ Financial Group,Inc (100)	Japan/Australia	1 March 2004
<a href="#">The Hongkong and Shanghai Banking Corporation (B)</a>	HSBC Holdings plc(100)	Hong Kong /United Kingdom	22 July 1987
<a href="#">TSB Bank Limited</a>	TSB bank Community Trust (100)	New Zealand	8 July 1989
<a href="#">Westpac Banking Corporation (B)</a>	Westpac Banking Corporation (100)	Australia	1 April 1987
<a href="#">Westpac New Zealand Limited</a>	Westpac Banking Corporation (100)	Australia	31 November 2006

Sources: RBNZ website: [www.rbnz.co.nz](http://www.rbnz.co.nz)

