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Cost Efficiency of Domestic and Foreign Banks in Thailand: Evidence from Panel Data

by
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Abstract

The paper estimates and compares cost efficiency of domestic and foreign banks in Thailand by using bank-panel data between 1995 and 2003. It also examines the effect of foreign bank entry on banking efficiency in Thailand since the significant acquisitions by foreign banks after the 1997 financial crisis. The widely used translog functional form specification is statistically tested by pooled regressions. The estimated results suggest that the unit costs of production of domestic and foreign banks are indistinguishable, although the two types of banks focus on different areas of the banking business. The findings suggest that based on bank operating efficiency, if foreign banks represent the best-practice banks in the industry, to a large extent, domestic banks in Thailand have caught up to the best-practice standards throughout 1995-2003, significantly after the 1997 financial crisis. This may be due to greater foreign participation through acquisitions, which increases the competitive pressure in the banking industry, and also to financial restructuring of domestic banks, which increases the cost efficiency of domestic banks, thereby benefiting banking customers.

JEL Classification: G21 G32 D24
Keywords: Banks, Financial Policy; Capital and Ownership Structure, Cost Efficiency

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1. Introduction

Thailand experienced massive changes since the 1997 Twin crisis, the worst recorded in its economic history. After 10 years (1987-1996) of stable and rapid economic and financial development, in 1997 the Thai economy experienced a severe twin crisis, which is a simultaneous crisis in the balance of payments and in the banking system (Glick and Hutchison, 1999 and Kaminsky and Reinhart, 1999). There is a close link between a country's currency stability and the health of its banking sector. Devaluation negatively affects the balance sheets of financial intermediaries, which leads to a tightening in credit market conditions and possibly to a contraction in output. In addition, the adverse effects of devaluation are worse if banks' balance sheets are deteriorated by non-performing loans (NPLs), or if banks borrow heavily in foreign currencies, particularly short term. As a result, banking and currency crises can amplify each other and generate a vicious circle (Pesenti and Tille, 2000 and Kaminsky and Reinhart, 1999).

Before the onset of the 1997 Twin crisis, Thailand's banks were regarded as a positive element in the economy, and Thailand was classified as one of the group of the 'East Asian miracle' countries which had notably improved in total factor productivity (World Bank, 1993). Although banks in emerging economies are weaker than those in industrialised countries, in terms of capital base, performance and regulations, it does not seem likely that they are inefficient in resource management (Bhagwati, 2002 and Menkhoff and Suwanaporn, 2003). Thai banks have not performed worse than any other bank in other countries, both in terms of allocative efficiency and operational efficiency (Menkhoff and Suwanaporn, 2003). However, it seems that a large number of Thai financial institutions were distressed by the first half of 1997. What went wrong in the Thai banking sector and made the positive performance disappear within a few years? One possible answer to this question is that financial liberalisation was rushed and the authorities did not pay sufficient attention to the fact that the capital market is not as safe as the goods market (Bhagwati, 2002).

Currency and banking crises are not a new episode. International economic crises will probably continue to occur in the future as they have for centuries. Emerging market countries which want to avoid the devasting effects of such crises should create efficient early warning systems, associated with standard country surveillance, reduce the vulnerability of their economies by getting macroeconomic policies right, and create sound banking, increasing international liquidity and shifting toward risk-based incentives to supervision regulations (Feldstein, 1999 and 2000 and Kawai et al, 2001).

After the crisis, Thailand has complied with most of the policy changes agreed with the IMF in the context of the 1997 rescue program. However, distressed assets of both the corporate sector and its financial sector counterpart have remained high. Because of the large debt overhang, the financial sector has not fully played its role as financial intermediary in facilitating sustained economic growth. Also, the credit channel of monetary policy transmission was impaired after the crisis. Hence, a close examination of bank performance, in particular in different groups of banks, is important for research and policy. This will contribute to handling and preventing crises and will be of use also for policy making relating to banking competition.

From a historical point of view, banking has been a heavily regulated industry in most countries. Consequently, the interest in studying bank efficiency and changes therein stems from a desire to know how deregulation and liberalisation affects the industry. For instance, in the US there used to be regulations which restricted banks in their ability to open branches outside their home state and regulations restricting commercial banks in their ability to enter investment banking etc. Early studies on banking efficiency for instance suggested that the minimum

efficient scale for banks is fairly large; this implied that regulations which prevented banks from operating outside their home state often forced banks to operate below efficient scale, and that deregulation would improve efficiency. Recent studies tried to check whether deregulation did increase competition and improve efficiency. Similar efforts have been made to examine whether increases in foreign bank participation when markets were liberalized would increase competition and efficiency (Berger and Mester, 1997, Berger and Humphrey, 1997, Goldberg et al, 2000, Clarke et. al, 2001, Sturm and Williams, 2004 and Detragiache and Gupta, 2004).

Banking efficiency research has been conducted extensively for U.S. commercial banks, to a smaller extent for European financial institutions and relatively little for Asian financial institutions (Kwan, 2003 and Berger and Hamphrey, 1997). There have also been only few studies comparing efficiency between domestic and foreign banks in one country.

Bank efficiency studies can be classified into those which examine scale and scope efficiency alone, and those which also examine X-efficiency[1]. Most studies focus on scale and scope efficiency. The scale and scope studies estimate an average practice cost function which explains bank cost to output levels and input prices. The technique fundamentally assumes that there is no X-inefficiency and banks use the same production technology. In this setting, inefficiently high costs can arise if banks fail to operate at the efficient scale, or if they fail to operate with efficient scope, i.e. with an efficient output mix. On the other hand, X-efficiency studies estimate a best practice cost function, which represents the predicted cost function of banks that are X-efficient, and then assesses the degree of inefficiency of banks in the sample relative to this best practice technology[2] (Mester, 1996). Hence in addition to the above sources of inefficiency, inefficiently high costs can arise in this setting also from banks failing to use the efficient production technology or input mix. The present study focuses on X- efficiency and compares domestic and foreign banks in Thailand.

Instead of via the cost function, scale, scope or X efficiency can in principle also be measured via the profit function. The reasons why most studies, including the present one, focus on cost efficiency can be classified into three main categories as asserted by Fries and Taci (2004) as follows. Firstly, stronger relative cost efficiency mostly comes along with the structural and institutional reforms. Secondly, greater cost efficiency or efficiency gains decrease the operating costs in both operations of payments systems and intermediation of savings into investments, which finally benefit the overall economic development. Thirdly, cost efficiency may be an advantage for other dimensions of bank performance which contribute to overall economic development, for instance, the identification of more productive lending opportunities. In addition, cost efficiency is one of the three common performance dimensions (the other two are capital adequacy and loan management) for identifying problem banks (Rahman et al, 2004).

Recently, the Bank of Thailand imposed the Financial Sector Master Plan, aiming at improving efficiency, stability and competition in the financial system and broadening accessibility of financial services to all potential users. In order to realise greater efficiency and less duplication of functions, under the restructuring the Thai financial institutions, there will be two types of licences to financial institutions that take deposits from the public: commercial

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[1] Scale efficiency – whether banks are operating with the efficiency level of outputs; scope efficiency – whether banks are operating with the efficiency mix of outputs; and X-efficiency – whether banks are using their inputs efficiently (Mester, 1996, pp. 1026).

[2] Three common methodologies are data envelopment analysis (DEA), thick frontier analysis, and stochastic econometric cost frontier analysis. None of these methodologies work without problems. (Mester, 1996).

banks and retail banks[3]. Whereas under the restructuring of foreign-owned financial institutions, there will be two types of foreign bank licenses: subsidiaries of foreign banks and full branches of foreign banks (BOT, 2004). In all, the study of cost efficiency of banks will enable policy makers to pinpoint current infrastructure weaknesses and promptly issue appropriate policy measures to cure such conditions.

The purposes of this paper are as follows:

1) To analyse the development of per unit operating costs of the banking industry in Thailand and to compare the cost efficiency of domestic and foreign banks in order to shed light on the cost advantages (if any) of foreign banks. The findings will have implications for regulatory policies relating to the size and competitiveness of domestic banks and foreign bank entry.

2) To examine the choice of input combination, for example, the combination of labour and physical capital in banking production across the different types of banks.

3) To investigate the effect of foreign bank entry on banking efficiency in Thailand after the significant acquisitions by banks from developed countries in 1999.

The rest of the paper is organised as follows. Section 2 provides an institutional background. Section 3 presents a review of the literature. Section 4 discusses the data and descriptive analysis and the methodology. Section 5 shows the analysis of empirical results and section 6 provides concluding remarks.

2. Institutional Background

2.1 The Development of the Thai Banking Industry

Thailand's financial system is deep compared to other emerging market economies with similar per capita income. In fact, at the end-2002, total financial assets stood at about 158 percent of GDP (IMF, 2004). Most of the financial deepening took place at the beginning of the 1980s and was mainly due to an increasingly large share of private savings which was channelled into accumulation of financial assets. The Thai system is bank-oriented with limited financial intermediation through mutual funds and other type of institutional investors (Alba et al., 1999).

Thailand's financial system includes four main constituents: commercial banks, capital markets (consisting of both stock and bond markets), government-owned specialised financial institutions (SFIs) and non-bank financial intermediaries (finance companies, credit foncier companies, life insurance companies, and various financial co-operatives). Commercial banks are the oldest and largest part of the Thai financial system (Disyatat and Nakornthab, 2003) (see table 9). Thailand's banking industry is characterised by an oligopolistic market structure. It seems that this oligopolistic structure and the lack of a threat of new entry obstructed innovation and diversification in the financial system (Alba et al., 1999). At end of 2002, commercial banks' assets stood at 106 percent of GDP (IMF, 2004), compared to 14 percent of GDP in 1960.

On the other hand, bonds and stock markets remain in the process of development. The value of all bonds outstanding increased from 12 percent of GDP at end-1997 to 42 percent of

[3] Commercial banks are banks with qualified and well capitalised and which provide financial services to all groups of customers and carry out all types of financial transactions, except insurance underwriting as well as brokering, trading and underwriting of equity securities. Retail banks are banks with qualified and smaller capital requirement and which offer financial services to retail customers and SMEs subject to exposure limits per customer and other conditions set by the BOT (BOT, 2004).

GDP at end-2002. As for Thailand's main equity market, at peak in 1993 the Stock Exchange of Thailand (SET) market capitalisation stood at 105 percent of GDP. However, after the 1997 financial crisis, the SET market capitalisation has been relatively small despite recent gains, compared to other stock exchanges in the region. As of June-2003, the SET market capitalisation accounted for 47 percent of GDP (Disyatata and Nakornthab, 2003).

Finance companies which have rather limited roles[4] tend to seek profits by allocating a major share of their portfolio into high risk areas, namely construction and real estate, leasing and personal consumption loans because of relative advantages of commercial banks in term of cost of funds and regulations (Alba et al., 1999). Finance companies were strongly affected by the 1997 financial crisis. At peak at end-1996, finance companies assets stood at about one-third of those of commercial banks. Since the financial crisis, the number of finance companies decreased from 91 to 19 and their assets accounted for only one-seventh of their assets level in 1996 (Disyatat and Nakornthab, 2003).

2.2 Reform of the Thai Banking Sector

The financial liberalisation which took place in the late 1980s and early 1990s increased competition in the financial sector. The financial liberalisation programme had four main components: to deregulate the financial system; to develop financial instruments; to improve the payments system; and to improve the supervision and examination of financial institutions. The three main objectives of the programme were as follows: to increase competition in the domestic financial sector with the ultimate goal of improving the efficiency of savings mobilisation and credit allocation; to expand the financial sector for supporting economic expansion; and to establish Bangkok as the leading offshore financial centre[5] in the region. Financial liberalisation was carried out through a series of three-year financial system development plans[6] (Intarachote and Williams, 2003).

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[4] Unlike commercial banks, finance and securities companies are not allowed to take direct deposits from the public. They fund their operations primarily through the issuance of promissory notes, credits from commercial banks, and funding from other financial institutions respectively. At the same time, like commercial banks, the largest share of finance companies' income comes from lending activities, followed by hire purchase business, securities trading, dividends on investments and other sources (Alba et al, 1999).

[5] The Bangkok International Banking Facilities (BIBFs) was established in 1993 with an aim of simplifying access to international capital in response to the IS gap. There are two types of BIBF transactions. The first is out-out transactions which deal with taking deposits and lending in foreign currencies for specific activities overseas. The second is out-in transactions which relate to foreign currency borrowings from overseas or other BIBFs, then to be on-lent in foreign currencies to the domestic sector.

[6] The first plan (1990-1992) increased competition and efficiency in the banking system which included the policies aiming to abolish interest rate restrictions, relaxing capital and foreign exchange controls, and extend the activities of banks and other domestic financial institutions. The second plan (1993-1995) enhanced savings mobilisation, expanded financial services to rural areas and developed Bangkok as a regional financial centre. The plan was consisted of many policies targeting the strengthening of bank supervision, relaxing reserve requirements and entry barriers, and further deregulation of foreign exchange and capital control. The third plan (1996-1998) included the policies relating to the further deregulation of foreign exchange controls and relaxation of entry barriers into the domestic financial sector (Intarachote and Williams, 2003).

Table 10 presents the regulatory situation both before and after the financial liberalisation. One of the effects of financial liberalisation was that Thai banks developed new lines of business, in particular in the areas of investment banking and asset management. Moreover, domestic banks and corporations reduced their financing costs by raising relatively cheap funds from international financial markets. After financial liberalisation, the stock market rapidly boomed. In fact, between 1986 and 1993, the ratio of domestic banks' deposits to total domestic financial assets declined from 70.8 percent to 36.8, while the stock market's share increased from 8.6 percent to 51.2 percent during the same period (Intarachote and Williams, 2003). Because of relatively high interest rates in Thailand, BIBFs activities led to a greater influx of foreign capital, and such foreign capital competed with domestic banks for domestic business more than the Bank of Thailand expected. Moreover, liberalisation allowed commercial banks to focus less on lending and more on lucrative fee-based services, for example, advising, providing information, selling unit trusts, acting as trustees for mutual funds and bonds, as well as providing custodial services (Leightner and Lovell, 1998).

An analysis based on data for the period of 1989-1994 suggested that Thai financial liberalisation had been successful despite the fact that it carried high risks which needed to be carefully monitored (Leightner and Lovell, p. 129, 1998). In contrast, financial fragility increased from the mid-1990s because of technical regress and a declining efficiency. In fact, in the deregulated environment of the 1990s, profit efficiency declined at an increasing rate over time. On average, Thai banks lost 2.66 and 38.5 percent of potential profits to inefficiency in 1990 and 1997, respectively (Intarachote and Williams, 2003). On the other hand, foreign banks performed little better with efficiency losses of 2.62 and 37.69 percent, respectively.

3. Literature Review

There are three strands of literature which relate to the present study: (1) those relating to bank efficiency which includes the methodologies of measuring bank efficiency, (2) those dealing with the impact of international financial integration on bank efficiency and (3) those studying bank efficiency in Asia including Thailand.

3.1 Bank Efficiency

Berger and Hamphrey (1997) surveyed 130 studies of financial institution efficiency in 21 countries, covering various types of depository institutions including commercial banks, savings and loans, and credit unions –as well as insurance firms. The studies surveyed five different econometric techniques of measuring efficiency with an aim at summarising and critically reviewing empirical estimates of financial institutions efficiency. They focused on frontier efficiency, in other words, how close financial institutions are to a 'best-practice' frontier. Frontier analysis is a complicated way to benchmark the relative performance of production units. Generally, studies of frontier efficiency are based on accounting measures of costs, outputs, inputs, revenues, profits etc. to calculate efficiency relative to the best practice within the available sample because engineering information on the technology of financial institutions is not available. The five major different econometric techniques for estimating efficiency frontiers are *nonparametric frontiers*[7] which include, for example, (1) data envelopment analysis (DEA) 2)

[7] DEA is a linear programming technique where the set of best-practice or frontier observations is the one for which no other linear combination of units has as much or more of every output (given inputs) or as

free disposal hull (FDH), and *parametric frontiers*[8] which comprise three main approaches; (3) stochastic frontier approach (SFA), (4) distribution-free approach (DFA) and (5) thick frontier approach (TFA). They found that the various efficiency methods do not always yield consistent results. Results from applications of efficiency analysis suggest that deregulation of financials can either improve or worsen efficiency. It depends on industry conditions prior to deregulation[9].

Casu et al. (2004) compared parametric and non-parametric estimates of productivity changes in European banking between 1994 and 2000. Productivity change has been further decomposed into technological change, or change in best practice, and efficiency change. The findings suggest that productivity growth mainly came from improvements in technology and it seems unlikely that there was a catch-up on the part of non best-practice institutions. They also found that although competing methodologies sometimes identify conflicting findings for the sources of productivity growth for individual years, the two approaches do not yield significantly different results in terms of identifying the components of productivity growth during the 1990s. Mester (1996) used the stochastic cost frontier approach to examine bank efficiency in the Third Federal Reserve District taking into account the quality and risk of bank output. The findings suggest that Third District banks operated at cost-efficient output levels and product mixes. However, there appears to be a significant level of X-inefficiency at the banks. With reference of coping with increased competitive pressures, inefficient banks in the Third District have more to fear from banks that are efficient producers than from banks that are producers with particular output level or product mixes. There is less cost savings advantage from changing output size or mix than from using inputs more cost-effectively.

Berger et al. (2004) tested the effects of the relative health of community banks on economic growth. The analysis employed data between 1993 and 2000 on the economic performance and financial systems of 49 developed and developing countries. The study suggests that greater market shares and efficiency ranks of small, private, domestically owned banks facilitate better economic performance. The coefficients on the interaction terms between market shares and efficiency ranks are positive and statistically significant for both developed and developing countries indicating that the marginal benefits of higher shares for community banks are greater

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little or less of every input (given outputs). FDH is a special case of the DEA model where the points on lines connecting the DEA vertices are not included in the frontier (Beger and Hamphrey, p. 5, 1997).

[8] SFA specifies a functional form for the cost, profit, or production relationship among inputs, outputs, and environmental factors, and allows for random error. SFA suggests a composed error model where inefficiencies are assumed to follow an asymmetric distribution, normally the half-normal, whereas random errors follow a symmetric distribution, usually the standard normal. The inefficiencies must have a truncated distribution because inefficiencies cannot be negative. DFA specifies a functional form for the frontier but separate the inefficiencies from random in a different way. DFA assumes that the efficiency of each firm is stable over time whereas random error tends to average out to zero over time. Unlike SFA, DFA has no strong assumptions relating to the specific distributions of the inefficiencies or random errors. Based on DFA, inefficiencies can be almost of any form of distribution, even one that is relatively close to symmetric as long as the inefficiencies are nonnegative. The last approach is TFA. TFA specifies form and assumes that deviations from predicted performance values within the highest and lowest performance quartiles of observations classified by size class represent random error. At the same time, deviations in predicted performance between the highest and lowest quartiles represent inefficiencies and random error exists within these quartiles (Berger and Hamphrey, 1997).

[9] For example, in many countries, deregulation led to rapid branch expansion, excessive asset growth, bank failures, and reduced efficiency. In fact, one of the objectives of deregulation is to improve efficiency, nevertheless, other objectives may intervene (Beger and Hamphrey, 1997, p. 4).

when these banks are more efficient. Mahajan et al. (1996) studied evidence on the economies of scale, subadditivity and efficiency in U.S. multinational and domestic banking. The results indicate that the cost structures of multinational banks and domestic banks are different. Multinational banks are able to fully utilize economies of scale and have lesser diseconomies from joint production and lower inefficiencies than domestic banks.

3.2 Impact of International Financial Integration on Bank Efficiency.

With reference to the impact of financial liberalisation on performance of financial institutions, Fohlin (2000) studied the German universal banking system in the pre-WW I period in comparison with American and British banking systems with an objective of examining whether universality[10] affects banking industry concentration, levels of market power, or the financial performance of banks. The empirical results suggest that universality is not linked with superior profitability, whether the hypothesised source is efficiency (economies of scope) or monopoly power.

Claessens, Demirguc-Kunt and Huizinga (2001) found that foreign banks achieve higher profits than domestic banks in developing countries, while the reverse is true in developed countries. The differences of financial conditions between foreign and domestic banks are attributed to differences in customer base, bank procedures, regulatory and tax regimes. Crystal et al (2001) suggested that foreign ownership may provide important positive effects on the stability and development of emerging market banking systems. Majnoni et al (2003) indicated that in the case of Hungary foreign banks are more successful in product innovation, offer a broader range of financial services and have better screening and monitoring procedures than domestic banks. Clarke et al (2001) suggested that if foreign bank entry is broad enough to exert competitive pressure on domestic banks, this will benefit consumers. On the other hand, foreign banks could be a source of financial instabilities in developing countries if they decrease their exposures to those countries during crisis times. Claessens and Laeven (2003) found that greater foreign bank presence and fewer activity restrictions in the banking sector can lead to more competition in banking systems. Based on data for the post-deregulation in Australia during the period 1988-2001, Sturm and Williams (2004) found that foreign banks were more efficient than domestic banks but the higher efficiency did not imply higher foreign bank profit. Bank efficiency has significantly increased during the post-deregulation. Interestingly, diversity in the types of banks was found to be an important source of improvements in productivity. Detragiache and Gupta (2004) argued that even subsidiaries of foreign banks were not necessarily invulnerable to the financial crises which struck in many emerging countries in 1997.

As far as the link of foreign bank presence, domestic bank performance and financial development is concerned, there are both positive and negative impacts of foreign bank participation on the domestic banking industry and economy (Claessens, Demirguc-Kunt and Huizinga, 2000, 2001, Mishkin: 2000, Goldberg, Deges and Kinney, 1999, 2000, and Sabi, 1996). For example, foreign banks in Hungary are more profitable than domestic banks and did not expose themselves to a greater liquidity or credit risk. They provided less consumer loans and were reluctant to give long-term loans (Sabi, 1996). More multinational bank entry caused a

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[10] Universality is the combination of commercial and investment banking services. Germany has been one of the first and most enthusiastic developers of large scale, joint-stock, mixed banks. In the decades leading up to WW I, the British financial system was the most specialised. On the other hand, at the start of the 20th century, the American banks were quasi-universal, because most significant investment houses maintained commercial bank affiliates, usually as subsidiaries (Fohlin, 2000).

lower total credit supply in the Polish economy during the early transition phase, which led to adverse effects on business investment (Weller, 1999). In fact, the consequences of deregulation can be different across countries. It depends on industry conditions prior to deregulation, for example, competition to pay higher deposit interest rates in the U.S., a need to rapidly expand market share in Spain and existing excess loan demand in Norway.

3.3 Asian Studies on Bank Efficiency

Kwan (2003) examined the banking industry's per unit operating costs in seven Asian economies, comprising Hong Kong, Indonesia, Malaysia, Philippines, Singapore, South Korea and Thailand. The study is based on commercial banks which are listed in the IBCA bank credit rating agencies Bankscope database[11] between 1992 and 1999. The study shows that the country ranking of per unit labour costs and the country ranking of per unit physical capital costs are highly related. Banks with high labour costs also faced high capital cost. There are systematic differences in bank operating efficiency across these Asian countries; however, bank operating efficiency seems to be unrelated to the degree of openness of the banking sector. The study also finds that bank operating costs among these Asian countries declined between 1992 and 1997, suggesting that on average banks improved their operating performance over time. In 1997, the banks increased per unit operating costs when they dealt with their problem loans while output decreased. Between 1997 and 1999, the labour cost shares of the banks significantly declined but physical capital input was less flexible. Importantly, significant differences in the labour cost share are found across countries indicating that different countries have different bank production functions.

Mori and Tsutsui (1993) investigated the industrial organisational features of the financial markets in Thailand and their role in economic development and examined whether or not the market-structure-performance hypothesis is valid by estimating profit and cost functions. The study is based on pooled data from 1983-1987 of the commercial banks, finance companies, the securities companies and the mortgage credit companies which constituted the main part of the private financial intermediaries in Thailand. The findings are as follows: the expense rate of the commercial banks between 1983 and 1987 in Thailand was considerably higher than that of Japanese banks; however, their profit rate was not much higher and the real cost of funds was not so different. The market concentration in Thailand was higher than that in Japan. Economies of scale for both commercial banks and other financial institutions in Thailand were not found. For the commercial banks in Thailand, the effect of higher concentration on profits was positive. The oligopoly market structure of the commercial banks seemed to cause wasteful expenditure of banks. The policy implication from the findings is that it seems desirable to encourage new entry and limit the size of large banks in order to reduce their market power.

Leightner and Lovell (1998) constructed Malmquist growth indexes and productivity indexes for two different specifications of banks' objectives: commercial banks objective (profit–orientation, i.e. maximizing net interest income and non-interest income) and Bank of Thailand's objective (fostering economic growth by maximising credits granted and investments in securities). The findings are as follows: 1) under the right conditions, financial liberalisation can contribute to growth in banks' ability to increase their profits and in their ability to finance economic growth. 2) With reference to BOT objectives, the average bank experienced rapid

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[11] Bankscope does not include foreign branches and agencies that are wholly owned by foreign banks. Consequently, most of the sample banks are locally owned. However, the ownership status somehow does not clear-cut because it is possible for foreigners to own stocks of local banks (Kwan, 2003, pp. 474).

growth relative to the previous year's best practice; however, the average Thai bank experienced falling total factor productivity growth (TFP) while the average foreign bank experienced raising TFP. 3) No matter what performance index is used or whether commercial bank or BOT objectives are used, the performance of foreign small banks improved more than other bank categories. Importantly, strong growth should not be always accepted as good. In contrast, regulators should keep careful watch in order to prevent rapid growth based on speculation.

Menkhoff (1999) studied bad banking in Thailand with an empirical analysis of macro indicators, revealing that long-term performance of Thailand's financial system is reasonable compared to other countries' experience. Nevertheless, the rapid liberalisation process resulted in severe problems of financial institutions; for example, it increased new kinds of credit risk and market risk. Consequently, formerly good banking practices became inadequate banking. Menkhoff and Chodechai (2003) analysed 560 credit files in the pre-crisis period (1992-1996) from Thai commercial banks. The study reveals that the structure in lending determinants is similar to those found in mature markets. The rationale of Thai commercial banks' lending was reasonable, and does not comply easily with the frequent belief that these banks played a major role in the crisis in the late 1990s.

With reference to the impact of foreign bank entry on the domestic banking sector, Herberholz (2002) found that foreign bank entry led to greater efficiency in the Thai domestic commercial banking sector. The narrowing of net interest margins suggests greater competition which provided welfare gains for both depositors and borrowers. The concomitant decline in profitability of domestic banks illustrates a decrease in excessive profits arising from oligopoly markets. However, an increase in cost margins (overhead expenses over total assets) seems to reflect rationalisation and restructuring efforts due to pressure from foreign bank entry. Interestingly, unlike what was found for other developing countries, foreign bank entry through the acquisition of locally incorporated banks had a stronger effect on the efficiency of the domestic commercial banking system in Thailand than had entry through the establishment of branches. Based on qualitative information, Intarachote and Williams (2003) found that foreign banks introduced due diligence and the monitoring, evaluating and disclosing of credit risks. This implies that foreign banks use their superior management skills and culture, while domestic banks are based on a learning-by-doing process.

4. Data and Methodology

4.1 Data and Descriptive Analysis

4.1.1 Data

The use of panel data provides many benefits for econometric estimation, for example, in three areas: 1) identification of economic models and discriminating between competing economic hypotheses, 2) eliminating and decreasing estimation bias, and 3) reducing problems of data multi-collinearity[12]. On the other hand, the special features of panel data can also create new and difficult econometric problems, in particular in nonlinear models (Hsiao, 1986).

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[12] Baltagi (1995) stated that there are several benefits from using panel data. These include the following: (1) Panel data suggest that individuals, firms, states or countries are heterogeneous. (2) Panel data gives more informative data, more variability, less collinearity among the variables, more degrees of freedom and more efficiency. (3) Panel data are better to study the dynamics of adjustment. (4) Panel data are

This study includes two types of data. The first data set which is used for the descriptive analysis is at an aggregate level covering 17 years between 1987 and 2003. It comes from the databank of financial institutions compiled by the Data Management Group, Bank of Thailand. The second data set is bank level panel data of income statements and balance sheets of domestic and foreign banks in Thailand covering 9 years between 1995 and 2003 for the regression analysis. The bank level panel data set covers 23 out of a total of 31 commercial banks as of December 2003 which accounted for almost 90 percent of total assets of banking systems. It excludes Japanese banks and other foreign banks because their annual reports are released in March and November respectively. The banks can be classified into three groups; nine domestic banks (representing both local private and state-owned banks), four joint venture banks (representing banks with more than 50 per cent of foreign ownership since the acquisitions by foreign banks in 1999[13]) and ten full branches of foreign banks (representing banks with 100 per cent of foreign ownership). The bank level panel data are based on financial data from the Stock Exchange of Thailand and bank annual reports.

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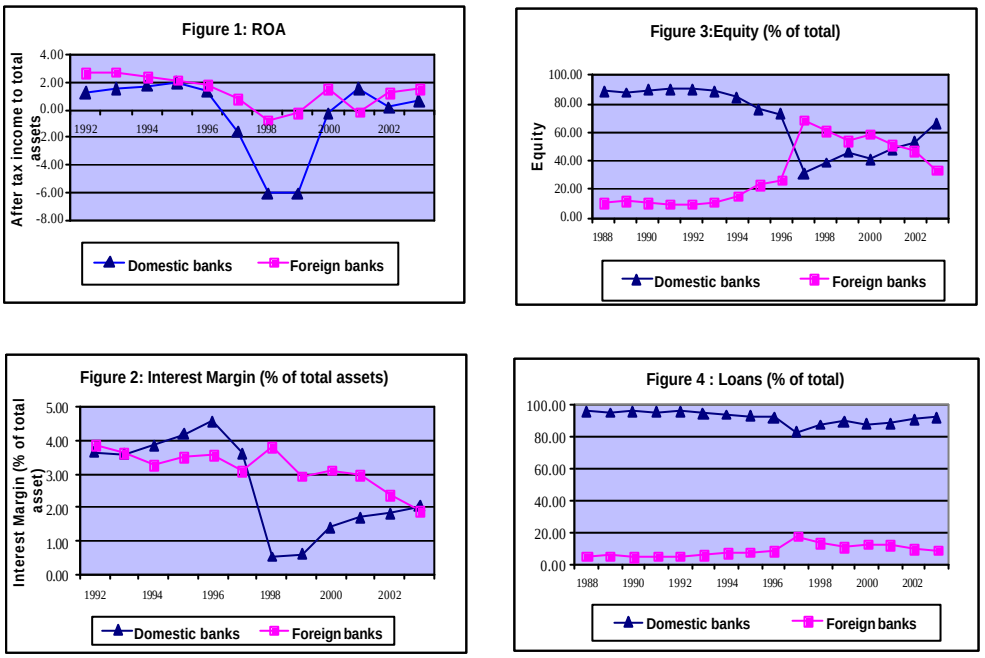
better to measure effects that cannot simply capture in pure cross-sections or pure time-series data. (5) Panel data models allow us to construct and test more complicated behavioural models than purely cross-section or time-series data. (6) Panel data are normally gathered on micro units, like individuals, firms and households and many variables can be more accurately measured at the micro level. However, there still have some limitations of panel data which include design and data collection problem, distortions of measurement errors, selectivity problems and short time-series dimension

[13] On June 27, 1997 the Government issued an Emergency Decree amending the commercial Banking Act B.E. 2505 (1962) (No. 2). The Emergency Decree relaxed existing restrictions on the foreign ownership of commercial banks by allowing 100% shareholding for foreign investors who step in to resolve or rehabilitate financial institutions, subject to certain conditions. In fact, foreign investors are permitted to acquire a majority ownership interest in locally-incorporated financial institutions for a period of 10 years, following which additional shares may not be acquired until the ownership interest (both existing and new holdings) are maintained at 49% of total shares outstanding or less.

4.1.2 Descriptive Analysis from Aggregated data

Figures 1-4 illustrate main financial ratios relating market share and profitability of domestic banks[14] and foreign banks which were calculated from aggregated data (see table 11). Although domestic banks still held a large market share during the post-crisis period, foreign banks had gradually increased their market share, particularly in term of equity. As for profitability, ROA (after-tax income to total asset) of domestic banks experienced a net loss during 1998-2000 and turned to a profit during 2001-2003. On the other hand, although foreign banks experienced a decline in ROA during the post-crisis year, averaged ROA of foreign banks recorded positive figures both in the pre-crisis and post-crisis periods. The ratio of interest margin to total assets of domestic banks was higher than that of foreign banks in the pre-crisis period, but lower in the post-crisis years.

Figures 1-4: Market Share and Profitability of domestic and foreign banks Between 1992 and 2003



From figures 5-8, during the post-crisis period, domestic banks gradually decreased their operating costs to total assets whereas the operating costs to total assets of foreign banks slightly increased. The gap between labour cost to total assets of domestic and foreign banks became smaller during the post-crisis period. The physical capital costs to total assets of domestic banks were higher than that of foreign banks in most years both in the pre-crisis and post-crisis periods. The ratios of loans to total assets of both domestic and foreign banks moved in the same pattern.

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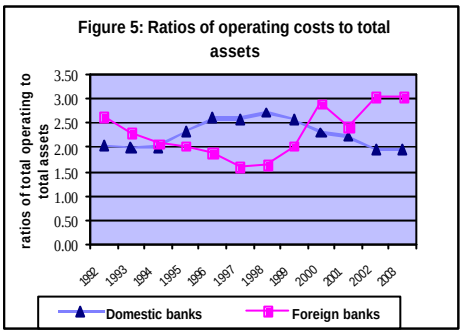
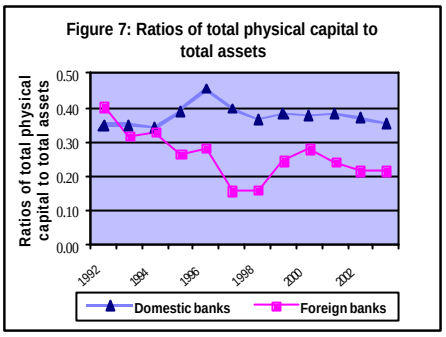
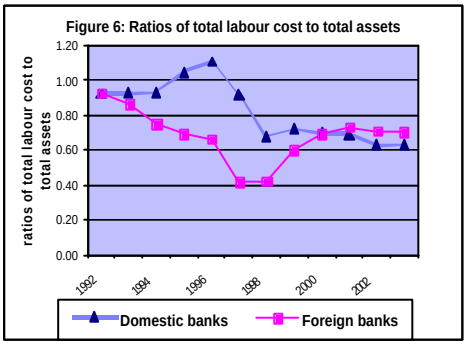
[14] Domestic banks include four merged banks which have more than 50% of foreign ownership. Foreign banks participation is greater if taking into account of four merged banks after the crisis years and foreign investor's participation in large domestic banks when they increased their capital after the outbreak of the crisis.

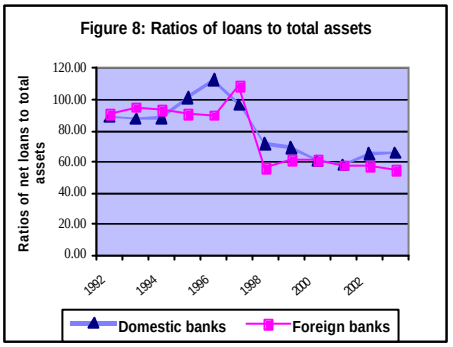
In fact, from table 12, the ratio of loans to total assets of domestic banks decreased from an average of 90.55 percent during 1988-1996 to an average 65.21 percent during 1998-2003. On the other hand, the loan to asset ratio of foreign banks declined from an average of 91.16 percent to an average of 58.18 percent during the same periods.

Figures 5-8: Operating Costs and loans of domestic* and foreign banks Between 1992 and 2003









4.2 Methodology

In theory, if the objective of the firms is to maximise profits, the firms will choose the cost-minimising production plans for every level of output. This behaviour will be observed in whether the firms are monopolists, perfect competitors or anything between, provided that they are perfectly competitive on their input markets and that therefore they face given input prices. There is a duality between production and cost, and as a result, we can use the cost function to generate a production function (Jehle and Reny, 2001). A production function is efficient when the maximum output is produced by each input level; in other words, the minimum level of each input is used for producing a given output (Maggi and Rossie, 2003).

Although there are a huge number of studies in bank efficiency, there does not seem to be a general agreement on how to define inputs and outputs of multi-product financial firms [15]. As a

[15] There are five most used approaches in the researches in this area. The first is the *production approach* which defines bank activities as production of services. The second is the *intermediate approach* which

result, the choices made by researchers should be a pragmatic compromise between the theoretical point of view and data availability (Maggi and Rossie, 2003). However, it should be noted that different efficiency concepts suggest that each concept measures a different type of optimisation. At the same time, the choices concerning measurement technique, functional form, and other variables normally provide very little differences in either average industry efficiency or the ranking of individual firms in the data set (Berger and Mester, 1997).

In this paper, there are three sets of concerns: the first is to compare the banking production costs between different bank types in Thailand, the second is to explore the choice of input mix in bank cost function and the third is the effects of foreign bank entry on cost efficiency in the Thai banking industry. Similar to Kwan's paper (2003), total operating costs consist of labour costs, physical capital costs and other costs and exclude the funding cost component which is assumed to significantly depend on domestic interest rates. The per unit cost measure can be constructed in two ways; total operating cost to total assets according to the asset approach of the banking output concept, and total operating cost to the sum of total assets and total deposits in line with the intermediation approach.

4.2.1 Cost Efficiency

I employ the translog cost function specification which is similar to the methodology used by Kwan (2003). In fact, the translog cost function is one of the most used functional forms in the empirical studies on bank efficiency (Maggi and Rossie, 2003). Cost efficiency provides a measure of how close a bank's cost is to best practice for producing the same output bundle under the same conditions. In other words, efficiency is defined relative to the best practice observed in the industry, rather than to any true minimum costs since the underlying technology is unknown (Berger and Mester, 1997 and Berger et al, 2004).The inefficiency which may cause costs higher than the best-practice level and random terms, u_c and e_c, are assumed to be multiplicatively separated from the rest of the cost function as follows:

$$ln\, C = f\,(w, y, z, v) + ln\, u_C + ln\, e_C \qquad (1)$$

where f denotes a functional form[16]. The $ln\, u_c$ term is a factor that represents a bank's inefficiency and $ln\, e_c$ is a random error which incorporates both measurement error and luck. The cost function is estimated using the ($ln\, u_c + ln\, e_c$) as a composite error term (Berger et al., 2004).

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defines banks as financial intermediaries that purchase input in order to generate earning assets. The third is *asset approach* which is a variant of the intermediation approach and defines liabilities as inputs and assets as output. The fourth is the *value added approach* which views any balance sheet item as output if it absorbs a relevant share of capital and labour. Otherwise it is treated as an input or non relevant output. The Fifth is the *user cost approach* which states that the net contribution to the bank revenue that explains inputs and output (Maggi and Rossie, 2003).

[16] C measures variable costs, w is the vector of prices of variable inputs, y is the vector of quantities of variable outputs, z represents the quantities of any fixed netputs (inputs or outputs), v is a set of environmental or market variables which may affect performance, u_c shows an inefficiency factor which may raise costs higher than the best-practice level and e_c presents the random error (Berger and Mester, 1997, p. 3-4).

Although the standard estimation method in empirical bank studies is the pooled ordinary least squares (OLS) method, this method raises a problem of interpretation if bank-specific characteristics, such as bank management which affects performance, are not considered (Jeon and Miller, 2004). In order to minimise the fundamental statistical problem arising from any omitted variables which are correlated with the included explanatory variables, one of three methods[17] when panel data are available is that of using dummy variables to capture the effects of time-invariant variables such as an individual-firm management and/or individual-invariant variables such as prices and interest rates. The pooled OLS estimate is generally consistent, although it is inefficient because it does not incorporate any prior knowledge about the form of serial correlation (Johnston and Dinardo, 1997). In contrast, the coefficients produced by the fixed-effects model (or also called least-squares dummy-variable approach) remain unbiased and consistent (Johnston and Dinardo, 1997, Hsiao, 1986). In response to these arguments, I tested both pooled OLS and fixed effects and between regressions. The paper presents the results from the pooled regressions which rendered better results.

I specify the widely used translog functional form to estimate whether production costs vary systematically across banks and over time:

Panel A: Domestic, Merged and Foreign Banks

$$\ln C_{jt} = a + ß_1 \ln X_{jt} + ß_2 DOMESTIC * \ln X_{jt} + ß_3 FOREIGN * \ln X_{jt} + g_1 FOREIGN + g_2 MERGED + d_1 DC_t + d_2 FOREIGN * DC_t + d_3 MERGED * DC_t + \ln e_{jt} \quad ....(2)$$

Panel B: Domestic and Merged Banks (Foreign Bank Entry Effects on Cost Efficiency)

$$\ln C_{jt} = a + ß_1 \ln X_{jt} + ß_2 MERGED * \ln X_{jt} + g\ MERGED + d_1 acquiredyr_t + d_2 MERGED * acquiredyr_t + \ln e_{jt} \quad .....(3)$$

It is should be noted that dummy variables for the ownership and time effect capture $\ln u_c$.

where $\ln C_{jt}$ is the natural logarithm of the dependent variable of observed cost over total assets for the *j*th bank at year *t*; three separate equations are estimated with total operating costs, labour costs and physical capital costs as dependent variables, respectively.

$\ln X_{jt}$ is the vector of the natural logarithm of the independent variables; it includes cash and inter-bank/total assets, loan loss provisions/total loans[18], equity capital /total assets loans/total assets and other earning assets[19]/total assets.

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[17] The other two methods are as follows: 1) differencing the sample observations to reducing the individual-specific and/or time-specific effects and 2) assuming a conditional distribution of unobserved effects, given observed exogenous variables (Hsiao, p. 215-216, 1986).

[18] As for X_2 loan loss provisions/total loans, I use the ratio figure of loan loss provisions/total net loans rather than natural log of that ratio in order to avoid of losing some observations because some observations are zero and negative figures. Total loans are defined as net loans which are loans less allowance for possible loan loss.

[19] The other earning assets include securities purchased under resale agreements and investments in securities.

DOMESTIC is a dummy which takes on the value 1 if the banks are domestic banks and 0 otherwise, *MERGED* is 1 if the banks are merged banks and 0 otherwise and *FOREIGN* is 1 if the banks are foreign banks and 0 otherwise. *DOMESTIC* is excluded as the reference category.

*DOMESTIC**independent variables and *FOREIGN**independent variables are the interaction terms between domestic and foreign banks and independent variables respectively. The interaction terms allow for different slope coefficients across different types of banks or in other words, they allow for bank-specific characteristics such as bank management styles.

DC is a time specific dummy variable for the financial crisis (*DC* =1 if period >= 1998 and *DC* = 0 if period <= 1997). I also tested for regressions which include yearly dummy variables; however, most of those coefficients were insignificant.

*FOREIGN*DC* and *MERGED*DC* are the interaction terms between foreign banks and post-crisis periods and merged banks and post-crisis periods, respectively.

acquiredyr is a time specific dummy variable for the period of foreign bank entry through acquisitions after the crisis (acquiredyr=1 if period >= 2000 and acquiredyr = 0 if period <= 1999).

*MERGED**acquiredyr is the interaction term between merged banks and the foreign bank acquisition year.

a , b , g and d are the vectors of regression coefficients; and e_{jt} is the error term.

The ratio of cash and inter-bank to total assets (X_1) captures <u>the liquidity of the banks</u>. Although liquid assets reduce the bank's liquidity risk, they seem more costly to manage since these assets involve additional transportation cost, storage and protection costs and labour cost. Consequently, the coefficient of the cash ratio is expected to be positive. The ratio of loan loss provision to total loans (X_2) controls for <u>output quality</u>. The coefficient of the ratio of loan loss provisions can be either negative or positive. If banks spend more of their resources on credit underwriting and loan monitoring, they would have less loan loss provisions. Then, the coefficient would be negative. However, if loan quality is endogenous in the quality management, an efficient bank with low operating costs would have less problem loans and consequently, less loans loss provisions. Thus, the coefficient would be positive. The ratio of equity capital to total assets (X_3) represents the <u>quality of bank management and risk preference</u>. Banks which have high equity capital, indicating both high quality management and aversion to risk taking, are more likely to have higher cost efficiency. As a result, the coefficient on the equity ratio is expected to be negative. The loans to total assets (X_4) capture the <u>output mix</u>. Because loans seem to be more costly to produce than investment securities, the coefficient of loans to total assets is assumed to be positive (Kwan, 2003). One difference from Kwan's work (2003) is that I propose the other earning assets to total assets (X_5) to control for output mix. Similar to the loan to total assets, the coefficient of the other earning assets to total assets is anticipated to be positive.

There are two types of dummy variables; one is the dummy variables for the ownership and the second is the time specific dummy variables. The dummy variables for the ownership capture whether there are systematic differences in operating costs across different types of ownerships (domestic, merged and foreign banks). The coefficients of the dummy variables for the ownership capture bank specific factors which include the productivity of labour, the efficiency in resource utilisation and management styles. The dummy variable for domestic

banks is excluded and defined as a reference category[20]. The time specific dummy variables control whether there are systematic changes in production costs over time, particularly pre- and post-crisis.

4.2.2 Choice of Input

The second set of concerns is to investigate whether the choice of input-mix, for example, the mix of labour and physical capital varies systematically across banks and over time:

Panel A: Domestic, Merged and Foreign Banks

$$\ln M_{jt} = a + ß_1 \ln X_{jt} + ß_2 DOMESTIC * \ln X_{jt} + ß_3 \; FOREIGN * \ln X_{jt} + g_1 FOREIGN + g_2 MERGED + d_1 DC_t + d_2 FOREIGN * DC_t + d_3 MERGED * DC_t + \ln e_{jt} \cdot \quad ....(4)$$

Panel B: Domestic and Merged Banks (Foreign Bank Entry Effects on Choice of Input)

$$\ln M_{jt} = a + ß_1 \ln X_{jt} + ß_2 MERGED * \ln X_{jt} + g \; MERGED + d_1 acquiredyr_t + d_2 MERGED * acquiredyr_t + \ln e_{jt} \quad ....(5)$$

where $\ln M_{jt}$ is the natural logarithm of the dependent variable of observed cost for the jth bank at year t; (M_1 = labour cost to total operating costs, M_2 = Physical capital cost/total operating costs). Other variables of the right hand side of the equations 4 and 5 are the same as explained for equations 2 and 3.

5. Empirical Results

5.1 Cost efficiency

Based on equation 2, table 1 reports the cost efficiency of domestic and foreign banks in terms of total operating costs. The t-statistics are computed by using heteroscedasticity-corrected robust standard errors. There are two regressions; regression 1 presents the ratio of total operating costs/total assets and regression 2 presents the ratio of total operating costs /total assets plus deposits. These two ratios allow us to disregard the disparity generated by the differences in bank size. Similar to Kwan's paper (2003), the results from regression 1 and 2 render almost the same results. Most of the coefficients have the same sign as expected from the theory. Taking the bank-specific characteristics such as bank management style into account by allowing for the different slope coefficients across types of banks, the results from regression 1 and 2 suggest that the operating costs of domestic banks are significantly positively related to cash and inter-bank, loan loss provisions and other earning assets but unrelated to equity and loans. On the other hands, those of foreign banks are significantly negatively related to equity and positively related

[20] One of the bank specific dummy variables is excluded and defined as a reference category so as to be assure of the existence of the inverse of $(X'X)^{-1}$ matrix which is important in OLS because it is necessary for computing the estimator $\hat{b}$. The det $(X'X) > 0$ which means no multicollinearity between the explanatory variables (multicollinarity relates to the event that two or more explanatory variables are strongly linearly correlated). In fact, X_i is not allowed to be an exact function of all other explanatory variables. If det $(X'X) = 0$ (has multicollinearity), the inverse of $(X'X)$ is not defined. As a result, we cannot calculate the least squares estimator $\hat{b}$.

to other earning assets but unrelated to cash and inter-bank, loan loss provisions, and loans. The findings illustrate that the production costs of domestic and foreign banks are different resulting from differences in business structures, management styles and customer bases (also see Claessens et. al, 2001).

In fact, domestic banks concentrated on reducing liquidity risk by holding high levels of cash and inter-bank which led to high operating costs. Domestic banks also had high levels of non-performing loans (the ratio of loan loss provisions to total loans). In contrast, foreign banks were well-capitalised banks and more focused on the quality of bank management and risk aversion (the ratio of equity capital to total assets). The results highlight that foreign banks seemed to be more efficient than domestic banks in terms of capitalisation and lower levels of non-performing loans. This finding is consistent with Detragiache and Gupta (2004)'s study which indicates that foreign banks in Malaysia had relatively low non-performing loans; at the same time, profitability and capitalisation improved during the crisis. In contrast, domestic banks in Malaysia had experienced rapid portfolio growth before the crisis and most of them concentrated in property sector and the share purchase sector which experienced strong losses.

Domestic banks concentrated on holding high levels of liquid assets, whereas foreign banks could receive liquidity and cash and other liquid assets from their headquarters. Interestingly, domestic and foreign banks had one thing in common. Their operating costs were significantly positively related to other earning assets, suggesting that banks engaged more in other earning assets which include securities purchased under resale agreements and investments in securities rather than concentrating in only loans. The reason for this is that after the 1997 financial crisis, banks faced a large amount of non performing loans, and as a result, banks moved towards other sources of earnings.

The coefficients on the interaction terms of other earning assets with the ownership dummies show by how much the marginal effect of other earning assets on costs differs across ownership categories. These coefficients are significantly positive and the marginal effect of other earning assets on costs is slightly stronger for foreign than for domestic banks. To obtain the overall marginal effect of other earning assets on costs for domestic banks, one has to add the coefficients on other earning assets (beta1) and on the interaction term (beta2). The result is 0.1229. For foreign banks, the effect is even bigger at 0.1769.

The dummy variables for the ownership capture whether there are systematic differences in operating costs across banks. Interestingly, the coefficient of merged banks is significantly negative, indicating that on average, the unit costs of production of merged banks are lower than those of domestic banks. Unexpectedly, based on the estimated coefficients of dummy variables for the ownership, the unit costs of production of domestic and foreign banks are indistinguishable. On the other hand, the unit costs of production of merged banks are lower than those of domestic and foreign banks. The reason for this is likely that merged banks were fully engaged in financial restructuring after the acquisitions by subsidiaries of foreign banks. In terms of bank operating efficiency, foreign banks did not outperform domestic banks. The findings suggest that if foreign banks represent the best-practice banks in the industry, to a large extent, domestic banks in Thailand have managed to catch up to the best-practice standard.

Regarding the time effect dummy variables, the coefficients of DC (crisis year dummy variable) and interaction term of *FOREIGN**DC are insignificant, showing that per unit of production costs of both domestic and foreign banks during the post-crisis period are not significantly different. On the other hand, the coefficient of the interaction term *MERGED**DC is significantly positive, illustrating that per unit of production costs of merged banks during the post-crisis period are higher than those of domestic and foreign banks. Possible reasons for the increase in operating costs of merged banks include the additional resources to operate with the

massive non-performing loans at a time when the output deteriorated as well as, the financial restructuring in order to increase their competitiveness.

In order to illuminate the production process, table 2 presents the cost efficiency of domestic and foreign banks in terms of labour costs (regressions 3 and 4) and physical capital costs (regressions 5 and 6). Similar to regressions 1 and 2, the results from regressions 3 and 4 and regressions 5 and 6 give the similar results. Regressions 3 and 4 show that per unit labour costs of domestic banks are statistically positively related to loans and other earning assets and those of foreign banks are significantly positively related to only other earning assets, illustrating that loans and other earning assets are labour intensive. As for the domestic banks, the estimated coefficient of the interaction term of *DOMESTIC**loans is higher than that of *DOMESTIC**other earning assets (the calculation method is illustrated earlier), suggesting that loans are more costly to produce than investment securities, a finding which confirms with Kwan's (2003). Surprisingly, the marginal effects of interaction terms of *DOMESTIC**other earning assets and *FOREIGN**other earning assets are similar. One possible conclusion that can be drawn from this is that there are few differences between the marginal labour costs with respect to other earning assets of domestic and foreign banks.

In regression 4 (higher r-square), the estimated coefficients of dummy variables for ownership are insignificant, indicating that on average the labour productivity of domestic, merged and foreign banks is indistinguishable. The coefficient of the post-crisis years is significantly negative, showing that per unit labour costs of domestic banks after the crisis were lower than those before the crisis. The evidence indicates that labour productivity in the banking sector in Thailand improved after the crisis, as did other Asian countries between 1992 and 1997 as found by Kwan (2003). The improvement of cost efficiency in the banking sector in term of labour productivity resulted from the financial restructuring which was forced upon banks by, the crisis, by increased competition through the acquisitions of majority stakes in locally incorporated banks by foreign banks, by new technology and financial innovation and at the same time, was speeded up during the recent IMF rescue package.

However, from regression 4 the estimated coefficients of the interaction terms of both *FOREIGN**DC and *MERGED**DC are significantly negative and positive; -0.4500+0.4091= -0.0409 and -0.4500+0.6880 = +0.2380, respectively. The results suggest that after the crisis, per unit labour costs of foreign banks were lower than those of domestic banks. On the other hand, per unit labour costs of merged banks were higher than those of domestic banks. One reason is that merged banks had major downsizing and reorganisation in the early phase of acquisitions which incurred high costs, in particular the early retirement schemes. At the same time, after reorganisation, merged banks, like other foreign banks hired more high skilled labour with higher pay, compared with that of domestic banks.

The physical capital cost regressions (regressions 5 and 6) render generally similar results as the total operating cost regressions (regressions 1 and 2). In contrast, Kwan (2003) found that the labour cost regressions provide generally similar results to the total cost regressions. From regression 5 with higher r-square, per unit physical capital costs of domestic banks are statistically positively related to cash and inter-bank, loan loss provisions, loans and other earning assets whereas those of foreign banks are significantly positively related to only cash and inter-bank and other earning assets. Surprisingly, the coefficients on the interaction terms of other earning assets with the ownership dummies are positively significant. The marginal effect of other earning assets on physical capital costs of foreign banks (0.3080) is stronger than that of domestic banks (0.1704), indicating that foreign banks utilised more physical capital in managing resale agreements and investments securities than domestic banks. As expected, the marginal effects of loans on physical capital costs of foreign banks (0.2723) is lower than those

of domestic banks (0.7268), suggesting that foreign banks are more efficient in managing loans than domestic banks, which may result from either better monitoring systems and risk managements or better loan quality.

From regression 5, the estimated coefficient for merged banks is statistically negative; illustrating that per unit physical capital costs of merged banks were lower than those of domestic banks. On the other hand, per unit physical capital costs of domestic and foreign banks are indistinguishable. The coefficient of the post-crisis dummy is insignificant. At the same time, the estimated coefficient of the interaction term of *MERGED**DC is significantly positive (0.5113), suggesting that per unit capital costs of merged banks were higher than those of domestic and foreign banks. After the 1997 financial crisis, most banks embarked on restructuring processes which needed long term investment in physical resources. One explanation is that some banks introduced outsourcing for capital-intensive activities related to information technology, for example, information system engineering, IT infrastructure, and information system processing[21] (Manager, 2003). Another explanation is that an increase in advanced technology in banking services resulted in banks moving away from the 'bricks and mortar' concept of branch-based retail banking towards e-banking as pointed out by Herberholz (2002).

5.2 Choice of input

It is generally accepted that there is substitution between labour and capital in the production process in the banking industry. This section tests whether the shares of labour and physical capital costs vary with the cash and inter-bank to total assets (the liquidity of the banks), the loan loss provision to total loans (output quality), the equity capital to total assets (quality of bank management and risk preference), loans to total assets and the other earning assets to total assets (output mix). The dummy variables for the ownership test whether there are systematic differences in labour and physical capital cost shares across different types of banks. The explanation of the variations among banks arises from remuneration and technology embracement across banks. The time specific dummy variables test for systematic time effects on labour and physical capital shares. The dummy variable for the year 1995 is excluded and defined as a year reference category. This effect may come from advances in technology which require more advanced machines rather than labour (Kwan, 2003).

The results from regression 7 from table 3 estimated from equation 4 shows that the labour cost share of domestic banks is significantly negatively related to loan loss provisions whereas that of foreign banks is significantly positively related to equity. The result confirms the earlier finding in 5.1 that production costs of domestic and foreign banks are different. One possible interpretation is that domestic and foreign banks have different businesses structures. Another possible interpretation is that domestic banks used more resources in handling non-performing loans; in contrast, foreign banks were well-capitalised banks and were more focused on the quality of bank management and prudent risk management. The estimated coefficients of the dummy variables for the ownership are insignificant, indicating that there are no significant differences among the three bank groups in terms of labour cost shares. Regarding the time

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[21] DBS Thai Dhanu bank which was acquired by DBS, Singapore in 1999 and has more 50% of foreign ownership, firstly introduced outsourcing. At end-2002, Kasikorn Bank (formerly named Thai Farmer Bank) made an biggest outsourcing deal in Thailand with IBM, in the amount of 10,000 million baht for 10 years (Manager Magazine, 2003)

effect dummy variables, the coefficient of the post-crisis dummy is significant negative. the estimated coefficient of the interaction term of *FOREIGN**DC is significantly negative (-0.0413), illustrating that the labour cost shares of domestic and foreign banks declined during the post-crisis period and that those of foreign banks were slightly lower than those of domestic banks'.

The regression 8 estimated from equation 4 reveals that the physical capital cost share of foreign banks is significantly positively related to equity and loans whereas that of domestic banks is unrelated to any independent variables. The estimated coefficients of the dummy variables for the ownership, the time effect dummy variables and interaction terms are all insignificant. The interpretation is that the physical capital inputs of the banks depend on banks' strategies and tend to be more long-term commitments. As a result, physical capital inputs are less flexible, which is also claimed by Kwan (2003).

5.3 Effects of Foreign Bank Entry through Acquisitions on Cost Efficiency

This section analyses the effect of foreign bank entry on banking efficiency in Thailand after the significant acquisitions by foreign banks in 1999. The same methodology as in 4.2 is applied in this section. In contrast to 5.1 and 5.2, the data set includes only nine domestic banks (representing both local private and state-owned banks) and four merged banks (representing banks with more than 50 per cent of foreign ownership since 1999) which represent foreign bank entry. The sample including only domestic and merged banks after the acquisitions allows me to compare banks which have similar business structures and customer bases. In fact, merged banks operate many businesses as domestic banks do. This enabled foreign banks to greatly expand their presence in the retail banking market through merged banks' branches and customer bases.

Table 4 presents regressions 1 and 2 which are estimated from equation 3. Both regressions provide very similar results. The findings show that per unit production costs of domestic banks are positively related to cash and inter-bank, loans and other earning assets; on the other hand, the costs of merged banks are negatively related to cash and inter-bank and other earning assets, illustrating that domestic and merged banks have similar business structures as expected. As for the domestic banks, loans are the most costly to handle, followed by cash and inter-bank and other earning assets. The estimated coefficients of the dummy variable for merged banks is insignificant, indicating that per unit production costs of domestic and merged banks between 1999 and 2003 are not significantly different. Regarding the time effect dummy variables, the estimated coefficient of acquiredyr is significantly negative, showing that per unit production costs of domestic banks after the acquisition year declined. The findings suggest that the cost efficiency of domestic banks improved, resulting from the foreign bank entry through acquisitions.

Table 5 shows the cost efficiency of domestic and merged banks in terms of labour costs (regression 3 and 4) and physical capital costs (regression 5 and 6). Regression 4 with higher r-square reveals that per unit labour costs of domestic banks are statistically positively related to cash and inter-bank, loan and other earning assets, whereas those of merged banks are statistically positively related to equity and negatively related to other earning assets. Interestingly, the findings illustrate that since the 1999 acquisition year merged banks focused on equity or quality of bank management and risk management in line with mother companies' directions. The estimated coefficients of merged, acquiredyr and of the interaction term of *MERGED**acquiredyr are all insignificant, suggesting that the labour productivity of domestic and merged banks is indistinguishable during the period 1999-2003.

Regressions 5 and 6 shows that the per unit of physical capital costs of both domestic and merged banks have the same pattern. In fact, these costs are related to cash and inter bank, loans

and other earning assets. Interestingly, the physical capital cost regressions give broadly similar results as those of the total operating costs regression. The estimated coefficient of merged is significantly negative, suggesting that per unit of physical capital costs of merged banks are lower than those of domestic banks, in other words, the capital productivity of merged banks is higher than that of domestic banks.

Referring to the choice of inputs, regressions 7 and 8 (table 6) are estimated from equation 5. Regression 7 shows that after the acquisition year (2000-2003) the labour cost share of merged banks is higher than that of domestic banks during the same period. In contrast, regression 8 reveals that the physical capital cost share of domestic banks is higher than that of merged banks during the same period. The interpretation is that foreign bank entry leads to greater competition in the banking industry. Evidence of this is that domestic banks increased their physical capital costs resulting from financial restructuring in response to pressures exerted by foreign banks' entry through the acquisition (see also[22] Herberholz 2002).

6 Concluding Remarks

Using a bank-level dataset including 23 domestic, merged and foreign banks in Thailand, this paper analyses the development of per unit operating costs of the banking industry, compares the cost efficiency of domestic and foreign banks and examines the effect of foreign bank entry on banking efficiency in Thailand after the significant acquisitions by foreign banks after the 1997 financial crisis. Total operating costs consist of labour costs, physical capital costs and others and exclude the funding cost component which is assumed to significantly depend on domestic interest rates. The widely used translog cost functional form is used to estimate pooled regressions.

The empirical findings indicate that the production costs of domestic and foreign banks are different, illustrating that domestic and foreign banks are different in terms of business structures, management styles and customer bases. The foreign banks seemed to be more efficient than domestic banks in terms of better capitalisation and lower levels of nonperforming loans. In contrast, domestic banks concentrated on holding high levels of liquid assets. Unexpectedly, the unit costs of production of domestic and foreign banks are indistinguishable. On the other hand, the unit costs of production of merged banks are higher than those of domestic and foreign banks. The reason for this is that merged banks needed additional resources for operating the massive non-performing loans incurred during the 1997 financial crisis and for financial restructuring after the acquisitions. In term of cost efficiency, foreign banks did not outperform domestic banks. A possible interpretation is that if foreign banks represent the best-practice banks in the industry, to a large extent, domestic banks in Thailand have managed to catch up to the best-practice standard.

Loans are more labour intensive than other earning assets. Surprisingly, there are fewer differences between the marginal labour costs with respect to other earning assets of domestic and foreign banks. On average the labour productivity of domestic, merged and foreign banks is indistinguishable. Regarding physical capital costs, domestic banks are more efficient in

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[22] It is interesting that foreign bank entry through the acquisition of locally incorporated banks strongly affects on the efficiency of domestic commercial banking systems than through the establishment of branches. The reasons for this include as follows; (1) generally foreign bank branches in Thailand do not compete on a level playing field and (2) access to retail banking seems to be heavily restricted (Herberholz, 2002).

handling resale agreements and investments securities than foreign banks. On the other hand, foreign banks are more efficient in managing loans than domestic banks, a finding which may be due to either better monitoring systems and risk managements or better loans quality in their portfolios.

Regarding the effect of foreign bank entry through acquisitions on cost efficiency, the results show that per unit production costs of domestic banks after the acquisition year during 2000-2003 were lower than those of 1999. This finding suggests that the cost efficiency of domestic banks improved, resulting from an increase in competition arising from the foreign bank entry through acquisition. Since the 1999 acquisition year, merged banks focused on equity or quality of bank management and risk management in line with mother companies' directions.

Among seven countries in Asia, the observed operating costs of banks in the Philippines are highest, followed by South Korea, Indonesia, Thailand and Malaysia, compared to those of banks in Hong Kong. The unit costs of production between banks in Hong Kong and banks in Singapore are similar (Kwan, 2003). Combining these findings with this paper's results, policy implications can be drawn as follows. One is that good management through long-term commitment to financial reform rather than only cost efficiency explains the survival of banks in the turbulent transition period in a banking sector which had to cope with the opening up of financial services to foreign competition (Kraft et al, 2002). The other implication as indicated in Detragiache and Gupta (2004) is that managerial incentives, good governance, and the quality of supervision at the level both of the subsidiary and of the parent banks play key roles and cannot be taken for granted, and that domestic banks in emerging market should aspire to achieve high standards in those areas.

Table 1: Regression Results (PANEL A): The Comparison of Cost Efficiency of Domestic and Foreign Banks: TOTAL OPERATING COSTS

Independent Variables	**Dependent Variables:OPERATING COSTS**	
	Regression 1 Operating costs/total assets	**Regression 2** Operating costs/total assets+deposits
	parameter t-stat	**parameter t-stat**
Cash and Interbank/Total Assets	-0.0238 (-0.21)	-0.0382 (-0.35)
Loan Loss Provisions/Total Loans	**-0.5635*** (2.94)**	**-0.5620*** (3.21)**
Equity/Total Assets	0.1675 (1.09)	0.2071 (1.42)
Loans/Total Assets	**0.3634** (2.12)**	**0.3812** (2.27)**
Other Earning Assets/Total Assets	**-0.2809** (-2.12)**	**-0.3216** (2.42)**
*DOMESTIC** Cash and Interbank/Total Assets	**0.2803** (2.16)**	**0.2754** (2.16)**
*DOMESTIC** Loan Loss Provisions/Total Loans	**2.8661** (2.07)**	**3.1870** (2.37)**
*DOMESTIC** Equity/Total Assets	-0.2528 (-1.44)	**-0.2976* (-1.75)**
*DOMESTIC** Loans/Total Assets	0.3849 (1.55)	0.2826 (1.08)
*DOMESTIC** Other Earning Assets/Total Assets	**0.4182*** (2.86)**	**0.4445*** (3.00)**
*FOREIGN** Cash and Interbank/Total Assets	0.1515 (1.18)	0.1510 (1.22)
*FOREIGN** Loan Loss Provisions/Total Loans	1.0818 (1.48)	1.0436 (1.39)
*FOREIGN** Equity/Total Assets	**-0.4938*** (-3.02)**	**-0.4589*** (-2.95)**
*FOREIGN** Loans/Total Assets	-0.1585 (-0.76)	-0.1724 (-0.85)
*FOREIGN** Other Earning Assets/Total Assets	**0.4941*** (3.31)**	**0.4985*** (3.36)**
FOREIGN	-0.3348 (-0.77)	0.1472 (0.33)
MERGED	**-1.2741* (-1.89)**	**-1.1641* (-1.74)**
DC	-0.0707 (0.82)	-0.1202 (-1.34)
FOREIGN *DC	0.1124 (0.86)	0.1207 (0.91)
MERGED *DC	**0.6986*** (5.08)**	**0.7248*** (5.42)**
Intercept	**-2.9029*** (-8.79)**	**-3.5850*** (-10.51)**
R-squared	0.4419	0.5523
Number of Obs.	200	200
Number of Banks	23	23

Notes:

1) *DOMESTIC* Dependent variables and *FOREIGN* *Dependent varibles are the interaction between domestic and all dependent variables and foreign and all dependent variables respectively.

2) *FOREIGN* *DC and *MERGED* *DC are the interaction between foreign and DC and merged and DC repectively.

3) The regressions are estimated by using ordinary least squared pooled cross-bank time-seris data.

4) * denotes 10% level of significance, ** denotes 5% level of significane, and *** denotes 1% level of significance and t-statistics which are reported in the parentheses are calculated by using heteroscedasticity-corrected robust standard errors.

Table 2: Regression Results (PANEL A): The Comparison of Cost Efficiency of Domestic and Foreign Banks :LABOUR AND PHYSICAL CAPITAL COSTS

Independent Variables	Dependent Variables:LABOUR COST		Dependent Variables:CAPITAL COST	
	Regression 3 Labour cost/total assets	**Regression 4** Labour cost/total assets+deposits	**Regression 5** Capital cost/total assets	**Regression 6** Capital cost/total assets+deposits
	parameter t-stat	**parameter t-stat**	**parameter t-stat**	**parameter t-stat**
Cash and Interbank/Total Assets	0.0209 (0.14)	0.0065 (0.04)	-0.0962 (-0.94)	-0.1107 (-1.13)
Loan Loss Provisions/Total Loans	-0.1188 (-0.30)	-0.1174 (0.32)	**-0.4474*** (-3.36)**	**-0.4460*** (-3.36)**
Equity/Total Assets	0.0264 (0.14)	0.0659 (0.36)	0.0213 (0.17)	0.0609 (0.49)
Loans/Total Assets	0.2357 (1.06)	0.2535 (1.17)	0.0172 (0.14)	0.0350 (0.29)
Other Earning Assets/Total Assets	-0.1857 (-1.22)	-0.2264 (-1.58)	**-0.2171* (-1.93)**	**-0.2578** (-2.31)**
*DOMESTIC** Cash and Interbank/Total Assets	0.2343 (1.42)	0.2293 (1.45)	**0.2370* (1.95)**	**0.2321** (1.99)**
*DOMESTIC** Loan Loss Provisions/Total Loans	0.9747 (1.05)	1.2955 (1.46)	**1.7091*** (2.67)**	**2.0299*** (3.30)**
*DOMESTIC** Equity/Total Assets	-0.0750 (-0.37)	-0.1199 (-0.63)	-0.0640 (-0.47)	-0.1088 (-0.82)
*DOMESTIC** Loans/Total Assets	**0.5766** (2.19)**	**0.4743* (1.85)**	**0.7096*** (3.47)**	**0.6073*** (3.28)**
*DOMESTIC** Other Earning Assets/Total Assets	**0.3328** (2.08)**	**0.3590** (2.37)**	**0.3875*** (2.94)**	**0.4138*** (3.20)**
*FOREIGN** Cash and Interbank/Total Assets	0.1652 (1.01)	0.1647 (1.06)	**0.2467* (1.95)**	**0.2462** (2.03)**
*FOREIGN** Loan Loss Provisions/Total Loans	0.2570 (0.46)	0.2188 (0.42)	0.6587 (1.00)	0.6205 (0.99)
*FOREIGN** Equity/Total Assets	-0.2109 (-1.05)	-0.1761 (-0.93)	-0.1580 (-1.01)	-0.1232 (-0.81)
*FOREIGN** Loans/Total Assets	-0.1794 (-0.73)	-0.1933 (-0.82)	0.2551 (1.32)	0.2412 (1.30)
*FOREIGN** Other Earning Assets/Total Assets	**0.3320** (1.96)**	**0.3364** (2.15)**	**0.5251*** (3.55)**	**0.5295*** (3.71)**
FOREIGN	**-0.6074* (-1.69)**	-0.1255 (-0.37)	-0.0831 (-0.15)	0.3988 (0.77)
MERGED	**-1.4654* (-1.65)**	-1.3554 (-1.60)	**-1.6529*** (-2.85)**	**-1.5428*** (-2.75)**
DC	**-0.4005*** (-5.95)**	**-0.4500*** (-6.84)**	-0.1105 (-1.26)	**-0.1600* (-1.80)**
FOREIGN *DC	**0.4009*** (3.34)**	**0.4091*** (3.59)**	-0.0171 (-0.10)	-0.0089 (-0.05)
MERGED *DC	**0.6618*** (3.40)**	**0.6880*** (3.76)**	**0.6218*** (4.57)**	**0.6480*** (4.91)**
Intercept	**-3.6244*** (-15.72)**	**-4.3066*** (-19.06)**	**-4.7168*** (-12.41)**	**-5.3990*** (-15.17)**
R-squared	0.4441	0.6175	0.3212	0.2394
Number of Obs.	200	200	200	200
Number of Banks	23	23	23	23

Notes:

1) *DOMESTIC* Dependent variables and *FOREIGN** Dependent varibles are the interaction between domestic and all dependent variables and foreign and all dependent variables respectively.

2) *FOREIGN* *DC and *MERGED* *DC are the interaction between foreign and DC and merged and DC respectively.

3) The regressions are estimated by using ordinary least squared pooled cross-bank time-seris data.

4) * denotes 10% level of significance, ** denotes 5% level of significane, and *** denotes 1% level of significance and t-statistics which are reported in the parentheses are calculated by using heteroscedasticity-corrected robust standard errors.

Table 3: Regression Results (PANEL A) of the Labour and Physical Capital Cost Shares of Domestic and Foreign Banks

Independent Variables	Dependent Variables: Labour and Capital Cost Shares	
	Regression 7 Labour cost/total operating costs	**Regression 8** Capital cost/total operating cost
	parameter t-stat	**parameter t-stat**
Cash and Interbank/Total Assets	0.0447 (0.43)	-0.0724 (-1.48)
Loan Loss Provisions/Total Loans	**0.4446* (1.69)**	0.1160 (0.80)
Equity/Total Assets	-0.1411 (-1.08)	-0.1462 (-1.45)
Loans/Total Assets	-0.1277 (-0.89)	**-0.3462*** (-3.36)**
Other Earning Assets/Total Assets	0.0952 (0.73)	0.0638 (0.95)
*DOMESTIC** Cash and Interbank/Total Assets	-0.0461 (-0.39)	-0.0433 (-0.50)
*DOMESTIC** Loan Loss Provisions/Total Loans	**-1.8915* (-1.86)**	-1.1571 (-0.96)
*DOMESTIC** Equity/Total Assets	0.1778 (1.24)	0.1888 (1.55)
*DOMESTIC** Loans/Total Assets	0.1917 (0.75)	0.3247 (1.20)
*DOMESTIC** Other Earning Assets/Total Assets	-0.0854 (-0.59)	-0.0307 (-0.31)
*FOREIGN**Cash and Interbank/Total Assets	0.0137 (0.13)	0.0952 (1.08)
*FOREIGN**Loan Loss Provisions/Total Loans	-0.8248 (-1.25)	-0.4231 (-0.55)
*FOREIGN**Equity/Total Assets	**0.2829** (2.11)**	**0.3357*** (2.71)**
*FOREIGN**Loans/Total Assets	-0.0209 (-0.13)	**0.4136*** (2.61)**
*FOREIGN**Other Earning Assets/Total Assets	-0.1621 (-1.16)	0.0310 (0.28)
FOREIGN	-0.2726 (-0.81)	0.2516 (0.45)
MERGED	-0.1913 (-0.29)	-0.3788 (-0.70)
DC	**-0.3298*** (-3.54)**	-0.0398 (-0.46)
FOREIGN *DC	**0.2885*** (2.61)**	-0.1296 (-0.82)
MERGED *DC	-0.0368 (-0.23)	-0.0768 (-0.64)
Intercept	**-0.7216** (-2.51)**	**-1.8140*** (-4.28)**
R-squared	0.3398	0.2720
Number of Obs.	200	200
Number of Banks	23	23

Notes:

1) *DOMESTIC* Dependent variables and *FOREIGN* *Dependent varibles are the interaction between domestic and all dependent variables and foreign and all dependent variables respectively.

2) *FOREIGN* *DC and *MERGED* *DC are the interaction between foreign and DC and merged and DC repectively.

3) The regressions are estimated by using ordinary least squared pooled cross-bank time-seris data.

4) * denotes 10% level of significance, ** denotes 5% level of significane, and *** denotes 1% level of significance and t-statistics which are reported in the parentheses are calculated by using heteroscedasticity-corrected robust standard errors.

Table 4: Regression Results (PANEL B): The Comparison of Cost Efficiency of Domestic and Merged Banks: TOTAL OPERATING COSTS

Independent Variables	**Dependent Variables:OPERATING COSTS**	
	Regression 1 Operating costs/total assets	**Regression 2** Operating costs/total assets+deposits
	parameter t-stat	**parameter t-stat**
Cash and Interbank/Total Assets	**0.2251*** (4.10)**	**0.2299*** (3.44)**
Loan Loss Provisions/Total Loans	0.4695 (0.65)	0.4985 (0.65)
Equity/Total Assets	-0.0743 (-1.31)	-0.0793 (-1.28)
Loans/Total Assets	**0.5775*** (3.15)**	**0.4622** (2.23)**
Other Earning Assets/Total Assets	**0.1962*** (2.87)**	**0.1756** (2.51)**
*MERGED**Cash and Interbank/Total Assets	**-0.2624* (-1.67)**	**-0.2553* (-1.69)**
*MERGED**Loan Loss Provisions/Total Loans	-0.4616 (-0.54)	-0.5172 (-0.58)
*MERGED**Equity/Total Assets	0.3835 (1.25)	0.4170 (1.40)
*MERGED**Loans/Total Assets	-0.1183 (-0.37)	-0.0037 (-0.01)
*MERGED**Other Earning Assets/Total Assets	**-0.5552*** (-3.05)**	**-0.5718*** (-3.28)**
MERGED	-0.1683 (-0.18)	-0.0563 (-0.06)
acquiredyr	**-0.1865** (-2.31)**	**-0.2113*** (-2.61)**
MERGED *acquiredyr	-0.2009 (-0.76)	-0.1880 (-0.71)
Constant	**-2.7467*** (-7.57)**	**-3.4930*** (-9.11)**
R-squared	0.7066	0.7106
Number of Obs.	60	60
Number of Banks	13	13

Notes:

1) *MERGED**Dependent variables are the interaction between merged and all dependent variables.

2) The regressions are estimated by using ordinary least squared pooled cross-bank time-seris data.

3) * denotes 10% level of significance, ** denotes 5% level of significane, and *** denotes 1% level of significance and t-statistics which are reported in the parentheses are calculated by using heteroscedasticity-corrected robust standard errors.

Table 5: Regression Results (PANEL B): The Comparison of Cost Efficiency of Domestic and Merged Banks :LABOUR AND PHYSICAL CAPITAL COSTS

Independent Variables	Dependent Variables:LABOUR COST		Dependent Variables:CAPITAL COST	
	Regression 3 Labour cost/total assets	**Regression 4** Labour cost/total assets+deposits	**Regression 5** Capital cost/total assets	**Regression 6** Capital cost/total assets+deposits
	parameter t-stat	**parameter t-stat**	**parameter t-stat**	**parameter t-stat**
Cash and Interbank/Total Assets	**0.2890*** (4.40)**	**0.2638*** (3.91)**	**0.2314*** (3.65)**	**0.2061*** (3.26)**
Loan Loss Provisions/Total Loans	-0.3635 (-0.25)	-0.3345 (-0.23)	1.2211 (1.08)	1.2501 (1.13)
Equity/Total Assets	-0.0376 (-0.72)	-0.0425 (-0.76)	-0.0223 (-0.49)	-0.0272 (-0.56)
Loans/Total Assets	**0.8154*** (4.55)**	**0.7001*** (4.04)**	**0.8421*** (4.74)**	**0.7267*** (4.46)**
Other Earning Assets/Total Assets	**0.1595** (2.27)**	**0.1389** (2.01)**	**0.2240*** (2.75)**	**0.2035** (2.55)**
*MERGED** Cash and Interbank/Total Assets	-0.2890 (-1.47)	-0.2820 (-1.49)	**-0.2888* (-1.92)**	**-0.2817* (-1.95)**
*MERGED** Loan Loss Provisions/Total Loans	0.7785 (0.51)	0.7229 (0.48)	-1.4578 (-1.25)	-1.5135 (-1.32)
*MERGED** Equity/Total Assets	0.5538 (1.58)	**0.5873* (1.71)**	0.0433 (0.17)	0.0547 (0.19)
*MERGED** Loans/Total Assets	-0.2442 (-0.67)	-0.1295 (-0.37)	**-0.7364*** (-3.01)**	**-0.6217*** (2.75)**
*MERGED** Other Earning Assets/Total Assets	**-0.5875** (-2.50)**	**-0.6040*** (-2.69)**	**-0.4466** (-2.38)**	**-0.4632** (-2.54)**
MERGED	-0.1281 (-0.12)	-0.0161 (-0.02)	**-1.1565* (-1.79)**	**-1.0445* (-1.69)**
acquiredyr	-0.0814 (-0.71)	-0.1062 (-0.95)	-0.0063 (-0.08)	-0.0312 (-0.40)
*MERGED**acquiredyr	0.1612 (0.62)	0.1742 (0.67)	-0.1596 (-0.67)	-0.1466 (-0.61)
Constant	**-3.8011*** (-11.13)**	**-4.5475*** (-13.41)**	**-4.4013*** (-12.56)**	**-5.1477*** (-15.16)**
R-squared	0.6604	0.6703	0.6956	0.7020
Number of Obs.	60	60	60	60
Number of Banks	13	13	13	13

Notes:

1) *MERGED** Dependent variables are the interaction between merged and all dependent variables.

2) The regressions are estimated by using ordinary least squared pooled cross-bank time-seris data.

3) * denotes 10% level of significance, ** denotes 5% level of significane, and *** denotes 1% level of significance and t-statistics which are reported in the parentheses are calculated by using heteroscedasticity-corrected robust standard errors.

Table 6: Regression Results (PANEL B) of the Labour and Physical Capital Cost Shares of Domestic and Merged Banks

Independent Variables	Dependent Variables: Labour and Capital Cost Shares	
	Regression 7 Labour cost/total operating costs	**Regression 8** Capital cost/total operating cost
	parameter t-stat	**parameter t-stat**
Cash and Interbank/Total Assets	0.0339 (0.48)	-0.0237 (-0.30)
Loan Loss Provisions/Total Loans	-0.8330 (-0.50)	0.7516 (0.75)
Equity/Total Assets	0.0368 (0.79)	0.0520 (0.96)
Loans/Total Assets	0.2379 (0.85)	0.2645 (0.89)
Other Earning Assets/Total Assets	-0.0367 (-0.50)	0.0278 (0.33)
*MERGED**Cash and Interbank/Total Assets	-0.0267 (-0.29)	-0.0264 (-0.28)
*MERGED**Loan Loss Provisions/Total Loans	1.2401 (0.74)	-0.9963 (-0.96)
*MERGED**Equity/Total Assets	0.1703 (1.16)	**-0.3401** (-2.38)**
*MERGED**Loans/Total Assets	-0.1258 (-0.42)	**-0.6180* (-1.93)**
*MERGED**Other Earning Assets/Total Assets	-0.0323 (-0.28)	0.1086 (0.97)
MERGED	0.0401 (0.06)	-0.9883 (-1.51)
acquiredyr	0.1050 (0.81)	**0.1801** (2.12)**
MERGED *acquiredyr	**0.3622** (2.28)**	0.0414 (0.21)
Constant	**-1.0545** (-2.49)**	**-1.6546*** (-3.43)**
R-squared	0.4221	0.2477
Number of Obs.	60	60
Number of Banks	13	13

Notes:

1) *MERGED**Dependent variables are the interaction between merged and all dependent variables.

2) The regressions are estimated by using ordinary least squared pooled cross-bank time-seris data.

3) * denotes 10% level of significance, ** denotes 5% level of significane, and *** denotes 1% level of significance and t-statistics which are reported in the parentheses are calculated by using heteroscedasticity-corrected robust standard errors.

Table 7: Regression Results: The Comparison of Cost Efficiency of Domestic and Foreign Banks : Pooled Regression (according to Kwan's estimations)

	Dependent Variables:OPERATING COSTS		Dependent Variables:LABOUR COST		Dependent Variables:CAPITAL COST	
	Regression 1 Operating costs/total assets	**Regression 2** Operating costs/total assets+deposits	**Regression 3** Labour cost/total assets	**Regression 4** Labour cost/total assets+deposits	**Regression 5** Capital cost/total assets	**Regression 6** Capital cost/total assets+deposits
	parameter **t-stat**	**parameter** **t-stat**	**parameter** **t-stat**	**parameter** **t-stat**	**parameter** **t-stat**	**parameter** **t-stat**
Cash and interbank/total assets	**0.1357*** (2.98)**	**0.1163*** (2.61)**	**0.1496*** (3.56)**	**0.1302*** (3.26)**	**0.1226** (2.18)**	**0.1031* (1.92)**
Loan Loss provisions/total net loans	-0.0490 (-0.20)	-0.0620 (-0.24)	0.2840 (1.23)	0.2710 (1.19)	0.1883 (0.70)	0.1753 (0.67)
Equity/total assets	**-0.2211*** (-3.85)**	**-0.1768*** (-3.29)**	**-0.1355*** (-3.14)**	**-0.0911** (-2.40)**	**-0.1039* (-1.65)**	-0.0596 (-1.01)
Loans/total assets	0.1063 (1.18)	0.1078 (1.25)	0.0299 (0.35)	0.0314 (0.41)	0.1418 (1.38)	0.1433 (1.49)
Other earning assets/total assets	**0.1302*** (2.60)**	**0.0986** (2.00)**	**0.1031** (2.01)**	0.0715 (1.50)	**0.1808*** (2.82)**	**0.1492** (2.41)**
Foreign banks	**0.5192*** (4.59)**	**0.8311*** (8.12)**	**0.3930*** (3.99)**	**0.7049*** (8.26)**	-0.0603 (-0.48)	**0.2516** (2.15)**
Merged banks	**0.3704*** (5.86)**	**0.3703*** (5.98)**	**0.3965*** (6.11)**	**0.3963*** (6.31)**	**0.4280*** (6.46)**	**0.4279*** (6.55)**
1996 (tdd2)	0.0794 (0.87)	0.0808 (0.90)	0.0658 (0.69)	0.0673 (0.76)	0.1239 (1.16)	0.1253 (1.17)
1997 (tdd3)	0.1503 (1.61)	**0.1690* (1.83)**	-0.0694 (-0.65)	-0.0507 (-0.50)	-0.0156 (-0.13)	0.0031 (0.03)
1998 (tdd4)	**0.2316* (1.90)**	**0.2381* (1.96)**	**-0.2152** (-2.00)**	**-0.2087** (-2.05)**	-0.0811 (-0.63)	-0.0746 (-0.58)
1999 (tdd5)	**0.1941* (1.80)**	**0.1756* (1.65)**	-0.1409 (-1.28)	-0.1593 (-1.55)	0.0640 (0.51)	0.0455 (0.37)
2000 (tdd6)	0.0905 (0.84)	0.0733 (0.68)	**-0.2057* (-1.78)**	**-0.2229** (-2.04)**	0.0547 (0.33)	0.0375 (0.23)
2001 (tdd7)	0.0515 (0.50)	0.0355 (0.35)	**-0.1964* (-1.82)**	**-0.2124** (-2.10)**	-0.0812 (-0.57)	-0.0972 (-0.69)
2002 (tdd8)	0.0129 (0.11)	-0.0075 (-0.06)	**-0.2078* (-1.86)**	**-0.2282** (-2.15)**	-0.1204 (-0.93)	-0.1410 (-1.09)
2003 (tdd9)	-0.0483 (-0.39)	-0.0773 (-0.65)	-0.1850 (-1.47)	**-0.2139* (-1.84)**	-0.0746 (-0.54)	-0.1035 (-0.76)
Constant	**-3.8909*** (-13.53)**	**-4.4542*** (-15.62)**	**-4.6287*** (-18.09)**	**-5.1919*** (-21.72)**	**-5.1495*** (-14.67)**	**-5.7128*** (-16.57)**
R-squared	0.3438	0.4954	0.2704	0.5057	0.2630	0.1780
Number of Obs.	200	200	200	200	200	200

Note:

1) The regression is estimated using Ordinary Least Squared pooled cross-bank time-series data.

2) * denotes 10% level of significance, ** denotes 5% level of significane, and *** denotes 1% level of significance.

3) t-statistics which are reported in parentheses are calculated by using heteroscedasticity-corrected robust standard errors.

Table 8 : Regression Results: The Comparison of Cost Efficiency of Domestic and Foreign Banks: Pooled Regression (according to Kwan's estimations)

Independent Variables	Dependent Variables: Labour and Capital Cost Shares	
	Regression 7 Labour cost/total operating costs	**Regression 8** Capital cost/total operating cost
	parameter t-stat	**parameter t-stat**
Cash and interbank/total assets	0.0139	-0.0132
	(0.55)	(-0.25)
Loan Loss provisions/total net loans	0.3330	0.2373
	(1.08)	(1.05)
Equity/total assets	**0.0856*** **	**0.1172** **
	(2.70)	**(2.01)**
Loans/total assets	**-0.0764***	0.0355
	(-1.71)	(0.38)
Other earning assets/total assets	-0.0271	0.0506
	(-0.89)	(0.95)
Foreign banks	**-0.1262** **	**-0.5795*** **
	(-2.06)	**(-5.64)**
Merged banks	0.0260	0.0576
	(0.65)	(1.18)
1996 (tdd2)	-0.0136	0.0445
	(-0.32)	(0.63)
1997 (tdd3)	**-0.2197*** **	**-0.1659** **
	(3.73)	**(-2.02)**
1998 (tdd4)	**-0.4468*** **	**-0.3126*** **
	(-6.05)	**(-3.18)**
1999 (tdd5)	**-0.3350*** **	-0.1301
	(-4.46)	(-1.36)
2000 (tdd6)	**-0.2962*** **	-0.0358
	(-4.30)	(-0.23)
2001 (tdd7)	**-0.2479*** **	-0.1328
	(-4.10)	(-1.16)
2002 (tdd8)	**-0.2207*** **	-0.1334
	(-3.02)	(-1.14)
2003 (tdd9)	**-0.1366*** **	-0.0262
	(-1.88)	(-0.23)
Constant	**-0.7378*** **	**-1.2586*** **
	(-4.30)	**(-4.09)**
R-squared	0.3420	0.2837
Number of Obs.	200	200

Note:

1) The regression is estimated using Ordinary Least Squared pooled cross-bank time-series data.

2) * denotes 10% level of significance, ** denotes 5% level of significane, and *** denotes 1% level of significance.

3) t-statistics which are reported in parentheses are calculated by using heteroscedasticity-corrected robust standard errors.

Table 9: Major Constituents of Thailand's Financial System (at end 2002)

Constituent	Year of Establishment	No.	Total assets (in bil Baht)	Share of total financial institution assets (%)
1. Commercial banks				
1.1 Domestic banks	1906	13	5,780	59.40
1.2 Foreign bank branch	1888	18	686	7.00
2. Capital markets				
2.1 SET market capitalisation	1975	n.a.	1,986	n.a.
2.2 Public bonds outstanding	1933	n.a.	1,757	n.a.
2.3 Corporate bonds outstanding	1992	n.a.	543	n.a.
2.4 Securities companies	1953	39	51	0.50
2.5 Mutual fund companies	1975	14	467	4.80
3. Special Financial Institutions (SFIs)				
3.1 Government Saving Bank	1913	1	600	6.20
3.2 BAAC	1966	1	396	4.10
3.3 Government Housing Bank	1953	1	362	3.70
3.4 IFCT	1959	1	210	2.20
3.5 Export Import Bank	1993	1	48	0.50
3.6 SME Bank (formerly SIFC)	1992	1	13	0.10
3.7 Secondary Mortgage Corp	1997	1	2	0.02
4. Non-bank financial intermediaries				
4.1 Finance companies	1969	19	254	2.60
4.2 Credit foncier companies	1969	6	6	0.10
4.3 Life insurance companies	1929	26	360	3.70
4.4 Agricultural cooperatives	1916	4,073	67	0.70
4.5 Non agricultural cooperatives	1937	2,333	437	4.50

Source: Disyatat and Nakornthab, 2003

Table 10: Financial Liberalisaion and Regulatory Change, 1990-1997

Regulation	*Pre-liberalisation*	*Post-liberalisation*	*Year*
A: STRUCTURE AND CONDUCT RULES			
1. Entry of new banks			
1.1 Thai banks	Moratorium since 1978	Permitted	1996
1.2 Foreign Banks	Moratorium since 1978	Entry under BIBF license	1993
		Full branch status	1996
2. Branching expansion			
2.1 Thai banks	16% bond holding requirement	Abolished	1993
2.2 Foreign Banks	Restricted	Permitted for a sound bank	1996
3. Interest rate ceilings			
3.1 Deposit rates	Controlled by the BOT	Free to set	1989-1992
		Temporarily controlled	1997
3.2 Lending rates	Controlled by the BOT	Set to BOT guidelines 1/	1992
4. Entry of new banking activities			
4.1 BIBF		Lincense required	1993
4.2 Credit cards		Directly	1994
4.3 Underwriting and trading of debt instruments		Approval required	1992
4.4 Mutual funds		Lincense required	1992
4.5 ortfolio requirement for Thai banks branches	Credit equal to at least 60% of deposits in each province	Credit equal to at least 60% of deposits in each province	1991
B: PRUDENTIAL AND SUPERVISORY RULES			
1. Capital requirement	8% of total assets	BIS standard	1993
		Foreign banks tier 1 ratio to be at least equal to 6%	
2. Foreign exchange exposure	15% of tier 1 capital (liabilities)	Reduced to 10%	1993
	20% of tier 1 capital (assets)	Reduced to 15%	1993
3. Provision: doubtful debt	50% of doubtful assets	Increased to 100%	1994-1995
4. Reserve requirement	7% of total deposits	7% of total deposits, 7% of non-resident baht account and 7% of short-term foreign borrowings	1995-1996
		A reduction from 7% to 6% for total deposits	1997
5. Ownership of non-financial business	10% of a company's shares	Approval required if holding exceeds 10%	1994
6. Credits ratings		First credit rating agency	1993
		The Thai Rating & Information Service (TRIS) started	
7. Stock market regulation		Securities and Exchange Commission founded.	1992
		Public companies can issue corporate bonds & debentures to general public	

Source: Intarachote and Williams, 2003

Note: 1/ Banks are advised to base their lending on the Minimum Lending Rate (MLR), Minimum Overdraft Rate (MOR) and Minimum Retail Rate (MRR). A maximum margin must be added to the MRR as a reference rate for customers other than those eligible for MLR.

Table 11: Indicators of Banking Systems in Thailand
Classified by Types of Banks
between 1988-2003

	Pre- Crisis Period			Avg	Crisis Period	Avg	Post-Crisis Period	
	1988-90	1991-93	1994-96	Pre-crisis	1997	Post-crisis	1998-00	2001-03
Market Share (% of total)								
Total assets								
Domestic Banks	95.30	94.75	90.84	**93.63**	**80.63**	**88.18**	87.18	89.17
Foreign Banks	4.70	5.25	9.16	**6.37**	**19.37**	**11.82**	12.82	10.83
Loans								
Domestic Banks	94.96	94.68	92.50	**94.05**	**82.52**	**88.77**	87.82	89.72
Foreign Banks	5.04	5.32	7.50	**5.95**	**17.48**	**11.23**	12.18	10.28
Cash 1/								
Domestic Banks	96.37	94.78	87.79	**92.98**	**71.21**	**87.29**	86.28	88.29
Foreign Banks	3.63	5.22	12.21	**7.02**	**28.79**	**12.71**	13.72	11.71
Deposits								
Domestic Banks	97.85	97.88	98.27	**98.00**	**95.68**	**95.14**	95.48	94.79
Foreign Banks	2.15	2.12	1.73	**2.00**	**4.32**	**4.86**	4.52	5.21
Equity								
Domestic Banks	88.96	89.89	78.11	**85.65**	**31.12**	**48.92**	41.90	55.95
Foreign Banks	11.04	10.11	21.89	**14.35**	**68.88**	**51.08**	58.10	44.05
Total employment 2/								
Domestic Banks	n.a.	97.84	97.60	**97.72**	**96.75**	**95.78**	95.91	95.66
Foreign Banks	n.a.	2.16	2.40	**2.28**	**3.25**	**4.22**	4.09	4.34
Profitabilty: Operating Asset Ratios (% of total avg assets)								
Interest Margin								
Domestic Banks	n.a.	3.62	4.20	**3.91**	**3.60**	**1.36**	0.86	1.86
Foreign Banks	n.a.	3.75	3.45	**3.60**	**3.10**	**2.85**	3.29	2.41
Non-interest income (net)								
Domestic Banks	n.a.	1.06	1.31	**1.19**	**1.35**	**1.00**	0.91	1.10
Foreign Banks	n.a.	2.89	1.84	**2.37**	**1.57**	**1.86**	1.46	2.25
Gross income								
Domestic Banks	n.a.	4.69	5.51	**5.10**	**4.95**	**2.36**	1.76	2.96
Foreign Banks	n.a.	6.64	5.30	**5.97**	**4.67**	**4.71**	4.75	4.66
Pre-tax income								
Domestic Banks	n.a.	2.13	2.53	**2.33**	**-1.36**	**-2.34**	-4.88	0.21
Foreign Banks	n.a.	3.97	3.05	**3.51**	**1.31**	**1.00**	0.65	1.35
After-tax Income (ROA)								
Domestic Banks	n.a.	1.41	1.70	**1.55**	**-1.59**	**-1.68**	-4.15	0.79
Foreign Banks	n.a.	2.73	2.15	**2.44**	**0.78**	**0.54**	0.18	0.90

Source: The author's calculation from groupped data from Data Management Group (DMG), Bank of Thailand

1/ Cash includes cash and due from financial institutions and money market.

2/ Total employment is based on the figures at end-year.

3/ Net interest income is calculated by interest income and dividend substracting with interest expenses.

4/ Gross income includes net interest income and non-interest income.

5) Domestic banks include four merged banks which have more than 50% of foreign ownership.

6/ According to the International Loan Classification and Provision (LCP) rules and accounting standards by 2000. Recognition of accured interest income was shortened from 12 months to 6 months and subsequently 3 months. As a result, banks faced huge increases in provisioning expenses since the introduction of these rules effective from end-December 1998. This led dramatic decrease in after-tax income.

Table 12 : Indicators of Cost Variables in Banking Systems in Thailand
Classified by Types of Banks
between 1988-2003

	Pre- Crisis Period			Avg	Crisis Period	Avg	Post-Crisis Period	
	1988-90	1991-93	1994-96	Pre-crisis	1997	Post-crisis	1998-00	2001-03
Ratio of total operating costs to total assets								
Domestic Banks 1/	n.a.	2.01	2.30	**2.16**	**2.58**	**2.28**	2.53	2.04
Foreign Banks	n.a.	2.46	1.99	**2.22**	**1.60**	**2.50**	2.18	2.82
Ratios of total labour cost 2/ tototl assets								
Domestic Banks	n.a.	0.93	1.03	**0.98**	**0.91**	**0.67**	0.70	0.65
Foreign Banks	n.a.	0.90	0.70	**0.80**	**0.42**	**0.65**	0.57	0.72
Ratios of total physical capital 3/ to total assets								
Domestic Banks	n.a.	0.35	0.40	**0.37**	**0.40**	**0.37**	0.37	0.37
Foreign Banks	n.a.	0.36	0.29	**0.33**	**0.16**	**0.23**	0.23	0.22
Ratio of loans 4/ to total assets								
Domestic Banks	82.09	88.43	101.14	**90.55**	**96.59**	**65.21**	67.23	63.19
Foreign Banks	88.23	93.76	91.49	**91.16**	**108.77**	**58.18**	59.57	56.79

Source: The author's calculation from groupped data from Data Management Group (DMG), Bank of Thailand
1/ Domestic banks include merged banks which were acquired by banks from developed countries in 1999.
2/ Labour cost includes salaries and employee benefits.
3/ Physical capital cost includes premises and equipments.
4/ Loans are calculated by loans plus accrued interest receivables and minus allowance for possible loan losses.

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