BANK REGULATIONS, FINANCIAL CRISIS, AND CREDIT CRUNCH:

THE CASE OF THAILAND

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ABSTRACT

The response of bank lending to a change in bank capital is crucial to the transmission of aggregate shocks throughout the economy. In Thailand, commercial bank lending contracted significantly when it was hit by the financial crisis of 1997. The contraction was made worse by the banking regulations (risk-based capital requirements and deposit insurance) that had been implemented earlier to promote a safe and sound banking system.

The purpose of this dissertation is to examine the credit crunch phenomenon in Thailand during the crisis in 1997 and find out whether the decline in commercial bank lending was made worse by bank regulations.

This dissertation develops a theoretical model of a bank's expected wealth. It is based on Peek and Rosengren's loan disbursement model (1995) but expands it to allow for government securities, bank regulations (risk-based capital requirements and deposit insurance), and the uncertainty relating to the bank's loan-repayment.

The model is tested against the data from a sample of ten Thai commercial banks and seven foreign owned banks operating in Thailand. The empirical results support the idea the hypothesis that bank regulations, especially risk-based capital requirements, contributed to the contraction of lending by the ten Thai banks. A similar impact is not found in the case of loans by the seven foreign owned banks.

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CHAPTER 1. INTRODUCTION

During the 1997 financial crisis in Thailand, bank balance sheets deteriorated due to reduced bank profitability, actual loan losses, increased loan loss reserves and a decline in asset prices. Deterioration in bank balance sheets put a downward pressure on the bank capital position, which is one of the funding sources for financing bank assets. As a result, bank lending in Thailand declined sharply during the 1997 crisis (Table 1.3). In Thailand the economy relies heavily on bank loans. Because the process of funding through public offerings is stricter and more costly than borrowing from banks, commercial banks are the most important financial intermediary providing funds to the business sector (see Table 1.1). Furthermore, direct financing and development of long-term debt instruments are still new to Thai corporations (see Appendix 1 for the development of the Thai capital market).

In addition to the bank capital, banking regulations, such as risk-based capital requirements and deposit insurance, which aim to promote safe and stable banking systems, may also influence bank lending. Risk-based capital requirements assign differential weights to various types of assets. When banks issue loans, they are required to maintain higher capital on these investments than investments in government securities. This required capital-to-asset ratio may affect the number of loans issued by banks especially during a crisis when bank capital already deteriorated. In other words, risk-based capital requirements could make the credit contraction worse. Furthermore, if deposit insurance is introduced, banks must also pay a uniform proportion of their deposits to an insuring agency. In the case of bankruptcy, an insuring agency guarantees

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deposits to bank depositors. Therefore, deposit insurance premiums may also affect a bank's ability to lend. Thailand first adopted risk-based capital requirements in 1993. Though the government always bailed out troubled financial institutions in the past, it was not until 1999, after the crisis, that banks were required to pay the deposit insuring agency a fixed premium of 0.2 percent of outstanding deposits.

Table 1.1. Sources of Corporate Funding in Thailand

Unit: Billions of Baht

	1995	1996	1997	1998
Capitalization in SET	129.6	117.9	63.3	185.4
Issuance of corporate debenture	87.4	139.9	43.3	3.9
Private capital inflows (non-bank)	238	333.7	-48.5	-79.4
Changes in banks lending (including BIBF's credit)	837.6	610.5	391.4	-272.7
Changes in finance company lending	286.2	209.7	-204.5	-794.7
Total	1,578.8	1,411.7	245	-957.4

Source: Bank of Thailand Economic Focus (April – June 1999)

During the 1990s, Thailand liberalized its financial system, resulting in unforeseen consequences. The establishment of the Bangkok International Banking Facility (BIBF) in 1993 caused a sudden increase in financial capital inflows. The inflows led to large investments in risky projects such as real estate. The inexperienced Thai financial system, however, could not efficiently handle the problems created by large capital inflows and the subsequent expansion of credit. In addition, there were no prudential limits on loan concentration. As a result, banks were overexposed to risky projects that worsened the portfolio quality of Thai banks. Moreover, short-term foreign

borrowing increased drastically in the 1990s (see Table 1.2). There was also a maturity mismatch problem among Thai financial institutions, where short-term borrowing was used to finance long-term projects. The borrowing was unhedged and the pegged exchange rate eliminated exchange risks from borrowing in foreign currencies.

Table 1.2. Thai Commercial Banks and Finance Companies External Debt

Unit: Millions of Baht

Year	Short-term external debt	
	End of period	As % of total external debt
1990	10.41	35.54
1991	15.39	40.63
1992	18.91	43.35
1993	22.63	43.43
1994	29.17	44.98
1995	52.39	51.96
1996	47.74	43.90
1997	38.29	35.04
1998	28.44	27.06

Source : Bank of Thailand

In 1996 Thai exports fell dramatically, triggering fears of Thai baht devaluation. The unfavorable news decreased investor confidence because they expected a fall in returns from their investments. This fear led to a sharp decline in real estate and stock prices, which had risen during the boom period. Thus, while the Thai economy had grown rapidly in the early 1990s, and bank loans had expanded until 1997, the loans declined sharply in 1998 (see Table 1.3).

Table 1.3. Thai Commercial Bank Loans

Unit: Millions of Baht

	1991	1992	1993	1994	1995	1996
All commercial banks	1,898,817	2,262,061	2,615,837	3,211,263	3,887,519	4,477,894
	1997	1998	1999	2000	2001	2002
All commercial banks	5,689,125	4,585,740	4,299,376	3,789,667	3,685,337	4,138,688

Source: Bank of Thailand

On July 7, 1997, Thai authorities decided to change the exchange rate system from a basket-pegged to a managed-float system. The system change caused the Thai baht to fall drastically. Because most commercial bank lending had land as collateral, the subsequent collapse in real estate prices led to deterioration in the quality of bank assets. Moreover, the economic downturn increased non-performing loans that required banks to set aside more provisions for loan losses at the expense of bank capital.

Two competing hypotheses describe the effect of bank capital deterioration on bank lending. One is "The Moral Hazard Hypothesis", and the other is "The Capital Crunch Hypothesis". The Moral Hazard Hypothesis postulates that decreased bank capital gives banks greater incentive to increase lending and asset risk for higher returns. The Capital Crunch Hypothesis postulates that decreased bank capital causes banks to take lower risks by limiting lending (Syron 1991, Peek and Rosengren 1995).

Within The Capital Crunch Hypothesis, an important contributing factor to restraining credit supply is a regulated capital-to-asset ratio. Decreased bank credit may take place because banks are required to maintain higher capital for holding high-risk

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assets than for holding safe assets. The enforcement of risk-based capital requirements may encourage substitution from higher risk assets, such as commercial loans, into lower risk assets such as government securities. According to Peek and Rosengren (1995), bank capital deterioration can cause banks to decrease their lending in order to restore the regulated target capital-to-asset ratio.

When banks face capital constraints, they have only two options to meet the required capital-to-asset ratio: raise new capital or reduce their portfolios. Banks may have more incentive to reduce their portfolios rather than to raise new capital since raising new capital is difficult and costly, especially in countries where the financial system is not well developed. Such capital crunch phenomenon took place in the United States during the 1990s, where banks substituted from loans issued to the private sector into government bonds, causing a credit contraction (Peek and Rosengren 1995).

If a decrease in bank capital causes a reduction in bank credit, there will be a vicious circle between deteriorated bank capital and an economic downturn. Specifically, banks with weakened capital may decrease credit supply, thereby exacerbating the economic depression. The prolonged recession caused by contracted bank credit will, in turn, increase non-performing loans and decrease bank capital.

This dissertation will investigate the credit contraction in Thailand during the 1997 crisis and will examine whether risk-based capital requirements and deposit insurance worsened the bank lending contraction. The focus will be bank lending behavior during the period 1988-2001. The focus is on this particular period because of the availability of quarterly data. This empirical study will employ macroeconomic data

and panel data of the sample of ten Thai commercial banks, as well as the sample of seven foreign owned banks from 1988-2001. Least-squares estimation techniques will be employed on panel data to test the following hypotheses:

Hypothesis I: Bank capital deterioration leads to a decrease in bank lending, i.e., a capital crunch.

Hypothesis II: Risk-based capital requirements and deposit insurance worsens the bank lending contraction.

In order to test these two hypotheses, bank loans will be regressed against many variables: bank capital, two banking regulations (risk-based capital requirements and deposit insurance), and other macroeconomic variables.

CHAPTER 2. LITERATURE REVIEW

Current literature concerning the effect of bank capital deterioration on bank lending predominantly discusses the moral hazard hypothesis and the credit crunch hypothesis. According to the moral hazard hypothesis, since banks are limited liability corporations, they may have an incentive to take high risks whenever they are at or near insolvency. When bank capital decreases, the chances of going bankrupt rise and commercial banks take high risks, increasing the proportion of loans in their portfolios and decreasing the proportion of safe assets such as government securities. On the other hand, with the capital crunch hypothesis, banks have to meet the minimum ratio of risk-based capital to assets. Therefore, when the capital adequacy is binding, bank capital reduction may cause a decrease in bank risk-taking by reallocating bank assets away from loans to safer assets such as government securities. The reduction of loans from bank portfolios, caused by capital shrinkage, is called the credit crunch hypothesis. In order to assess the applicability of these hypotheses to the Thai banking crisis, we examine the current literature concerning the effect of bank capital deterioration on bank lending.

2.1. The Moral Hazard Hypothesis

Since bank capital deteriorates during a crisis, increasing the chances of bankruptcy, banks may decide to take high risks by lending more. Deposit institutions are mandated to pay an insuring agency a fixed insurance premium per unit of deposit as a measure that maintains public confidence as well as creates a safe environment in the financial system. The moral hazard hypothesis, as applied here, stipulates that because managers do not suffer the consequences of their actions, they have a tendency to invest in relatively risky assets. Since bank deposits are insured, depositors are guaranteed their money back even though investment projects fail. Moreover, while high-risk assets entail a much higher return in case of success, the loss associated with an unsuccessful outcome is mostly born by regulators at the taxpayers' expense. With this "moral hazard" in mind, most literature concerning the moral hazard hypothesis focuses on basic theories of corporate finance, such as the option pricing model, which analyze the influence of capital structure on shareholders' and managers' risk-taking incentives. The option pricing model implies that a bank's liability is limited due to deposit insurance. According to the option pricing model, the limitation of shareholders' liability is the main cause of moral hazard behavior.

The hypothesis of a moral hazard, as analyzed by Merton (1977), describes the influence of a uniform deposit insurance premium on bank risk-taking incentives. According to his study, deposit insurance can be viewed as a put option on the value of bank assets, where a strike price equals the value of a bank's debt. Because the insurance premium does not rise with insolvency risk, banks can potentially transfer wealth from

the insuring agency. Therefore, banks seek to maximize the value of the put option by decreasing bank capital or by holding an asset portfolio with a high variability of returns.

Marcus (1984), Herring and Vankudre (1987), Ritchken et al. (1993), and Keely (1990) follow Merton's argument by introducing a bank charter value in their models. According to their analysis, there is a trade-off between the put option value and the charter value of banks. Marcus (1984) asserts that when a bank charter has a value because of barriers to entry into the industry, a value-maximizing bank will choose either extreme high-risk or low-risk strategies. Thus, midrange policies will be suboptimal.

Keely (1990) develops a theoretical model using an option state preference to explain the moral hazard behavior of U.S. deposit insurance during the 1980s. The model clarifies the conditions under which a bank can benefit by increasing the default risk to maximize the value of the put option. When capital decreases (holding deposits constant), the value of put options increases, and with a decline in the capital-to-asset ratio, banks take greater risks. Conversely, when deposits decrease (holding capital constant), a decline in the capital-to-asset ratio increases the bankruptcy possibility and reduces the bank charter value. Since the owners of banks cannot sell the charter once the banks are declared insolvent, the banks choose to increase their asset risks if the gain from increasing the value of put options exceeds the loss from the charter value. Thus, a higher charter value reduces bank incentives to engage in moral hazard behavior because banks do not need to invest in high risk assets in order to gain high returns. In addition, Ritchken (1993) states that:

> "There is a trade-off between the risk minimizing strategy, which reduces the likelihood of losing the charter, and risk-maximizing strategy, which exploits the deposit insurance.

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Higher bank risk-taking increases the probability of bank failures, escalating the probability that shareholders would lose the charter value, enjoyed as long as their bank continues to operate."

The studies up to this point develop theoretical models for maximizing put option values and reveal the effects of deposit insurance on bank risk-taking. Few sources conduct empirical tests regarding this issue. Marini (2003), however, empirically studies a sample of 61 countries over the period 1980-1997. He finds that explicit deposit insurance increases the likelihood of banking crises. According to Marini, the harmful impact of deposit insurance is the greatest when bank interest rates have been deregulated and the institutional environment is weak. Marini also finds that the destabilizing impact of deposit insurance tends to be stronger where more extensive coverage is offered to depositors, where the scheme is funded, and where it is government run. These results offer empirical support to the hypothesis that deposit insurance enables the moral hazard.

Without deposit insurance, bank depositors would require some compensation from banks to assume more risk. Hence, banks cannot gain from maximizing the value of put options any longer. As Ramos (1998) explains, without deposit insurance, banks have to trade-off between asset risks (loan-to-asset ratio) and financial risks (capital-to-asset ratio). This trade-off means that when banks' capital-to-asset ratios decrease, banks have to compensate depositors by decreasing their loans. However, a fixed premium rate of deposit insurance prevents this mechanism of compensation.

All of the above authors agree that the limited liability of uniform deposit insurance may create incentives for banks to take more risks by lending to high-risk

projects. However, the theoretical models that have been developed to study the impact of deposit insurance on bank risk-taking are based on corporate finance theory (put option value maximizing models), which are only appropriate for studying the effect of deposit insurance on bank lending. In this dissertation, since we focus on bank lending in Thailand and two regulations, deposit insurance and risk-based capital requirements, we need a more general theoretical model of a bank to include other regulations as well as deposit insurance. Besides, because explicit deposit insurance was introduced to Thailand in 1999, after the crisis, there has not been an empirical study of the effect of deposit insurance on Thai bank lending.

2.2. The Capital Crunch Hypothesis

With the literature that discusses the relationship between bank capital and bank lending, two widely used terms are "credit crunch" and "capital crunch." A credit crunch is defined as a significant reduction in the available supply of credit. Berger and Udell (1994) and Cantor and Wenniger (1993) define it as "a decline in credit availability or a leftward shift in the supply curve for loans relative to a normal time." Bernanke and Lown (1991) define the credit crunch as "a significant leftward shift in the supply curve of bank loans, holding constant the safe real interest rate and the quality of borrowers." Likewise, Llewellyn (1992) defines the credit crunch as "an inability or unwillingness of banks to supply credit." Peek and Rosengren (1995) refer to a credit crunch as "a situation where loan supply has fallen faster than loan demand." According to Syron (1991), "historically, credit crunches have been associated with disintermediation or loss of bank deposits when higher rates of return on assets were available from outside the banking sector. While the extent of deposit losses would vary across institutions, depending on their depositors' sensitivity to return differentials," Syron further clarifies that most depository institutions respond to periods of disintermediation by tightening their credit. On the other hand, if the tightened credit is the result of a loss in bank capital and not a loss of deposits, the decline in bank credit availability may be more accurately characterized as a capital crunch. Syron (1991) and Peek and Rosengren (1995) describe a capital crunch, as "a decrease in bank lending due to a decline in bank capital." Thus, a credit crunch is a significant reduction of credit supply, and a capital crunch is a significant reduction of credit supply *caused by a loss in bank capital*. According to

many accounts (Syron 1991, Bernanke and Loan 1991), the severity of the recession that began in July 1990 in the U.S. was worsened by a credit crunch. The drop in real estate prices during the recession caused a substantial increase in nonperforming assets, and banks were forced to increase their loan loss reserves, resulting in lower capital. During the recession, New England, in particular, experienced a sharp fall in bank loans as a result of a shortage in bank capital, which is the most important factor reducing loan supply.

Many studies describe the impact of capital requirements on bank lending. Most literature finds that banks decrease their lending in response to risk-based capital requirements.[1] Furlong and Keely (1989, 1990), examining the case of a bank that maximizes the value of their stock through public trading, found that, due to increased capital standards, such a bank never increases portfolio risks by more lending. Konishi and Yasuda (2004) empirically examine the determinants of risk-taking at commercial banks in Japan from 1990 to 1999, using the stock price data of commercial banks. Konishi and Yasuda find that the implementation of the capital adequacy requirement reduces risk-taking at commercial banks. To measure the level of bank risk, Konishi and

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[1] However, some literature finds that banks do not always decrease their lending in response to increased capital standards. Koehn and Santomero (1980) and Kim and Santomero (1988) show that banks might still choose higher-risk portfolios as a result of increased capital standards as they maximize their utility along a restricted risk-return frontier. Conversely, Gennotte and Pyle (1991) use the value maximizing model to show that both portfolio risk and the probability of bank failure may increase as a result of increased capital requirements.

Yasuda use the standard deviation of a bank's daily stock returns for each fiscal year measured in percentage points. However, using stock value as a proxy of a bank's performance is not the best measurement for Thai banks. Because stock prices in the Thai market are often vulnerable by speculation, rather than fundamental changes, stock values cannot be used as a proxy for bank performance in Thailand.

In New England where a reduction in bank capital caused bank lending to contract in the early 1990s, Peek and Rosengren (1995) conclude that bank credit supply played an independent role in the decline of New England bank lending. Losses in capital cause banks to shrink their lending in order to restore the target capital-to-asset ratio. Peek and Rosengren, with a highly simplified model of a bank firm, demonstrate that losses of bank capital cause the bank to behave differently when capital requirements are binding. The result is that when the capital adequacy is binding, the negative effect of capital shocks will force bank deposits and lending to decrease.

Hancock and Wilcox (1995) observe the dynamic effect of a shock in bank capital on bank holdings of loans using a vector regression model. Hancock and Wilcox's results claim that bank capital shocks tend to affect total portfolio sizes and bank holdings of Commercial and Industrial loans, single family real estate loans, and commercial real estate loans. Moreover, Hancock and Wilcox observe that banks adjust their loan portfolios more slowly than their capital. Similarly, Drake and Llewllyn (1997) conclude that, due to minimum capital regulations, the expansion of bank assets is constrained to bank capital. The loss of capital causes a reduction in both banks' ability and willingness to lend.

Beatty and Gron (2001) examine bank capital and lending decisions in the U.S. from 1986 to 1995. They assume that profit-maximizing banks choose to adjust their equity and total assets to restore the target capital-to-asset ratio. Beatty and Gron find only low-capital banks increase their equity financing as they increase their assets. In addition, Bris and Cantale (2004) analyze the effect of capital adequacy requirements on bank risk policies. They find that because banks have to maintain the required risk-based capital-to-asset ratio, banks choose only high-quality loans. Some profitable but risky investments are bypassed. Their results relate to theoretical and empirical literature that deals with the effects of the Basle Accord on bank credit policy.

Peek and Rosengren (above) assume that a bank has only one asset, loans, in their model. Similarly, Hancock and Wilcox, Drake and Llewllyn, Beatty and Gron, and Bris and Cantale (above) also assume that bank assets consist only of loans. The bank does not invest in any securities. In reality, banks hold not only loans, but also safe assets such as government securities, and there is a substitution effect between loans and government securities. Thus, the above models are too simplistic.

Bernanke and Lown (1995) empirically analyze the New England real estate bubble bust of the early 1990s that caused a decline in the capital of U.S. banks. The failed real estate projects forced U.S. banks to write down their loans, which in turn depleted their equity capital. To meet the new Basle regulatory capital standard enforced during this period, banks sold their assets and reduced their lending. Bernanke and Lown (1995) regress only lending growth against the banks' capital-to-asset ratios, finding that the coefficient of the capital-to-asset ratio is positive but not significant. However, the

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coefficient of capital-to-asset ratio indicates only the relationship between bank lending and bank capital. This model does not directly take into account risk-based capital requirements as the cause of changes in bank lending.

Blum and Helwig (1995) propose that capital adequacy requirements lead to a contraction in bank loan supplies. In their model, an economic shock increases borrower defaults and reduces the borrowers' ability to pay bank debts. This reduction in debt payments lowers bank equity and, due to capital adequacy requirements, decreases bank lending. However, Blum and Helwig do not use any control period variables when analyzing the possibility of a credit crunch in their model, which demonstrates that this model would not be appropriate to the case of Thailand. Since this dissertation focuses on the impact of capital requirements in Thailand during a normal economy as well as during a financial crisis, the capital adequacy requirements could affect bank lending differently during a normal economy or a downturn. Therefore, variables that differentiate between time periods and represent different economic conditions are needed.

There are a few non-regulation-based explanations of portfolio shifts in the financial sector. In the 1990s, credit unions in the U.S. reduced overall lending though they were not affected by risk-based capital requirements. The possible reason is that banks voluntarily reduced their risks by having safer portfolios and higher capital in 1990s, perhaps a lesson learned from the 1980s [See Hancock and Wilcox (1995) and Berger and Udell (1994)]. According to Berger and Udell (1994), banks might voluntarily reduce their risks by tightening their credit standards in order to have safer portfolios,

perhaps in response to loan losses and real estate problems (also in their example following the 1980s). This reduction in the supply of bank credit would constitute a credit crunch. In addition, banks that already meet the capital standards might voluntarily become more risk averse in response to a recession without being forced to decrease their lending by the capital adequacy standard. However, these non-regulation based explanations are outside the scope of this dissertation.

2.3. Analysis

A review of the exiting literature concerning the effect of bank capital deterioration on bank lending reveals shortcomings as well as models that may not be appropriate to Thailand.

The theoretical models for the moral hazard hypothesis, studying the impact of deposit insurance on bank risk-taking, are based on corporate finance theory (put option value maximizing models). In order to see the effect of risk-based capital requirements and deposit insurance in Thailand, this dissertation will provide a more general theoretical model of a bank. This dissertation focuses on these particular two regulations because the Thai financial system was liberalized in early 1990s, and risk-based capital requirements were introduced in 1993, both of which played very important roles in determining banks' risk-taking. More so, the 1997 crisis destroyed the confidence of depositors. Thus, deposit insurance was introduced in 1999 to restore depositors' confidence. Therefore, since the 1990's these two particular regulations have been very important to the Thai banking system.

Most literature on the capital crunch hypothesis, examining the effect of changes in bank capital and capital requirements on bank lending, assumes that banks hold only one asset: loans. In reality, banks hold not only loans, but also safe assets such as government securities. When banks have choices of investing in loans or government securities, an interest rate change of either would cause a substitution effect. For example, an increase in loan interest rates with no change in the government securities interest rate would cause an increase in returns from lending. As a result, this interest rate change may cause banks to substitute away from investing in government securities and to lend more. Thus, based on Peek and Rosengren's model, this dissertation will develop a more complex theoretical model that allows banks to invest in two asset categories: loans and government securities.

Most literature simply uses a ratio of total bank equity to total bank assets as a representation for risk-based capital enforcement in empirical studies. However, the total capital-to-asset ratio is not an adequate measure of the effect of risk-based capital requirements enforcement because the coefficient of the capital-to-asset ratio indicates only the relationship between bank lending and bank capital. In order to see clearly the effect of risk-based capital requirements on bank lending, a model must also include an explanatory variable that provides evidence of an explicit link to the enforcement of risk-based capital requirements. This added variable separates the effects on bank lending from risk-based capital requirements enforcement from changes in bank capital. Thus, the empirical analysis of this dissertation will include a dummy variable representing the enforcement of capital requirements.

In Thailand, after risk-based capital requirements were introduced in 1993, the crisis of 1997 hit. It is important to see whether the Thai credit contraction during the crisis was caused only by deteriorated bank capital or was also affected by risk-based capital requirements. No study has focused on different effects of a regulation on bank credit supply in a normal economic period as well as in a crisis. This dissertation will introduce additional dummy variables to capture the risk-based capital requirements effect on bank lending during a normal time as well as in a crisis.[2]

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[2] Since the Thai crisis ended in 1998, and deposit insurance was introduced in 1999. There will not be different effects of deposit insurance on bank lending during a normal time and during the crisis.

CHAPTER 3. THE THAI COMMERCIAL BANKING SYSTEM

AND BANK REGULATIONS

The development of the Thai banking system shows that a concentration of bank ownership and financial liberalization led to the 1997 crisis. Together with risk-based capital requirements and deposit insurance, these factors have all affected bank lending. This chapter provides the background of the Thai banking system as well as banking regulations related to lending. The first section presents the conditions of the Thai banking system as they related to lending and the developments that led to the crisis. The second section details the implementation of risk-based capital requirements and deposit insurance, the main regulations discussed in this dissertation. The second section also includes a discussion with respect to the loan loss provision, an important aspect of lending during the crisis.

3.1. The Thai Commercial Banking System

As the Thai banking system evolved, the system created problems that led to the Thai crisis of 1997. Thus, the developments were crucial, because of the nature of the Thai banking system, where banks were mostly family-owned, nepotism led to corrupt lending practices. Later, banking deregulation aimed at enhancing competition among banks, allowed banks easier access to foreign borrowing, which in turn brought about the crisis. However, before we can discuss the crisis, we need to begin with the history of the Thai banking system, detailing those factors that led to corrupt lending practices and deregulation.

The Thai banking system developed slowly at first with restrictions focused on bank branches. Thailand's commercial banking business began during the reign of King Rama V. The first bank, a branch from a foreign bank, opened in 1888. Its main objective was to facilitate international trade. In the early stages, the Thai banking system was heavily influenced by British banking traditions. Thus, the banking system became a branch banking system with a network of branches throughout the country. Over the next century, particularly during the three decades following the 1961 introduction of the Economic and Social Development Plan, Thai commercial banking operations proceeded smoothly and in line with economic growth. Today, local commercial banks and branches of foreign banks are governed by the Commercial Banking Act of 1962. Prior to the 1962 Act, however, foreign banks were allowed to open sub-branches. After 1962, the banks were not allowed to extend sub-branches in the Thai Kingdom. In addition, the Bank of Thailand became very restrictive in terms of granting licenses to new local banks. Hence, domestic banks and branches of foreign banks remained low in number; for example, by the end of December 1993 only 15 local banks and 13 branches of foreign banks were operating in the Kingdom.

Even though branch expansion policies were cautious, within Thai banks problems arose from family-owned banks. The major shareholders of domestic commercial banks mostly belonged to a few families. For example, Bangkok Bank, the largest bank in the country, with a market share of 21 percent, belonged to the Sophonpanich family. The third largest bank, with a market share of 13 percent, belonged to the Lumsum family. The Bank of Ayuthaya, the fifth largest bank with a market share

of 8 percent, belonged to the Ruthanaruk family. There was only one state-owned bank, the Krung Thai Bank, which was the second largest bank in the Kingdom and held a market share of 15 percent. The fourth largest bank, the Siam Commercial Bank, had a market share of 9 percent, and was owned by the crown property (Bank of Thailand 1999). More so, because family-owned banks were generally managed by family members and mainly extended loans to business of their executives and relatives, in the late 1970s commercial banks in Thailand were heavily shaken by two major factors. First, the emergence of finance companies brought about a greater degree of competition. Second, their distress was worsened by more volatility in the world markets in terms of commodity prices, interest rates, and exchange rates. Consequently, commercial banks in Thailand became more cautious in their operations, management, and expansion, and the Commercial Banking Act was revised to better regulate commercial banks.

As a result of the banking crisis in the late 1970s, the Commercial Banking Act was amended a few times to solve the problems caused by family owned banks. In 1979, the Central Bank revised the Commercial Banking Act, with the following multiple objectives: (1) to increase share divestiture; (2) to prevent commercial banks from becoming involved in the business of their executives or relatives; (3) to limit exposure on contingent liabilities; and (4) to improve the flexibility and the effectiveness of bank supervision. In the first half of the 1980s, however, commercial banks were severely hit by a global recession and volatility in exchange and interest rates, which initiated another crisis in 1984. At the height of this crisis, the financial positions of some commercial banks were notably weakened by mismanagement and fraud. Asia Trust Bank, for

example, faced financial tension due to imprudent management, maturity mismatching, and excessive exchange risks. From 1985 to 1987, critical problems occurred in two other commercial banks, one by excessive speculation in foreign exchange, the other by unscrupulous lending practices. The authorities ordered both banks to upgrade their management systems and operational efficiency. Their capital bases had to be enlarged and strengthened. The Commercial Banking Act was amended again in 1985, as was the Bank of Thailand Act, as well as acts on the Finance Business, the Securities Business and the Credit Foncier Business (the Bank of Thailand). These amendments were aimed at enabling authorities to deal with troubled financial institutions in an effective and timely manner. The amendment to the Bank of Thailand Act also led to the establishment of the Financial Institutions Development Fund as a separate entity to rehabilitate ailing financial institutions. After a few amendments of the Commercial Banking Act, Thailand entered the phase of financial liberalization by relaxing foreign exchange control, which led to an increase in foreign borrowing.

In May 1990 Thailand accepted the Article VIII of the IMF agreements by relaxing foreign exchange control and by reducing restrictions on capital transactions. In April 1991 the Bank of Thailand launched the second stage of liberalization on foreign exchange controls, including more liberal outward transfer of dividends, sales proceeds and profits from stock market. The foreign exchange control liberalization was the major factor that led to easier access to funds from abroad and consequently caused the 1997 crisis. However, before we discuss the exchange control liberalization, an explanation of

the exchange rate system reform is needed since Thailand has been through many phases in the exchange rate system.

3.1.1. Reforming the Exchange Rate System

Reforming the Thai exchange rate system can be traced to immediately after World War II when, due to economic difficulties and a serious shortage of foreign exchange, Thailand was forced to adopt a multiple exchange rate system. By 1963 the economy had grown substantially, and the exchange rate regime switched to a par value system, such that the value of the Baht was fixed in terms of U.S. dollars. In order to maintain Baht parity, the Exchange Equalization Fund (EEF) was established with the aim of stabilizing exchange rate movement within prescribed margins. The system operated smoothly until 1981 when problems emerged due the strong appreciation of the U.S. dollar relative to other currencies. The Baht depreciated rapidly, and although the government devalued the currency twice in mid-1981, public confidence could not be restored. However, in July 1981 a decision on daily fixing was made, and the EEF (Exchange Equalization Fund) fixed the exchange rate of the U.S. dollar at 23 Baht. This rate was held fixed until 1984 when the government announced a replacement of the dollar-pegging system by pegging the Baht to a basket of currencies. The new system allowed greater flexibility in the exchange rate adjustments, to reflect more accurately economic and monetary conditions. The basket-pegged system also facilitated the stability of the Baht since the currency was no longer tied with any particular currency. After many phases of changes in the exchange rate system, Thailand introduced financial

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liberalization, especially the establishment of the BIBFs, which allowed easier and cheaper access to foreign funds.

On May 21, 1990, the Bank of Thailand took the most important step in the process of exchange rate deregulation by accepting the obligations under Article VIII of the Articles of Agreement of the International Monetary Fund (IMF) and by implementing the first phase of exchange control relaxation. The aim was to liberalize the foreign exchange system in line with the globalization of the economic and financial systems and to allow freedom of international capital movements. Specifically, exchange rate deregulation was implemented in the three main phases. Phase I of the exchange control deregulation began on May 12, 1990, by allowing commercial banks to process customers' applications for the purchase of foreign currency for trade-related transactions, i.e., imports and exports without prior approval from the Bank of Thailand. Phase II of the exchange rate deregulation began on April 1, 1991, by allowing greater flexibility to private businesses and the general public in the purchase and sale of foreign exchanges. All exchange controls were abolished and new forms were introduced, for reporting purposes only. The limit was raised to U.S. $10 million for an annual investment by one person and for the acquisition of real estate and stocks overseas. Foreign funds, on the other hand, were allowed to move in and out of the country freely. Phase III began on April 30, 1992, to further provide greater convenience for the public and exporters. Exporters were allowed to receive and make payment in Baht in addition to foreign currencies and to transfer foreign currency deposits for overseas debt payment.

Of all the financial liberalization measures, the establishment of offshore banking facilities, known as the Bangkok International Banking Facilities (BIBFs), was the most important for establishing Bangkok as a regional financial center. BIBFs were introduced in 1993 when the bank of Thailand perceived that the Thai financial system should be promoted as a regional financial center, given its stable economic conditions, deregulated exchange control, and high international borrowing transactions. The Bank of Thailand proposed the establishment of BIBFs in order to facilitate and reduce the cost of international borrowing while encouraging foreign capital inflows to finance domestic investment and investment throughout South East Asia. Initially, forty-six BIBF licenses were granted. Licensed banks could use foreign funds raised overseas to lend to their domestic customers (known as "out-in" operations), or to overseas customers (known as "out-out" operations). Apart from out-in and out-out operations, which were considered the core businesses, BIBFs were also allowed to provide other international banking services, such as cross-currency trading, trade financing on strictly out-out basis, loan syndication arrangements, agreement of debt instruments issuing, and the underwriting of foreign currencies. However, financial liberalization, aimed at promoting stiffer competition among financial institutions, brought in excessive capital inflows and foreign borrowing too quickly, leading to the crisis. As a result, the managed-float exchange rate system was adopted in July 1997.

However, the managed-float system exacerbated the crisis by raising foreign debt values following the highly depreciated Thai Baht. After the floatation of the Baht currency in July 1997, net capital outflows peaked in the third quarter of 1997, and the

Baht depreciated against the US dollar until it reached 55 Baht per U.S. dollar in January 1998. The Baht then stabilized at around 36-40 Baht per U.S. dollar from the fourth quarter of 1998 onward (Bank of Thailand 1999). Although short-term nominal interest rates climbed to more than 20% during the crisis, low confidence and exchange rate uncertainties led to huge capital outflows towards the end of 1997 and through 1998. The net outflows of private capital at the end of 1997 accounted for U.S. $8.4 billion and increased to more than U.S. $16.0 billion in 1998. The banking sector, including the BIBFs, shouldered the biggest impact of the financial crisis. The commercial banks recorded net outflows of U.S. $4.7 billion in 1997. The BIBFs followed with net outflows of U.S. $1.7 billion in 1997, peaking in 1998 at U.S. $9.6 billion.

Financial liberalization allowed easier access to funds from abroad and increased short-term debts, since most of the credits were on a short-term basis and continually rolled over for long-term use. Because of mismatching and misuse of funds, the 1997 crisis occurred. The deterioration of investor confidence and the deceleration of economic growth made foreign creditors unwilling to roll over BIBF credits. Moreover, the crisis caused the exchange rate floatation, which in turn worsened the crisis itself. The volatile exchange rates motivated borrowers to repay loans, resulting in high net capital outflows throughout the second half of 1997 and 1998. In addition, interest rate liberalization had a major role in determining bank lending.

3.1.2. Interest Rate Liberalization

In Thailand, the liberalization of interest rates, aimed at promoting more banking competition, caused unproductive and low quality lending. Interest rate liberalization was conceived and implemented as a three-year plan (1990 – 1993), aimed at enabling the banking system to adjust to changing demand and supply, both domestically and externally. With continuous economic expansion after 1987, there was a need to mobilize long-term and stable funds for national development. When long-term deposits had not expanded in line with borrowing needs, the Bank of Thailand in 1989 deemed it appropriate to lift the ceiling rate on term deposits exceeding one-year maturity from the pervious ceiling of 9.5 percent to 10.5–11 percent per annum, in order to accelerate the process of saving mobilization. With regard to the ceilings on other types of deposits, the Bank of Thailand continued the interest rate liberalization policies. Ceilings on deposits for all maturity periods were abolished on March 16, 1990. On January 8, 1992, the Bank of Thailand announced the removal of the ceiling on savings deposit rates. The lifting of the lending rate ceiling became effective on June 1, 1992, allowing domestic interest rates to fully adjust in accordance with demand and supply conditions. After January 1993 the Bank of Thailand began to implement measures encouraging commercial banks to reduce their lending rates for general customers in response to changes in the cost of deposits. The Bank of Thailand managed to do so by requesting cooperation from commercial banks and by cutting the bank rate twice, in June and September. As a result, commercial banks responded by reducing their deposit and lending rates.

However, the Bank of Thailand did not wish to lead or to intervene in the operation of commercial banks every time. Instead, the Bank of Thailand wanted to establish an adjustment mechanism for the lending rate for retail customers, a rate that automatically adjusts to the actual cost of funds as determined by the market mechanism. The Bank of Thailand and the Thai Bankers' Association set up a working group to study and determine the benchmark for the lending rate for retail customers. Finally, the working group agreed to introduce the Minimum Retail Rate (MRR) as a reference lending rate for retail customers. The commercial banks and branches of foreign banks began to announce the MRR at the end of October, and the MRR was adopted by all banks in mid-November 1993. During the month that the MRR became effective, the interest margin between the lending rate for retail customers and the one-year deposit rate rose to 7.5 percent, as commercial banks cut the deposit rate by more than the lending rate. Nevertheless, since the profit margin for retail customers was set at not more than 2 percent, banks were forced to adjust by lowering the rates on both loans and deposits. Moreover, the lending at lower interest rates by the BIBF in the domestic market enhanced stiffer competition among banks and enabled borrowers to acquire cheaper loans. Because of the high competition, banks had incentives to extend as many loans as possible, sacrificing the quality of the loans or the projects. Interest rates went up later, in response to other signs of the economic downturn.

As a result of increased interest rates, the Bank of Thailand did what it could to maintain stability in the financial system when weakness in economic indicators began to appear, especially the current account deficit. Interest rates started to go up by late 1996.

The Bank of Thailand had to maintain high interest rates to help support the Baht currency and to raise funds to bail out ailing finance companies through the Financial Institutions Development Fund (FIDF). The policy continued until the floatation of the Baht in July 1997. Thailand then sought assistance from the IMF and had to follow the advice that high interest rates were necessary to help reverse the outflow of capital and to stabilize the currency. The interbank rate peaked in the third quarter of 1997 through the second quarter of 1998 at 18–20 percent

In May 1997 the MLR (Minimum Loan Rate) and MRR (Minimum Retail Rate) were allowed to move freely according to the market mechanism in order to help stimulate the economy. The Bank of Thailand asked the commercial banks to set the MLR limit in line with market conditions and the MRR, keeping in mind the cost of funds, to reflect the risk differentials between wholesale and retail customers. However, as the competition among financial institutions increased and customers were offered higher rates on deposits and loans, difficulties arose in liquidity management because of the high cost of funds to the banks. In June – July 1997 the Bank of Thailand temporarily limited the ceiling on time deposits to 12-14 percent, to reduce the high lending and deposit rates, thus, maintaining stability in the financial system. Nevertheless, in July 1998 when the economy cooled down, the Bank of Thailand allowed commercial banks to adjust interest rates more freely by using the reference rate. Interest payable on savings deposits was subjected to the reference rate plus no more than a 2 percent mark up while time deposits of over 3 months were subjected to the reference rate plus no more than a 3

percent mark up. All the rates had to be disclosed, and the new rules applied to the head office and all branches.

Reviewing the history and the development of the Thai banking system shows that the concentration of bank ownerships, financial liberalization, and interest rate liberalization all had their parts in creating the 1997 financial crisis. The problems of the Thai banking system started with the concentration of bank ownerships. Family-owned banks caused imprudent managements, such as unscrupulous lending practices, maturity mismatching and excessive exchange risks. The basket pegged exchange rate system encouraged large unhedged foreign borrowings because the pegged exchange rate eliminated risks from borrowing in foreign currencies. Interest rate liberalization (the removal of interest rate ceilings) and financial liberalization (the establishment of BIBFs) encouraged high competition in the domestic credit market among banks by enabling borrowers to acquire cheaper loans, followed by excessive bank lending.

The BIBFs also increased the problems of maturity mismatching, where short-term borrowing was used to finance long-term projects. Financial Liberalization in the early 1990s fueled a spree of excessive or speculative spending practices in many sectors of Thailand's economy. Funded largely by foreign borrowing, enterprises in these "bubble" sectors became vulnerable to unfavorable exchange rate changes, to the unwillingness of creditors to roll over maturing debts, and to the possibility that businesses that borrowed might go bankrupt. The negative impacts of financial liberalization on the financial system did not emerge until the mid-1990s. Since those enterprises were also considerably accommodated by domestic commercial banks, the

asset quality of commercial banks deteriorated alarmingly. For example, the non-performing loans of Thai commercial banks jumped from 8 percent of total loans in June 1997 to 20 percent in December 1997 and 45 percent in December 1998 (Bank of Thailand 1999), due to the excessive lending to unproductive and risky projects. After the crisis, bank loans contracted sharply and depositors' confidence was destroyed.

3.2. Commercial Bank Regulations

Because this dissertation focuses on two regulations, risk-based capital requirements and deposit insurance, which aim to promote a safe banking system and may affect bank lending, the next section will provide the details of risk-based capital insurance and deposit insurance. In addition, another regulation, loan loss provisions, is discussed as well. Since the crisis increased non-performing loans that required banks to set aside more provisions for loan losses at the expense of bank capital, the deteriorated capital also affected bank lending.

3.2.1. Risk-based Capital Requirements

Because of an increase in non-performing loans for banks, The Bank of Thailand had to adjust risk-based capital requirements in response to the crisis. Risk-based capital requirements have a major role in determining bank lending because, when bank capital deteriorates as a result of a crisis, banks may decrease their lending in response to risk-based capital requirements. Risk-based capital requirements assign differential weights to various types of assets. When banks invest in riskier assets (loans), they are required to

maintain higher capital on these investments than on investments in risk-free assets (government securities). In order to comply with international capital standards, banks in Thailand must maintain certain ratios of capital to assets. These ratios have changed in response to economic conditions, such as the 1997 crisis. In Thailand, since January 1, 1993, banks have had to hold at least the minimum capital fund (regulatory capital) to risk weighted assets according to the standards of the Bank for International Settlement (BIS), as prescribed by the Bank of Thailand. In order to comply with the guidelines of the Basle Committee on capital adequacy, the Bank of Thailand proposed to amend the Commercial Banking Act B.E. 2505 with the aim of upgrading local banking standards to international standards. The new capital adequacy ratio addressed both on and off balance sheet items. Since the implementation of the Basle Committee standards in 1993, Thai commercial banks have been permitted to include long-term subordinated debts and asset revaluation surpluses as supplementary capital.

The Basle capital adequacy ratios assigned weights for various types of assets, with greater capital required for riskier types of loans. Maintained capital is divided into two categories: first tier capital, defined as equity and retained earning, and second tier capital, defined as subordinated debts and revaluation from assets, such as bank offices (see Appendix 2). The minimum capital adequacy ratio was initially set at 7 percent and was gradually raised to 8.5 percent. The first tier capital ratio was also raised to 6 percent in October 1996. Following the depreciation of Baht in July 1997 (see Table 2.1), the commercial banks faced increased non-performing loans and had to set aside provisions to meet the requirements of the Bank of Thailand. This capital-to-asset ratio fell below

the Basle ratio and the commercial banks were forced to try to recapitalize, but the time was not ripe to do so. In order to solve the problem of continuing decreases in capital, especially Tier 1 capital, in August 1998, the Bank of Thailand reduced the Tier 1 requirement from 6 percent to 4.25 percent, while still maintaining the overall risk-based capital adequacy ratio of 8.5 percent. Because banks have to comply with these risk-based capital requirements, when bank capital deteriorated, banks may decrease their lending.

Table 3.1. Capital Adequacy Standard

Year	Tier 1 Capital (% risk weighted asset)	Tier 2 Capital (% risk weighted asset)	Total capital fund to risk asset ratio
1993	5	2	7
1994	5	2.5	7.5
1995	5.5	2.5	8
1996	6	2.5	8.5
1997	6	2.5	8.5
1998	4.25	4.25	8.5

Source: the Bank of Thailand

3.2.2. Deposit Insurance

Thailand did not adopt an explicit deposit insurance system for the first time until 1999, after the crisis. Intended to cope with the loss of depositors' confidence in banks, the deposit insurance system succeeded in restoring depositors' confidence and rescued the Thai banking system from the contagiousness of bank-runs. An explicit deposit insurance system was first proposed after the 1979 "*Raja* Finance Crisis", the case of a single bank failure that had a contagious impact on the entire financial system. Raja was a big finance and securities company that lent a substantial amount to its associates in order

to manipulate its share price in the stock market. As Raja's financial position was weakened by a collapse of the stock index, depositors who had lost confidence in Raja, withdrew their deposits and Raja had eventually closed down. Even though depositors were reimbursed a portion of their deposits, confidence in the sector eroded as depositors also withdrew money from other finance companies. Policy makers in Thailand needed a formal arrangement of depositors' protection in order to prevent the contagious effect of a single bank failure. A draft act to set up a deposit insurance institute was submitted to parliament and a lot of implementation preparation was carried out by the Bank of Thailand.

However, the draft act was later withdrawn from parliament. In 1983, four years after the collapse of Raja, Thailand encountered another banking crisis, caused by loopholes in the supervisory power of the Bank of Thailand to regulate bank executives against malpractice. A number of finance companies could not redeem their deposits, and some were closed down. The government had to take direct ownership of several weak financial institutions. An explicit depositor protection system was reconsidered but the government decided that the conditions of the banking sector were not suitable for introducing a limited deposit insurance system. In 1985 The Financial Institution Development Fund (FIDF) was established to rehabilitate the financial institution system, providing financial assistance to depositors and creditors of financial institutions. Still, in Thailand an explicit deposit insurance system was not introduced until 1999, after the crisis.

Even though the crisis had damaged the Thai banking industry, the FIDF succeeded in preventing panicked bank-runs. The 1997 crisis started in March when the Bank of Thailand announced that it had ordered 10 financial institutions, mostly finance companies, to recapitalize. At the same time, the FIDF issued a statement that it was ready to give financial support to these undercapitalized financed companies and to pay their depositors in order to restore public confidence in the system (see Appendix 3). The situation was deteriorating when the currency was floated in July, resulting in withdrawals from domestic financial institutions. Shortly after the float, the government made a request to the IMF for a loan stand-by program. The situation did not improve and by August the government had temporarily suspended 58 out of 91 finance companies. The panic continued to undermine the banking system as depositors shifted funds from finance companies and small banks to large banks.

In the end, the government decided that a full guarantee for depositors and creditors was required in order to prevent the panic-runs from damaging the whole financial sector and further disrupting the functioning of economic activities. The panic and contagious bank-runs ceased when the FIDF announced a guarantee to deposits of the remaining financial institutions. A deposit insurance corporation evolved from the FIDF to provide a limited insurance system on January 1, 1999, and banks have been required to contribute 0.2 percent of the outstanding deposit to the Financial Institution Development Fund (FIDF).

A deposit insurance scheme in Thailand has three objectives: first, to enhance the stability of the financial system by exposing large depositors and unsecured creditors to

loss, forcing depositors and creditors to monitor the condition of their banks and impose market pressure on the banks to remain sound; second, to improve consumer protection for depositors who are most likely to be unsophisticated and lack information to study the condition of their bank; and third, to provide an opportunity to design and improve a legal and institutional framework for intervening, selling, or closing troubled banks.

After the crisis, despite various bailout efforts by the Bank of Thailand, through the injection of liquidity for more than one trillion baht, seven banks out of fifteen total banks were finally nationalized and fifty-six finance companies from the total of ninety one companies had closed down. The financial crisis has completely altered the Thai banking industry. The excessive number of firms has been reduced, and financial institutions have become more efficient and transparent. Competition has been intensified by arrivals of new international banks that have a stake in weak domestic banks. Though bank governance has improved, with transparency and accountability strengthened, the massive public spending to rescue troubled financial institutions will not be recovered. The Bank of Thailand will have to incur losses by selling underperforming banks, with the hope that the long run gain to the Thai economy as a whole would offset the short run losses.

The only widely discussed aspect of deposit insurance is its function in maintaining depositors' confidence and preventing the panic of bank-runs. However, deposit insurance may also affect bank lending in other ways. Either banks would have an incentive to lend more because of limited liability, or deposit insurance premium would decrease banks' ability to lend. Because the deposit insurance premium in

Thailand is 0.2 percent of outstanding deposits, which is relatively high compared to the U.S., only 0.0032 percent of outstanding deposits. This relatively high deposit insurance premium in Thailand may limit banks' ability to lend.

3.2.3. Loan Loss Provisions

Since the 1997 crisis led to increased loan losses, banks had to set aside funds for the loan losses, at the expense of bank capital. Furthermore, the Bank of Thailand came up with stricter loan loss regulations to cope with decreased non-performing loans. The crisis contributed to the collapse of land prices and the consequent deterioration of a largely collateral-based bank asset quality. Moreover, the economic slowdown resulted in poor business performance, which caused increases in non-performing loans, further deteriorating bank profitability (see Table 3.2).

Table 3.2.

All Commercial Banks' Operating Profits and Provision for Possible Loan losses

Unit: Millions of Baht

	1994	1995	1996	1997	1998	1999	2000
Operating Profit (Loss)	65,663	77,735	58,167	-71,018	-355,583	-334,768	239
Provision for possible loan loses	17,150	17,037	41,009	200,871	323,696	303,500	122,021

Source: Bank of Thailand

The largest provisions against loan losses were made in 1997 and 1998. The allowance required for a doubtful account was increased from 75 percent to 100 percent. These large provisions were partly because the Bank of Thailand imposed stricter

guidelines on banks in the recording of allowances for doubtful accounts during 1997 to 1998.[3] Until 1997 commercial banks had been required to record allowances only for the loans that did not pay their interest for a period of greater than twelve months from their due dates. The stricter guidelines were imposed after the crisis began. Two new important guidelines were announced in June 1997 and March 1998. According to the new guidelines, commercial banks had to record allowances not only for the loans that did not pay interest for more than twelve months but also for other classified debts. The new guidelines in recording allowances for doubtful accounts, which were announced in June 1997, required 15 percent allowance for substandard debts[4] and 100 percent for doubtful debts. The other important guideline in recording allowances for doubtful accounts was imposed on March 30, 1998, called Loan Classification and Provisioning rule, or LCP-2000. This provision was first implemented in the fourth quarter of 1998. The Bank of Thailand has prorated the semiannually increasing minimum allowances to the full record.

According to the new rules, banks had to record the minimum allowances 20% of the full record at the end of 1998, 40 percent for the second quarter of 1999, 60 percent at the end of 1999, 80 percent at the second quarter of 2000, and 100 percent at the end of 2000. This new rule caused the provision for possible loan losses to increase sharply for the second half of 1998. The increment in provisions for possible loan losses was at the

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[3] Doubful debt is briefly defined as loans for which interest has been in arrears more then twelve months from their due dates. Allowance for a doubtful account, also known as loan loss reserve, is the accumulated provision for possible loan losses plus the bad debt recoverd, and debt restructuring adjustment minus the bad debt write-off.

[4] Substandard loans are briefly defined as loans for which their interest or principal has been in arrears for more than six months.

expense of a decline in capital; thus, the target minimum requirement for allowances in doubtful accounts has increased since the end of 1998 and created a capital inadequacy problem for the banks. Consequently, this increase has had a negative effect on bank lending. Though the regulation of loan loss provisions is not the focus in this dissertation, this regulation is worth mentioning because increased loan losses due to the crisis put more pressure on banks to set aside more funds in response to the loan losses and at the expense of bank capital, decreasing banks' ability to lend.

3.2.4. Conclusion

After reviewing the history, the developments, and the regulations of the Thai banking system, two of the major problems that led to the crisis in 1997 are the concentration of ownership and financial liberalization. These caused the crisis through the unscrupulous lending practices. In addition, the mismatched maturity of foreign borrowings further forced the Thai Baht to float, which exacerbated the crisis. As a result of the crisis, non-performing loans increased, causing bank capital to deteriorate, and The Bank of Thailand had to adjust risk-based capital requirements in response. Banks were forced to change their lending practices in response to risk-based capital requirements. Also, due to the crisis, depositors' confidence in banks was destroyed. Thailand adopted the explicit deposit insurance system for the first time in 1999, after the crisis. The deposit insurance implementation ended the panic and bank-runs. When bank capital deteriorates as a result of crises, banks may reduce their lending in response to risk-based

capital requirements. While deposit insurance, which aims to maintain depositors' confidence, may also affect banks' ability to lend.

CHAPTER 4. THEORETICAL ARGUMENTS

The purpose of this chapter is to provide a theoretical model of a banking firm that demonstrates the effects on bank lending of changes in capital, risk-based capital requirements and deposit insurance. This model would allow a bank to invest in two assets, loans and government securities, in order to see the substitution effect between bank investments.

However, before this dissertation discusses the model, we need to consider why the lending slow-down occurred. It seems probable that demand factors, including the weakened state of borrowers' balance sheets, caused much of the slowdown. Yet, this dissertation argues that a shortage of bank equity capital limited the ability to make loans. Since this dissertation will be testing the impact on bank lending of changes in capital, risk-based capital requirements and deposit insurance; only the supply side of the loan market will be discussed. For simplicity, section 4.3. will develop the model of a bank's expected wealth without any regulations. In section 4.4., risk-based capital requirements and deposit insurance will be incorporated into the model.

This dissertation's model will be based on two previous models, one by Peek and Rosengren (1995) and one by Cosci (1995). Peek and Rosengren provide a good base model for a banking firm; however, their model is highly simplified, assuming that a bank holds only one asset (loans) and that the bank has a simple capital constraint from capital adequacy requirements. Cosci's model provides an asymmetric information aspect of the uncertainty of repaying the loans by borrowers; still, he also assumes that the bank holds only loans. Before this dissertation develops a bank model to serve its purpose, we

will first discuss Peek and Rosengren's model (1993) and Cosci's model (1995) and their shortcomings.

4.1. The Peek and Rosengren Model

Peek and Rosengren's model (1995) is a simplified one-period model of a banking firm. The bank is assumed to have only one asset, loans (L), and two categories of liabilities, bank capital (E) and total deposits (D). The balance sheet constraint requires that total assets, A (here restricted to loans (L)), must equal total liabilities.

$$A = L = E + D$$

They hypothesize that the bank can expand total deposits by offering an interest rate on deposits greater than the mean rate in its market (r_D). Similarly, the bank's loans decrease as it offers a loan rate higher than the mean loan rate in its market (r_L).

$$D = f_0 + f_1(r_D - \overline{r_D})$$

$$L = g_0 - g_1(r_L - \overline{r_L})$$

Finally, bank behavior may be further constrained by the required capital-to-asset ratio (μ).

$$E \geq \mu A = \mu L$$

The bank is assumed to maximize profits (π). Total profits are simply the difference between the interest income on loans $(r_L L)$, net of loan losses (ϕL) and of the interest paid on deposits $(r_D D)$.

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Peek and Rosengren maximize profits and find that when bank behavior is not constrained by binding capital requirements, a reduction in capital decreases loan supply- but generally by less than dollar for dollar[5]:

$$0 \le \frac{dL}{dE} = \frac{\cdot g_1}{f_1 + g_1} \le 1$$

$$^5 Max\pi = \frac{[g_0 + g_1(\overline{r_L} - \phi) - E - D][E + D]}{g_1} - \frac{[D - f_0 + f_1\overline{r_D}]D}{f_1} + \lambda[E - \mu(E + D)]$$

When the capital ratio is not binding, $\lambda=0$, and the profit function is unconstrained.

Choosing D to maximize profits results in the two first-order conditions:

$$\frac{d\pi}{dD} = \frac{g_0 + g_1(\overline{r_L} - \phi) - 2D - 2E}{g_1} - \frac{2d - f_0 + f_1\overline{r_D}}{f_1} - \lambda\mu = 0;$$

$$\frac{d\pi}{d\lambda} = (1 - \mu)E - \mu D = 0$$

For $\lambda \neq 0$, we can solve for D:

$$D = \frac{1 - \mu}{\mu} E$$

When $\lambda=0$, the level of D can be obtained:

$$D = \frac{f_1(g_0 + g_1(\overline{r_L} - \overline{r_D}) - g_1\phi) + f_0 g_1 - 2f_1 E}{2(f_1 + g_1)}$$

From $A = L = K + D$

$$L = \frac{f_1(g_0 + g_1(\overline{r_L} - \overline{r_D}) - g_1\phi) + f_0 g_1 - 2f_1 E - 2E(f_1 + g_1)}{2(f_1 + g_1)}$$

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In other words, as bank capital increases, the bank will increase its loan supply, at the ratio of the marginal loan supply to the sum of the marginal deposit and the marginal loan supply, assuming that the bank offers the higher deposit rate, and a lower loan rate than the mean market rate, respectively. Since both f_1 and g_1 are positive, when bank capital increases by one dollar, the bank will increase its loan supply, but by less than one dollar.

However, when faced with binding the capital constraint, a reduction in capital decreases loan supply. In this case, loans decline more than one for one with the decline in E:

$$\frac{dL}{aE} = \frac{1}{\mu}\rangle 1$$

In other words, as the bank capital increases by one dollar, the bank will extend additional loans at the amount of the inversion of the required capital-to-asset ratio. Since μ is positive by less than 1, when the bank capital increases by one dollar, the bank will increase the loan supply by more than one dollar. Thus, in Peek and Rosengren's model (1995), in which the bank has only loans in its portfolio, when a uniform capital adequacy is binding, an increase (decrease) in bank capital causes an increase (decrease) in bank lending, more than in the case where the capital constraint is not binding.

In Peek and Rosengren's model (1995) the bank is assumed to have only one asset: loans. Since the issue of the impact of capital requirements has much to do with banks reallocating their portfolios to safer assets, as a result of capital standards, it is important to allow the bank in the model to hold risk-free assets, such as government

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securities. Moreover, Peek and Rosengren assume that the bank is constrained only by a uniform total capital-to-total asset ratio, where the risk-based capital adequacy requires the bank to maintain differential capital-to-asset ratios, depending on asset risks. Furthermore, Peek and Rosengren do not consider the bank's uncertainty, which is caused by asymmetric information in the loan market. If information is imperfect and asymmetric, each loan applicant has inside information about the quality of the project, and direct verification of this information by the lender is very difficult and costly to obtain. Banks have to face the uncertainty of the probability of loan repayment. Therefore, besides developing a bank model that allows the bank to hold two assets and introduces risk-based capital requirements and deposit insurance in the model, this dissertation will include asymmetric information that the bank has to face with the uncertainty in the loan repayment, due to the uncertainty of the investment project's returns. Thus, this dissertation will borrow the idea of the bank's expected utility when facing asymmetric information from Cosci (1993).

In order to incorporate the uncertainty into the model, the bank's profit model will be transformed into the bank's wealth model. With the wealth model, the bank has to face the uncertainty of the probability of repaying loans, caused by asymmetric information in the loan market. This dissertation will develop a representative expected wealth model for a bank, extended from the generalized model by Cosci (1993). Before we can develop the model, Cosci's (1993) model should be discussed.

4.2. The Cosci Model

In Cosci's model (1993), he assumes that information about borrower's affairs is not homogeneously distributed in the credit market: the borrower has this information but the bank must pay monitoring costs to get it. Borrowers, for example, know their own collateral, industriousness, and moral rectitude better than do lenders, so they posses "inside" information about their own projects for which they seek financing. In this model, a borrower (an investor) is faced with an uncertain investment project, but the required project input exceeds his personal initial wealth (W(0)). In this case, the individual must borrow in order to invest. The borrower wants to invest his equity capital (K), which is his initial wealth in the project, and intends to supplement this K with L, loaned by the bank at a contractual interest rate (r_L). Therefore, the borrower's initial wealth is:

$$W(0) = K$$

The total investment project is then K + L. Hence, the cash flow of the investment is (K+L)(1+R), where R is the rate of return on investment. I has a probability density function F(R) and varies from -1 to ∞. The borrower defaults on his loan when the rate of return on his project is R, such that the total return from the investment ((K+L)(1+R)) is less than the principal and the interest payment on loan[6].

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[6] From the default condition for the rate of return;

$$R < R* = \frac{L(1+r_L)}{K+L} - 1$$

The critical value rate of return (R*) is the ratio of the difference between the interest payment on the loan and the borrower's initial wealth to the total investment. When R is less than R*, the borrower fails to repay the amount as obligated in the loan contract. Thus, the bank lends L to the borrower who has initial capital (K). Then the borrower invests K+L in the project with the rate of return R. In order to succeed in repaying the loan, the return from the borrower's investment ((K+L)(1+R)) must exceed the principle plus the interest payment on the loan (L(1+r_L)).

Cosci assumes that in the case of default, the bank must bear administrative costs to determine the financial position of the borrower. Since Cosci names "k", the additional administrative costs of the bank in case of default, the expected wealth of the bank is:

$$V = V\{ \int_{-1}^{R*} [(K+L)(1+R) - k]dF(R) + \int_{R*}^{\infty} L(1+r_L)dF(R) - L(1+r_D) \}$$

The first term in the above equation is a pay-off to the bank from the loan in the event that the borrower defaults. The second term is the pay off from the loan in the event of full repayment of the loan plus the contractual interest rate. Thus, with uncertainty, if the

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$$(1+R)(K+L) \langle L(r_L +1)$$

$$(1+R) \langle \frac{L(r_L +1)}{K+L}$$

$$R \langle \left(\frac{L(r_L +1)}{K+L} -1 \right) = R*$$

borrower defaults, the bank's return from lending is only the return from the borrower's investment, minus the administrative costs. In the case of successful payment, the bank will get the principal, plus the interest payment on loan. Though Cosci developed a model where the bank faces asymmetric information, which this dissertation will utilize, he again assumes that the bank does not hold risk-free assets. Therefore, this dissertation will include government securities in the bank's portfolio.

4.3. The Theoretical Model of a Bank's Expected Wealth without Bank Regulations

This section will develop a theoretical model of a bank's expected wealth, comprised of the bank's returns from lending, the returns from investing in government securities and the returns from deposits. For simplicity, this dissertation will first develop a model of a bank's expected wealth, without any regulations. Then, in the following section, the two regulations, risk-based capital requirements and deposit insurance, will be incorporated.

Assume that the bank operates in a less-than-perfectly-competitive market. The bank has some degree of power, which is credit rationing (excess demand of credit) and lending at a contractual interest rate. Moreover, in this model, instead of the bank's administrative cost, that the bank has to pay when the borrower defaults by Cosci, let us assume that the loan contract includes a collateral requirement (C(L)). Assume that the collateral is a borrower's pecuniary cost of default. Collateral is the amount that the bank receives when the borrower defaults. Here, the collateral a bank requires is positively

related to the loan size. The bigger the loan, the more collateral the bank will require in order to grant the loan. Thus,

$$C_L(L) > 0$$

The borrower's initial wealth must be sufficient to raise collateral and to finance the investment project such that:

$$W(0) = K + C$$

where K is the borrower's capital.

In the event of default, the rate of return is less than the critical value rate of return $(R < R^*)$. The bank receives all the cash flow $((K + L)(1 + R))$, as well as the collateral (C). The investor receives nothing on his equity investment. If $R > R^*$ the investor receives all the cash flow in excess of the contractual loan payment $(L(1 + r_L))$. Therefore, collateral acts as the borrower's pecuniary cost of defaults and the borrower is required to raise more collateral as the loan size gets bigger.

Next, consider the lender (the bank). On the bank's balance sheet, the bank has two sources of funds: deposits (D) and equity capital (E). Equity capital is exogenously given. On the other side of the bank's balance sheet, the bank decides to invest funds in two types of assets, risky loans (L) and safe assets (S), such as securities. Introduction of securities will allow us to examine how the bank alters its behavior when the bank has a choice between loans and government securities.

Commercial banks face a simple balance sheet identity

$$E + D = L + S \qquad\qquad (4.1)$$

total liabilities = total assets

where E = bank equity capital

  D = deposits

  L = loans

  S = safe assets such as securities

The bank pays an interest rate on the deposits (r_D) while the borrower pays the bank an interest rate on loans (r_L). The bank also gets an interest rate from investing in government securities (r_S). The interest rate on securities, r_S, is exogenous. In the securities market, commercial banks purchase and sell securities at the given market rate. The demand function for deposits is given as:

$$D = f(r_D) \qquad\qquad \text{(demand function for deposits)}$$

where an increase in the deposit rate (r_D) enhances the bank's deposits. With this demand of deposits function, we get the inverse demand function for deposits:

$$r_D = f(D) \text{ where } f_D(D) > 0 \qquad\qquad (4.2.a)$$

The demand function for loans is given as:

$$L = g(r_L) \qquad\qquad \text{(demand function of loans)}$$

where an increase in the lending rate (r_L) decreases bank loans. With this demand function of loans, we get the inverse demand function of loans:

$$r_L = g(L) \text{ where } g_L(L) < 0 \qquad\qquad (4.2.b)$$

The reason we use the inverse function of the demand for deposits and the inverse function of the supply of loans, instead of the normal function of both, is to make it convenient for substitution in the model, deriving the comparative static results. Thus, the bank in this model has a choice of investing in loans and government securities, and these two assets create interest income for the bank. The bank also pays a depositor interest rate on the deposits.

Furthermore, this model assumes asymmetric information since borrowers are not equal and they have more information than the bank. In particular, different borrowers have different probabilities of repaying their loans, thus the expected return for the bank depends on the probability of repayment of a loan. Peek and Rosengren provide a loan disbursement model, which maximizes a bank's profit function. In this dissertation, in order to include uncertainty caused by asymmetric information, the bank will maximize its expected final wealth. The bank's expected final wealth model will show the bank's risk through the uncertainty of the rate of returns on the investment projects.

The bank maximizes its expected final wealth, which is:

$$W(r_L) = \int_{-1}^{R*}[(K+L)(1+R)+C(L)]dF(R) + \int_{R*}^{\infty}[L(1+r_L)]dF(R) + S(1+r_S) - D(1+r_D)$$

(4.3)

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where

$$R^* = \frac{L(1+r_L)-C}{K+L} - 1$$

is the critical value of the rate of return on investments when the loan contract includes collateral.[7] Therefore, the critical value of the rate of return is equal to the difference between the loan interest payment and the borrower's initial wealth, in this case, with the ability to raise collateral.

$(K + L)(1 + R)$ is total cash flow of the investment.

$F(R)$ is a probability density function of total cash flow and varies from -1 to ∞.

r_S is the securities interest rate.

S is government securities.

r_L is contractual loan interest rate.

r_D is deposit rate.

D is deposit.

Bank revenue is comprised of the total earnings from securities ($r_S S$) and total earnings from loan issues ($r_L L$) if the borrower does not default. The cost to the bank is the deposit

---

[7] From the default condition for the rate of return;

$$(1 + R)(K + L) + C \langle L(r_L + 1)$$

$$(1 + R)\langle \frac{L(r_L + 1) - C}{K + L}$$

$$R\langle \left(\frac{L(r_L + 1) - C}{K + L} - 1 \right) = R*$$

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interest paid to the depositor (r_DD). In addition, the bank also faces the uncertainty from imperfect information. The first term in the equation (4.3) is the bank's expected wealth in the event that the borrower defaults, as the rate of return is less than the critical value rate of return ($R < R^*$). The second term is the bank's expected wealth in the event of full repayment of the loan plus contractual interest. The third term is the bank's revenue from holding government securities. The last term in the equation (4.3) is the bank's cost for taking deposits from depositors.

We rewrite (4.3) using equation (4.1), (4.2.a) and (4.2.b)

$$W(g(L)) = \int_{-1}^{R^*} [(K+L)(1+R) + C(L)]dF(R) + \int_{R^*}^{\infty} [L(1+g(L)]dF(R) + S(1+r_s) - D(f(D)+1)$$

$$(4.4)$$

Thus, the bank's wealth consists of the returns from lending (either in the case of borrower defaults or successful loan payment), the returns from investing in government securities, and the returns from deposits.

4.4. The Theoretical Model of the Bank's Expected Wealth with Regulations: "Risk-Based Capital Requirements and Deposit Insurance"

In the previous section, this dissertation developed a model for a bank's expected wealth that allows the bank to hold two assets, loans and government securities. The bank also faces the uncertainty of a borrower's loan repayments. In this section, the model will incorporate the two regulations (risk-based capital requirements and deposit insurance), and focus on their roles in determining bank lending.

The bank faces a binding risk-based capital constraint set by the BIS (The Bank of International Settlement). According to Peek and Rosengren (1995), the constraint is $E/A = \mu$, where μ is the minimum requirement of the total capital-to-total asset ratio, which is a uniform rate. While risk-based capital requirements assign differential weights to asset categories, banks are required to hold more capital when banks invest in risky assets, such as loans, rather than in safe assets, such as government securities. Thus, this dissertation will incorporate risk-based capital requirements in the model, such that the bank faces a binding risk-based capital constraint.

$$E = aS + bL \quad where \quad 0 < a < b < 1 \tag{4.5}$$

In the equation (4.5), 'a' and 'b' represent the relative share of assets which must be maintained as bank equity E. The 'b' ratio is greater than 'a' because, on average, loans are considered riskier than government securities. Thus, a higher amount of capital backup is needed for loans than for securities. The level of capital requirements is stipulated by regulators for the purpose of reducing bank failure. The numerical standard of 'a' and 'b' is determined by regulators.

Using the balance sheet constraint (4.1) and the capital constraint (4.5), S is eliminated and D is solved for. D is linearly related to L and E, as shown in the equation

$$D = \frac{(1-a)}{a}E + \frac{(a-b)}{a}L$$

(4.6.a)

The equation (4.6.a) is simplified to the equation (4.6.b).

$$D = \alpha(a)E + \beta(a,b)L$$

(4.6.b)

where $\alpha = (1-a)/a$ and $\beta = (a-b)/a$ such that $\alpha > 0$ and $\beta < 0$, given 'b' is greater than 'a'. Thus instead of the uniform capital requirement, the risk-based capital adequacy requires the bank to maintain higher capital when issuing loans than when holding government securities.

Another regulation incorporated in the model is deposit insurance. Because of the crisis in 1997, Thailand adopted the explicit deposit insurance system for the first time in 1999. Banks are required to pay the premium of 0.2 percent of outstanding deposits to the Financial Institution Development Fund (FIDF).

With the two particular bank regulations (risk-based capital requirements and deposit insurance), the bank's expected terminal wealth becomes:

$$W(r_L) = \int_{-1}^{R^*}[(K+L)(1+R)+C(L)]dF(R) + \int_{R^*}^{\infty}[L(1+g(L))]dF(R) + S(1+r_S)$$
$$- (\alpha E + \beta L)(1 + f(\alpha E + \beta L) + \rho),$$

(4.7)

where ρ is the deposit insurance premium, which is a uniform proportion of deposits.

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In this model, not only does the bank have a contractual obligation to pay its depositors interest at a risk-free interest rate (r_D), but the bank also pays a deposit insurance premium (ρ).

To rewrite (4.7) only in terms of the variable L, therefore, S and D are eliminated by using the equations (4.1) and (4.5) and (4.6.b). The bank's expected terminal wealth becomes:

$$W(g(L)) = \int_{-1}^{R^*}[(K+L)(1+R)+C(L)]dF(R) + \int_{R^*}^{\infty}[L(1+g(L)]dF(R)$$
$$+ (E+\alpha E+\beta L-L)(1+r_S)-(\alpha E+\beta L)(1+f(\alpha E+\beta L)+\rho)$$

$$(4.8)$$

The equation (4.8) results by substituting D (the equation 4.6.b) into the equation (4.2.a) and by substituting that result into the equation (4.7) and by substituting r_L (4.2.b) directly into the equation (4.7).

The next task is determining the effects on bank lending (L) caused by changes in bank capital (E), in the government securities interest rate(r_S), in risk-based capital requirements (a,b), and in deposit insurance (ρ). To do so, the first-order and the second-order conditions for L are needed for the comparative statics.

The following is the first-order condition for L:

$$\frac{dW}{dL} = R + \frac{R^2}{2} + RC_L(L) + LRg_L(L) + (1+g(L))R + (\beta-1)(1+r_S) - \beta Df'(.) - \beta f(.) - \beta(1+\rho) = 0$$

$$(4.9)$$

The following is the second-order condition for L:

$$\frac{d^2W}{dL^2} = C_{LL}(L) + LRg_{LL}(L) + 2g_L(L)R - \beta^2 f''(.)D - 2\beta^2 f'(D) < 0$$

$$(4.10)$$

In equation (4.10), $C_{LL} \leq 0$, $g_{LL} \geq 0$, and $f'' \leq 0$ are sufficient to guarantee the second-order condition if g_{LL} is positive but not large.[8]

4.5. Comparative Static Results for the Loan Quantity

Since we have a model of the bank's expected wealth, this section will contemplate how changes in bank equity capital (E), capital requirement on government securities (a), capital requirements on loans (b), the government securities interest rate (r_S) and deposit insurance (ρ) will affect bank loans. In the next chapter, the comparative results will be used as theoretical predictions of an empirical test, using commercial bank data in Thailand.

Assume that $d^2W/dL^2 < 0$. In order to get any comparative result, the relevant second–order condition is used to advantage. The condition for comparative statics is:

$$\frac{\partial^2W}{\partial L \partial E}dE + \frac{\partial^2W}{\partial L^2}dL = 0$$

$$(4.11)$$

Switching sides in equation (4.11) and deriving the expression for $\partial^2W/\partial L \partial E$, we get the expression for dL/dE:

---

[8] $0 \langle g_{LL} \langle \dfrac{\beta^2(2f' - C_{LL} - f'D)}{LR} - \dfrac{2g_L}{L}$

$$\frac{dL}{dE} = -\frac{\frac{\partial^2 W}{\partial L \partial E}}{\frac{\partial^2 W}{\partial L^2}} = \frac{\alpha\beta f''(.)D + 2\alpha\beta f'(.)}{\frac{\partial^2 W}{\partial L^2}} \rangle 0$$

(4.12)

Given the previously made assumptions that $f'' \leq 0$ and $f' > 0$, and recalling that $\alpha > 0$ and $\beta < 0$, dL/dE is positive. In other words, an increase in equity capital of the bank enhances the loan quantity issued by the bank.

The other comparative static results are the impact of regulatory parameters ' a ' (capital requirement against securities) and ' b ' (capital requirement against loans) on lending quantity L. The effect of capital requirements ' a ' on L is given as:

$$\frac{dL}{da} = -\frac{\frac{\partial^2 W}{\partial L \partial a}}{\frac{\partial^2 W}{\partial L^2}} = \frac{-\frac{a}{b^2}[1 + r_S - r_D - \rho - \beta D f''(.)L - 2\beta f'(.)L] - \frac{1}{a^2}[-2\beta f'(.)E - f''(.)\beta DE]}{\frac{\partial^2 W}{\partial L^2}}$$

assuming $r_S > r_D$

(4.13)

In general, the sign of the expression in equation (4.13) is ambiguous because an increase in 'a' has two opposing effects:

(i)   If 'a' increases (the capital requirement against securities), the bank will shrink assets. That shrinkage can occur when L declines (asset effect).

(ii)   An increase in 'a' will cause the substitution between assets L and S. Since S becomes subject to a higher capital requirement, L will be substituted for S, thereby increasing L (substitution effect).

In other words, an increase in 'a' would require a decline in total asset holdings for a given E. A decline in asset holdings can occur by reducing L together with S. However, an increase in 'a' would also lead to the substitution of L for S, as securities now become subject to a higher capital requirement.

Similarly, an increase in the capital requirement 'b' on government securities gives;

$$\frac{dL}{db} = -\frac{\dfrac{\partial^2 W}{\partial L \partial b}}{\dfrac{\partial^2 W}{\partial L^2}} = -\frac{\beta_b[(1 + r_S - r_D - \rho) - \beta L f''(.)LD + 2f'(.)]}{\dfrac{\partial^2 W}{\partial L^2}} < 0$$

assuming $r_s > r_D$

$$(4.14)$$

If the restriction mentioned above holds ($r_s > r_D$), then dL/db is negative. An increase in 'b' would cause disincentive for banks to extend additional loans for two reasons:

(i)   An increase in 'b' will require banks to shrink assets, and that can occur when L goes down for a given E.

(ii)   An increase in 'b' will require banks to substitute away from L and into S, thus reducing L for a given E.

In the next comparative results the effects of the securities interest rate (r_S) and deposit insurance premium (ρ) are illustrated. The effect of a change in government securities interest rate (r_S) on loans (L) is:

$$\frac{dL}{dr_S} = -\frac{\dfrac{\partial^2 W}{\partial L \partial r_S}}{\dfrac{\partial^2 W}{\partial L^2}} = -\frac{(\beta - 1)}{\dfrac{\partial^2 W}{\partial L^2}} < 0$$

Where $\beta < 0$ (4.15)

In other words, dL/dr$_S$ is negative. With an increase in the alternative rate of return (securities interest rate), more funds are invested in securities and less in loans.

The effect of rising ρ, deposit insurance premium, on loans is:

$$\frac{dL}{d\rho} = -\frac{\dfrac{\partial^2 W}{\partial L \partial \rho}}{\dfrac{\partial^2 W}{\partial L^2}} = -\frac{-\beta}{\dfrac{\partial^2 W}{\partial L^2}} > 0$$

(4.16)

Further, an increase in the deposit insurance premium will increase the bank's incentive to extend more loans (L). Since more deposits are guaranteed, the bank will be more willing to take risks by investing more in risky assets (L), expecting higher returns.

From comparative static results, we find that an increase in bank capital enhances bank lending, while an increase in capital requirements for government securities has ambiguous effects on bank lending. A bank could respond to a rise in the capital requirement for loans by shrinking the whole portfolio (decreasing both loans and government securities). On the other hand, the bank could substitute government

securities with loans, which leads to increased lending. An increase in capital requirements on loans causes a decline in bank lending. A rise in the government securities interest rate also leads to decreased lending. Finally, an increase in the deposit insurance premium will elevate the bank's incentive to lend because of the limited liability. In the next chapter, empirical tests are conducted using the data of a sample of ten Thai banks and seven foreign owned banks in Thailand. The intent is to determine the effects on bank lending caused by deteriorated bank capital (as a result of the 1997 crisis), of risk-based capital requirements, and of deposit insurance.

CHAPTER 5. EMPIRICAL ANALYSIS

Having developed the theoretical model of the bank's expected wealth with regulations (risk-based capital requirements and deposit insurance), this chapter will use empirical data from a sample of ten Thai banks and seven foreign owned banks during 1988 to 2001 to test the hypothesis that risk-based capital requirements and deposit insurance contributed to a greater lending contraction in Thailand. In other words, the bank lending contraction would not have been as severe if there were no risk-based capital requirements and deposit insurance. The first section of this chapter will perform the unit root test. The next section will propose the empirical methodology that this dissertation will employ to test the hypothesis. The last section will present the empirical results from the estimations for the ten Thai banks and the seven foreign banks to determine whether risk-based capital requirements and deposit insurance contributed to a greater credit contraction[9].

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[9] **Testing for unit roots**: Since the data feature individual bank data over the sample period from 1988 to 2001, we use the data for each bank to perform augmented Dickey-Fuller tests for unit roots. Augmented Dickey-Fuller tests are applied to the following time series variables: the change in the real total loans normalized by the beginning of the period real asset (LARATIO), the change in the real total bank equity normalized by the beginning of the period assets (EARATIO), the real interest rate on three-month T-bills (TBILL_R), and the log of real gross domestic product (lnRGDP). The results show that for all banks in the sample, LARATIO, EARATIO, TBILL_R, and lnRGDP are stationary.

5.1. Empirical Methodology

To propose an empirical methodology and modeling strategies that will be used in empirical analysis, this section will use the theoretical arguments from the previous chapter to form a regression equation that tests the relationship between bank capital, regulations (risk-based capital requirements and deposit insurance) and bank lending.

The theoretical argument from equation (4.8) shows that the bank lending (loan quantity) L can be described by the following equation:

$$L = \varphi(E, a, b, r^S, \rho)$$

$$(4.17)$$

L depends on E (bank equity), 'a' (the fraction of securities that is required to be backed up by the equity), 'b' (the fraction of loans that needs to be backed up by the equity)[10], r^S (T-Bills interest rate), and ρ (the deposit insurance premium). Based on the theoretical analysis in the preceding chapter, $\varphi_E > 0$; $\varphi_a > 0$ or < 0; $\varphi_b < 0$; $\varphi_{rs} < 0$; and $\varphi_\rho > 0$. However, because this dissertation is interested in the effects of the period that risk-based capital requirements were enforced and the period of the introduction of the deposit insurance premium that banks are now obligated to pay the insuring agency (FIDF), we replace the required capital-to-asset ratio with a time dummy variable that represents the enforcement of risk-based capital requirements. We also use a time dummy variable to represent the introduction of the deposit insurance premium that banks now are obligated to pay the FIDF.

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[10] $E = aS + bL$ where $0 < a < b < 1$
where E is the equity, S represents securities, and L represents loans

Here, panel data are used for empirical work. The data were quarterly collected

from the ten Thai commercial banks[11] and the seven foreign owned banks[12] for the period

1988 to 2001.[13] The data includes information on loans, gross domestic product, total

bank equity capital, three-month T-Bill rate, and regulatory dummy variables

representing the implementation of risk-based capital requirements and deposit insurance.

Gross Domestic Product (GDP) is included in equation (4.17) because we choose to use

the GDP as a proxy for the macroeconomic performance. While regulatory dummy

variables for risk-based capital requirements and deposit insurance are the proxy for

implementation of these two regulations, the dummies equal 0 during the period before

the enforcement, and equal 1 during the period of the enforcement. The nominal data are

transformed to real data by adjusting for inflation. For gross domestic product, loans, and

total bank equity capital, nominal values are divided by the GDP deflator to transform

nominal data into real data. For three-month T-Bill rate, the inflation rate is subtracted

from the nominal interest rate to get the real interest rate. No adjustments are needed on

the regulatory dummies for risk-based capital requirements and deposit insurance, which

are inflation free.

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[11] Bangkok Bank, Krung Thai Bank, Thai Farmers Bank, Siam Commercial Bank, Bank of Ayudhya, Thai Military Bank, Siam City Bank, Bank of Asia, Thai Danu Bank and Nakornthon Bank
[12] ABN-AMRO Bank, The International Bank of China, Standard Chartered Bank, Bank of Tokyo Mitsubishi, Hongkong and Shanghai Bank, Citi Bank and Deutsch Bank
[13] The data are actually end-of-quarter data (i.e.,Q1 data are for March 31, while Q4 data are for December 31).

For a panel regression, the linear representation of equation (4.17) is

$$
\begin{aligned}
LARATIO_{i,t} &= \alpha + \beta_1 EARATIO_{i,t} + \beta_2\ EARATIO_{i,t} \cdot CRISISDUM_{i,t} + \beta_3 TBILL\_R_{i,t} \\
&+ \beta_4 TBILL\_R_{i,t} \cdot CRISISDUM_{i,t} + \beta_5 \ln RGDP_{i,t} + \beta_6 \ln RGDP_{i,t} \cdot CRISISDUM_{i,t} \\
&+ \beta_7 RBCDUM_{i,t} + \beta_8 RBCDUM_{i,t} \cdot CRISISDUM_{i,t} + \beta_9 DEPDUM_{i,t} + \beta_{10} TIME + \\
&\beta_{11} QUARTER1 + \beta_{12} QUARTER2 + \beta_{13} QUARTER3 + \varepsilon_{i,t}
\end{aligned}
$$

$$(4.18)$$

where,

$LARATIO_{i,t}$ is the change in real total loans normalized by the beginning of the

period real assets for the ith bank at time t. We normalize loans with assets to

reduce the potential heteroskedasticity problems with the error term.

$EARATIO_{i,t}$ is the change in real total bank equity normalized by the beginning of the

period real assets for the ith bank at time t, also to reduce the potential

heteroskedasticity problems with the error term.

$CRISISDUM_{i,t}$ is the dummy variable for the financial crisis: the variable equals 0

from the first quarter of 1988 to the second quarter of 1997; and from the first

quarter of 1999 to the fourth quarter of 2001. $CRISISDUM_{i,t}$ equals 1 from the

third quarter of 1997 to the fourth quarter of 1998.

$TBILL\_R_{i,t}$ is the real interest rate on three-month T-bills (same for all banks) at time t.

$lnRGDP_{i,t}$ is the log of real Gross Domestic Product, which is used as a proxy for

economic performance, at time t.

$RBCDUM_{i,t}$ represents the introduction of risk-based capital requirements in Thailand

in 1993: the variable equals 0 for the period 1988 to 1992 and 1 for the period

1993 to 2001. We replace the required capital-to-asset ratio with the time dummy variable because we would like to see the effects of risk-based capital requirements enforcement rather than the effects of changes in capital requirement ratios on bank lending. RBCDUM is an explanatory variable that provides evidence of an explicit link to the enforcement of risk-based capital requirements. This variable separates the effects on bank lending caused by risk-based capital requirements enforcement from changes in bank capital. Moreover, since this dissertation focuses on the effect of risk-based capital requirements on bank lending during a normal economy and during the crisis, the dummy variable is convenient for separating the bank lending effect in both periods.

$DEPDUM_{i,t}$ represents the introduction of the deposit insurance premium, which was effective in January 1999. Under this system, banks now have to pay the insurance premium of 0.2 percent of their outstanding deposits to the insuring agency (FIDF): DEPDUM equals 0 for the period 1988 to 1998 and 1 from 1999 to 2001. Again we replace the deposit insurance premium with the time dummy variable because we would like to see the effects of deposit insurance enforcement, which banks now, are obligated to pay the insurance premium. DEPDUM is an explanatory variable providing evidence of an explicit linkage to the implementation of the deposit insurance premium. However, since the deposit insurance was introduced in 1999, after the crisis, we cannot separate the effect of deposit insurance on bank lending before and after the crisis.

TIME is the time trend variable.

QUARTER1, QUARTER2 and QUARTER3 are seasonal adjustment variables.

$\varepsilon_{i,t}$ is the error term, which has zero mean and a constant variance.

During the crisis, with risk-based capital requirements enforcement and the introduction of the deposit insurance premium, banks might respond differently to changes in bank capital, T-Bill rate and GDP, compared to how they would during a normal economy, with the absence of the risk-based capital requirements and the deposit insurance premium. Since the crisis and the two regulations could cause banks to change their risk-taking behavior, it is important in equation (4.18) to see the interactions between the CRISISDUM variable and EARATIO, TBILL_R and lnRGDP variables. EARATIO·CRISISDUM, TBILL_R·CRISISDUM, RBCDUM·CRISISDUM and lnRGDP·CRISISDUM terms allow bank lending (LARATIO) to respond to EARATIO, TBILL_R, RGDP and RBCDUM during the crisis period (1997: quarter3 – 1998: quarter4). However, over the sample period of 1988-2001, banks also faced risk-based capital requirements enforcement (1993: quarter1-2001: quarter4) and the introduction of the deposit insurance premium (1999: quarter1- 2001: quarter4). Therefore, this dissertation tries to capture the effects of the interaction between explanatory variables and the crisis, risk-based capital requirements enforcement and the introduction of the deposit insurance premium. The coefficients of explanatory variables during different events are shown in Table 5.1.

Table 5.1. Coefficients During Different Events

Events	Variables				
	EARATIO	TBILL_R	lnRGDP	RBCDUM	DEPDUM
No Crisis, No RBC, No DEP	β_1	β_3	β_5		
No Crisis, With RBC, No DEP	$\beta_1 + \beta_7$	$\beta_3 + \beta_7$	$\beta_5 + \beta_7$	β_7	
With Crisis, With RBC, No DEP	$\beta_1 + \beta_2 + \beta_7$	$\beta_3 + \beta_4 + \beta_7$	$\beta_5 + \beta_6 + \beta_7$	$\beta_7 + \beta_8$	
No Crisis, With RBC, With DEP	$\beta_1 + \beta_7 + \beta_9$	$\beta_3 + \beta_7 + \beta_9$	$\beta_5 + \beta_7 + \beta_9$	$\beta_7 + \beta_9$	$\beta_7 + \beta_9$

Since the deposit insurance premium was first implemented on January 1, 1999, which is considered after the crisis, there will not be the term that represents the effect of deposit insurance during crisis.

The data for the regression consists of n cross-sectional units, denoted by i = 1,...,10 for the Thai banks and i = 1,...,7 for the foreign owned banks. The data are observed at each time period t, t = 1,...,56 (quarterly data from 1988-2001). There are 560 observations for Thai banks and 392 observations for foreign owned banks. The theoretical variables of equation (4.17) were modified and renamed in equation (4.18) where several least-squares estimation techniques will be performed on the panel data.

Equation (4.18) will be tested against the following hypothesis:

Hypothesis I: Bank capital deterioration leads to a decrease in bank lending or a "Capital Crunch".

Hypothesis II: If there is a "Capital Crunch", where bank lending contracts, the regulations (capital requirements and deposit insurance) contribute to a greater contraction in bank lending.

In order to test hypothesis II, we will compare the actual bank lending (LARATIO) to the following bank lending estimations:

1. $LARATIO_{w/o\ RBC}$ which are the loans that the banks would have made if there were no risk-based capital requirements (RBCDUM=0).

2. $LARATIO_{w/o\ DEP}$ which are the loans that the banks would have made if there were no deposit insurance (DEPDUM=0).

3. $LARATIO_{w/o\ RBC,DEP}$ which are the loans that the banks would have made if there were no both capital requirements and deposit insurance (RBCDUM=0, DEPDUM=0).

The actual bank lending will be compared to the estimation of bank lending in each case (above) in order to see the effect of each regulation separately. If $LARATIO_{w/o\ RBC,\ DEP}$ is greater than LARATIO in the actual case, we will accept hypothesis II. We can conclude that the regulations (risk-based capital requirements and deposit insurance) worsened the credit crunch.

In the next section, the regressions will be run separately between the Thai commercial banks and the foreign owned banks because we expect Thai commercial banks that are mostly family owned to behave differently from foreign owned banks. Even though banking regulations apply equally to both Thai and foreign owned banks, since the branches for foreign banks have to follow their headquarters' lending policies, often stricter than Thai banking policies, the lending behavior of foreign banks may be different from Thai banks, where ownership is often concentrated in a few families.

5.2. Empirical Results

This discussion of empirical results is a three part process. First, the estimation results are reported. Second, the estimators are then used to predict the bank lending in the case without risk-based capital requirements and without deposit insurance. Third, the two results above are compared to determine whether risk-based capital requirements and deposit insurance contributed to a greater lending contraction in Thailand.

5.2.1. Regression Estimate Results of Lending (LARATIO) for the Ten Thai Commercial Banks

Table 5.2 reports the regression results. This section will discuss the estimated parameters of the equity-to-asset ratio, the lnRGDP, the T-Bill rate, risk-based capital requirements and deposit insurance. Since the FGLS heteroskedasticity with panel specific AR (1) model gives us the closest results to the theoretical predictions, only the results from using FGLS heteroskedasticity with panel-specific AR(1) estimation technique are reported on Table 5.4.[14]

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[14] The random effects and the fixed effects models are first employed. Since the sample data does not cover the entire Thai commercial banking system and since we also separate the sample data into two groups, the Thai banks and the foreign owned banks, the individual firm effects should be uncorrelated with the regressors. It might be appropriate to model the individual specific constant terms as randomly distributed across banks (random effects). Breusch and Pagan Lagrange Multiplier test is conducted to test random effects. We obtain a Lagrange Multiplier test statistic of 4.44 which barely exceeds the 95 percent critical value of chi-squared with 1 degree of freedom, 3.84. We then conclude that the random effects model with a single constant term is appropriate for these data. The result of the test is to accept the null hypothesis of

After taking heteroskedasticity into account and we expect changes to register in the bank loan-to-asset ratio for a period greater than a single quarter, we suppose that the regression residuals are AR(1), which seems natural as one might expect the error terms to be auto-correlated. The results using FGLS heteroskedasticity with panel-specific AR(1) model are as follows:

During a normal period and in the absence of both risk-based capital requirements and the deposit insurance premium (1988: quarter1-1992: quarter4): The coefficient of the equity-to-asset ratio is significantly positive at 0.8978. This confirms the theoretical analysis that an increase in equity capital led the ten Thai banks to increase their lending. The coefficient of the T-Bill rate is significant and has an expected negative sign of -0.0493, supporting the theoretical prediction that an increase in the alternative rate of return (government securities interest rate) caused the banks to purchase more treasury bills. The parameters of lnRGDP is significant and positively correlated to the bank loans, with the coefficient of 0.2109, indicating that when real GDP increased by 1 million Baht, the ten Thai banks increased their lending by 21 percent during a normal period and in the absence of risk-based capital requirements and the deposit insurance premium.

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the random effects model. The Hausman statistic is 0.00. The critical value from the chi-squared table with 12 degrees of freedom is 21.03, which is larger than the test value. The hypothesis that the individual effects are uncorrelated with other regressors in the model cannot be rejected. Based on the Breusch and Pagan test and the Hausman test, we are able to conclude that the random effects model is a better choice. However, except the coefficient of EARATIO·CRISIS, the coefficients of explanatory variables using the OLS, Random Effects and Fixed Effects models are significant.

During a normal period, with risk-based capital requirements enforcement, but in the absence of deposit insurance premium (1993: quarter1-1997: quarter2): The coefficient of the equity-to-asset ratio during this period is significantly positive at 0.7815 (the product of the sum of β_1 and β_7). The result still supports the theoretical analysis that an increase in equity capital led the ten Thai banks to increase their lending. However, with lower magnitude than during the period without risk-based capital requirements. The explanation is that because the banks had to maintain the minimum equity-to-asset ratio when they issued loans, risk-based capital requirements put more pressure on the bank capital, especially in the case if Thai banks that had aggressive lending behaviors. The coefficient of risk-based capital requirements is significantly negative at -0.1163. Because the banks had to maintain their capital when they invested in loans according to the capital standard, the coefficient confirms the theoretical prediction that the capital adequacy decreases the bank lending. This decrease in lending in turn reduced the bank lending. The coefficient of the T-Bill rate is significant and has the expected negative sign of -0.1656, which is the product of the sum of β_3 and β_7, supporting the theoretical prediction that an increase in treasury bill interest rate caused the banks to invest in more treasury bills. The parameter of lnRGDP is significant and positively correlated to the bank loans, with the coefficient of 0.0946, which is the product of the sum of β_5 and β_7. The coefficient of lnRGDP indicates that when real GDP increased by 1 million Baht, the ten Thai banks increased their lending by 9 percent during a normal period, when risk-based capital requirements were enforced but in the absence of the deposit insurance premium.

During the financial crisis, with risk-based capital requirements enforcement but in the absence of deposit insurance premium (1997: quarter3-1998: quarter4): the coefficient of the equity-to-asset ratio is significantly positive at 1.7777, (the product of the sum of β_1 and β_2 and β_7). This result is consistent with the theoretical prediction that deteriorated bank capital, as a result of the crisis, caused banks to reduce their lending. The coefficient of bank equity has a higher magnitude than in the previous case (during a normal period), possibly explained by the ten Thai banks' aggressive lending behaviors. Because Thai banks had "connections" with industrial groups and influential families, these relationships led banks to lend to unproductive and risky projects with good connections to bank executives or supervisors. Moreover, the weakness in corporate governance and transparency, as well as concentrated ownership, allowed expansion of lending into risky investments. During the crisis, when the bank capital deteriorated, the loans to unproductive and risky projects turned into loan losses. Because the banks had to set aside part of their capital for the loan losses, resulting in less lending, these losses put more pressure on bank capital. Therefore, when the bank capital deteriorated during the crisis, the loans issued by the Thai banks contracted more than they did during a normal economy. The coefficient of risk-based capital requirements is significantly negative at -7.672 (the product of the sum of β_7 and β_8), which has a higher magnitude than in the case of a normal period, indicating that, because the ten Thai banks extended of a higher number of loans, the enforcement of risk-based capital requirements caused bank lending to contract more during the financial crisis. During this crisis period, however, the coefficient of the T-Bill rate is significant, but has an unexpected positive sign of 1.7065

(the product of the sum of β_3, β_4 and β_7), contradicting the theoretical prediction. The results show that the T-Bill rate positively correlated with the bank loans, which is unusual: when the T-Bill interest rate increases, banks should issue fewer loans because the returns from alternative assets rise. The explanation of this unexpected sign could be that since the banks faced the pressure of reducing their loans caused by the crisis, and since they also had to maintain the minimum risk-based capital-to-asset ratio, the banks had no choice but to reduce their lending, regardless of what the T-Bill interest rate was. Even though the T-Bill rate declined during the crisis, the bank loans also declined. The lnRGDP as a fundamental economic factor has a significant positive relationship with a change in the loans issued by the banks with the coefficient of 0.5653 (the product of the sum of β_5, β_6 and β_7), indicating that the ten Thai banks decreased their lending during the crisis when the Thai economy did not perform well.

During a normal period, with risk-based capital requirements enforcement and with the presence of deposit insurance premium (1999: quarter1-2001: quarter4); the coefficient of the equity-to-asset ratio is significantly positive at 0.6901 (the product of the sum of β_1 and β_7 and β_9), indicating that after the crisis the ten Thai banks increased their lending as their capital increased again. The coefficient of risk-based capital requirements is significantly negative at -0.2077 (the product of the sum of β_7 and β_9), implying that after the crisis and with the presence of the deposit insurance premium, risk-based capital requirements caused the ten Thai banks to decrease their lending. However, this coefficient has a much lower magnitude than during the crisis and without the deposit insurance premium (-7.672), implying that the crisis had a major role of

contributing to the lending contraction among the ten Thai banks. However, the negative coefficient of deposit insurance (the product of the sum of β_7 and β_9), the same as the coefficient of risk-based capital requirements during this period[15]), implies that the deposit insurance implementation caused the ten Thai banks to reduce their loans. This result contrasts the theoretical analysis we performed, which stipulated that when the deposits are guaranteed, the banks will be more willing to lend. In the case of the Thai banks, the results suggest that, because of the deposit insurance premium that the banks are required to pay the insuring agency, banks have to set aside some funds to pay the premium, which is relatively high (0.2 percent of outstanding deposits), therefore reducing the banks' lending ability. During this period, the parameter of T-Bill rate is significant and negatively correlated to the bank lending with the coefficient of -0.2077 (the product of the sum of β_3 and β_7 and β_9), supporting the theoretical prediction. The lnRGDP as a fundamental economic factor has a significant positive relationship with the coefficient of a change in the loans issued by the banks at 0.0032 (the product of the sum of β_5 and β_7 and β_9), indicating that the ten Thai banks increased their lending when the Thai economy performed better after the crisis[16].

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[15] When the deposit insurance premium was implemented in 1999, risk-based capital requirements had also been enforced since 1993. Therefore, when assessing the effect of the deposit insurance premium on bank lending, we alsk have to include the interaction effect of risk-based capital requirements.

[16] We also ran two additional separate regressions, excluding the only state-owned bank (Krung Thai bank), and the biggest bank (Bangkok bank). The results are qualitatively the same; therefore, we did not report the results.

5.2.1.1. Summary

From the evidence of the ten Thai commercial banks, there are positive relationships between the bank capital and the loans, especially the high positive coefficient of the bank capital parameter during the crisis. This evidence leads us to accept the first hypothesis, that there was a capital crunch during the financial crisis. Moreover, risk-based capital requirements, especially during the crisis, had a major role in reducing the credits extended by the ten Thai commercial banks. Thus, risk-based capital requirements caused a larger contraction in bank loans during the crisis period than a normal period.

Table 5.2. Estimates of Changes in Loans of the Ten Thai banks

Regressors	Heteroskedasticity with Panel-Specific AR(1) FGLS [6]
E/A Ratio	**0.8978*****
	(0.1634)
E/A Ratio*Crisis	**0.9962***
	(0.6035)
Tbill_r	**-0.0493***
	(0.0273)
Tbill_r*Crisis	1.8718**
	(0.8338)
LnRGDP	**0.2109*****
	(0.0300)
lnRGDP*Crisis	**0.4707****
	(0.2189)
RBC	**-0.1163*****
	(0.0237)
RBC*Crisis	**-7.5557****
	(3.3714)
Deposit Insurance	-0.0914***
	(0.0246)
Time	0.0008
	(0.0010)
Quarter1d	-0.0414***
	(0.0135)
Quarter2d	0.0120
	(0.0135)
Quarter3d	0.0005
	(0.0130)
Constant	-0.7915***
	(0.1429)
Wald-Test for join significant	184.16
Observations	550

Standard errors are in parentheses.
*** Significant at the 1 percent confidence level.
** Significant at the 5 percent level.
*Significant at the 10 percent level.
Bold represents an expected sign and significant

5.2.2. Regression Estimate Results of Lending (LARATIO) for the Seven Foreign Owned

Banks

This section will discuss the estimated parameters of equity-to-asset ratio, lnRGDP, T-Bill rate, and risk-based capital requirements and deposit insurance for the seven foreign owned banks. Since the FGLS heteroskedasticity with panel specific AR (1) model gives us the closest results to the theoretical predictions. Only the results using FGLS heteroskedasticity with panel-specific AR(1) estimation technique are reported on Table 5.3[17]. The results using FGLS heteroskedasticity with panel-specific AR(1) model are as follows:

During a normal period and in the absence of both risk-based capital requirements and the deposit insurance premium (1988: quarter1-1992: quarter4); the coefficient of equity-to-asset ratio is significantly positive at 0.4937. This coefficient confirms the theoretical analysis that an increase in equity capital led the seven foreign owned banks to

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[17] The random effects and the fixed effects models are first employed. Since the sample data does not cover the entire Thai commercial banking system and since we also separate sample data into two groups (the Thai banks and the foreign owned banks), the individual firm effects should be uncorrelated with the regressors. It might be appropriate to model the individual specific constant terms as randomly distributed across banks (random effects). The Breusch and Pagan Lagrange Multiplier test is conducted to test random effects. The Lagrange Multiplier test statistic of 1.25 led us to reject the null hypothesis of the random effects model. The Hausman statistic is 1.04; therefore, the hypothesis that the individual effects are uncorrelated with other regressors in the model cannot be rejected. However, the coefficients of explanatory variables using the OLS, Random Effects and Fixed Effects models are very close to the results from FGLS heteroskedasticity with panel-specific AR(1).

increase their lending. However, the coefficient of T-Bill rate is not significant. The parameter of lnRGDP is significant and positively correlated to the bank loans, with the coefficient of 0.2174, indicating that when real GDP increased by 1 million Baht, the ten Thai banks increased their lending by 21 percent during a normal period and in the absence of risk-based capital requirements and the deposit insurance premium.

During a normal period, with risk-based capital requirements enforcement but in the absence of the deposit insurance premium (1993: quarter1-1997: quarter2); the coefficient of equity-to-asset ratio during this period is significantly positive at 0.3637 (the product of the sum of β_1 and β_7). The result still supports the theoretical analysis that an increase in equity capital led the ten Thai banks to increase their lending, however, with lower magnitude than during the period without risk-based capital requirements. Again, the explanation is that, because the banks had to maintain the minimum equity-to-asset ratio when they issued loans, risk-based capital requirements put more pressure on the bank capital. The coefficient of risk-based capital requirements is significantly negative at -0.1300. This coefficient confirms the theoretical prediction that the capital adequacy decreases bank lending because the banks had to maintain their capital when they invested in loans, according to the capital standards. This in turn reduced the bank lending. Again, the coefficient of T-Bill rate is not significant. The parameter of lnRGDP is significant and positively correlated to the bank loans, with the coefficient of 0.0874 (the product of the sum of β_5 and β_7). The coefficient of lnRGDP indicates that when real GDP increased by 1 million Baht, the ten Thai banks increased their lending by 8 percent

during a normal period, with risk-based capital requirements enforcement, but in the absence of the deposit insurance premium.

During the financial crisis, with risk-based capital requirements enforcement but in the absence of the deposit insurance premium (1997: quarter3-1998: quarter4); the coefficient of equity-to-asset ratio during this period is significantly positive at 0.8471 (the product of the sum of β_1 and β_2 and β_7). The result is consistent with the theoretical analysis that deteriorated bank capital, as a result of the crisis, caused banks to reduce their lending. The higher coefficient of bank equity than in the previous case (during a normal period) can be explained by the fact that bank capital deteriorated during the crisis. Because the coefficient of risk-based capital requirements during this period (β_8) is not statistically significant, we cannot conclude that there was any relationship between risk-based capital requirements and the bank lending during this period. Furthermore, since the coefficients of TBILL_R and TBILL_R·CRISIS are not significant, we also cannot find the relationship between T-Bill rate and the loans issued by the seven foreign owned banks during this period. In addition, because the coefficient of lnRGDP·CRISIS is not significant, we cannot conclude that there was a relationship between lnRGDP and the bank lending during the crisis period with the presence of only risk-based capital requirements.

During a normal period, with risk-based capital requirements enforcement and with the presence of the deposit insurance premium (1999: quarter1-2001: quarter4) the coefficient of equity-to-asset ratio during this period is significantly positive at 0.2614 (the product of the sum of β_1 and β_7 and β_9), indicating that after the crisis the seven

foreign owned banks increased their lending, as their capital increased again. The coefficient of risk-based capital requirements is significantly negative at -0.2323 (the product of the sum of β_7 and β_9), implying that after the crisis and with the presence of the deposit insurance premium, risk-based capital requirements caused the ten Thai banks to decrease their lending. The negative coefficient of deposit insurance (also the product of the sum of β_7 and β_9) implies that the deposit insurance implementation caused the ten Thai banks to reduce their loans. Like the case of the ten Thai banks, this result contrasts the theoretical analysis we performed, which stipulated that when the deposits are guaranteed, the banks will be more willing to lend. Again this results suggest that, because of the deposit insurance premium that the banks are required to pay the insuring agency, the banks have to set aside some funds to pay the premium, therefore, reducing the banks' lending ability. Because the coefficient of TBILL_R·CRISIS is not significant, we cannot conclude that there was any relationship between T-Bill rate and the loans issued by the seven foreign owned banks during this period. The lnRGDP, as a fundamental economic factor, has a significant positive relationship with a change in the loans issued by the banks. The coefficient of lnRGDP is 0.0032 (the product of the sum of β_5 and β_7 and β_9), indicating that the ten Thai banks increased their lending when the Thai economy performed better after the crisis.

5.2.2.1. Summary

In the case of the seven foreign owned banks that operate in Thailand, the relationship between bank capital and lending is as predicted by the theory: an increase in capital led the banks to expand their loans. This relationship is also true during the crisis with a higher magnitude, where a decrease in the bank capital caused a greater reduction in loans than during a normal period. However, when we compare the coefficients of equity capital between the Thai and the foreign owned banks, we discover that the Thai banks have higher coefficients during both a normal economy and the crisis periods. This suggests that the Thai banks lent more aggressively and possibly to riskier endeavors than the foreign owned banks. As a result, when the economy was hit by the crisis, these practices by the Thai banks led to greater deterioration on Thai banks balance sheets. In the case of the foreign banks, a different management style was the reason they did not lend as aggressively and riskily as did the Thai banks. Because the foreign banks have technologies and know-how from their headquarters, big and successful banks, their lending policies have better screening and monitoring of loan applicants. This advantage led the foreign banks to have a higher quality of loan portfolios that contained less risky loans. Thus, the foreign banks' loan losses problem during the crisis was not as severe as the Thai banks' problems. As expected, risk-based capital requirements forced the foreign banks to reduce the loans in their portfolios, in order to maintain the minimum capital ratio, as shown in the positive coefficient of the risk-based capital requirements. However, the results during the crisis show no relationship between the implementation of risk-based capital requirements and the lending from the foreign owned banks,

indicating that, on average, risk-based capital requirements did not contribute to a lending contraction among the foreign owned banks. Perhaps the reason was that the foreign owned banks could not earn a sufficient market share. Also, their limited branch expansion ability may have resulted in fewer, safer loans than those issued by the Thai banks. The only negative effect on foreign bank lending was from the deterioration of bank capital. Thus, during the crisis period they did not have to reduce the number of loans to maintain the minimum capital requirements. The deposit insurance implemented in 1999 had the same effect on the foreign owned banks as the on Thai banks. Because the banks have to set aside some funds to pay for the deposit insurance premium, this reduces the banks' ability to lend. Lastly, in the case of the foreign owned banks, the T-Bill rate variables are not significant during both periods, implying there is no relationship between changes in the Thai government securities interest rate and foreign owned bank lending. This result makes sense since foreign owned banks have to follow the policies of their headquarters and have more choices for holding safe assets, rather than ones offered by the Thai government alone. Therefore, the foreign banks' decision to lend might not be affected by changes in the Thai government securities interest rate.

Table 5.3. Estimates of Changes in Loans of the Seven Foreign Owned Banks

Regressors	Heteroskedasticity with Panel-Specific AR(1) FGLS [6]
E/A Ratio	**0.4937***
	(0.0822)
E/A Ratio*Crisis	**0.4834***
	(0.1727)
Tbill_r	-0.0078
	(0.0312)
Tbill_r*Crisis	0.2698
	(0.9790)
LnRGDP	**0.2174***
	(0.0337)
lnRGDP*Crisis	0.0705
	(0.2643)
RBC	**-0.1300***
	(0.0264)
RBC*Crisis	-1.0847
	(3.9933)
Deposit Insurance	-0.1023***
	(0.0276)
Time	0.0007
	(0.0011)
Quarter1d	0.0161
	(0.0184)
Quarter2d	0.0564***
	(0.0155)
Quarter3d	0.0153
	(0.0130)
Constant	-0.9316
	(0.1593)
Wald-Test for join significant	249.47
Observations	385

Standard errors are in parentheses.
*** Significant at the 1 percent confidence level.
** Significant at the 5 percent level.
*Significant at the 10 percent level.
Bold represents an expected sign and significant.

In addition, to see whether bank ownership affects bank lending behavior, we also run a separate regression for the ten Thai banks with dummy variables representing different ownerships, state-owned banks and private-owned banks. The results are reported in Table 5.4. The results for private-owned banks are similar to the previous case with no ownership dummies. The coefficient of bank equity is significantly positive during a normal period, and is significantly positive with a higher magnitude during the crisis. However, for the state-owned bank (Krung Thai bank), the coefficient of bank equity is only significant during a normal period. The insignificant coefficient of bank equity during the crisis indicates that there was no relationship between Krung Thai bank's equity and it lending during the crisis. For the coefficients of the two regulations (risk-based capital requirements and deposit insurance), the results of both state-owned and private-owned banks suggest the same negative relationships between risk-based capital requirements, deposit insurance, and bank lending.

Table 5.4. Estimate of Changes in Loans for Thai Banks (Ownership Dummies)

Regressors	Heteroskedasticity with panel-specific AR(1)
EARATIOSTATE	4.0118***
	(0.9150)
EARATIOCRISISSTATE	-3.6266
	(4.9120)
EARATIOPRIVATE	0.7543***
	(0.1613)
EARATIOCRISISPRIVATE	1.0444***
	(0.6467)
TBILL_RSTATE	-0.0467
	(0.0782)
TBILL_RCRISISSTATE	5.3604
	(4.7806)
TBILL_RPRIVATE	-0.0457***
	(0.02835)
TBILL_RCRISISPRIVATE	1.7874***
	(0.8647)
LnRGDPSTATE	0.2037***
	(0.5603)
LnRGDPCRISISSTATE	1.2463***
	(0.0856)
LnRGDPPRIVATE	0.2049***
	(0.0302)
LnRGDPCRISISPRIVATE	0.4605**
	(0.2269)
RBCDUMSTATE	-0.1175***
	(0.0464)
RBCDUMCRISISSTATE	-6.1384***
	(-2.2386)
RBCDUMPRIVATE	-0.1161***
	(0.0238)
RBCDUMCRISISPRIVATE	-7.2717**
	(-3.4960)
DEPDUMSTATE	-0.0820*
	(0.0526)
DEPDUMPRIVATE	-0.0923***
	(0.0249)
Time	0.001
	(0.0010)
quarter1d	0.0533***
	(0.0133)
quarter2d	0.0401***
	(0.0132)
quarter3d	0.0419***
	(0.0135)
Constant	-0.8166***
	(0.1408)
Wald-Test for joint significant	198.65
Obs.	550

Furthermore, to see whether bank size affects bank lending behavior, we also ran another regression for the ten Thai banks with dummy variables representing different sizes of bank assets. We followed Leightner and Lovell (1998) and categorize the banks into 3 groups, 'big' if bank assets exceed 100 million baht, 'Medium' if bank assets exceed 50 million baht but are less than 100 million baht, and 'small' if bank assets are less than 50 million baht. The results are reported in Table 5.5. Only medium size banks have a significantly positive relationship between bank equity and their lending during both a normal period and the crisis. The coefficients of bank equity during the crisis for big and small banks are not statistically significant. The coefficients of the two regulations (risk-based capital requirements and deposit insurance), for big, medium and small banks, suggest the same negative relationships between risk-based capital requirements, deposit insurance and bank lending.

Table 5.5. Estimate of Changes in Loans for Thai Banks (Size Dummies)

Regressors	Heteroskedasticity with panel-specific AR(1)
EARATIOBIG	6.4945***
	(0.3996)
EARATIOCRISISBIG	0.5387
	(0.9646)
EARATIOMED	7.4623***
	(0.4272)
EARATIOCRISISMED	6.2122***
	(1.7277)
EARATIOSMALL	0.1799
	(0.1495)
EARATIOCRISISSMALL	-0.1294
	(0.6771)
TBILL_RBIG	0.0349
	(0.0267)
TBILL_RCRISISBIG	4.941***
	(0.9059)
TBILL_RMED	-0.0005
	(0.0268)
TBILL_RCRISISMED	1.0796
	(0.8604)
TBILL_RSMALL	-0.0862***
	(0.3827)
TBILL_RCRISISSMALL	2.5583**
	(1.2824)
LnRGDPBIG	0.0798***
	(0.0236)
LnRGDPCRISISBIG	1.354***
	(0.2340)
LnRGDPMED	0.1007***
	(0.0235)
LnRGDPCRISISMED	0.3326*
	(0.2253)
LnRGDPSMALL	0.1623***
	(0.0291)
LnRGDPCRISISSMALL	0.6899**
	(0.3321)

Table 5.5. (Continued) Estimate of Changes in Loans for Thai Banks

(Size Dummies)

Regressors	Heteroskedasticity with panel-specific AR(1)
RBCDUMBIG	**-0.0615*****
	(0.0188)
RBCDUMCRISISBIG	**-6.4513*****
	(-2.6496)
RBCDUMMED	**-0.0460*****
	(0.0187)
RBCDUMCRISISMED	**-4.6078*****
	(2.4814)
RBCDUMSMALL	**-0.0963*****
	(0.0239)
RBCDUMCRISISSMALL	**-5.5747*****
	(1.1741)
DEPDUMBIG	-0.0131
	(0.0204)
DEPDUMMED	-0.0528***
	(0.0199)
DEPDUMSMALL	-0.0895***
	(0.0265)
Time	0.0007
	(0,0006)
Quarter1d	-0.6124
	(0.0093)
Quarter2d	0.0117
	(0.0089)
Quarter3d	0.0069
	(0.0089)
Constant	-0.4631***
	(0.0928)
Wald-Test for joint significant	1011.47
Obs.	550

5.3. The Predicted Bank Lending in The Case of No Regulations

According to the estimation results (Table 5.2 and 5.3), we were able to accept the first hypothesis: bank capital deterioration leads to a decrease in bank lending (capital crunch) in Thailand. We are next interested in testing the second hypothesis: whether the regulations (risk-based capital requirements and deposit insurance) contribute to a greater credit contraction. In order to test this hypothesis, we will use the estimated coefficients of both the ten Thai and the seven foreign owned banks to predict bank lending without risk-based capital requirements, without deposit insurance, or without both. The results will be used to compare with the actual bank lending to determine whether the regulations contributed to a greater credit contraction. The results of are illustrated in Figures 5.1 to 5.23.

5.3.1. The Ten Thai Banks

Figures 5.1 to 5.13 present the comparisons of the actual bank lending from 1988 to 2001 and the predicted lending results among the ten Thai banks without risk-based capital requirements, deposit insurance, or both.

5.3.1.1. Without Risk-Based Capital Requirements. For all the banks in the sample, there are two periods that bank lending contracted drastically: during the implementation of risk-based capital requirements and during the financial crisis. When we look at the predicted bank lending without risk-based capital requirements, it is clear that the bank loans would not have been contracted as much as the actual lending contraction during a

normal period and during the crisis. According to the empirical results discussed in the previous section (risk-based capital requirements forced the banks to decrease their lending because they had to maintain the minimum capital-to-asset ratio), it makes sense that risk-based capital requirements contributed to a greater contraction in bank lending. During a normal period, risk-based capital requirements caused the Thai banks to lend less than if this particular regulation were not enforced. Because the banks had to maintain the required capital-to-asset ratio when they issued loans, the result was lower capital, which is the source of funds for bank loans. During the crisis, the aggressive and risky lending of the ten Thai banks generated large loan losses from the economic downturn. Thus, the banks had to provide more capital for those loan losses, reducing the already deteriorated bank capital even more and further limiting bank lending.

5.3.1.2. Without Deposit Insurance. Since deposit insurance was implemented in 1999, after the crisis, we can only compare the results of the prediction without the deposit insurance to the actual lending after 1999. The predicted bank lending results show that without deposit insurance the ten Thai banks would have issued more loans, which makes sense, because the deposit insurance premium the banks had to pay reduced the banks' lending ability.

5.3.1.3. Without Both Regulations. When we take both regulations into consideration, we can predict the bank loans in the absence of the both regulations. Without risk-based capital requirements and deposit insurance, we find that the contraction of Thai bank

lending would have been less than the actual lending contraction. In other words, for the ten Thai commercial banks, the credit crunch situation would have been less severe without the two regulations. Thus, the risk-based capital requirements and deposit insurance contributed to a greater credit contraction.

5.3.2. The Seven Foreign Banks

Figures 5.14 to 5.23 present the comparisons of the actual bank lending from 1988 to 2001 and the predicted lending results among the seven foreign banks without risk-based capital requirements, deposit insurance, or both.

5.3.2.1. Without Risk-Based Capital Requirements.

On average, the foreign owned banks faced a sharp contraction in their lending only during the crisis period. Furthermore, when we compare the results from the foreign banks to the Thai banks, unlike the ten Thai banks, the foreign bank lending significantly contracted only during the crisis, the result of more conservative lending behavior due to lending policies from their headquarters. During a normal period, the foreign banks did not expand their loans as aggressively as the Thai banks did. As a result, they did not have to set aside as much capital to maintain the minimum capital-to-asset ratio. Thus, the lending of the foreign banks was not affected much by capital shortage that the Thai banks experienced. During the crisis period, the foreign banks faced capital deterioration, which is normal during economic downturns, resulting in a lending contraction. Moreover, the regression results in the earlier section suggest that there was no relationship between risk-based capital

requirements and lending during the crisis, implying that the contraction of the foreign bank loans during the crisis was primarily caused by the deterioration of the bank capital. Thus, on average, risk-based capital requirements did not have a significant impact on the lending of the seven foreign banks, compared to the ten Thai banks.

According to the regression results of the bank lending discussed earlier, the Thai banks have higher coefficients of equity both during a normal period and during the crisis. These coefficients imply that the Thai banks lend more aggressively. This lending behavior put more burdens on the Thai banks to maintain capital requirements, especially during the crisis when the bank also suffered from loan losses. Furthermore, the more stringent rules of allowances for doubtful debts led to a severe capital shock. Therefore, the difference between the Thai and the foreign banks was that, during the crisis the Thai banks' portfolios were deteriorated from loan losses as well as from the pressure to maintain capital requirements, causing a further decline in loans. Conversely, the foreign banks reduced their loans mostly in response to the capital deterioration. Thus, we can conclude that risk-based capital requirements had a bigger role in contributing to the greater contraction of loans issued by the Thai banks compared to loans issued by the foreign owned banks.

5.3.2.2. Without Deposit Insurance. However, similar to the case of the Thai banks, after the deposit insurance was implemented in 1999, the predicted foreign bank lending shows that, without the deposit insurance, the foreign owned banks would have issued more loans.

5.3.3.3. Without Both Regulations. In the case of the absence of the both regulations, on average the loans issued by the foreign banks would not have contracted as much as they did when the both regulations were enforced.

5.4. Summary

The lending prediction results for both the ten Thai banks and the seven foreign banks suggest that, when risk-based capital requirements were first enforced, they contributed to a greater contracting in loans issued by the ten Thai banks, as opposed to no risk-based capital requirements. However, this relationship does not apply to the loans issued by the foreign owned banks on average, which was due to a different management style regarding loan extension. Because the foreign banks were more cautious about the quality and the quantity of loans they issued, they were not pressured much by the need to maintain the minimum capital-to-asset ratio, resulting in a better capital position and more stable lending. During the crisis, while the Thai banks and the foreign banks both suffered from the lending contraction, the foreign banks' lending shrinkage had a lower magnitude than the shrinkage for the Thai banks. This difference can be explained by the more conservative lending policies of the foreign banks. While deposit insurance affected the lending of the Thai and the foreign banks in the same way, the lending prediction results suggest that both risk-based capital requirements and deposit insurance contributed to a more severe credit contraction by both the Thai banks and the foreign banks. However, the effect of risk-based capital requirements and deposit insurance had a higher magnitude of impact for the Thai banks.

Figure 5.1.
Bangkok Bank: Changes in Loan/Asset Ratio

96
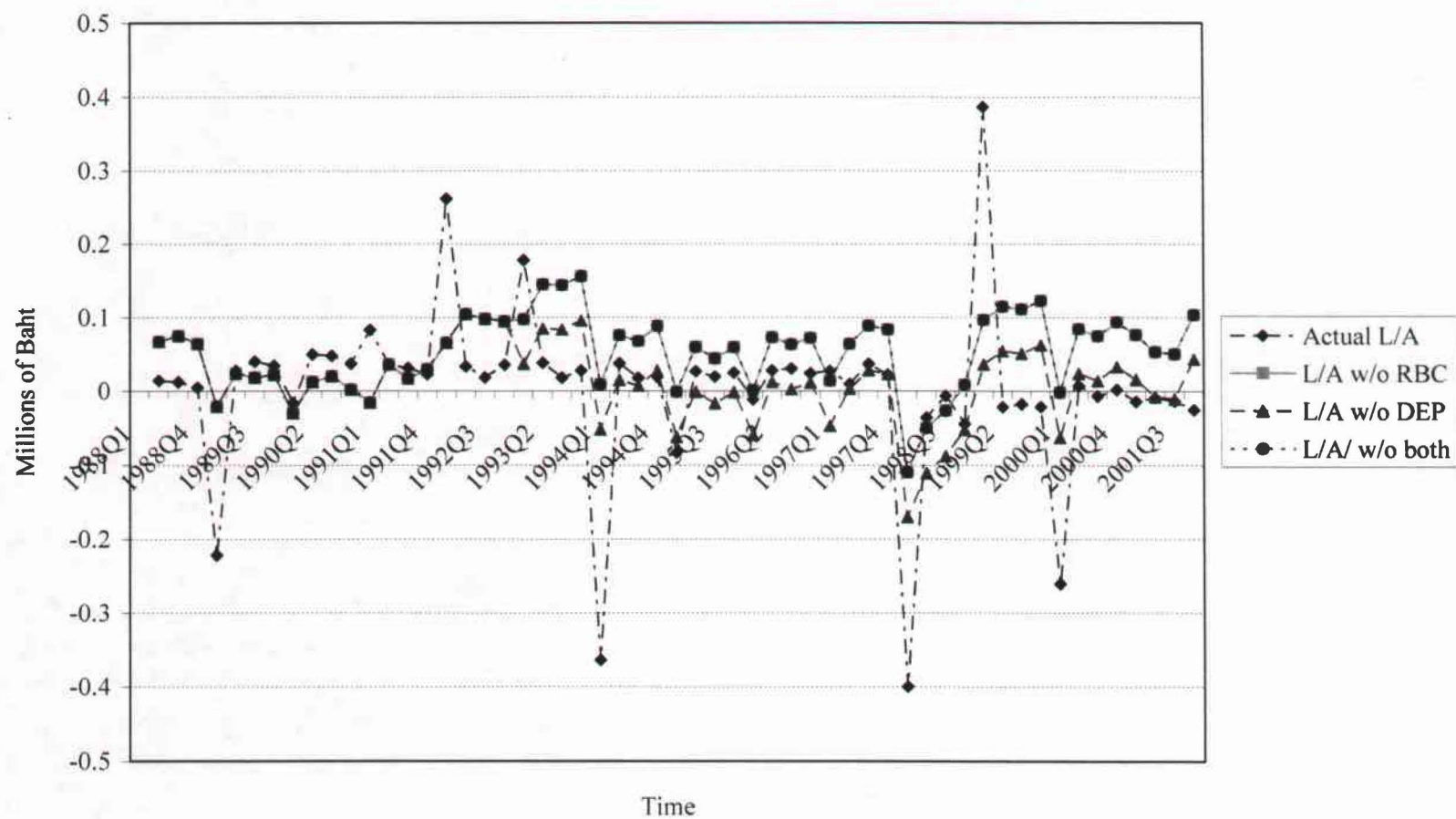
Figure 5.2.
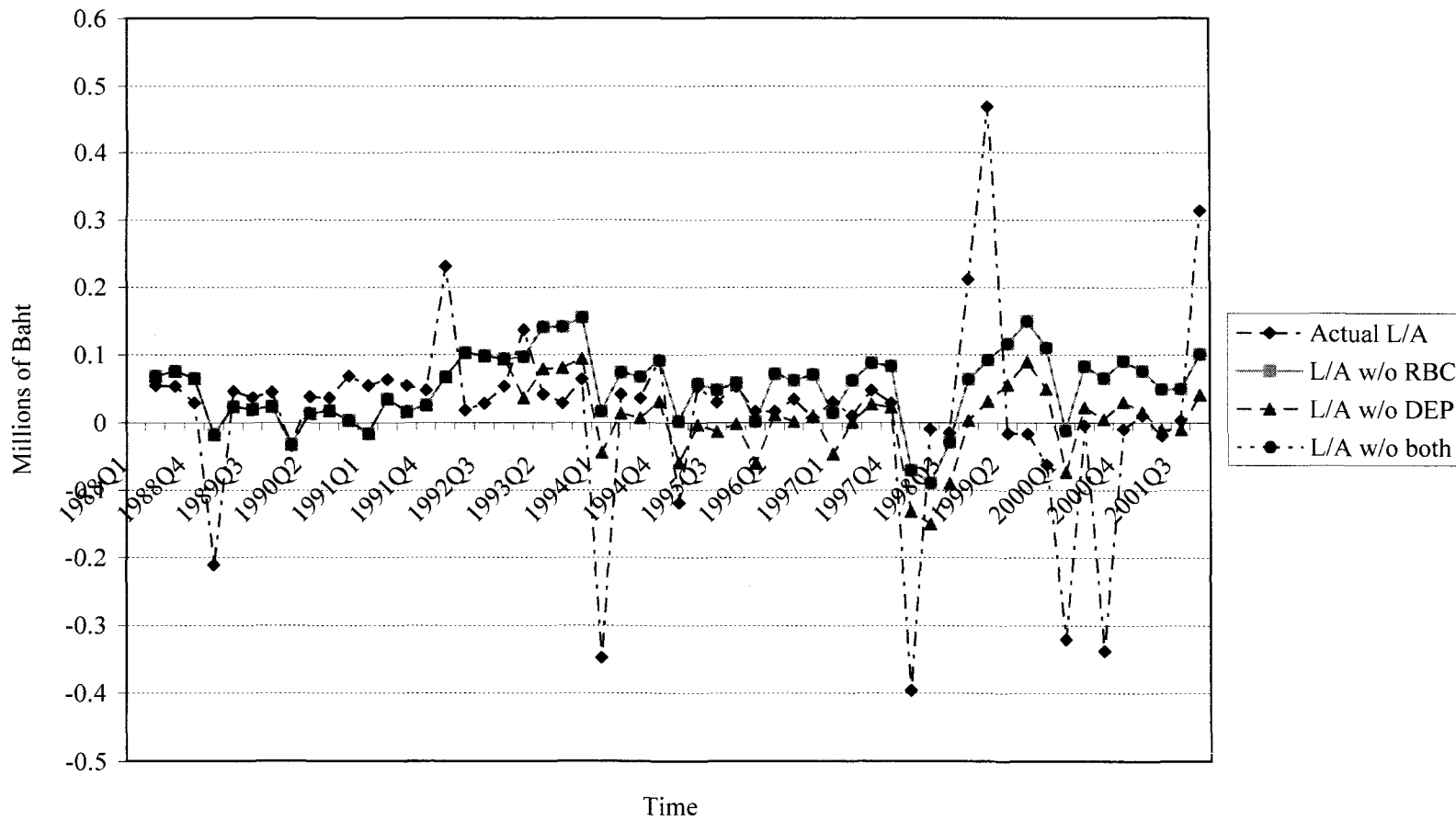Krung Thai Bank: Changes in Loan/Asset Ratio

Figure 5.3.
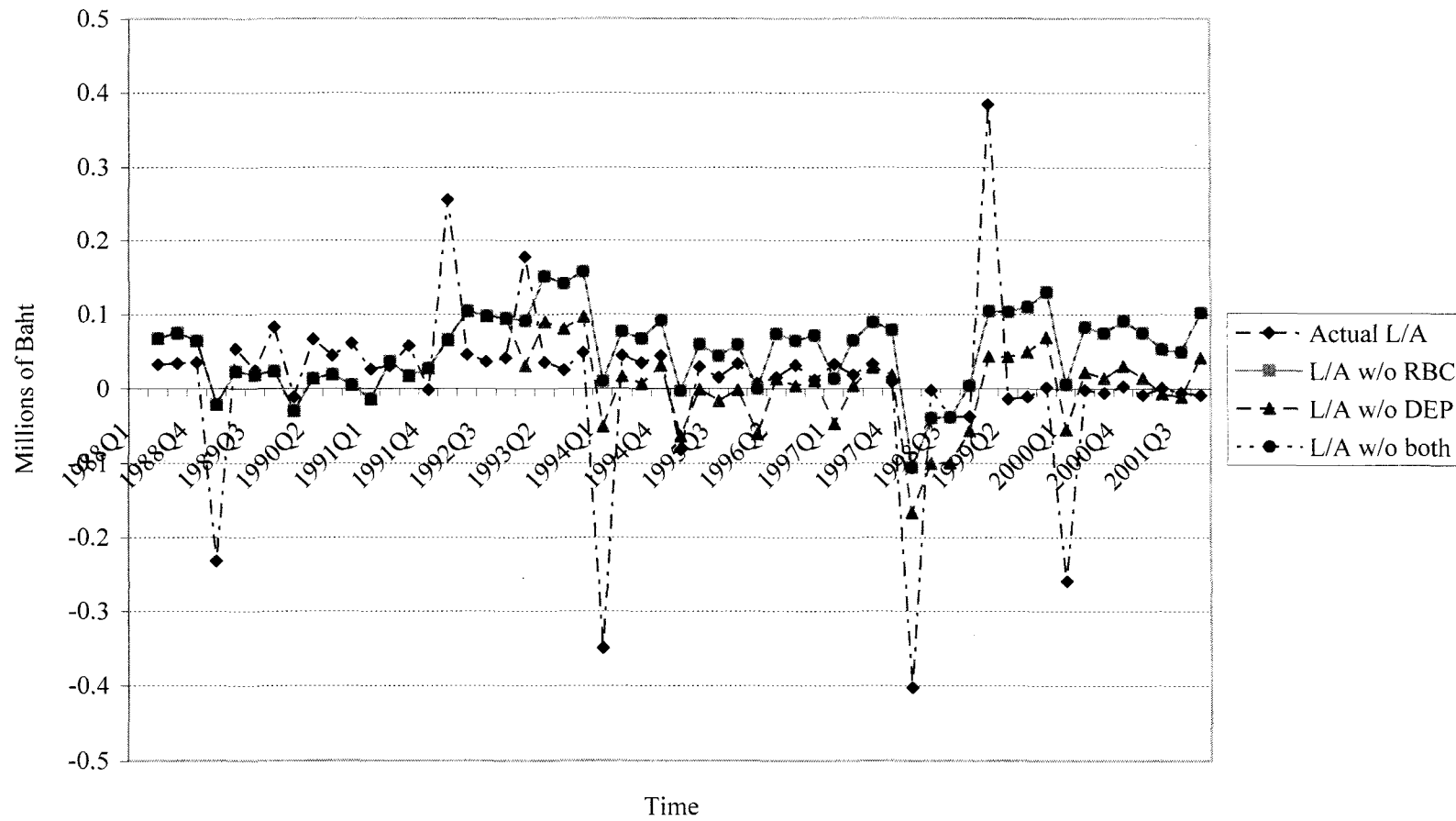Thai Farmers Bank: Changes in Loan/Asset Ratio

Figure 5.4.
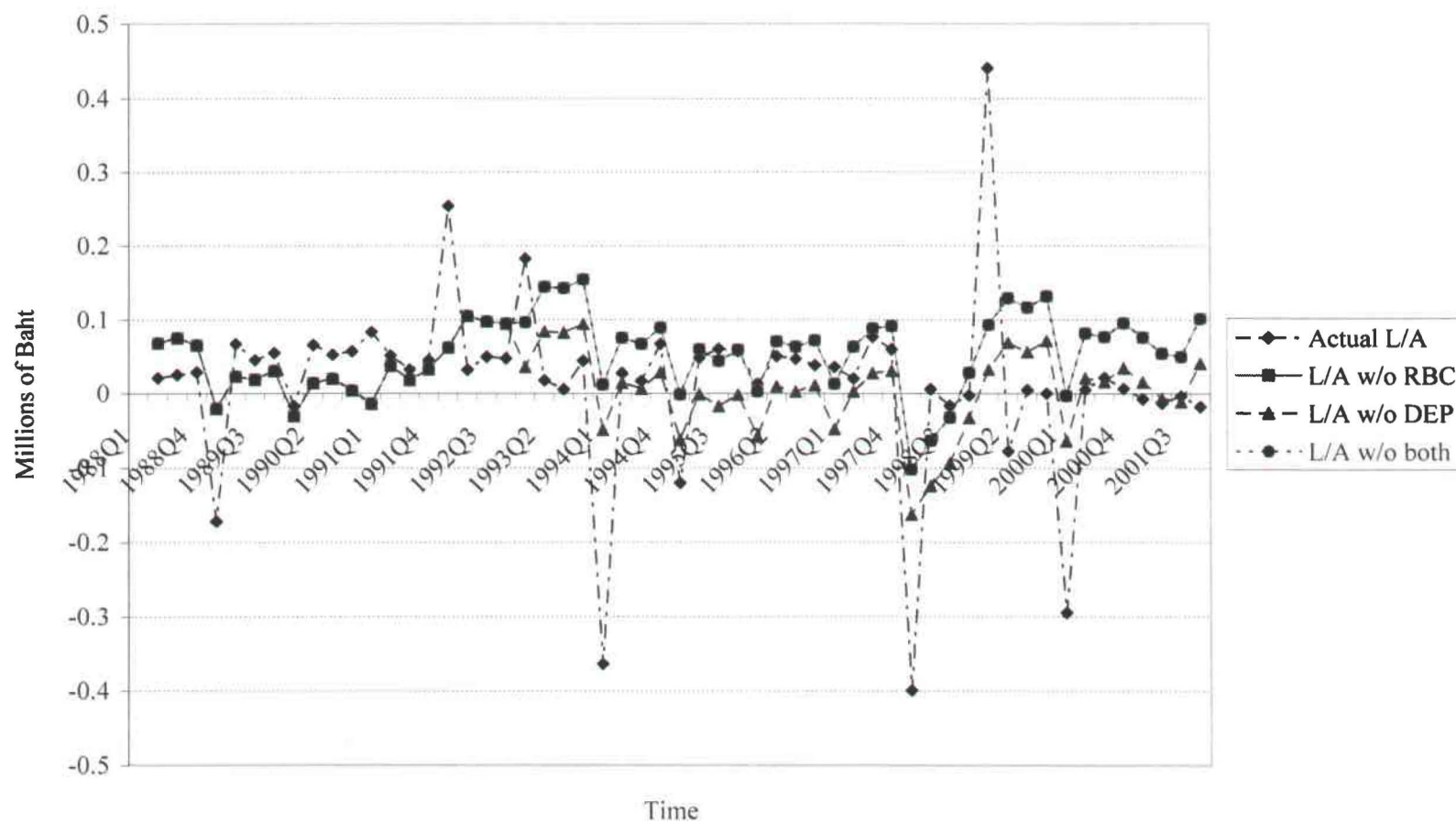Siam Commercial Bank: Changes in Loan/Asset Ratio

Figure 5.5.
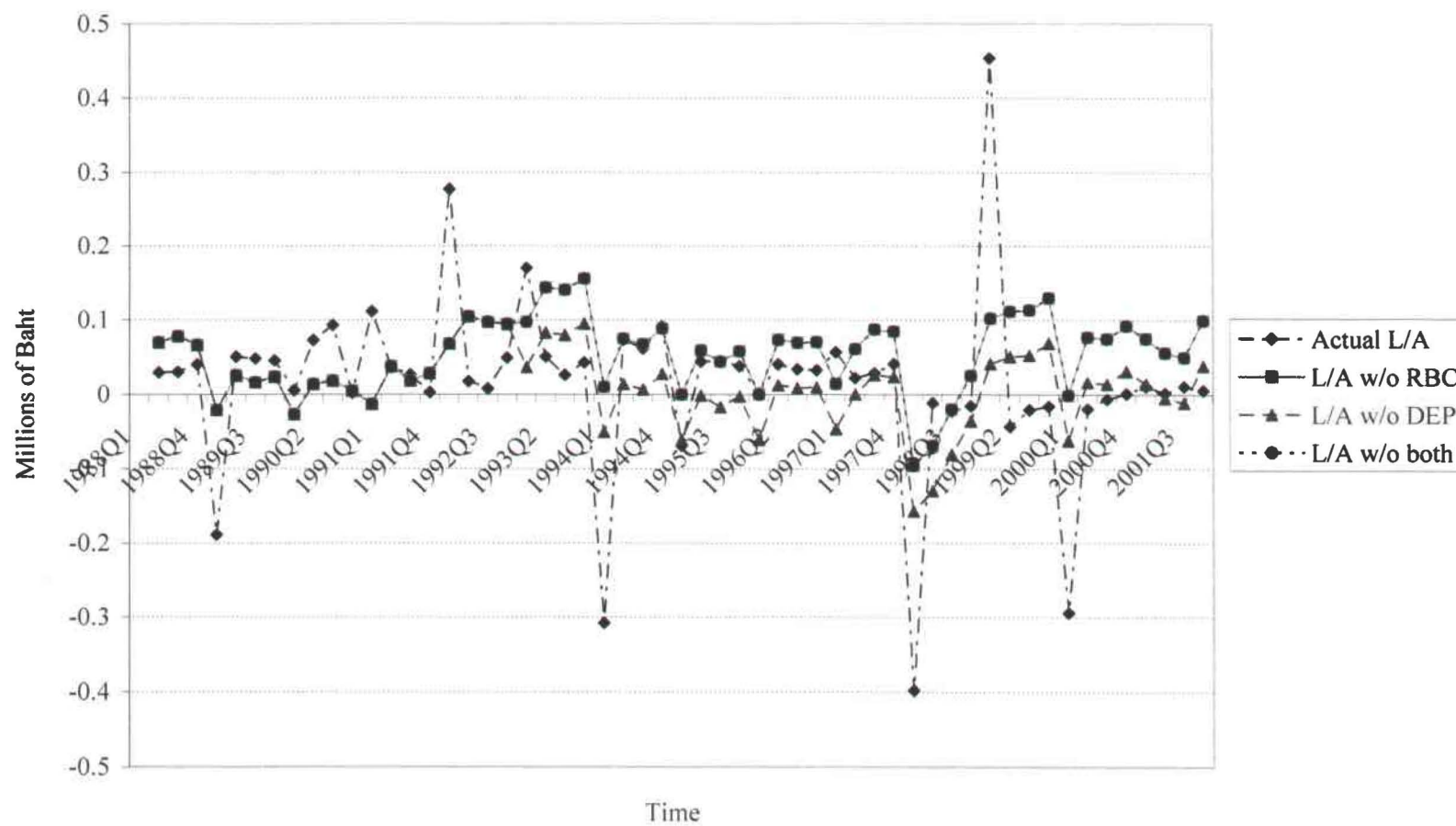Bank of Ayudhya: Changes in Loan/Asset Ratio

Figure 5.6.
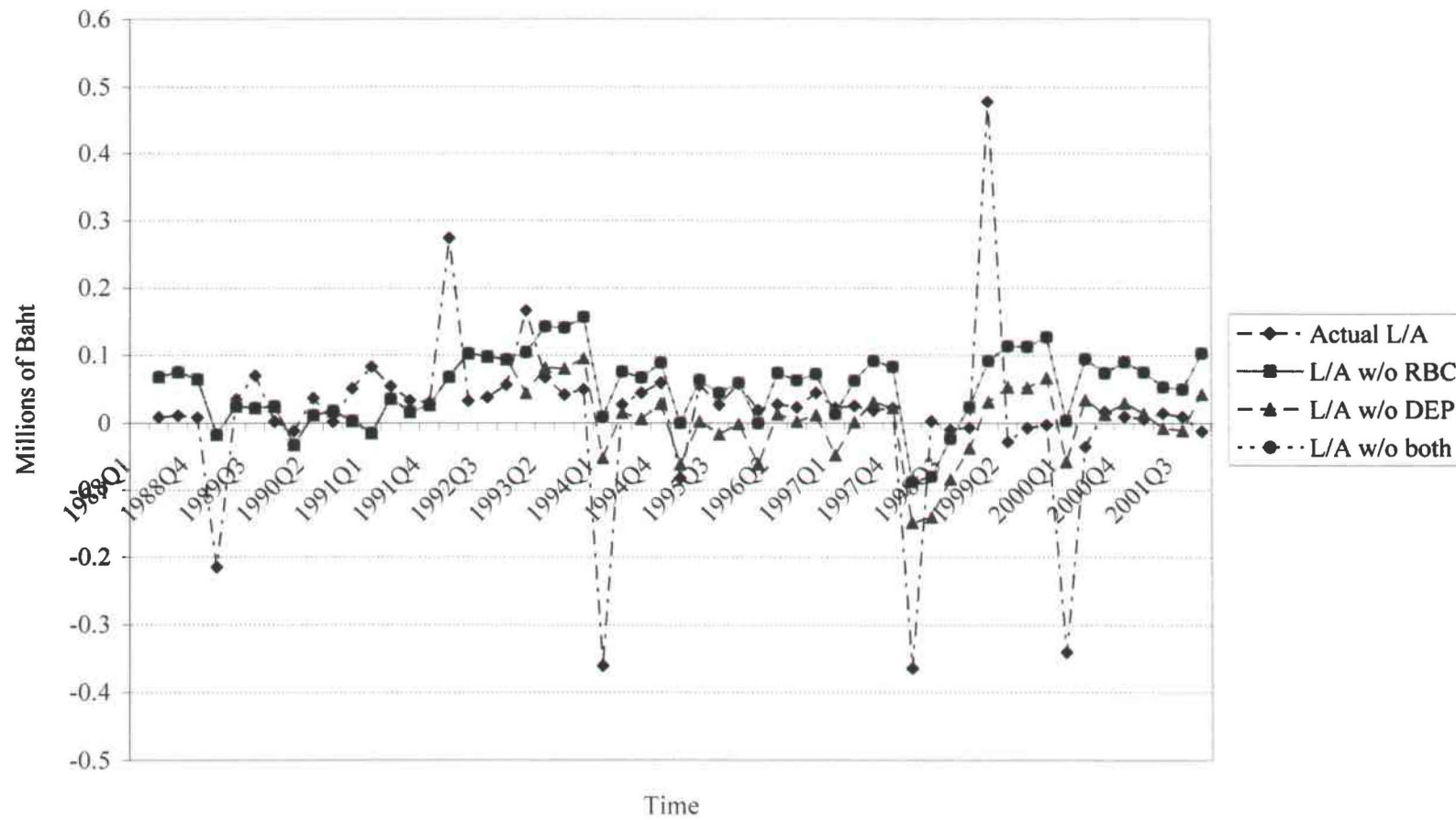The Thai Military Bank: Changes in Loan/Asset Ratio

Figure 5.7.
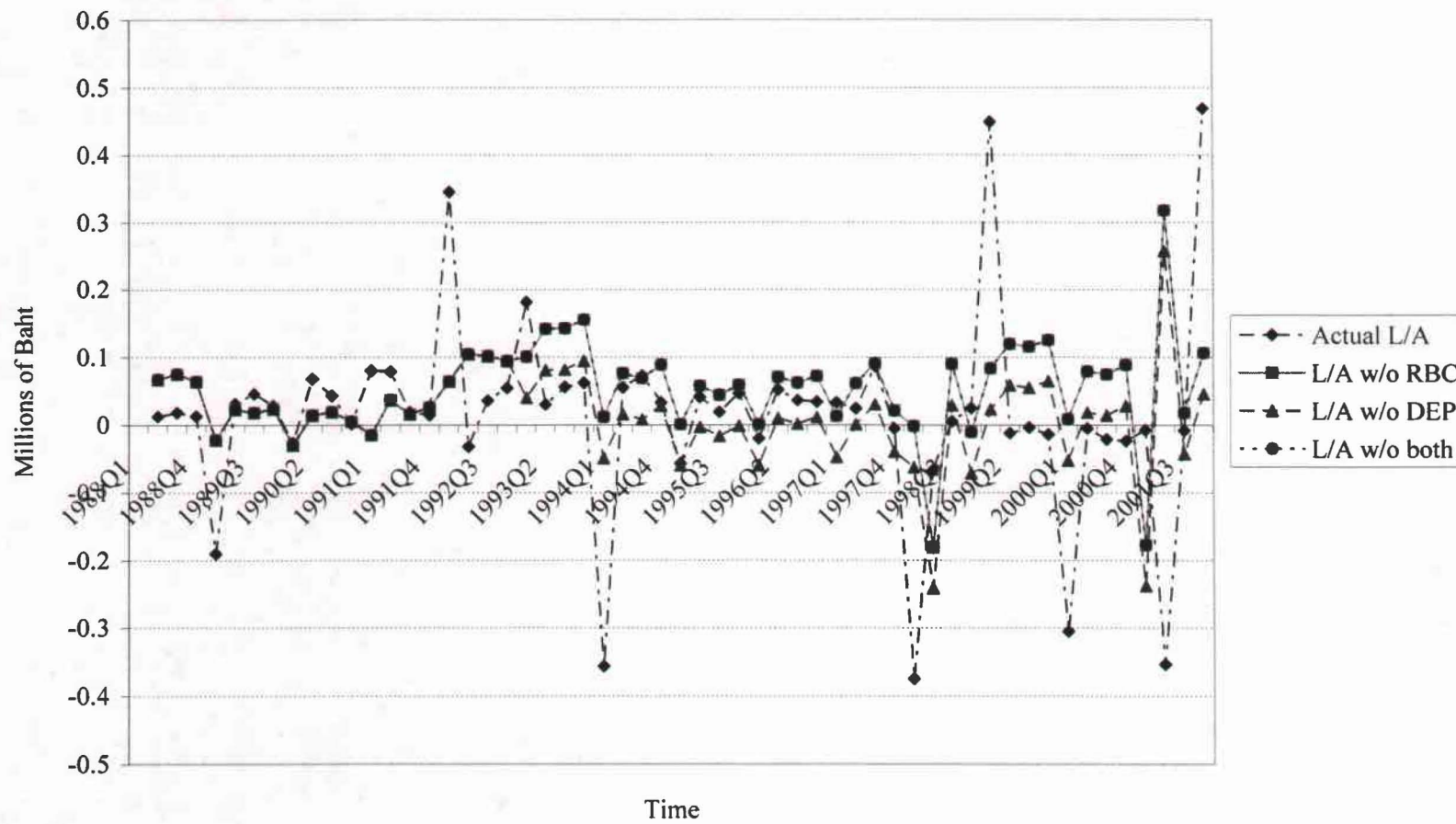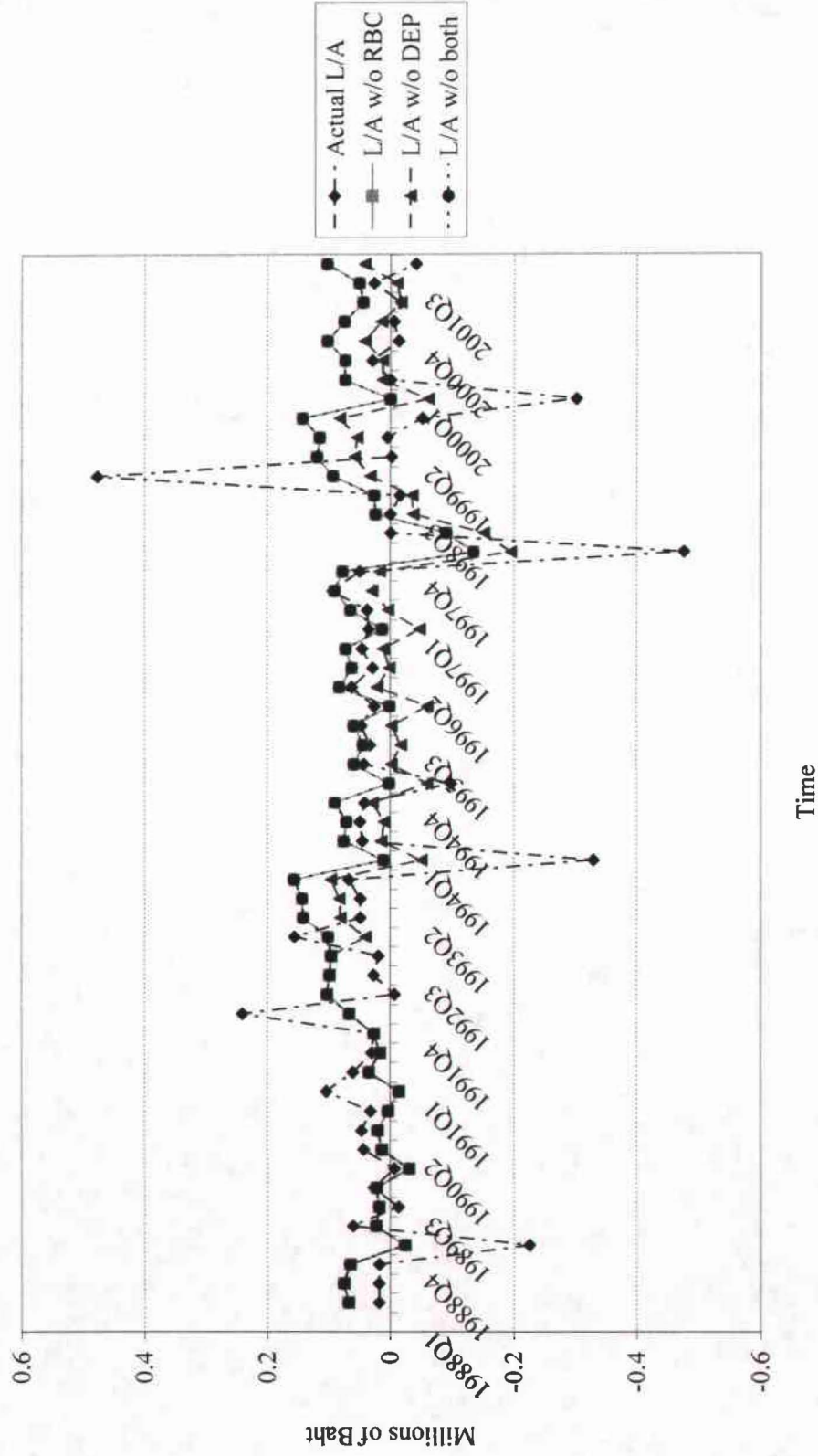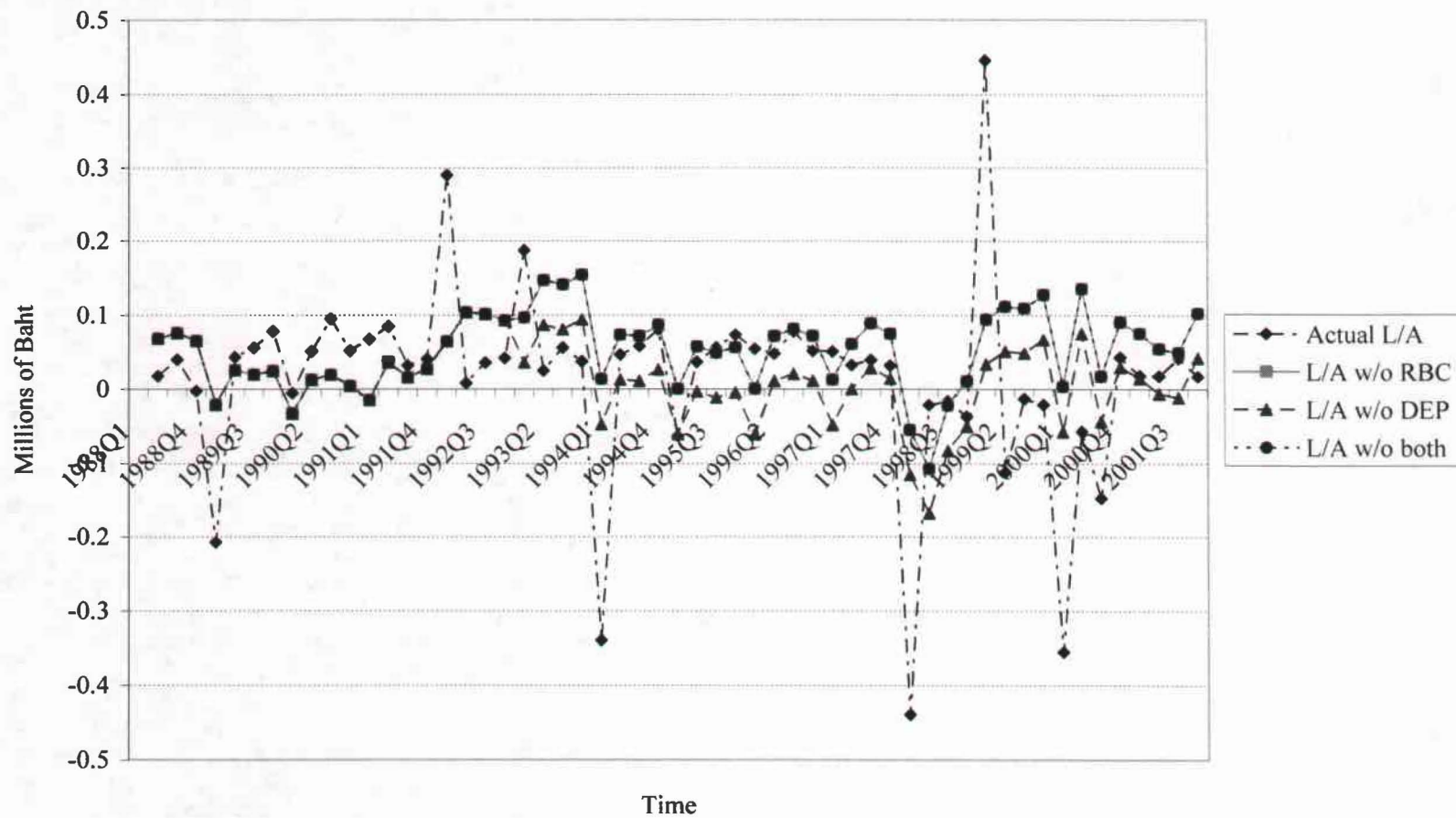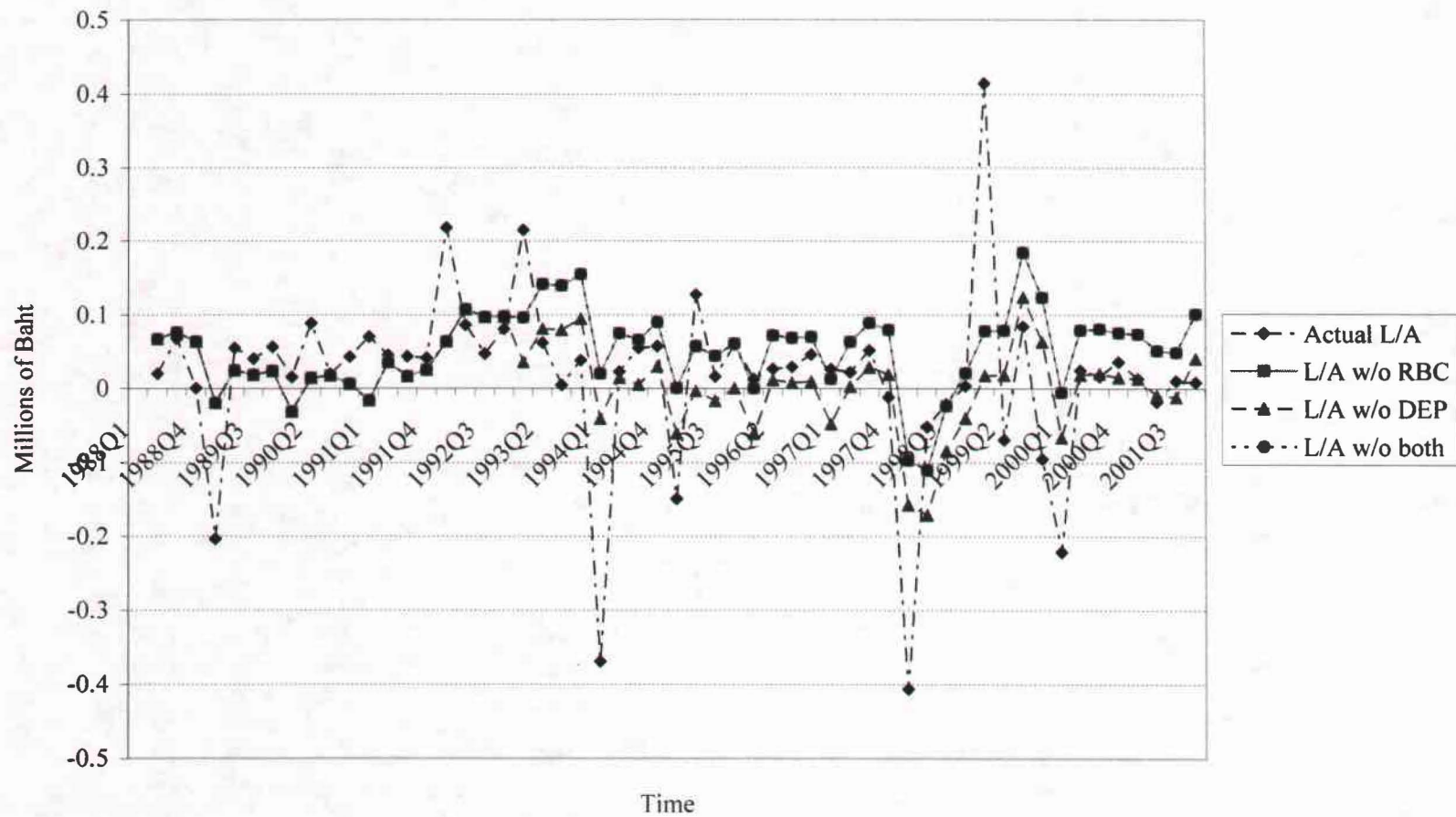Siam City Bank: Changes in Loan/Asset Ratio

102

Figure 5.8.
Bank of Asia: Changes in Loan/Asset Ratio

Millions of Baht

Time

Figure 5.9.
Thai Danu Bank: Changes in Loan/Asset Ratio

Figure 5.10.
Nakornthon Bank: Changes in Loan/Asset Ratio

105

Figure 5.11.
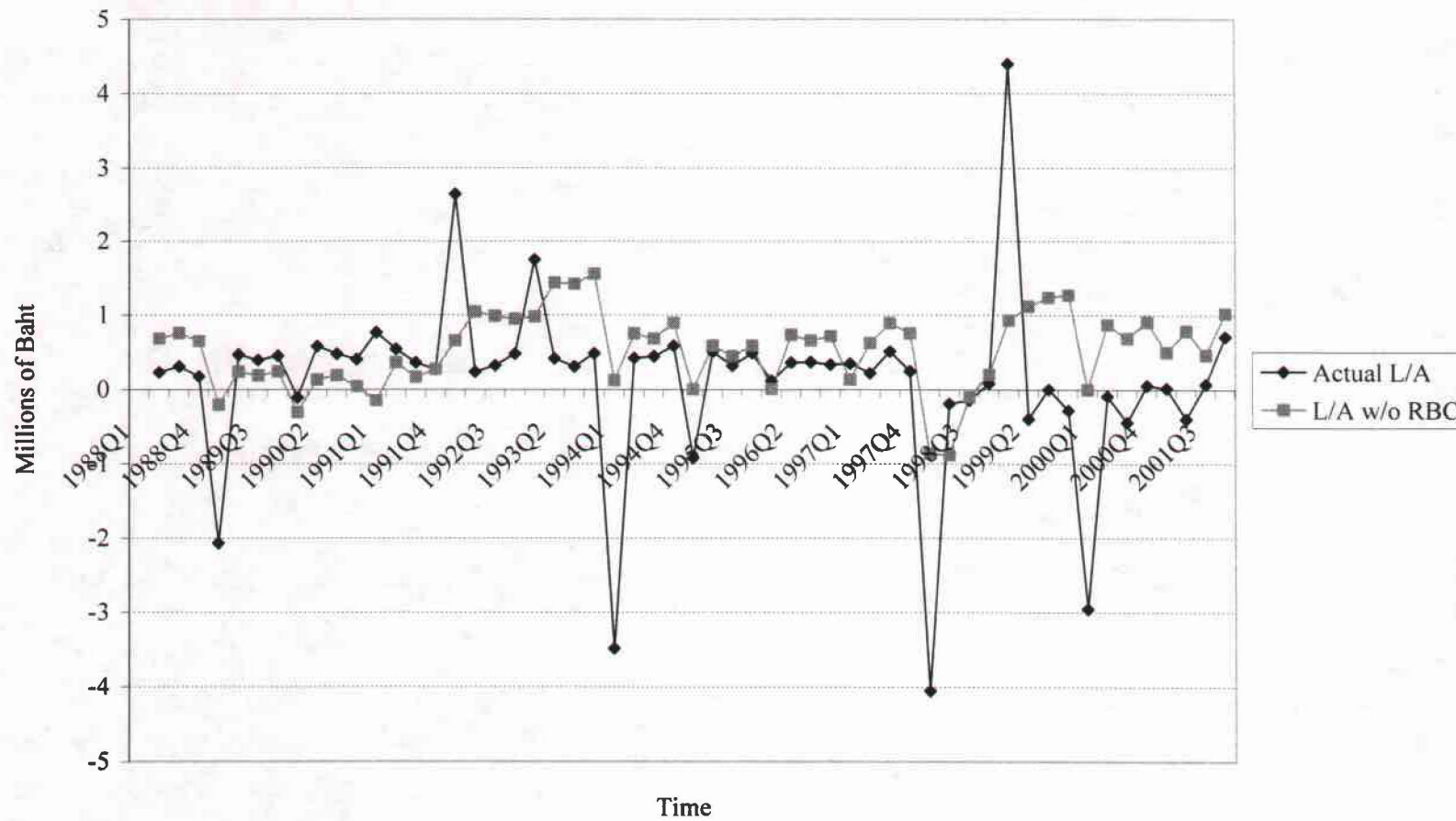Total of the 10 Thai Banks: Changes in Loan/Asset Ratio (The Case of RBC)

Figure 5.12.
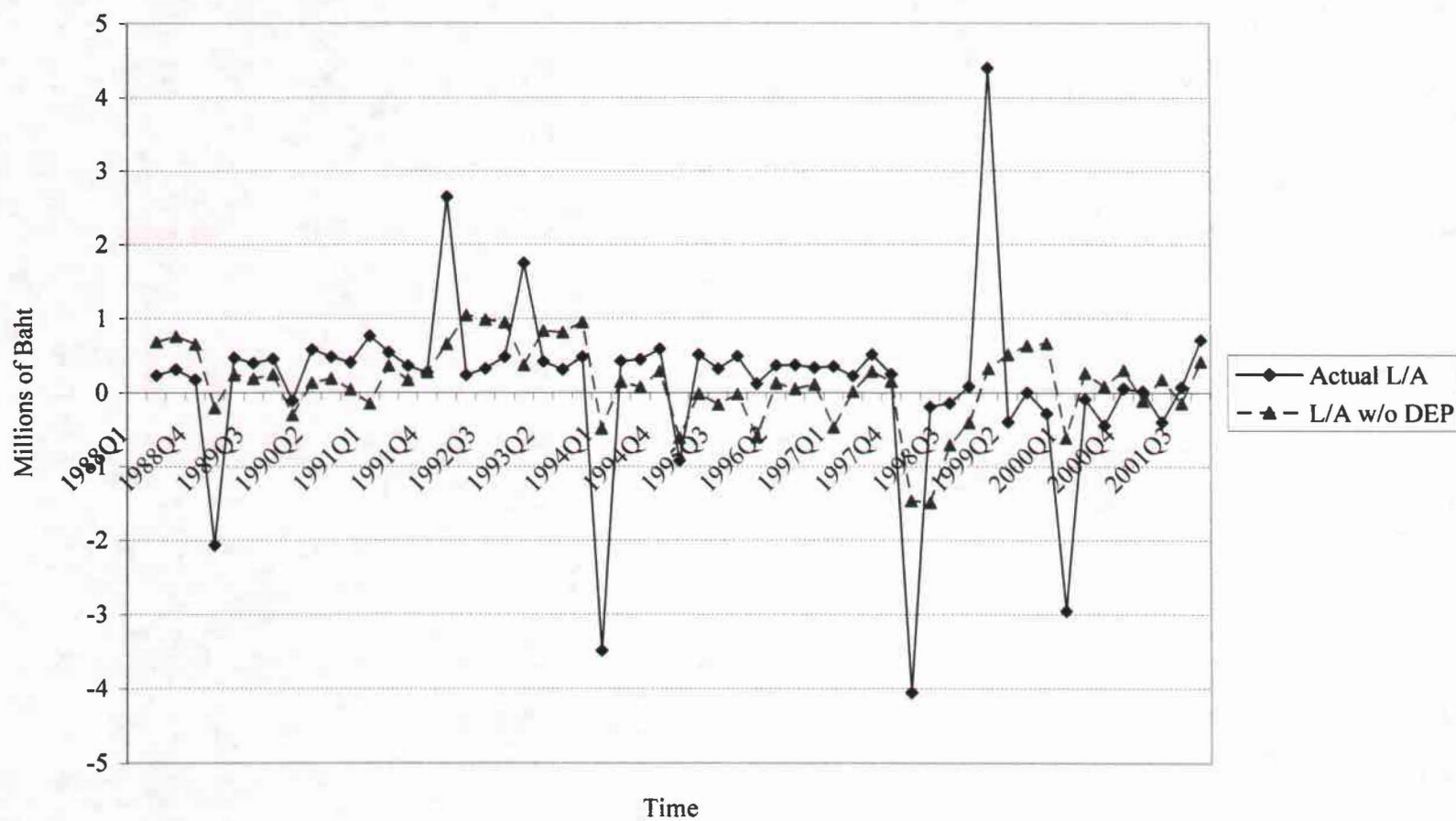Total of The 10 Thai Banks: Changes in Loan/Asset Ratio (The Case of Deposit Insurance)

Figure 5.13.
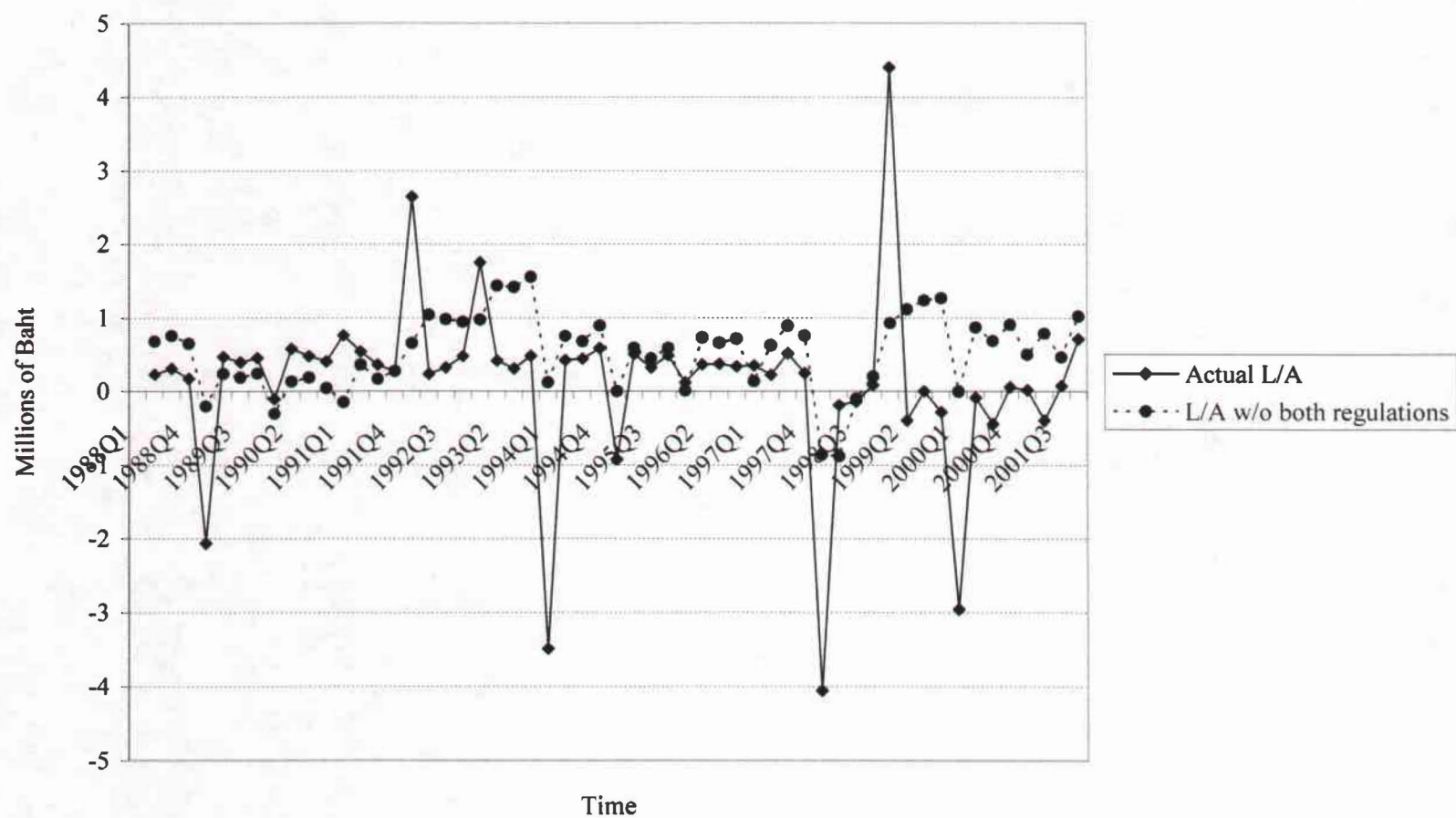Total of The 10 Thai Banks: Changes in Loan/Asset Ratio (The Case of Both Regulations)

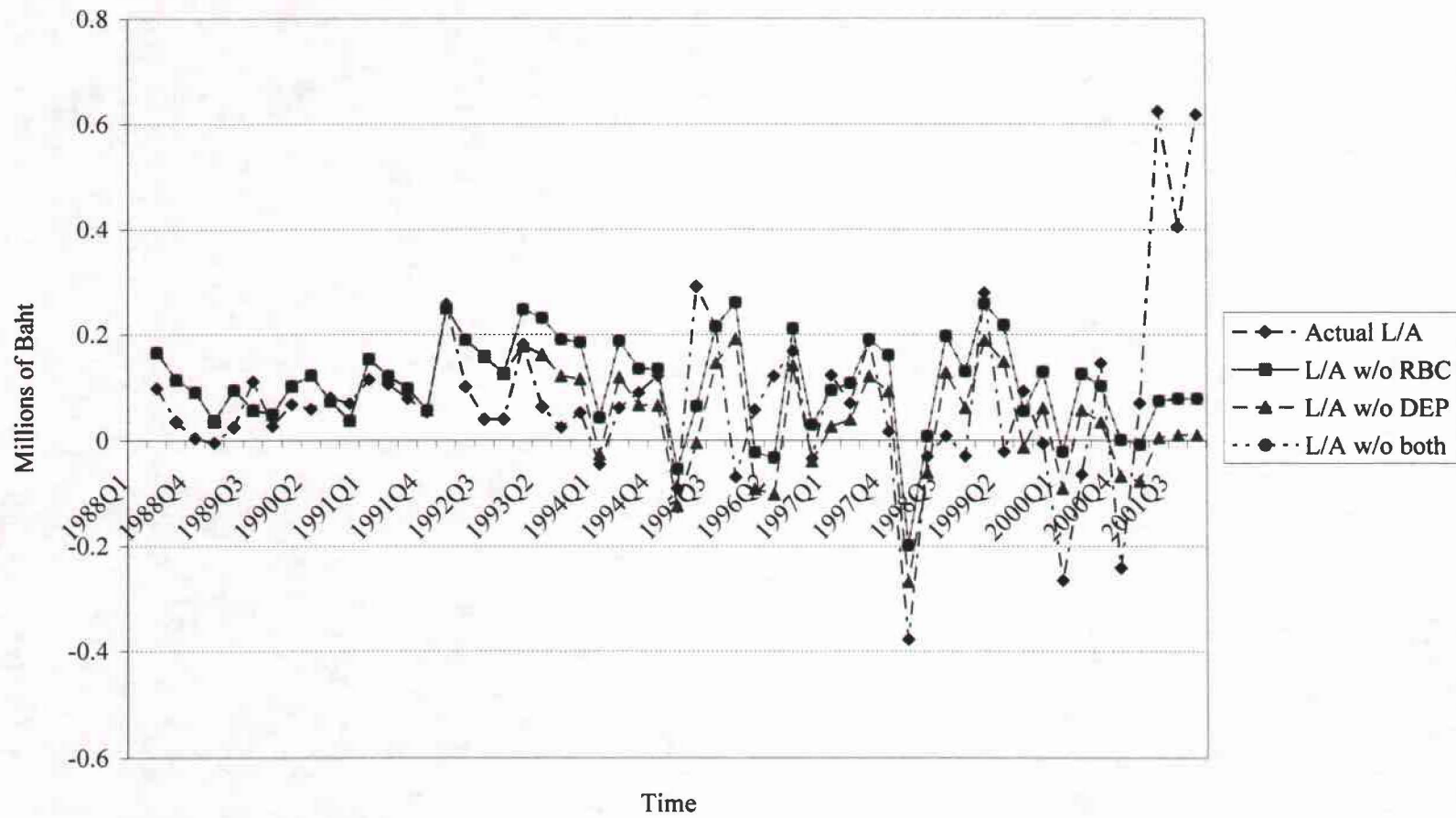Figure 5.14.
ABN-AMRO Bank: Changes in Loan/Asset Ratio

Figure 5.15.
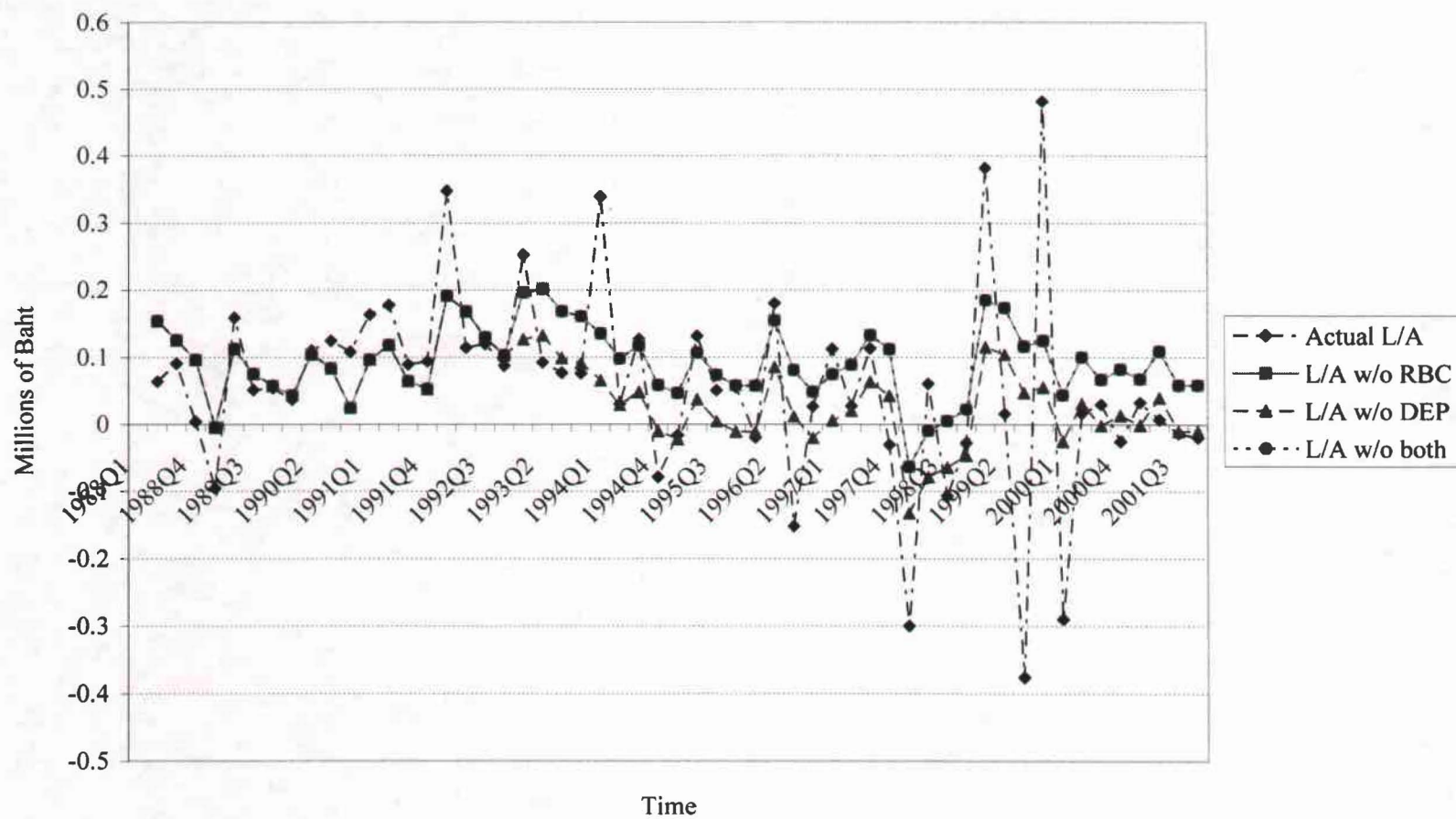The International Bank of China: Changes in Loan/Asset Ratio

Figure 5.16.
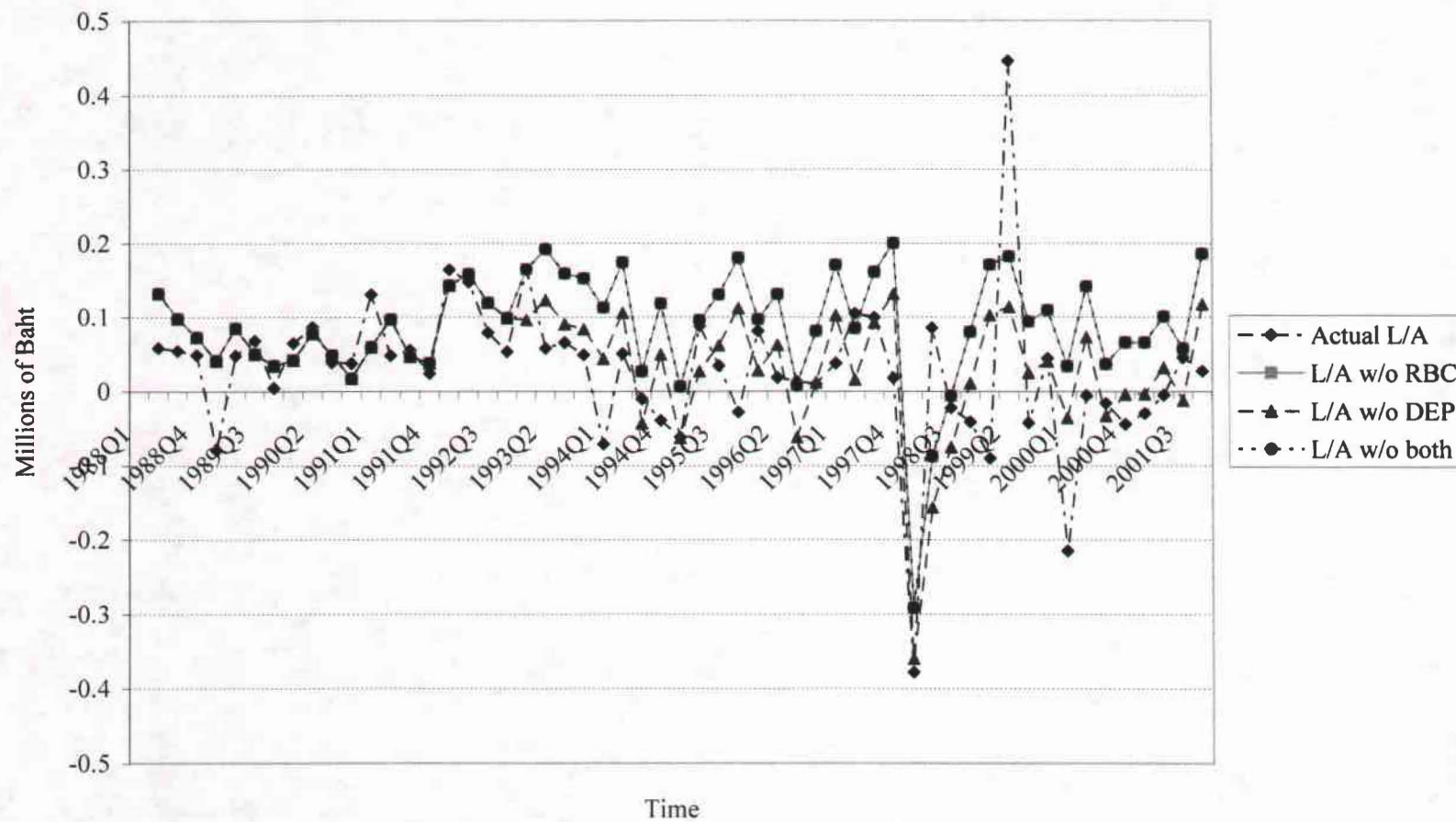Standard Chartered Bank: Changes in Loan/Asset Ratio

Figure 5.17.
Bank of Tokyo Mitsubishi: Changes in Loan/Asset Ratio

112
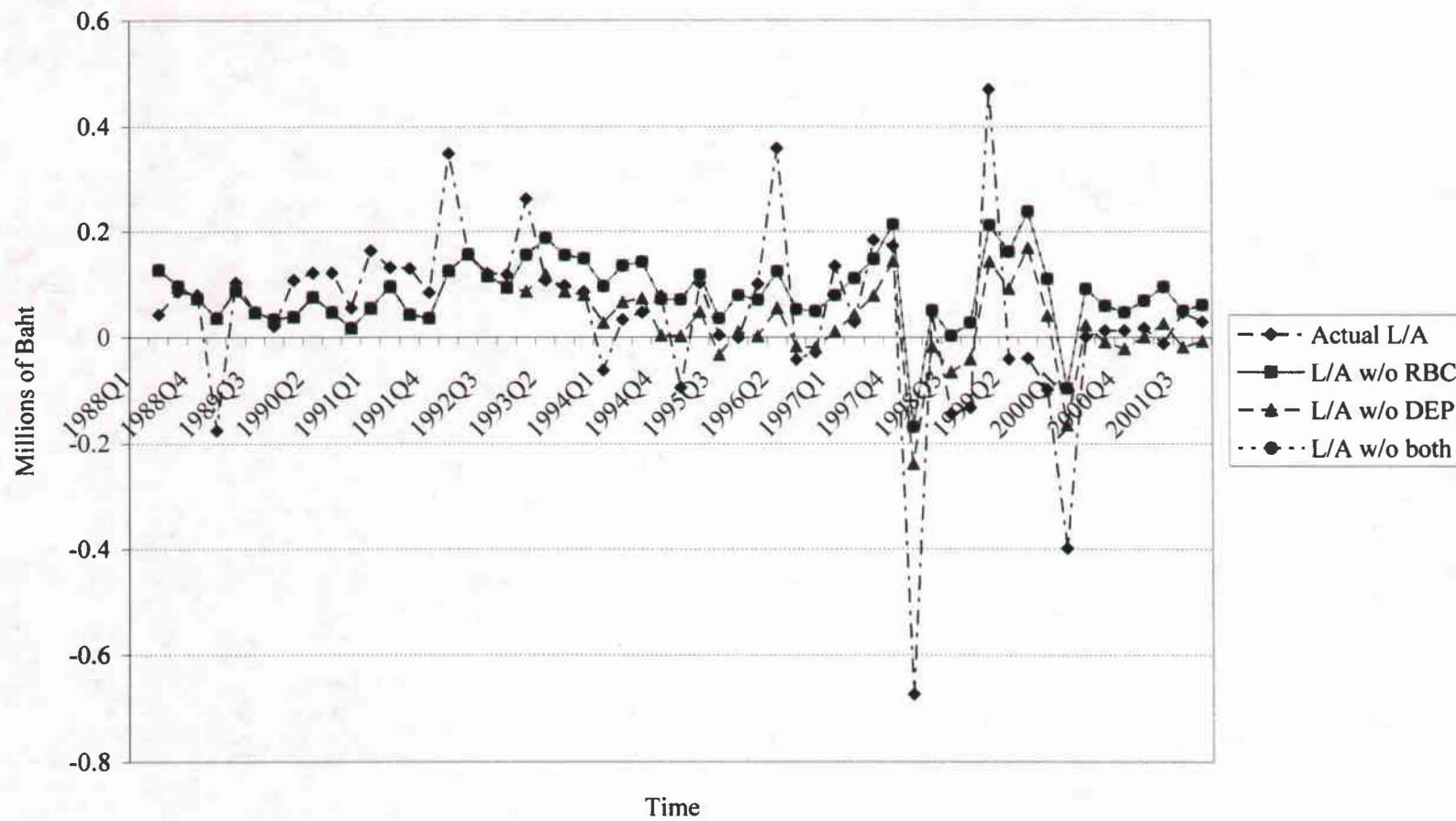
Figure 5.18.
The Hongkong and Shanghai Bank: Changes in Loan/Asset Ratio

Figure 5.19.
Citi Bank: Changes in Loan/Asset Ratio

114

Figure 5.20.
Deutsche Bank: Changes in Loan/Asset Ratio

Figure 5.21.
Total of The 7 Foreign Banks: Changes in Loan/Asset Ratio (The Case of RBC)
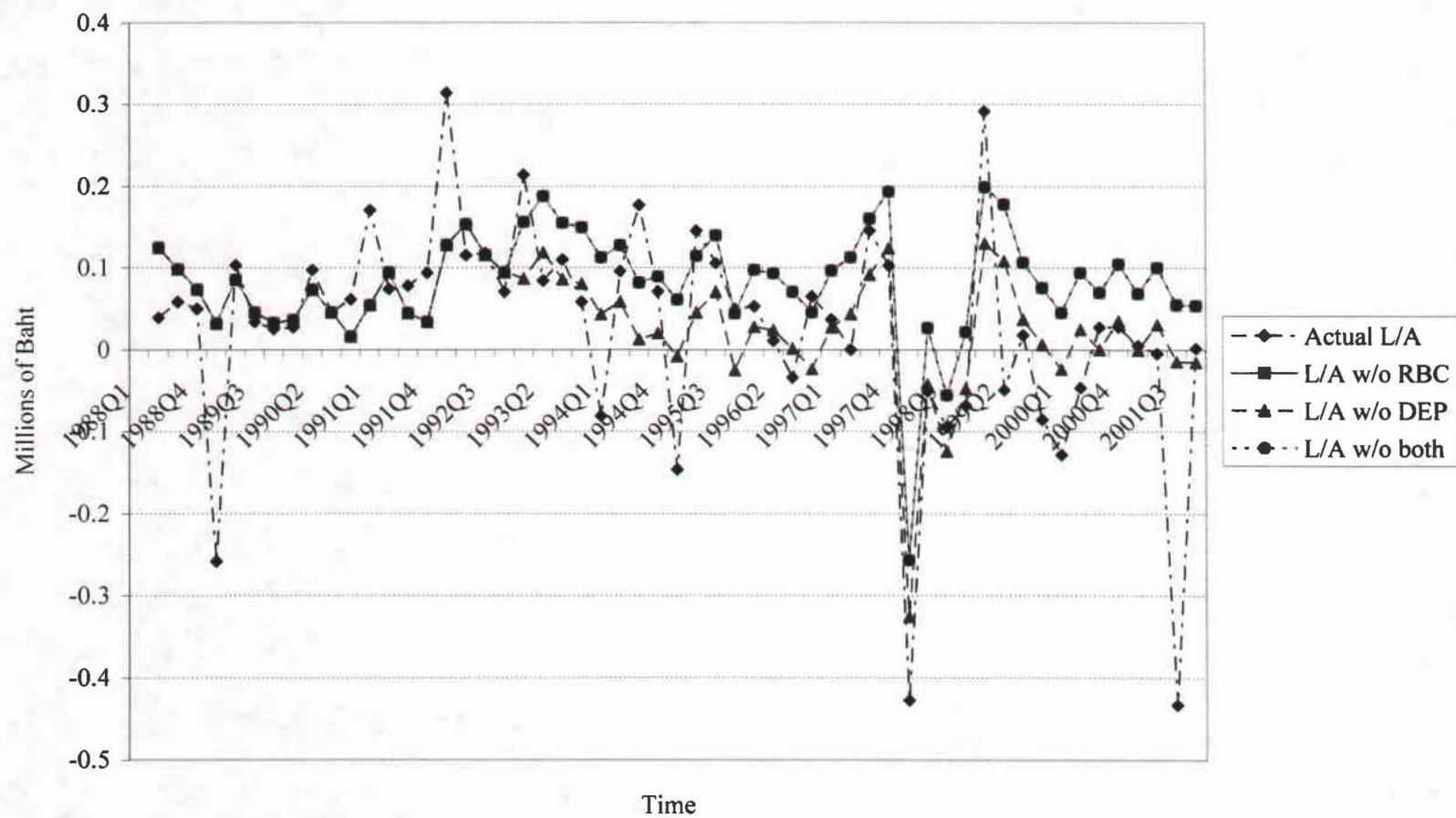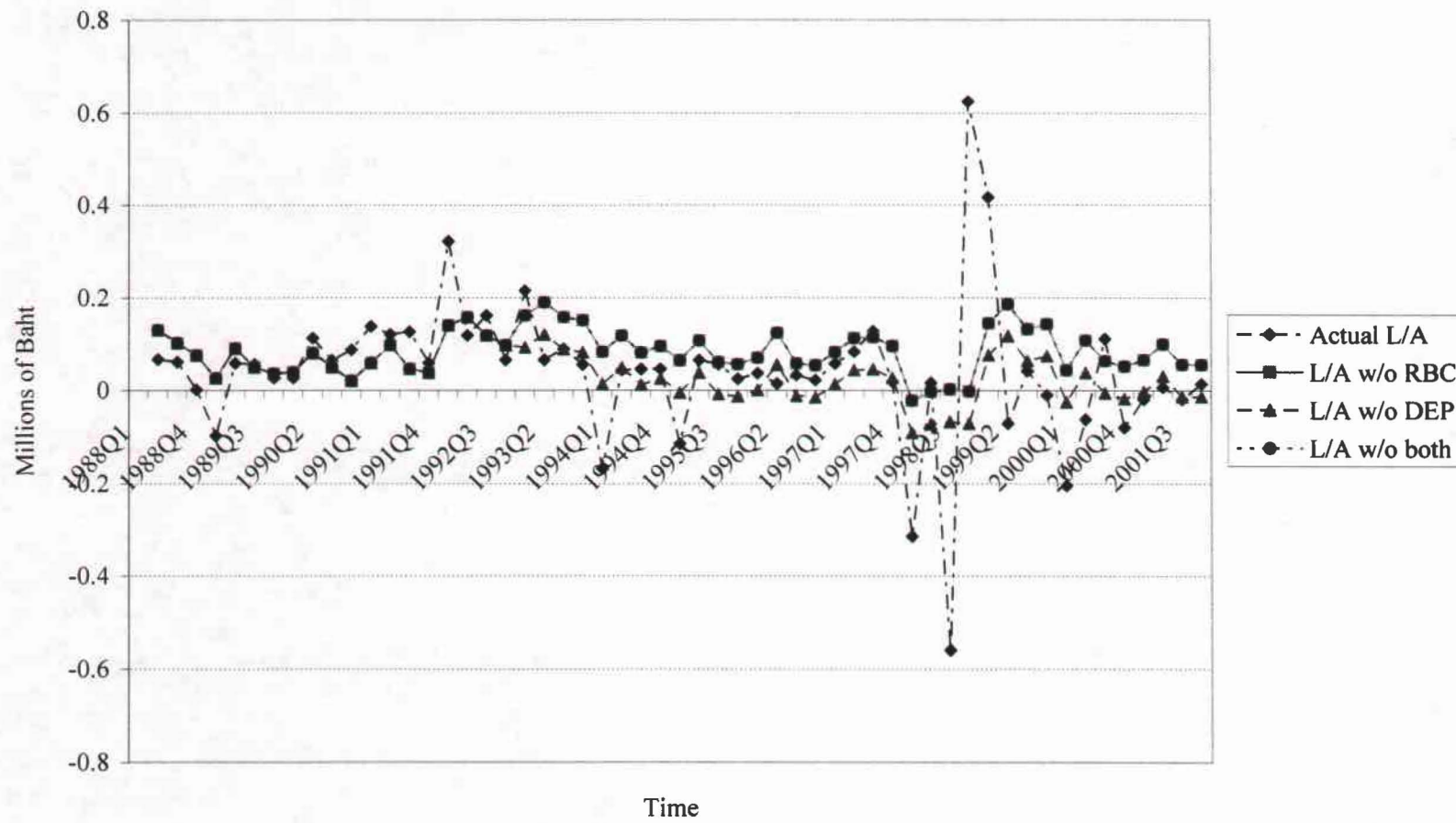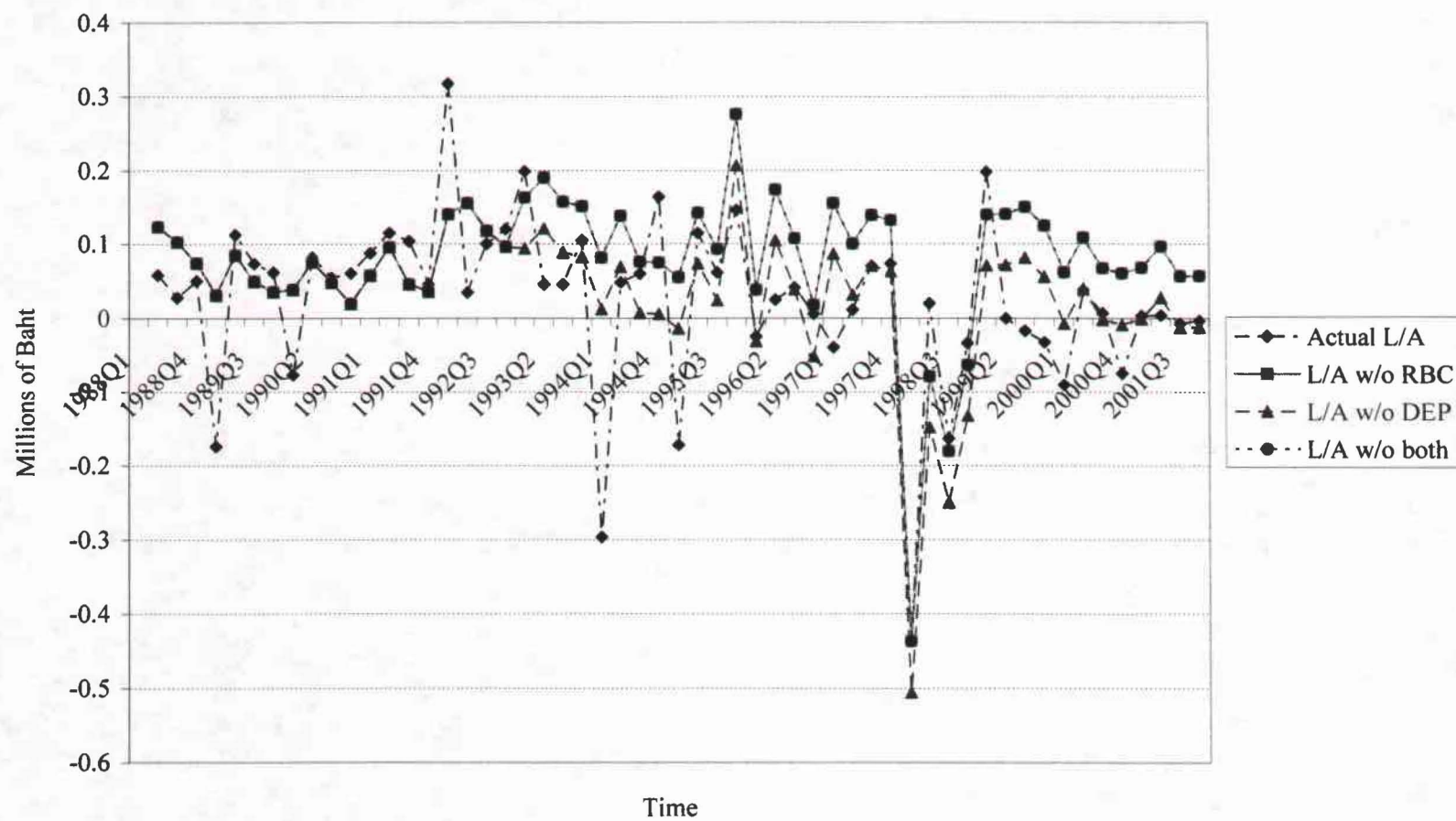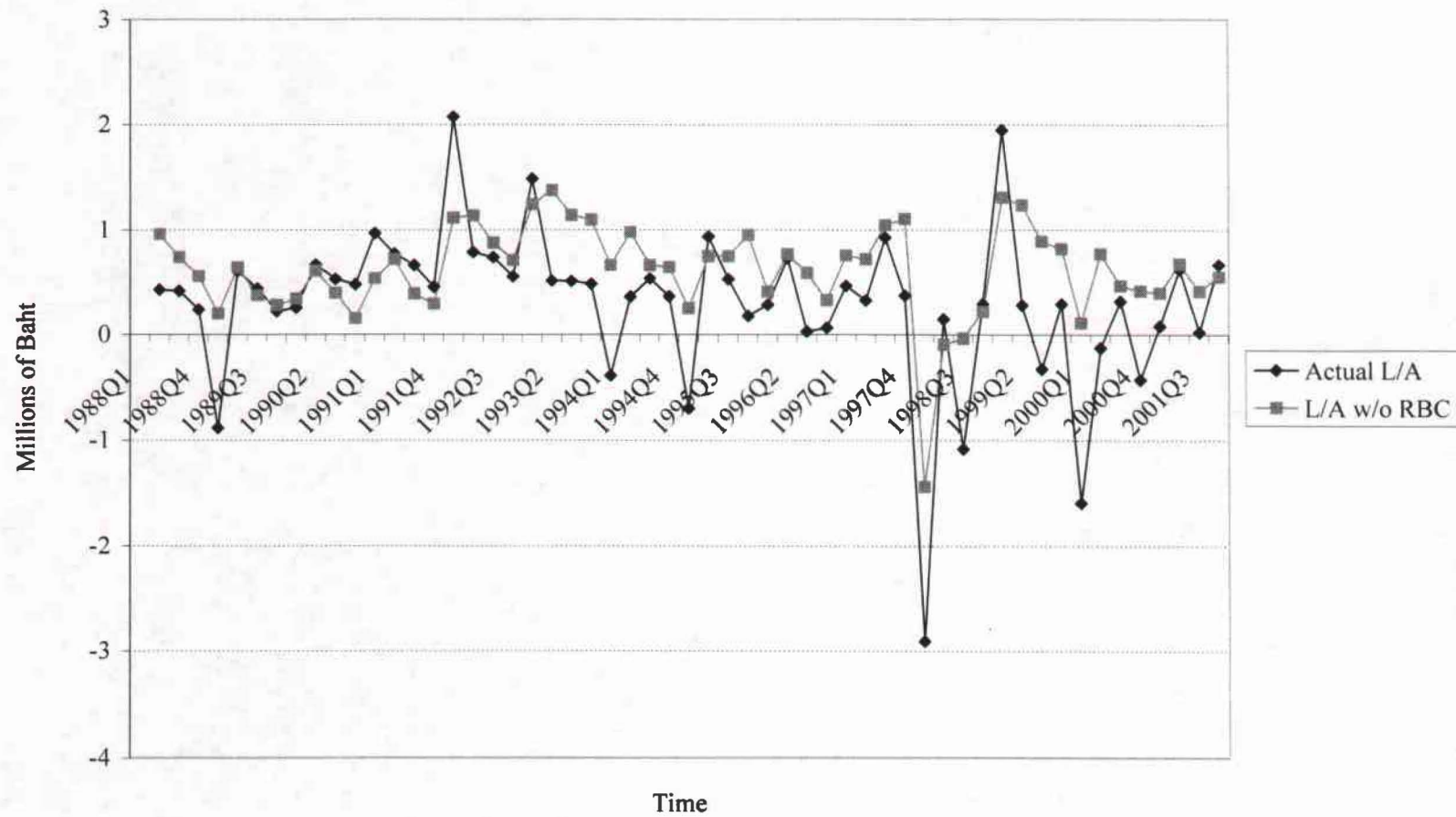
Figure 5.22.

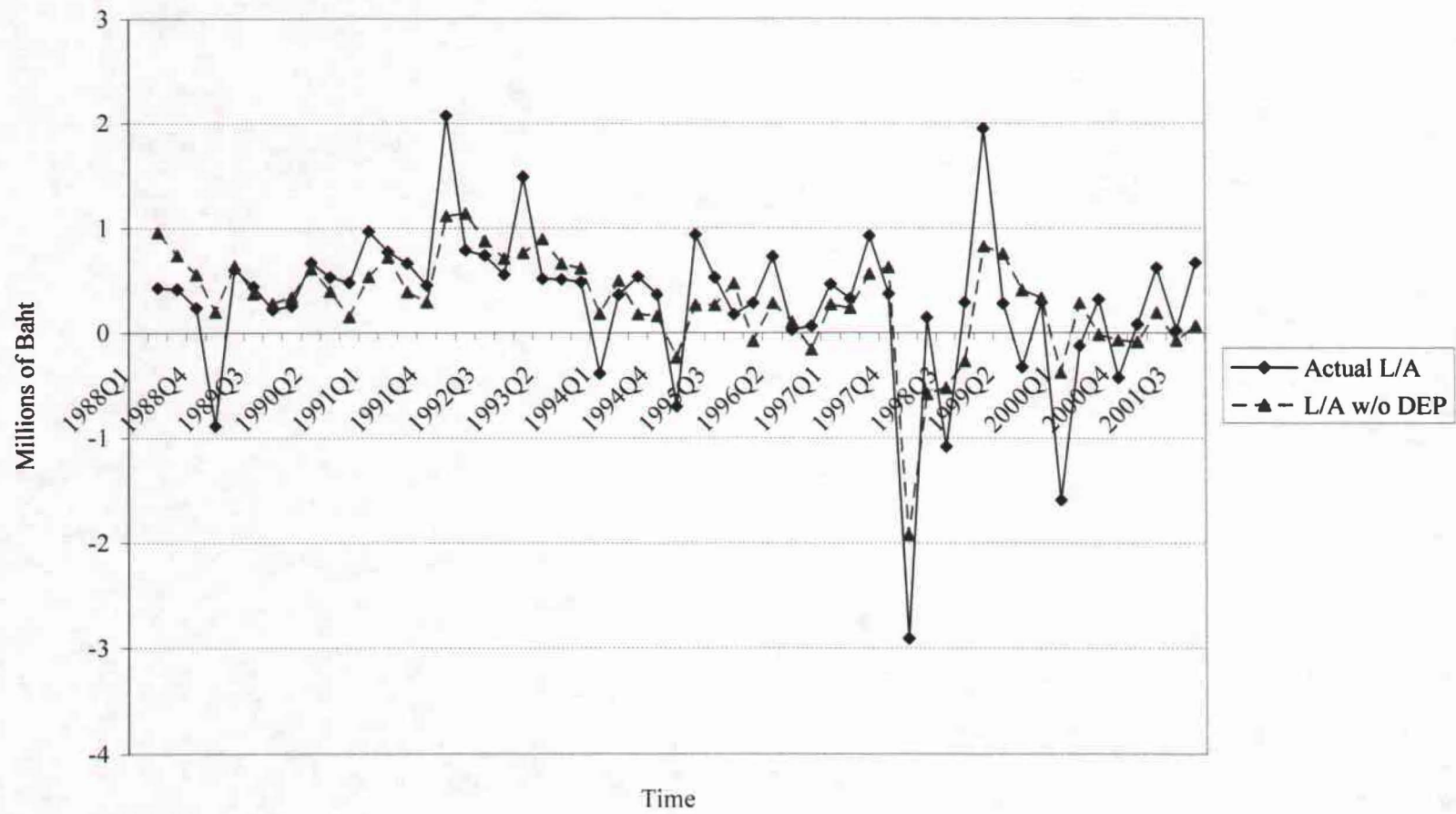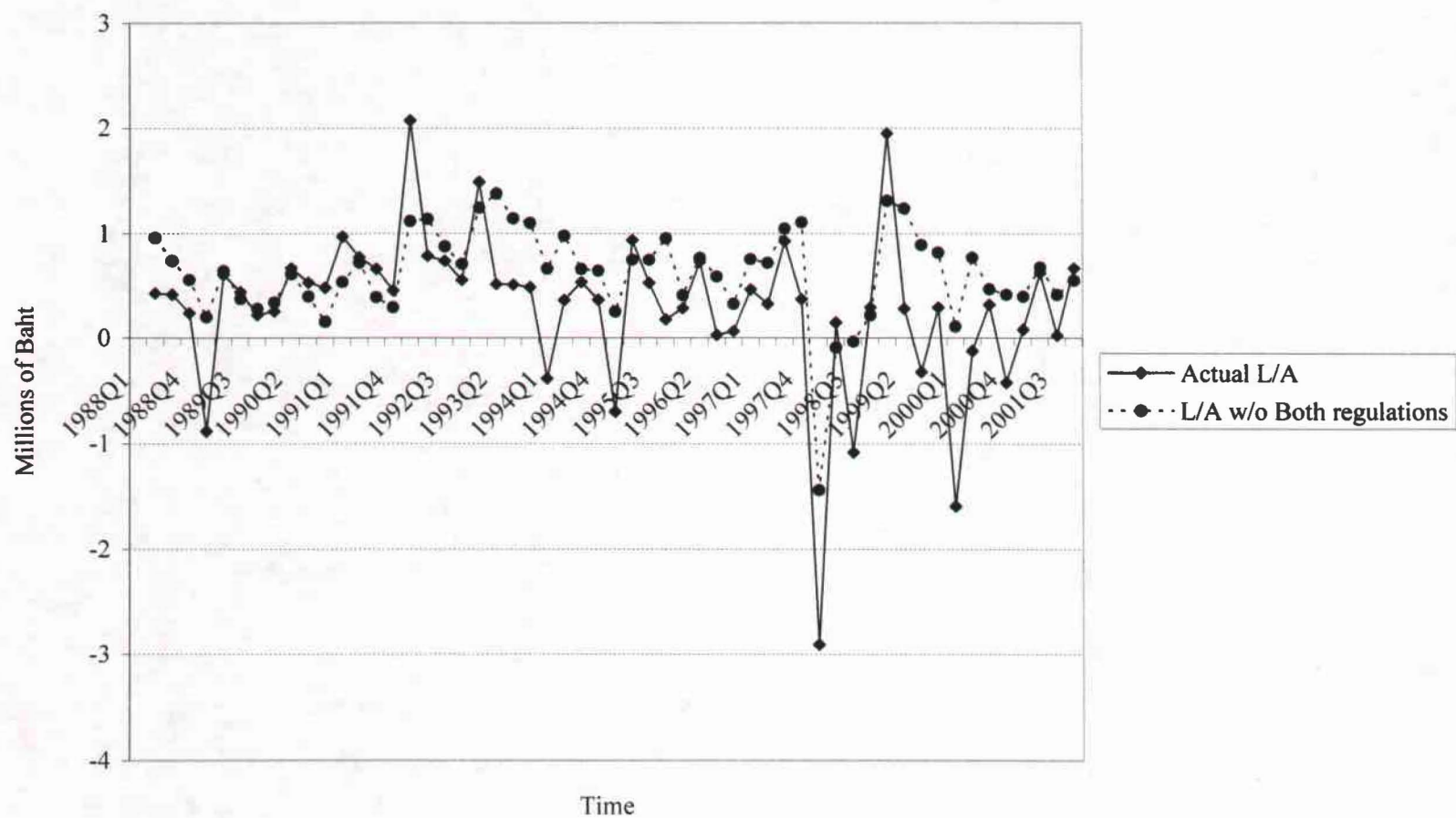Total of The 7 Foreign Banks: Changes in Loan/Asset Ratio (The Case of Deposit Insurance)

Figure 5.23.
Total of The 7 Foreign Banks: Changes in Loan/Asset Ratio (The Case of Both Regulations)

CHAPTER 6. CONCLUSIONS AND POLICY IMPLICATIONS

6.1. Conclusions

This dissertation examined the effect of bank regulations on commercial bank lending in Thailand where bank lending is the most important source of investment funds. To find out whether risk-based capital requirements and deposit insurance contributed to a lending contraction, we conducted an empirical analysis. The results support the hypothesis that those two regulations aggravated the credit contraction caused by the financial crisis of 1997.

According to the empirical results, there was a credit crunch among the ten Thai banks as well as the seven foreign owned banks in Thailand. A decline in the bank equity capital caused the banks to reduce lending. Regulatory variables also had a negative effect on the bank lending but with different magnitudes between the ten Thai and the seven foreign banks. The Thai banks suffered more from both the financial crisis and the regulations than the seven foreign banks did. We attribute this to excessive lending to risky projects by the Thai banks. Because they could reach more diverse groups in population than the foreign banks they had a portfolio of loans of lower quality. In contrast, the foreign banks, which faced limitations on branch expansion, had issued fewer but higher quality loans (Goldstien and Turner 1996). Another reason for the difference in the quality of loan portfolio is, as suggested by Goldstein and Turner, that the foreign banks tend to have a more professional staff whose goals center exclusively on meeting the banks' performance objectives, which in turn leads to quality projects, whereas many Thai banks are family-owned and -operated and employment decisions are

based on family relationships. Often the goal of such banks is to maximize the performance of the family's assets, which sometimes include risky projects. Such banks also practice "connected lending," loans extended to the banks' owners or managers and to their related businesses. The risks involved in such loans are primarily due to of lack of objectivity (sometimes even fraud) in credit assessment and an undue concentration of credit risk. The failure of a few large, related borrowers, or a collapse of a particular sector of the economy, severely deteriorated the banks' capital.

As the Thai banks were lending aggressively, while the Thai economy was hit by the crisis, they were experiencing a deteriorating capital base and loan losses as well as the pressure of having to maintain the required capital ratio. As a result, the Thai banks had no choice but to decrease their lending dramatically. Unlike the Thai banks the foreign-owned banks followed their headquarters' policies on bank lending and due to the limitations imposed on their branching operations they issued fewer loans with a better loan quality. As a result, they were in a better position with regards to risk-based capital ratios: thus they were not pressured as much as Thai banks to maintain the required capital to back up the loans they had issued.

We also found that after the crisis the deposit insurance caused both the Thai and the foreign banks to reduce their lending, possibly because they had to set aside some funds to pay the insurance premium, 0.2 percent of outstanding deposits. Considered as a substantial rate compared to the rate charged in the United States, only 0.0023 percent of outstanding deposits, this insurance premium resulted in a decreased lending ability for both the Thai and the foreign banks. The decrease contributed to fewer loans issued.

The financial crisis that hit Thailand in 1997 revealed a number of significant weaknesses in the Thai financial sector. They are poor corporate governance and the lack of transparency as well as concentrated ownership. As stated earlier, the majority of the Thai commercial banks were closely held and managed by a few families. This concentrated family ownership caused the Thai banks to lend to unproductive projects. Loans would not have been made to such projects by banks with better governance and more transparent management. Furthermore, Thailand offered more overt protection to its banking sector by imposing tight limits on the number of branches that foreign banks could open. Such restrictions are an additional source of the weakness in the Thailand's financial sector. If banks are globally diversified, a downturn in one economy or region would not have such adverse effects on the quality of their loans portfolios in comparison with those in a relatively closed system where banks are lending only to domestic firms and are exposed to the same economy-specific risks (Gavin and Hausman 1996).

In conclusion, risk-based capital requirements and deposit insurance made worse the credit contraction by the ten Thai banks caused by the financial crisis of 1997. In contrast, no such effect was found in the case of the seven foreign banks in Thailand.

6.2. Policy Implications

We may fault the bank regulations for the severe credit crunch that Thailand suffered during the crisis. We need to be reminded, however, that bank regulations are in place to promote a safe and sound banking system. Although risk-based capital requirements are implemented to reduce bank risk-taking, overly tight capital

requirements may lead banks to reduce their lending and thus contribute to a decrease in productive investments. According to Tanaka (2003), even though risk-based capital requirements are likely to strengthen banks' incentives to control their risk-taking, these requirements may reduce credit supply to certain borrowers such as small and medium-sized enterprises (SMEs) and firms in developing countries. At the same time, risk-based capital requirements are needed to control the risks taken by commercial banks, especially for Thai banks, which are mostly family-owned and tend to make "connected lending" rather than "quality lending." Therefore, coordination on some parts of banking regulation (risk-based capital requirements) but not others (the forbearance in supervisor's closure policies) can give rise to negative externalities and destabilize the financial system. One might argue that decreasing the required capital adequacy ratios would improve the credit crunch situation in developing economies such as Thailand, where investments should be promoted. However, if Thai banks continue to make risky loans, which may eventually turn to losses, decreased capital adequacy ratios will hurt the economy in the long run. Thus, the best solution is to address the problem where it started: that is, to ensure that banks issue good quality loans we first need to focus on improving the bank supervisory framework, risk management, and transparent loan procedures among Thai banks.

Furthermore, deposit insurance is a controversial and intricate issue. If mishandled, it could bring about the moral hazard on the part of the banks. What should be pursued simultaneously are transparency, pricing insurance premium and/or offering insurance coverage in accordance with actual market risks. A deposit insurance, together

with efficient examination and supervision carried out by the central monetary authorities, will not only upgrade the caliber of domestic financial institutions but also increase public confidence, which is extremely indispensable in any financial system.

Moreover, there is a lesson to be learned from the fact that foreign banks were not affected by the crisis and the regulations as much as Thai banks. Bongini, Claessens and Ferri (2001) investigated the occurrence of distress and closure decisions for a sample of 186 banks and 97 non-bank financial institutions from five crisis-affected East Asian countries: Indonesia, Korea, Malaysia, the Philippines and Thailand. They found that foreign portfolio ownership decreases the probability of financial distress and that none of the foreign controlled institutions was closed while privately owned institutions were more likely to be distressed. They point out that "connection" with industrial groups or influential families increases the probability of distress, suggesting that supervisors had granted selective prior forbearance from prudential regulations.

Another study by Laeven (1999) uses a non-stochastic frontier technique called *data envelopment analysis* to explain differences in efficiency across East Asian banks prior to the crisis (1992-1996). Laeven finds that foreign-owned banks took less risk, relative to other banks in the East Asian region, and that family-owned banks were among the most risky banks. The share of foreign banks in Thailand is only 7 percent and there is room for further internationalization of the Thai banking system, which may reduce macroeconomic risks faced by the economy. According to Gavin and Hausman (1996), permitting domestically owned banks to diversify internationally will render them less vulnerable to large shocks. Similarly, since foreign banks are less concentrated in

local investments, a shock to the domestic economy will have a smaller effect on their capital base. In addition, foreign banks may have better access to foreign liquidity from their head offices funding. For these reasons, foreign banks could provide a stabilizing influence in the Thai banking system. However, Gavin and Hausman also stated that an increase in the number of foreign banks, which leads to an increase in competition, might lower the "franchise value"[18] of domestic banks. This effectively reduces the equity at stake in domestic banks, perhaps not by the standard accounting or regulatory definitions, but in the economically meaningful sense of the value, that shareholders would lose in the event that a bad roll of the dice leads to bankruptcy. Therefore, an increase in competition might, in turn, raise incentives for bankers to adopt excessively risky investment strategies because of the lowered franchise value of the banks. Furthermore, some literature that shows that emerging economies can take advantage of foreign direct investment spillovers in the financial sector by transferring technology and learning-by-doing. However, the development of the host country capital market is "necessary and sufficient" to foster the "adoption of best-practice technologies and learning by doing." If entrepreneurship allows greater assimilation and adoption of best technology practices made available by FDI, then the absence of well-developed financial markets limits the potential positive FDI externalities (Alfaro et al., 2003). Thus, apart from the positive externalities, it is a controversial issue whether increasing the number of foreign banks will benefit domestic banks.

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[18] Franchise value is the expected stream of future profits from banking..

Another factor that caused Thai banks to be vulnerable to the crisis was the rapid loan growth during the lending boom period (followed the financial liberalization in the early 1990s), even though the regulations, such as risk-based capital requirements, were well designed and effectively implemented. According to Balls (2005), lending booms have been used to explain many banking crises, including Chile's in 1982, Mexico's in 1994, and Thailand's in 1997. He defines a lending boom as a period when the ratio of private credit to private gross domestic product deviates from its historical trend. During a boom, credit to the private sector increases rapidly, together with the danger of declining quality of funded projects and vulnerability of the banking sector.

According to Goldstien and Turner (1996), when credit is abundant and the economy expands rapidly, banks have a difficult time sorting good risks from bad ones because many borrowers are at least temporarily very profitable. Bad loans therefore tend to accumulate during a lending boom and result in a crisis when the boom is interrupted by an adverse economy shock. The sharp swings in real estate and equity prices intensify the crisis because of high loan concentration, and the asset price declines depress the market value of collateral. Moreover, bank capital and loan loss provisions have not yet expanded to compensate for the volatility of bank assets. Gavin and Hausman (1998) argue that bankers in recently liberalized financial systems are likely to make excessively risky loans and incur large loan losses simply because they are unpracticed in the new lines of business in which they are operating. According to Goldstein and Turner (1996), financial liberalization is followed by a significant rise in bank lending, along with a growing concentration of loans in higher-risks activities, including real estate and

financial market speculation. While foreign banks' managers, who have more experiences and skills, will expend their balance sheets cautiously and will not engage in a sort of lending boom. Bank supervision is crucial because it is the job of banks to generate information about the value of their portfolios. In many circumstances, banks will have an incentive to hide portfolio problems from supervisors, and in the short run the hiding can be done with problem loans being rolled over. In summary, inexperienced bankers in the recently liberalized financial systems such as Thailand practiced excessive lending to risky projects during the booming period. When the economy was hit by an adverse economic shock, the excessive lending behavior together with opaque supervision in loan procedures turned the lending boom into a crisis. Thus the lending boom-turned-crisis places important limits on the ability of regulators to detect and prevent problems from occurring again.

In conclusions, since regulations such as risk-based capital requirements and deposit insurance are necessary to promote the financial system's stability, it is a very challenging task for regulators to find the optimal degree of regulations that would safeguard a banking system but at the same time provide enough funds to productive investments. More importantly, our study of the problems that the Thai economy experienced during the crisis suggests that it must improve its financial supervisory system, risk management and loan procedures. How Thailand may do so remains for future research.

6.3. Data Sources

The data consist of the quarterly reports of 17 commercial banks from 1988 to 2001. They were obtained from bank balance sheets, which were quarterly reported to the Stock Exchange of Thailand and the Bank of Thailand. T-Bill rate and Gross Domestic Products were obtained from the Bank of Thailand Quarterly Bulletin.

The data include:

Loans: Nominal values of individual bank loans are divided by the GDP deflator to transform to real values (unit: million Baht).

Gross Domestic Product: Nominal values of GDP are divided by the GDP deflator to transform to real values (unit: million Baht).

Total Bank Equity Capital: Nominal values of the individual bank total equity are divided by the GDP deflator to transform to real values (unit: million Baht).

Total Bank Asset: Nominal values of the individual bank total equity are divided by the GDP deflator to transform to real values (unit: million Baht).

Three-Month T-Bill Rate: The inflation rate is subtracted from the nominal interest rate to get the real interest rate.

Quarterly data of Loans and total bank equity from 1994-2001 were obtained from the Bank of Thailand. However, prior to 1994, commercial banks were not obligated to submit their balance sheets to the Bank of Thailand. Quarterly data from 1988-1993, however, were obtained from the Stock Exchange of Thailand library (hard copies.

Appendix 1

The Development of the Thai capital Market

Recognizing investors' need for liquidity, over the last quarter century the central authorities established a number of secondary markets and undertook measures to facilitate trading different types of securities. First, the Stock Exchange of Thailand (SET) was originated in 1974 for trading common shares. Then, in 1979 the Bank of Thailand initiated the repurchase market to accommodate financial institutions' temporary liquidity shortages and simultaneously implement monetary policy (Vichyanond 2002).

The capital market saw many more institutional changes and experienced significant growth from the mid 1990s. In 1993 the first credit rating agency, the Thai Rating Information Service Co., Ltd. (TRIS), was founded to help investors evaluate bond and share issuers. The Bond Dealers' Club (BDC) was put into action in 1994 to entertain secondary trading of public securities and corporate bonds. Banks were permitted to engage in bond underwriting in 1993. Since then, banks' role in underwriting has grown remarkably, from 4 percent of the total value of bonds registered at BDC in 1995 to 46 percent in 2000 (the Bank of Thailand). Banks also became major dealers in the secondary bond markets from 1998 to 2000.

Towards the end of the 1990s the government began to accept the principle of market discipline. According to this way of thinking, if market forces function efficiently, movements of securities prices will reflect the most relevant data and status of firms. Hence, government should allow and encourage market forces to function freely, so that

securities prices promptly signal any emerging problems to both regulators and firm owners.

Based on this new point of view, Thai authorities took a number of policy actions to improve the functioning of the capital market. From 1997, the SEC allowed investors to conduct short selling and securities lending. Short selling provides investors an opportunity to make profits when the market goes down, whereas securities lending is meant to support short selling activities. In June 1999, recognizing the fact that many Thai businesses are small, the SET established the "Market for Alternative Investment," or MAI, to attract small and medium-sized enterprises (SMEs). The MAI follows the same trading, and settlement procedures and trading hours as the main market, but the minimum paid-up capital to list on the MAI is only 40 million baht compared to 200 million baht for a listing in the main market.

As further incentive for SMEs to utilize the capital market, the corporate income tax rate for companies listed on the MAI is only 20 percent, compared to 25 percent for firms listed on SET, and 30 percent for non-listed companies.

According to the Master plan to reform the Thai capital market (The Ministry of Finance 2002), among the actions taken since 1999 are the following:

- The government authorized the organization of inter-dealer brokers in 2000 in order to enhance liquidity and to facilitate transactions in the secondary debt market.

- The SET modified the listing criteria in June 2000 to make them more flexible. In place of the requirement that a prospective company has no accumulated losses, it allowed prospective companies to qualify under one of three criteria: net profit at

least 30 million baht in the pre-listing year, sales revenues of at least 2 million baht in the pre-listing year, or market capitalization of at least 1.5 billion baht.

- SET replaced its check payment and electronic book entry delivery and clearing system with a delivery-versus-payment system in September 2000. Under the new system clearing members, which are custodian banks, can make or receive payment directly to the Thailand Securities Depository through the Bank of Thailand's BAHTNET system.

- Brokerage commission fees were liberalized in October 2000 to stimulate competition and to provide investors with more alternatives, with commission rates varying in accordance with the services provided.

- The authorities coordinated efforts to expedite privatization for some state enterprise such as electricity power plants, the petroleum authority, and Thai Airways in order to upgrade the quality of securities available to investors in the market. At the end of 2000 Ratchaburi Electric Power Plant became the first such privatized enterprise listed on the SET.

- To cultivate investors, in 2000, the SEC set up a capital market information center where investors can gather information before making their investment decisions. The SEC promotes various activities to provide information access, education and training, and investor protection. The agency has also developed a capital market information website.

- In January 2001, the SET launched regulations for internet trading, under which securities companies with computer support and information security systems may be

permitted to offer internet trading services to their customers. Afterwards, the SET

organized a new company called SETTRADE.COM, which provides Internet trading

services for securities companies in order to promote Internet trading and to reduce

risk and investment expenses for securities houses.

- Fitch Ratings was approved in February 2001 as the country's second credit rating

  agency. This addition addresses investors' need for credit rating information to help

  them assess risks and returns with greater accuracy and confidence.

- Commencing March 2001, the SEC began easing the application process for

  companies that have won promotion from the office of the Board of Investment in

  order to encourage the listing of private companies.

- Along with other liberalization measures, in March 2001 the SEC permitted securities

  companies to expand their scope of businesses to include life insurance brokering,

  back office service provisions, computer vending, and mutual fund business via

  subsidiaries.

- Some mutual funds such as the Thai Trust Fund were established in 1997 to enable

  foreigners to invest in companies that had reached the allowable limit on foreign

  shareholding. Similarly, in mid-2001 a non-voting depository receipt (NVDR) was

  introduced as a new type of security. Holders of NVDRs have all the same rights as

  shareholders except the vote.

- Foreseeing the importance of long-term savings as a shock absorber for the economy,

  in the last quarter of 2001 the SEC established retirement mutual funds (RMFs) as a

  vehicle to encourage long-term savings for retirement. RMFs are eligible for tax

privileges similar to those for provident funds if savers satisfy certain conditions, such as a five-year investment history and no redemption until the owner reaches age 55.

Appendix 2

The Basle Accord adopted by the bank of Thailand

The Basle Accord distinguishes between two tiers of capital. Tier 1 consists of items qualifying as pure or "core capital", namely equity shares or common stock, perpetual non-cumulative preference shares, and disclosed reserves, retained earnings. Tier 2, which comprises less pure forms of capital, may include the following items: undisclosed reserves (subject to the condition that they are freely available to meet unforeseen losses); asset revaluation reserves (which may reflect periodic revaluation of fixed assets and which, in the case of latent revaluation reserves, must be prudently valued to reflected the possibility of price volatility or forced sale, a discount of 50 percent being applied for this reason to the difference between current market value and historic cost); general provision or loan loss reserves held against future unidentified losses and freely available to meet such losses as they materialize; hybrid (debt/equity) securities subject to such conditions as being unsecured, subordinated, and carrying interest obligations which allow for deferral in the event of the issuer being unable to pay (even though the obligations are not waived as in the case of non-cumulative preference shares mentioned above).

Tier-2 elements in the aggregate are limited to a maximum of 100 percent of those in Tier 1, i.e. to one half of total capital; and there are additional lower ceilings for individual Tier-2 elements. Goodwill is subtracted from Tier-1 capital, and investments in unconsolidated financial firms are subtracted from total capital.

Risk-weighted assets

Measurement of banks' exposure for the purpose of estimating the denominator of the ratio was based on the attribution to defined asset classes of weights reflecting their credit risk. Off-balance-sheet exposures were converted to their credit risk equivalents by the multiplication of nominal principle amounts by a factor specified for this purpose, the results then being weighted according to the counterparty, as in the case of on-balance-sheet exposures.

The attribution of risk weights can be described as follows:

(i)   0 percent: (a) cash in Thai Baht and foreign currencies, gold bullion; (b) claims on Thai government and the Bank of Thailand; (c) claims collateralized securities issued by the Thai government, or guaranteed by the Thai government;

(ii)   20 percent: (a) claims on commercial banks in Thailand, and claims guaranteed or collateralized by securities issued by such banks; (b) claims on finance companies, credit fanciers companies, and claims guaranteed or collateralized by such banks; (c) claims on Thai government organizations, and claims guaranteed or collateralized by such organizations; (d) claims on multilateral development banks, and claims guaranteed or collateralized by securities issued by such banks; (e) claims on banks incorporated in the OECD and loans guaranteed by such banks;

(iii)   50 percent: loans fully secured by a mortgage on residential property;

(iv)   100 percent: other claims, assets, and investments, including claims on the private sector not otherwise specified on banks incorporated outside Thailand and the OECD, and on publicly owned commercial companies, as well as investments in commercial real estate and in capital instruments issued by other banks.

The Basle Committee divided off-balance-sheet exposures into five broad categories:

(i)   substitutes for loans carrying a conversion factor of 100 percent such as general guarantees of indebtedness, bank acceptances, and standby letters of credit serving as financial guarantees for loans and securities;

(ii)   certain transaction-related contingencies carrying a conversion factor of 50 percent, such as performance bonds, where the risk of loss relates as much to the performance of the transaction as to the financial risk of the counterparty;

(iii)   short-term, self-liquidating trade-related contingent liabilities carrying a conversion factor of 20 percent (such as documentary credits collateralized by the underlying shipments, as in the case of finance provided on the security of a bill of lading);

(iv)   commitments such as standby commitments and credit lines with an original maturity exceeding one year carrying a conversion factor of 50 percent (short-term commitments and those that can be cancelled at any time receiving a zero weight); and

(v)   Interest-rate and exchange-rate related items, agreement on whose credit-

risk equivalents proved more difficult and which require slightly more

extended discussion.

Appendix 3

Principles Governing the Insurance of Companies Conducting Normal Operations

5 August 1997

1. The government will entrust the Financial Institution Development fund (FIDF) to undertake the insurance operation. This operation must be separated from the normal account of the fund, while the government shall support the mobilization of funds as well as take full responsibility for the insurance scheme.

2. Insured financial institutions shall comprise all commercial banks, finance companies and credit foncier companies which have not been ordered to suspend operation today or earlier. Companies with acceptable rehabilitation plan which subsequently receive permission to resume their normal operation shall be eligible for government insurance.

3. The insurance shall cover both principal and interest at the rate not exceeding the maximum set by the authorities.

4. The categories of bona fide depositors and creditors of financial institutions, both domestic and foreign, which the government will insure are:

   4.1 All types of depositors, including holders of Negotiable Certificates of Deposit (NCD) and promissory notes;

   4.2 Creditors arising from the normal business operation of the particular financial institution, namely commercial banking, finance, securities, and credit foncier businesses.

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The following categories of depositors and creditors shall be excluded:

(a) depositors and creditors not acting in good faith or in the normal business practice:

(b) Holders of debentures or convertible debentures or creditors of subordinated rights. Ineligibility for the government insurance shall not override the rights of depositors or creditors of this category under the Thai legal system; and

(c) Depositors or creditors who are directors or related persons as stipulated in the Commercial Banking Act or Act on the undertaking of finance companies, securities companies and credit foncier companies, or management from the level of department director upward or equivalent of that particular financial institution, unless it can be verified that they are bona fide depositors pr creditors.

Finance companies ordered to suspend operations

To enable companies whose operations are suspended to have some time to settle their affairs and lay down the groundwork for the rehabilitation process, the Minister of Finance, acting upon Article 26 quarter of the Act on the Undertaking of Finance Business. And Credit Foncier Business B.E. 2522, hereby issues the order for such companies to suspend their operations. Nevertheless, to protect the assets of such companies from further deteriorating, the companies are permitted to conduct certain operations, for example:

(1) Debt collection and recovery;

(2) Releasing of mortgage or pledges so as to transfer ownership and return collateral to borrowers which have completed all their repayments;

(3) Receiving sales orders of margin customers in order to pay back their debts to the company, including allowing customers with no debt burden to be able to transfer securities deposited to other securities companies; and

(4) Receiving payment for rights issues to service customers' subscriptions.

In the mean time, the company shall not redeem promissory notes, and shall not transfer or operate in a way that will depreciate the value of the assets of the company.

Measures to protect bona fide depositors and creditors

Bona fide depositors of companies which have been ordered to suspend their operations, are given the choice to exchange their promissory notes and NCDs at the designated financial institution, namely Krung Thai Bank Public Company Limited. Criteria and conditions for the exchange of notes will be the same as those used for the exchange of the notes of the 16 finance companies for those of Krung Thai Thanakit Public Co.Ltd., as follows:

(1) Notes or NCDs with amount per holder of less than 1 million baht shall be redeemed upon 6 month maturity with interest;

(2) Notes or NCDs with amount per holder of less than 1 million but not more than 10 million baht will be redeemed upon 3 year maturity with interest; and

(3) Notes and NCDs with amount per holder above 10 million will be redeemed upon 5 year maturity with interest.

Regarding interest rates, Krung Thai Bank Public Co. Ltd. will announce the rates equal to those of Krung Thai Thanakit Public Co. Ltd. Holders of notes or NCDs may request for a monthly or quarterly payment of interest. Holders of notes or NCDs who wish to change them for cash will be allowed to discount the notes or sell the NCDs. Alternatively; they may be used as collateral for loans from Krung Thai Bank Public Co. Ltd. or other financial institutions.

The exchange of notes or NCDs at Krung Thai Bank Public Co. Ltd. will be permitted as soon as the Bank's preparatory work is completed. The exchange will be available to holders of notes or NCDs as a first priority, followed by creditors. Notes which have earlier been avaled by the FIDF shall be redeemed at the FIDF through issuing companies as normally practiced.

Bona fide creditors, both domestic and foreign, of finance companies which have been ordered to suspend their operations, will also have the rights to exchange notes or NCDs or arrange for a new borrowing contract with Krung Thai Bank Public Co. Ltd., period of redemption shall be the same as those mentioned above. Interest will be set by Krung Thai Bank Public. Co. Ltd., and an announcement will be made for creditors to register the amount of credit owed to them.

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