

The Put Option Approach to Banking Crises in Emerging Markets: Valuing Implicit Deposit Insurance in Thailand

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November 9, 1998

Abstract: In this paper, I develop an approach to evaluate deposit insurance as a contributing factor in banking crises in emerging markets. Deposit insurance, as a government guarantee of the banking system, acts as a subsidy to banks. As banks try to increase this subsidy by growing rapidly and undertaking riskier lending, they create conditions that make banking crises possible. Using an established result that models deposit insurance as a put option on the value of bank assets, I construct a program that maximizes a likelihood function relating the observed equity values of the bank to the unobserved asset values implied by the put option. Results show that the average value of this subsidy to Thai commercial banks between 1992 and 1996 was almost Bt 330 billion or 13 percent of total deposits. The guarantee, while sizeable during 1992-1995 increased sharply in 1996. Large subsidy values prior to 1996 suggest that the crisis had incubated for years and was not solely caused by the sudden fall in the Baht. The increase in the subsidy in 1996 reflects the lower net worth of banks and their greater incentives for risk-taking. Moreover, those banks with the highest insurance subsidies over the sample were the banks that were nationalized by the government or bought by foreign owners in 1998.

1. Introduction

In this paper, I develop an empirical approach to banking crises in emerging markets based upon an estimation of the option value of deposit insurance to banks. This paper shows that the put-option approach can serve as an early warning system to regulators by indicating the depth of the dependence of the banking system on deposit guarantees. Another advantage to the put-option approach is its ability to distinguish unsafe banks before a crisis emerges.

In contrast, the empirical macroeconomic literature seeks to predict crises by identifying variables that signal a crisis. By applying this methodology to Thailand, it is found that a few variables “signal” a crisis during 1996. However, this approach is unable to identify the crisis more than a year in advance. An alternative empirical methodology uses balance sheet information to examine banking crises in the United States. However, an examination of the balance sheets of Thai banks generates the misleading conclusion that these banks were relatively healthy.

Following Merton (1977), a related empirical literature models deposit insurance as a put option on the value of bank assets. By using the market's valuation of banks, this approach includes information that is omitted by both the macro and balance sheet approaches. Papers based on Merton's insight calculate the fair insurance premiums that would eliminate the moral hazard associated with the provision of deposit guarantees. However, few empirical papers that calculate the price of fair deposit insurance to banks examine the wider implications of the insurance subsidy.

I show that the implicit deposit insurance subsidies to individual banks can explain much about the origins and incidence of Thailand's 1997 banking crisis. Using the fact that equity can be modeled as a call option on the value of the bank, I calculate these subsidies from an indirect maximum likelihood approach that estimates the unobserved value of bank assets and their volatility. I find that over 1992-1996 the average value of deposit insurance for the Thai banking system was 13 percent of total deposits or 7.5 percent of GDP. Moreover, the Thai banks with the highest values of deposit insurance were later nationalized by the government or bought by foreign banks in 1998.

Section 2 of this paper discusses the macroeconomic approach to the modeling of banking crises and applies the empirical methodology to Thailand. Section 3 presents the microeconomic approach to the modeling of banking crises and reviews the empirical option-pricing methodology used in this paper. Section 4 discusses Thailand's financial system and the events of the 1997 banking crisis. Section 5 presents the results of the option-pricing model. Section 6 compares these results with actual outcomes and balance sheet data. Section 7 concludes the study.

2. The Macroeconomic Approach to Banking Crises

The macroeconomic approach to balance-of-payments and banking crises emphasizes the behavior of the real exchange rate in response to external and internal shocks. The banking system is a recipient of the crisis through the behavior of the exchange rate and interest rates. In Krugman's (1979) speculative attack model, a government's monetization of an unsustainable fiscal deficit produces a speculative attack against the fixed exchange rate regime. Empirically, the lack of sizable fiscal deficits in the EMU crisis in 1992, Latin America in 1995, and in East Asia in 1997, suggests this model does not fit most contemporary balance-of-payments crises.

A more recent set of models posits that balance-of-payments crises are a result of self-fulfilling expectations and are one of multiple equilibria present in the economy. Calvo and Mendoza (1996) model Mexico's 1995 crisis in a similar manner to Krugman (1979). In this model, however, expansion of domestic credit is needed to rescue the banking system. The authors accept the weakness of the banking system as a result of the exchange rate policy and capital inflows. In an alternative model, Dornbusch and Werner (1994) and Dornbusch, Goldfajn, and Valdes (1995) argue that inflation inertia produces an overvalued real exchange rate, which eventually causes the collapse of the stabilization program. In this model again, the overvalued exchange rate causes domestic economic activity to collapse which eventually filters to the banking system. Kamin (1996) and Kamin and Rogers (1996) give limited empirical support to the notion that inertial inflation was responsible for Mexico's 1995 crisis. Instead, they find the real appreciation of the peso was more likely caused by an increase in domestic demand. Calvo (1987, 1995), Calvo and Végh (1994), and Rebelo and Végh (1995) develop a model in which the perceived impermanence of the exchange-rate regime leads to a

consumption boom and thus, an appreciation of the real exchange rate. The ultimate devaluation of the currency further reduces confidence in the economy and undermines future stabilization programs. Using a Markov switching analysis, Kaminsky and Leiderman (1998) and Kaplan (1997) find evidence of a lack of credibility in Argentina and Chile's stabilization programs, respectively.

Empirical papers examining balance-of-payments and banking crises have focused on constructing large panel data sets to examine the commonalities among crises. By examining various macroeconomic variables, these studies hope to separate external, contagion theories from internal, fundamental theories as causes of the crises. To identify crises, empirical studies create an index of multiple macroeconomic variables. Sachs, Tornell, and Velasco (1996) develop an index consisting of the weighted average of the change in reserves and the devaluation rate with respect to the dollar. Kaminsky and Reinhart (1996, 1998) use the same index for balance of payments crises and use bank runs, the closure or merging of banks, or large-scale government assistance to banks to identify banking crises. Frankel and Rose (1996) identify currency crises as instances when the nominal exchange rate depreciated by 25 percent and the depreciation rate is at least 10 percent greater than the past year. In examining a sample of over 20 countries, Sachs, Tornell, and Velasco find that a high real exchange rate, an increase in bank lending, and a high ratio of M2 to reserves account for movements in their index. Both Frankel and Rose and Kaminsky and Reinhart look at over 100 crisis episodes and examine the effects of variables on their index in a 15-18 month window on either side of their crisis date. In a probit analysis, Frankel and Rose find currency crashes are more likely when FDI inflows slow, reserves are low, domestic credit growth is high, when U.S. interest rates are high, and when the real exchange rate is overvalued. Kaminsky and Reinhart find a large portion of their financial variables, external variables, and real variables exhibit deviations from their levels in "tranquil" times when their index indicates a crisis.¹ Kaminsky and Reinhart and Sachs, Tornell, and Velasco conclude that "fundamentals" were likely to have played a role in balance-of-payments and banking crises.

¹ Financial variables include the M2 multiplier, the ratio of domestic credit to nominal GDP, real deposit interest rates, the ratio of lending to deposit interest rates, the ratio of M2 to reserves. External variables include export growth, import growth, the terms of trade, the real exchange rate, and reserves. Output growth and changes in equity prices measure the real sector.

One problem facing these analyses is that they use variables, which although empirically relevant, have no strong underlying theoretical basis. Moreover, the ability of these studies to predict crises is weak. Kaminsky and Reinhart find that the M2 multiplier, excess real M1 balances, and exports are statistically different from their levels in tranquil times up to 18 months prior to the crisis. They do not report the number of banking crises that would be predicted by these three indicators. Frankel and Rose use their probit analysis to predict currency crashes one year in advance; they find they were able to correctly predict crises in 5 out of 69 episodes. Part of this difficulty stems from the implied assumption that crises develop over a short horizon, and not multiple years.

2.1 Empirical Application of Macroeconomic Approach to Thailand

In this section, I apply the methodology of Kaminsky and Reinhart (1996) to Thailand and the results are qualitatively the same as theirs. Namely, most variables during the crisis show a significant deviation from their pre-crisis levels, a few variables show a deviation from their pre-crisis levels in the year preceding the crisis, and no variables show a deviation from their pre-crisis levels more than a year preceding the crisis.

For this analysis, the 12-month percent changes were calculated for the M2 multiplier, the ratio of domestic credit to nominal GDP, excess real M1 balances, the ratio of M2 to reserves, reserves, exports, imports, and real GDP.² Interest rate variables-- the real interest rate on deposits, the lending-to-deposit rate differential, and the Thai-to-U.S. real deposit rate differential-- remained in monthly rates. Each graph shows the percent change from the pre-crisis period (1/1992 to 12/1996)³ and is plotted with confidence bands of one standard deviation.⁴

² M2 multiplier is the ratio of M2 to base money. Excess real M1 balances were the residuals of the regression of real M1 on a time trend, real GDP, and domestic inflation. Monthly nominal and real GDP were extrapolated from annual GDP using a monthly industrial production index. Deposit interest rates are 12-month time deposit rates for both the United States and Thailand. The lending rate in Thailand is the minimum lending rate (MLR).

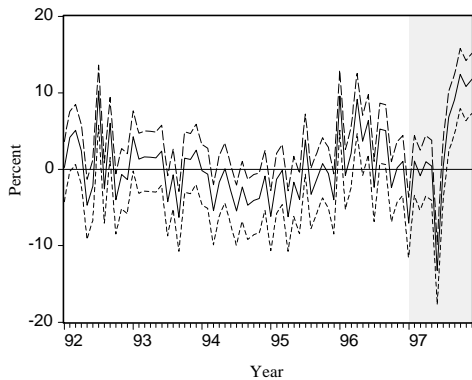
³ Following Kaminsky and Reinhart, I date the crisis period as beginning 6-months prior to the devaluation of the currency.

⁴ The percent change from the pre-crisis period was found by subtracting the mean over the pre-crisis period off the entire series.

Examining Graphs 1 through 12 shows that 10 variables indicate that the crisis period was statistically different from the pre-crisis period. Moreover, it might be claimed that certain variables “signal” a crisis before January 1997.⁵ However, these variables may simply indicate that the crisis began in the summer of 1996 rather than January 1997. Indeed, the crisis can be dated as beginning in May 1996 with the collapse of Bangkok Bank of Commerce.

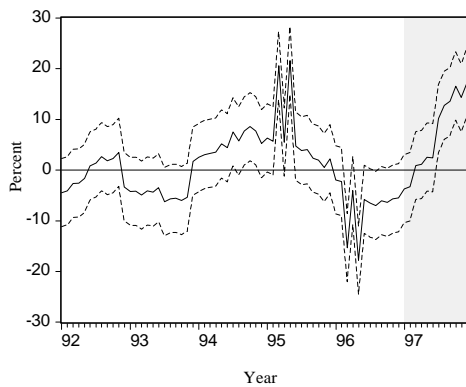
⁵ These variables are: M2 to reserves beginning in April 1996, reserves beginning in July 1996, the lending-to-deposit rate differential beginning in March 1996, deposits beginning in August 1996, exports beginning in May 1996, and imports beginning in September 1996.

Graph 1
M2 Multiplier



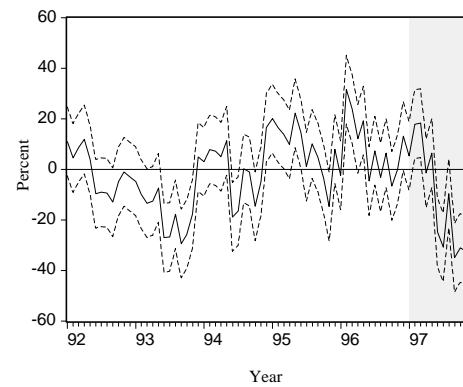
Graph 2

Domestic Credit to Real GDP

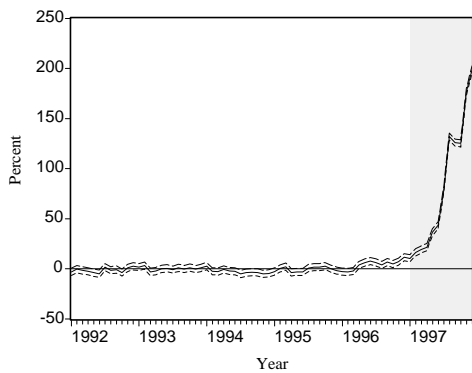


Graph 3

Excess Real M1 Balances

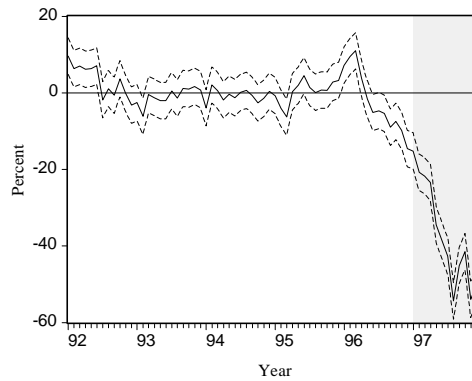


Graph 4
M2 / Reserves



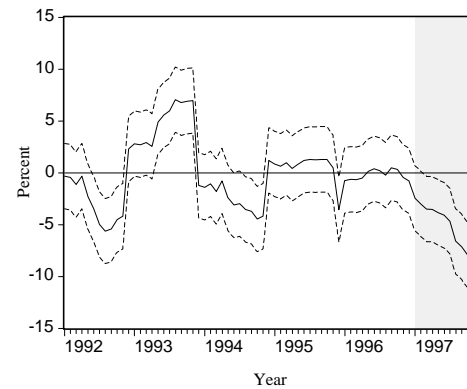
Graph 5

Reserves



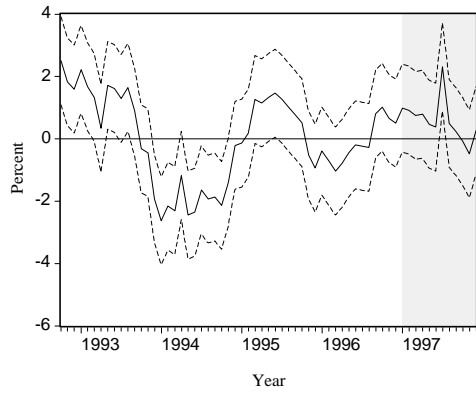
Graph 6

Real GDP



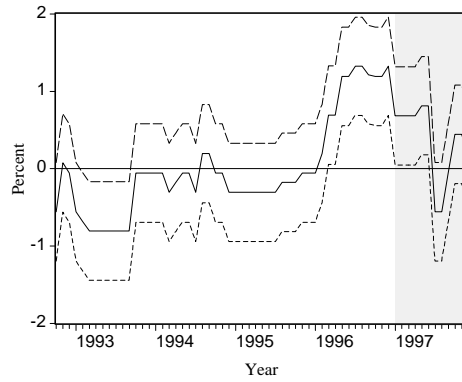
Graph 7

Real Interest Rate on Deposits



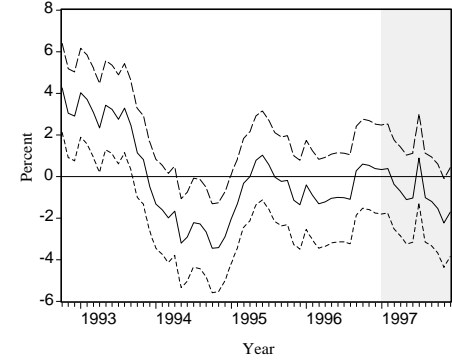
Graph 8

Lending - Deposit Interest Rate Differential



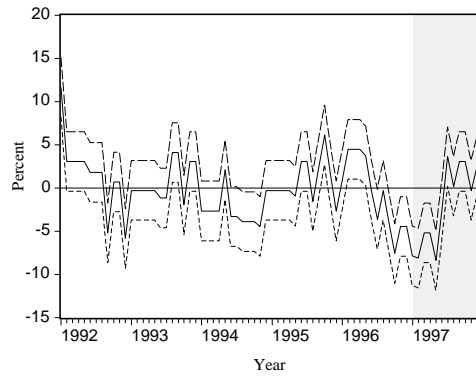
Graph 9

Thai - U.S. Real Interest Rate on Deposits Differential



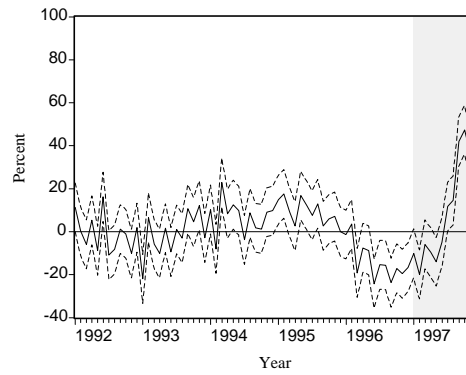
Graph 10

Deposits



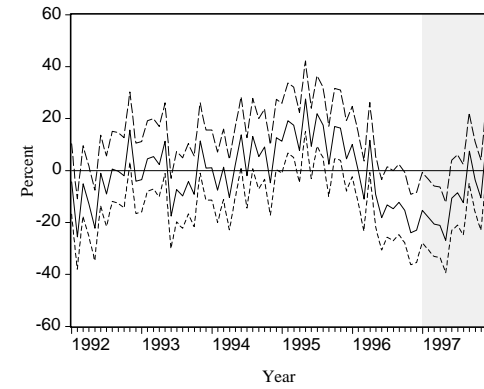
Graph 11

Exports



Graph 12

Imports



3. The Microeconomic Approach to Banking Crises

The microeconomic approach to banking crises has emphasized the institutions and incentives present in the banking system and, in particular, the role of deposit guarantees. White (1991) presents the causes of the savings and loan crisis using banks' balance sheets and anecdotal evidence. He shows that certain thrifts responded to deregulation by increasing the size of their insurance subsidy. For over six years, the S&Ls exploited the government guarantee through rapid growth of their insured liabilities and more high-risk lending behavior. These themes reappear in Gunther and Robinson's (1990) and Horvitz's (1992) studies on Texan thrift failures, Calomiris (1989, 1992) and Calomiris and Mason's (1997) studies of bank failures in the United States during the 1920s and 1930s, and Brock's (1996) examination of the 1982-83 Chilean banking crisis. Theoretical work has concentrated on designing optimal deposit guarantee systems in the presence of moral hazard and adverse selection (Dewatripont and Tirole 1994). Indeed, it is debated whether or not fairly priced deposit insurance is even possible (Chan, Greenbaum, and Thakor 1992, Freixas and Rochet 1997).

Merton (1977) first showed that deposit insurance can be modeled as a put option on the value of bank assets. Empirical papers beginning with Marcus and Shaked (1984) and Ronn and Verma (1986) have focused on calculating actuarially fair deposit insurance premiums for U.S. commercial banks. This focus stems from the hypothesis that the moral hazard incentives produced by insurance could be eliminated if banks paid actuarially fair premiums. Other papers have extended this analysis to different institutions. Cordell and Gordon (1990) estimate the price of deposit guarantees for U.S. savings and loans and show that the insurance value indicated at an earlier date those banks that failed than traditional GAAP measures. Giammarino, Schwartz and Zechner (1989) calculate deposit insurance premiums for Canadian banks and found that there was cross-subsidization across banks. Fries, Mason and Perraudin (1993) and Sato, Ramachandran and Kang (1990) estimate the value of deposit insurance to Japanese banks. Numerous extensions to the option-pricing model have been proposed to include forbearance (Nagarajan and Sealey 1995 and Allen and Saunders 1993), audit costs and liquidation costs (Mullins and Pyle 1994), endogenous closure rules (Fries, Mella-Barral

and Perraudin 1997), and charter value (Acharya 1996). However, these extensions cannot be used empirically.

In this paper, I will use the option-pricing approach to calculate the value of the insurance subsidy to banks in Thailand. With the exception of Duan and Yu's (1994) treatment of Taiwan, no papers have applied the option approach to an emerging market. Instead of concentrating on calculating actuarially fair premiums as in much of the literature, I expand the option-pricing methodology to uncover the extent to which Thai banks benefited from the deposit insurance subsidy. Moreover, I show the provision of implicit deposit insurance in Thailand generated incentives for banks to grow and take on risk that made Thailand's 1997-98 banking crisis almost inevitable.

3.1 The Option-Pricing Model of Deposit Insurance

The option-pricing model of deposit insurance stems from Merton (1977). This approach models a bank's shareholders as holding a one-year European-style put option on the value of the bank's assets. Given a firm that issues a single, homogenous debt that will mature to \$B, the firm will be solvent if the value of its assets, V , are larger than the value of its total debt. If the value of the firm is less than the value of its debt, then the firm is insolvent and the insurer assumes the claims to the debt holder. To apply this model to a bank, several assumptions are made. First, it is assumed that the bank's debts are equal to its deposits and that all deposits including their interest are insured. Therefore, insured deposits are riskless and their book value, D , equals Be^{-rT} . Second, it is assumed that the time, T , until the maturity of the deposits is equal to the time until the next annual audit of the bank. Finally, assuming the bank's asset values follow geometric Brownian motion:

$$d \ln V_t = \mu dt + \sigma dW_t, \tag{1}$$

where:

V = the value of assets,

μ = the instantaneous expected return on assets,

σ = the instantaneous standard deviation of asset returns,

W_t = a standard Wiener process,

we can apply the Black-Scholes option-pricing model to value deposit insurance as follows:

$$I = N(\sigma\sqrt{T-t} - y_t) - \frac{(1-\delta)^n V_t}{D} N(-y_t), \quad (2)$$

where:

$$y_t \equiv \frac{\ln\left(\frac{(1-\delta)^n V_t}{D}\right) + \frac{\sigma^2}{2} \cdot (T-t)}{\sigma\sqrt{T-t}},$$

I = value of deposit insurance guarantee per dollar of deposits,

N = cumulative standard normal density function,

T = time until maturity of the debt,

D = face value of debt,

δ = dividend payment per dollar of equity,

n = frequency of dividend payment per year.

To use this model empirically to calculate the value of the guarantee to the bank, we need estimates of the unobserved value of bank assets, V , and their volatility, σ . Ronn and Verma (1986) approach this problem by modeling the bank's equity as a call option on the value of the bank's assets with a strike price equal to the value of the bank's debt.

$$E_t = V_t N(x_t) - DN(x_t - \sigma\sqrt{T-t}) \quad (3)^6$$

where:

$$x_t \equiv \frac{\ln\left(\frac{V_t}{D}\right) + \frac{\sigma^2}{2} \cdot (T-t)}{\sigma\sqrt{T-t}},$$

E_t = market capitalization of the bank at time t ,

D = face value of debt,

T = time until maturity of call option,

Applying Ito's Lemma to equation (3) derives the second equation:

⁶ Ronn and Verma model equity as being dividend protected and therefore dividends do not appear in equation (3).

$$\sigma = \frac{\sigma_E E_t}{V_t N(x_t)}, \quad (4)$$

where,

σ_E = standard deviation of equity returns.

Using data on total debt, bank equity, and equity volatility, equations (3) and (4) can be solved simultaneously for V and σ . Given these values, equation (2) is used to solve for the insurance premium per dollar of deposits. In order for this approach to be valid, the time until maturity, T , of the put and call options must be the same. Ronn and Verma use Merton's assumption that the time until maturity of the debt is equal to the time until the next audit. They interpret the strike price of the put option to be equal to the total debt of the bank (total domestic deposits plus total borrowings) instead of just total deposits. This assumes that all of the debts of the bank are insured and that they are issued at the risk-free rate of interest.⁷

In this paper, I retain the basic structure of Ronn and Verma (1986), but utilize a maximum likelihood framework based on Duan (1994).⁸ Equation (4) was derived by applying Ito's lemma to the call-option formula (equation (3)); therefore, equation (4) cannot be used as a separate restriction from equation (3) in solving for V and σ .

Duan (1994) shows that writing the log-likelihood function for the unobserved asset values, V_t , in terms of the observed equity values will avoid these problems. Since the unobserved values of the bank's assets follows a continuous time lognormal process, the log-likelihood function for V can be expressed as:

$$L_t(V_t; \mu, \sigma) = -\frac{n-1}{2} \ln(2\pi\sigma^2) - \frac{1}{2\sigma^2} \sum_{t=2}^n \left[\ln\left(\frac{V_t}{V_{t-1}}\right) - \mu \right]^2 \quad t=1, \dots, n \quad (5)$$

Since the call-option formula (equation (3)) is an element-by-element transformation from unobserved asset values to observed equity values, we can write the sample log-likelihood function for equity as:

⁷ Ronn and Verma show that compounding the non-deposit debt of the bank by the rate paid and discounting it by the risk-free interest rate makes little empirical difference in the value of deposit insurance.

⁸ Fries, Mason, and Perraudin (1993) use a similar technique to value deposit insurance for Japanese financial institutions.

$$L(E_t; \mu, \sigma) = -\frac{n-1}{2} \ln(2\pi\sigma^2) - \sum_{t=2}^n \ln(N(\hat{x}_t)) - \frac{1}{2\sigma^2} \sum_{t=2}^n \left[\ln\left(\frac{\hat{V}_t(\sigma)}{\hat{V}_{t-1}(\sigma)}\right) - \mu \right]^2 \quad t=1, \dots, n \quad (6)^9$$

where $\hat{V}_t(\sigma)$ is the unique solution to equation (3) for any σ , and \hat{x}_t is x_t evaluated with $\hat{V}_t(\sigma)$ instead of V_t . Given starting values for μ and σ and data on equity values (E_t) and debt (D), equation (3) can be solved to yield a series of bank asset values (V_t). Equation (6) is then used to solve for $\hat{\mu}$ and $\hat{\sigma}$. This process is iterated to find the maximum likelihood estimates of $\hat{\mu}$ and $\hat{\sigma}$ and their standard errors. Using the put option formula for deposit insurance (equation (2)), one can then solve for the value of the guarantee per dollar of deposits and its standard error.

4. Overview of the Thai Financial System and Current Banking Crisis

The Thai financial system consists of domestic commercial banks, foreign commercial banks, finance companies, securities firms, credit fonciers, government development banks, and insurance companies. Due to data limitations, I calculate the value of the insurance subsidy solely for Thai commercial banks. From Figures A1 and A2 in Appendix A it is apparent that commercial banks are the dominant providers of credit and holders of deposits in the Thai economy. In 1997 commercial banks in Thailand furnished 92% of the credit in the economy and held 83% of domestic deposits.¹⁰ Foreign banks are limited to three branches and mostly provide trade finance to multinational firms. Therefore, concentrating on the domestic commercial banking system should not distort our perceptions of Thailand's financial system.

Thailand experienced a banking crisis in the mid-1980s. In 1984 Asia Trust Bank was taken over by the government and subsequently renamed Sayam Bank. Following this event, in 1985, new banking legislation was approved that allowed the Bank of

⁹ Duan derives equation (6) showing that the likelihood function of observed equity values is equal to the likelihood function of unobserved asset values (evaluated at the optimal sigma) minus the sum of the logarithm of the first derivative of the observed equity values with respect to the unobserved asset values,

$$\text{or } - \sum_{t=2}^T \ln\left(\frac{\partial E}{\partial V}\right) = - \sum_{t=2}^T \ln\left(N(\hat{x}_t)\right).$$

¹⁰ Prior to 1997 before the majority of finance companies were closed, commercial banks provided somewhat less credit and held fewer deposits than indicated by Figures A1 and A2.

Thailand either to seize or to freeze assets and to replace bank management. The legislation also created a Fund for the Rehabilitation and Development of the Financial Institution System. Banks were required to provide annual contributions of 0.1% of their total deposits. Empowered with these new tools, the Bank of Thailand assumed control of First Bangkok City Bank and Siam City Bank. The Rehabilitation and Development Fund assumed the bad debts of these banks, recapitalized the banks, and issued new shares, which it sold to the private sector. Additionally, the Bank of Thailand closed 50 finance companies. According to Caprio and Klingebiel (1996), the three insolvent banks comprised 14.1% of the assets of the commercial banking system and the cost to the government from providing assistance to the finance companies totaled 0.5% of GNP. The banking crisis in the mid-1980s was important because it established a precedent, as well as the Fund, to undertake future bailouts.

Table 1 lists the 16 domestic commercial banks in Thailand as of 1998 and ranks the banks according to their size in 1997. Our sample consists of 15 of these banks from 1992 to 1997. The central bank formed the 16th bank, Radansim Bank, in 1998 with the assets of closed finance companies. Appendix B presents a chronology of the financial events in Thailand since 1992. The following section details the important incidents in Thailand's banking crisis.

The Bank of Thailand's provision of deposit insurance, coupled with poor regulation and supervision of the banking system, generated incentives for banks to exploit the government guarantee. One way for banks to increase the size of their insurance subsidy was to grow quickly. Table 1 lists the average rate of growth over 1992 to 1997. These growth rates are substantially higher than the growth rate of nominal GDP, which averaged 11% over this period. Furthermore, the most rapid growth, when compared to the growth of nominal GDP, took place in 1997. Until 1997, secured loans were not classified as nonperforming until no payments were made for over one year. Banks, therefore, could make unsound loans to increase the value of the government guarantee and there would be a lag before these actions became apparent to regulators.

Table 1 : Thai Domestic Commercial Banks

Bank Name	Bank Assets, 1997 (Baht billions)	Growth in Bank Assets (percent per year 1992-97)
Bangkok Bank	1,416.0	16.3%
Thai Farmers Bank	795.4	16.9%
Krung Thai Bank	791.1	16.9%
Siam Commercial Bank	717.2	21.4%
Bank of Ayudhya	493.8	23.2%
Thai Military Bank	388.5	20.4%
First Bangkok City Bank	287.6	17.8%
Siam City Bank	264.2	21.4%
Bangkok Metropolitan Bank	190.3	16.4%
Bangkok Bank of Asia	158.3	23.0%
Bangkok Bank of Commerce	148.0	22.0%*
The Thai Danu Bank	130.3	25.8%
Union Bank of Bangkok	77.6	16.4%
Nakornthon Bank	73.8	20.4%
Laem Thong Bank	51.1	29.2%
Radansim Bank	Not in existence until 1998	
Total	5,983.2 (120% of GDP)	

* Bangkok Bank of Commerce data excludes 1996 and 1997. Source: Datastream.

The proximate cause of the current banking crisis in Thailand was traced to the collapse of Bangkok Bank of Commerce (BBC). Despite evidence of fraudulent behavior by top management, the Bank of Thailand waited until BBC experienced bank runs in May 1996 to take action. At that time, the Bank of Thailand injected Bt 13 billion into BBC; this action reaffirmed the central bank's guarantee of the banking system. Throughout 1996, confidence in the Thai financial system eroded as details of BBC's ties to politicians and the central bank surfaced. In July 1996, the Central Bank Governor resigned and the Finance Ministry began an investigation into the treatment of BBC.

In conjunction with lax supervision of the banking system, the central bank's interest rate policy contributed to the crisis. The Bank of Thailand pursued a tight monetary policy designed to contain inflation, maintain the peg of the baht to the dollar, attract capital inflows, and spur the development of Thailand's offshore banking center. Interest rates in Thailand rose to as much as 6 percent above comparable rates in the United States. Commercial banks and finance companies concentrated on borrowing overseas and re-lending in Thailand. As a result, the Thai financial system was heavily dependent on the exchange rate regime and the private sector had a large external debt

burden.¹¹ In July 1997, the central bank abandoned the exchange rate peg. By the end of July the Bank of Thailand had suspended 58 finance companies. The assets of these companies represented one-fifth of the total assets of Thai finance companies.

In October 1997 the government made a formal statement guaranteeing the deposits of the 15 commercial banks and the remaining 33 finance companies. The financial health of commercial banks continued to worsen throughout 1997 and 1998. In 1997, only seven of Thailand's commercial banks reported profits for the year and these profits were substantially less than in 1996. Table 2 reports the pretax profits of these seven "marginal" banks. Table 3 presents the losses of Thailand's other eight "bad" banks. Under the IMF program Thailand maintained high interest rates to shore-up confidence in the Baht. However, these high interest rates contributed to the collapse of economic activity in Thailand.¹² Non-performing loans and provisions have increased dramatically because borrowers cannot repay their loans and because standards are being tightened.¹³ Moreover, the central bank has increased the level of provisions that banks have to provide against nonperforming loans. (See Appendix B) Tables 2 and 3 list the provisions made by banks in 1997 and their percent change over 1996.¹⁴

Table 2: Marginal Banks, Selected Results in 1997

(Millions of Baht)

Bank	Profit (pre-tax)	Profit /Assets (percent)	Change from 1996 (percent)	Provisions	Change from 1996 (percent)
Bangkok Bank	8,664	0.61%	-72%	28,414	396%
Bank of Ayudhya	2,727	0.55%	-62%	7,085	474%
Krung Thai Bank	338	0.04%	-98%	18,973	503%
Siam Commercial Bank	5,232	0.73%	-57%	11,597	932%
The Thai Danu Bank	63	0.05%	-96%	2,236	375%
Thai Farmers Bank	1,030	0.13%	-94%	16,810	620%
Thai Military Bank	1,962	0.50%	-43%	3,505	776%

Source: Datastream.

¹¹ Following the devaluation in 7/1997, the debt-to-equity ratio of the private sector jumped from 100% to 250%. EIU Country Report 3rd Quarter 1998.

¹² Real GDP is predicted to contract by 8% in 1998. EIU Country Report 2nd Quarter 1998.

¹³ In October 1997, nonperforming loans were redefined as loans 6-months past due, and again in April 1998, as loans 3-months past due.

¹⁴ Data on nonperforming loans is not available.

Table 3: Bad Banks, Selected Results in 1997

(Millions of Baht)

Bank	Profit (pre-tax)	Profit / Assets (percent)	Change from 1996 (percent)	Provisions	Change from 1996 (percent)
Bank of Asia	-374	-0.24%	-115%	1,675	264%
First Bangkok City Bank	-31,476	-10.94%	-605%	38,594	4724%
Laem Thong Bank	-891	-1.74%	-397%	107	49%
Nakornthon Bank	-170	-0.23%	-118%	1,053	792%
Siam City Bank	-13,809	-5.23%	-390%	17,664	1907%
Union Bank of Bangkok	-3,431	-4.42%	-1354%	2,958	4138%
Bangkok Bk. of Commerce	-15,644	-10.57%	-37%	N. A.	N. A.
Bangkok Metropolitan Bk.	-23,590	-12.40%	-1824%	N. A.	N. A.

Source: Datastream.

In August 1998 the Thai legislature approved new legislation to speed the resolution of the banking crisis. The central bank can now force finance companies and commercial banks to merge and can issue bonds to recapitalize banks. As of November 1998 the Bank of Thailand has assumed control of 6 commercial banks and 63 finance companies. The closed commercial banks include: Bangkok Bank of Commerce, Bangkok Metropolitan Bank, Siam City Bank, First Bangkok City Bank, Laem Thong Bank, and Union Bank of Bangkok. Foreign-owned banks bought Bank of Asia and the Thai Danu Bank. Krung Thai Bank has already sought assistance from the FIDF to recapitalize, while Bank of Ayudhya, Siam Commercial Bank, and Thai Military Bank are likely to seek assistance. Only Bangkok Bank and Thai Farmers Bank have raised new capital by issuing shares to foreign entities. (See Appendix C for more details.)

The costs thus far of Thailand's banking crisis are staggering. As of April 1998 the Financial Institutions Development Fund (FIDF) had Bt 1.1 trillion in debt outstanding. This amounts to over one-fifth of expected Thai GDP for 1998. In September 1998, the Bank of Thailand announced that problem loans of the entire financial system totaled Bt 1.72 trillion.

5. Estimating the Value of Deposit Insurance for Thai Banks

The data used in this paper includes market capitalization, total deposits, total liabilities, dividends per baht, and dividend frequency for 15 Thai banks from 1992

through end-1996.¹⁵ The data comes from Datastream.¹⁶ Daily data was available for market capitalization values, but total deposits and total liabilities were only available annually. For equation (2), equation (3), and equation (6), I used a series of daily market capitalization values for equity, end-of-year total deposits or total liabilities for D , dividends per baht for δ , and dividend frequency for n . Thus for each year and each bank, I estimated the option value of deposit insurance using the December value of deposits or liabilities, and daily, January through December values of market capitalization for the bank. I retain the assumption that the put option expires in December of the following year. The sample included all days the stock market was open for trading.¹⁷

I constructed a constrained maximum likelihood estimation procedure that used as inputs starting values for μ and σ , and data on market capitalization, dividends, and debt for one bank for one year.¹⁸ In the maximum likelihood estimation, σ was constrained to be positive because the put and call option formulas (equations (2) and (3)) are sensitive to small values of σ .¹⁹ The procedure then generated a daily series of implied asset values using the call pricing formula (equation (3)). The implied asset values were used to construct the likelihood function (equation (7)). Maximizing the likelihood function produced estimates of the expected return on bank assets, $\hat{\mu}$, and their standard deviation, $\hat{\sigma}$. The program iterated until optimal estimates of $\hat{\mu}$ and $\hat{\sigma}$ were found. The maximum likelihood estimates were used in the call option formula (equation (3)) to construct the end-year asset value, $\hat{V}(\sigma)$. Using the estimates $\hat{V}(\sigma)$ and $\hat{\sigma}$, the program

¹⁵ While data was available for 1997, I do not calculate the 1997 value of deposit insurance. This is because the 1997 put option expires at end-1998, and by this time all of the banks had already sold their claims to the insurer. Moreover, the standard deviation of asset returns is assumed to be constant over the year in which the option is priced. This assumption is likely to be violated in 1997 when there was a sharp fall in asset prices.

¹⁶ Market capitalization values are listed as datatype MV. Total deposits are total interest and non-interest bearing deposits (code 847) and equal the sum of fixed term deposits (844), deposits on demand (954), savings accounts (959), and other customer accounts (963). Total liabilities (code 2401) equals total short and long-term liabilities. Dividends per baht are equal to dividends per share (code 190) divided by share price. Dividend frequency is reported as datatype DT.

¹⁷ The number of days was 254 in 1992, 253 in 1993, 252 in 1994, 252 in 1995, and 254 in 1996.

¹⁸ The estimation code was written in Gauss and utilized the optimization library, Optmum, and the constrained maximum likelihood library, CML. The estimation code is available upon request.

¹⁹ In most cases, the constraint that σ is positive is not binding. In the few cases that the constraint was binding, standard errors of the estimates could not be calculated because the standard error of $\hat{\sigma}$ was undefined.

calculated the value of the one-year deposit insurance put-option, $I(\hat{V}(\sigma), \hat{\sigma})$, using equation (2). Finally, the program calculated the standard errors of $I(\hat{V}(\sigma), \hat{\sigma})$ ²⁰ and $\hat{V}(\sigma)$ ²¹.

I estimated the value of deposit insurance using several different specifications. In estimating the first set of results, I assume that only the deposits of the bank were insured. Deposits were likely to be perceived as insured because of the existence of the FIDF, the central bank's rescue of Bangkok Bank of Commerce in 1996, and the Bank of Thailand's October 1997 statement that guaranteed the deposits of commercial banks. Table A1 in Appendix A contains the complete set of results for 13 Thai banks from 1992 through 1996.²² Table A1 lists end-of-year values of equity and deposits in millions of baht. The maximum likelihood estimates of $\hat{\mu}$ and $\hat{\sigma}$ and their standard errors are listed next. These were used to calculate an estimate of the end-year bank asset value, $\hat{V}(\sigma)$, in millions of baht, and its standard error. Finally, given $\hat{V}(\sigma)$ and $\hat{\sigma}$, the value of deposit insurance and its standard error were calculated as a percent of total deposits and as a percent of equity.

Given the negligible premiums they paid (0.1% of deposits), Thai banks were receiving a subsidy in the form of deposit insurance. This subsidy could either go to owners of the banks, depositors, borrowers, or more likely, all three. I interpret the

²⁰ The asymptotic standard error of I is given by $\sqrt{\left(\frac{\partial I}{\partial V} \frac{d\hat{V}}{d\sigma} + \frac{\partial I}{\partial \sigma}\right)^2}$ * std. error of $\hat{\sigma}$, where

$$\frac{\partial I}{\partial V} = -\frac{N(-y_t)}{D},$$

$$\frac{dI}{d\sigma} = -\sqrt{\frac{1}{2\pi}} \exp\left[-\frac{(y_t - \sigma)^2}{2}\right] \text{ and is evaluated at } \sigma = \hat{\sigma}.$$

²¹ The asymptotic standard error of \hat{V} is given by $\sqrt{\left(\frac{d\hat{V}}{d\sigma}\right)^2}$ * std. error of $\hat{\sigma}$, where

$$\frac{d\hat{V}}{d\sigma} = -\sqrt{\frac{1}{2\pi}} \frac{D}{N(x_t)} \exp\left[-\frac{(x_t - \sigma)^2}{2}\right] \text{ and is evaluated at } \sigma = \hat{\sigma}.$$

²² Deposit insurance values could not be calculated for Bangkok Metropolitan Bank and Bangkok Bank of Commerce because Datastream did not report total deposits.

results in two different ways in order to illustrate the size of the subsidy. In the first case, if bank owners captured the entire subsidy, the estimate of deposit insurance expressed as a percent of equity (Table 4) would measure the portion of the stock market value of the bank attributable to insurance. In other words, in the presence of deposit insurance, banks are able to offer depositors a lower, riskless deposit rate. As a result, banks could achieve higher spreads than if banks had to compensate depositors for some default risk.

Table 4: Estimates of Deposit Insurance as a percent of Equity

BANK	1992	1993	1994	1995	1996
Bangkok Bank (BBL)	57.59 (6.52)	25.94 (3.24)	49.07 (2.60)	19.90 (2.41)	39.08 (5.09)
Bank of Asia (BOA)	88.97 (9.27)	35.86 (3.58)	58.69 (3.81)	75.13 (3.68)	91.31 (8.07)
Bank of Ayudhya (BAY)	73.71 (7.15)	52.43 (3.14)	52.53 (6.22)	41.79 0.00	198.86 (10.58)
First Bangkok City Bank (FBC)	108.18 (6.72)	60.93 (4.56)	62.18 (3.83)	72.42 (4.72)	157.84 (17.41)
Krung Thai Bank (KTB)	77.26	35.58 (3.63)	44.48 (4.06)	27.19 (3.78)	199.62 (7.32)
Laem Thong Bank (LTB)	222.73 (14.74)	51.48 (5.63)	91.62 (7.50)	114.14 (8.17)	103.08 (7.55)
Nakornthon Bank (NTB)	72.30 (16.40)	59.88 (14.62)	76.17 (3.65)	55.57 (4.53)	80.03 (5.89)
Siam City Bank (SCB)	76.21 (4.87)	37.92 (3.64)	35.58 (2.64)	41.86 (3.92)	196.49 (11.90)
Siam Commercial Bank (SBB)	73.12 (7.03)	39.39 (4.41)	52.47 (3.30)	29.51 (3.34)	98.59 (5.22)
The Thai Danu Bank (TDB)	51.71	51.03 (4.07)	45.30 (3.68)	77.69 (8.00)	130.57 (8.00)
Thai Farmers Bank (TFB)	52.73 (6.00)	40.53 (4.33)	30.33 (2.00)	15.54 (2.13)	56.71 (6.54)
Thai Military Bank (TMB)	115.23 (11.77)	46.77 (3.93)	63.15 (4.20)	50.48 (4.68)	76.25 (4.54)
Union Bank of Bangkok (UBB)	215.52 (11.79)	63.19 (5.29)	90.59 (6.72)	58.23 (7.28)	119.60 (9.25)
Average	72.94	37.75	47.21	30.83	94.34

Estimates of deposit insurance as a percent of equity correspond to results in Table A1, Appendix A. Model was estimated with total deposits. Standard errors of estimates in parentheses. When no standard error is listed, the constraint that σ is greater than zero is binding.

Another way to judge the magnitude of the insurance subsidy is to express the estimate of deposit insurance as a percent of deposits (Table 5). In this case, depositors

could capture the entire subsidy if competition among banks increased the deposit rate. Alternatively, competition among banks for borrowers could allow borrowers to capture the subsidy. Borrowers would then pay interest rates below the fair risk-adjusted lending rate.

Table 5: Estimates of Deposit Insurance as a percent of Deposits

BANKS	1992	1993	1994	1995	1996
Bangkok Bank (BBL)	10.51 (1.19)	8.80 (1.10)	15.02 (0.80)	5.72 (0.69)	9.06 (1.18)
Bank of Asia (BOA)	17.18 (1.79)	15.95 (1.59)	21.52 (1.40)	20.94 (1.03)	16.31 (1.44)
Bank of Ayudhya (BAY)	11.81 (1.15)	11.68 (0.70)	8.59 (1.02)	6.69	19.58 (1.04)
First Bangkok City Bank (FBC)	22.79 (1.42)	16.69 (1.25)	16.39 (1.01)	14.61 (0.95)	18.23 (2.01)
Krung Thai Bank (KTB)	9.67	8.95 (0.91)	10.63 (0.97)	8.44 (1.17)	27.17 (1.00)
Laem Thong Bank (LTB)	19.25 (1.27)	10.52 (1.15)	16.92 (1.39)	16.82 (1.20)	15.98 (1.17)
Nakornthon Bank (NTB)	13.50 (3.06)	21.05 (5.14)	21.70 (1.04)	13.27 (1.08)	15.62 (1.15)
Siam City Bank (SCB)	17.64 (1.13)	10.39 (1.00)	10.17 (0.75)	8.52 (0.80)	17.13 (1.04)
Siam Commercial Bank (SBB)	13.48 (1.30)	11.16 (1.25)	14.53 (0.91)	8.33 (0.94)	16.55 (0.88)
The Thai Danu Bank (TDB)	7.13	10.34 (0.82)	9.06 (0.73)	11.80 (1.21)	17.63 (1.08)
Thai Farmers Bank (TFB)	9.96 (1.13)	10.43 (1.11)	10.41 (0.69)	4.69 (0.64)	11.28 (1.30)
Thai Military Bank (TMB)	15.84 (1.62)	12.36 (1.04)	13.63 (0.91)	10.44 (0.97)	13.04 (0.78)
Union Bank of Bangkok (UBB)	34.71 (1.90)	13.81 (1.16)	19.42 (1.44)	8.78 (1.10)	16.78 (1.30)
Average	12.50	10.69	12.85	8.01	15.91

Estimates of deposit insurance as a percent of deposits correspond to results in Table A1, Appendix A. Model was estimated with total deposits. Standard errors of estimates in parentheses. When no standard error is listed, the constraint that σ is greater than zero is binding.

More realistically, bank owners, depositors, and lenders all captured some of the deposit insurance subsidy. In this case, depositors would have received slightly higher deposit rates than the riskless deposit rate, borrowers would have paid somewhat lower loan rates than the risk-adjusted lending rate, and the stock market value of the bank would have been somewhat overstated. While the relative ability of these three groups to

capture the insurance subsidy is unknown, Tables 4 and 5 indicate that the size of this subsidy was large. As a comparison, studies using the same maximum likelihood technique found that the highest value of deposit insurance was 2.5% of liabilities for a Taiwanese bank (Duan and Yu 1994), 2.4% for a Japanese bank (Fries, Mason, and Perraudin 1993), and 0.5% for a U.S. bank (Duan 1994).

From 1992 to 1996, the average value of deposit insurance for the Thai commercial banking system totaled nearly Bt 330 billion, 13 percent of deposits, or 53 percent of equity. The large subsidy values in 1992 most likely reflect the political crisis that occurred when the military initiated a violent crackdown on protestors.²³ After falling slightly from 1992, the estimates of deposit insurance increased in 1996. The larger subsidy to banks in 1996 reflects the erosion in bank assets. Moreover, following the Bank of Thailand's injection of funds into Bangkok Bank of Commerce, if banks revised upward their belief that they would be bailed out by the central bank, this would also make deposit insurance more valuable.

The next set of results employ total liabilities instead of total deposits as the strike price of the deposit insurance put option. The assumption that the total liabilities of the Thai banking system were insured is not unrealistic. The central bank's pledge to keep the baht pegged to the dollar was in effect a guarantee that banks would be able to repay their foreign currency loans.

Data on total liabilities is available for all 15 of Thailand's banks. The results of the maximum likelihood estimation using total liabilities are located in Appendix A, Table A2. Table 6 and Table 7 below list the estimates of deposit insurance as a percent of equity and deposits, respectively, when total liabilities are used. The value of the insurance subsidy was not calculated for Bangkok Bank of Commerce in 1996 because the bank was already receiving support from the Bank of Thailand. The high values of the insurance subsidy as a percent of equity for Bangkok Bank of Commerce in 1993-95 illustrate the ability of this approach to identify weak banks. Table A2 reports the value of deposit insurance as a percent of total liabilities as a comparison to Table 7.

²³ Thai Military Bank was particularly hard hit by the military crackdown as depositors voiced their opposition by withdrawing funds. Thai Military Bank was sufficiently concerned that they considered changing their name. (EIU Country Report 2nd Quarter 1992). This fact is evident in the estimate of the insurance subsidy for TMB in 1992.

Table 6: Estimates of Deposit Insurance as a percent of Equity

BANKS	1992	1993	1994	1995	1996
Bangkok Bank (BBL)	64.57 (5.20)	28.20 (2.84)	54.76 (4.56)	22.00 (2.40)	43.47 (3.99)
Bank of Asia (BOA)	98.14 (7.34)	39.86 (3.61)	67.86 (5.34)	83.14 (6.13)	105.69 (7.57)
Bank of Ayudhya (BAY)	77.52 (5.63)	55.31 (4.48)	56.83	44.29	210.17 (13.22)
First Bangkok City Bank (FBC)	116.69 (7.91)	65.37 (5.12)	66.98 7.91	79.31 (5.90)	172.29 (10.83)
Krung Thai Bank (KTB)	61.19	36.75 (3.47)	46.68 (4.18)	29.42 (2.93)	212.89 (12.76)
Laem Thong Bank (LTB)	227.89 (14.97)	53.28 (4.83)	97.76 (7.46)	121.56 (8.93)	110.54 (8.29)
Nakornthon Bank (NTB)	106.24 (6.98)	52.47 (4.38)	95.20 (6.64)	63.30 (5.12)	99.00 (7.17)
Siam City Bank (SCB)	81.87 (6.32)	40.31 (3.80)	38.02 (3.64)	45.28 (4.23)	215.51 (14.34)
Siam Commercial Bank (SBB)	63.67	53.60 (4.07)	57.25 (4.75)	32.43 (3.14)	109.08 (7.98)
The Thai Danu Bank (TDB)	67.74	55.01 (4.73)	51.71 (4.53)	92.99	146.58 (10.03)
Thai Farmers Bank (TFB)	57.63 (4.55)	42.87 (3.83)	32.17 (3.08)	16.65 (1.95)	60.05 (5.01)
Thai Military Bank (TMB)	127.074	50.12 (4.24)	68.30 (5.46)	55.73 (4.68)	115.88 (7.63)
Union Bank of Bangkok (UBB)	236.27 (13.48)	66.63 (5.64)	98.16 (7.45)	62.22	127.25 (9.49)
Bangkok Metropolitan Bank (BMB)	89.47 (7.12)	53.37 (4.77)	66.70 (5.55)	71.93 (6.16)	224.58 (15.27)
Bangkok Bank of Commerce (BBC)	87.84 (7.07)	367.64 (19.75)	154.91	107.68 (8.51)	
Average	75.54	46.54	52.86	36.02	106.74

Estimates of deposit insurance as a percent of equity correspond to results in Table A2, Appendix A. Model was estimated with total liabilities. Standard errors of estimates in parentheses. When no standard error is listed, the constraint that σ is greater than zero is binding.

For all banks and for all years, the estimates of bank assets increase and their volatility decrease when total liabilities are used instead of total deposits. The value of deposit insurance as a percent of equity or deposits increased in all cases, with the exceptions of KTB in 1992, NTB in 1993, and SBB in 1992. Therefore the broader guarantee of the commercial banking system led to a larger subsidy to banks.

Table 7: Estimates of Deposit Insurance as a percent of Total Deposits

BANKS	1992	1993	1994	1995	1996
Bangkok Bank (BBL)	11.78 (0.95)	9.56 (0.96)	16.76 (1.39)	6.32 (0.69)	10.08 (0.93)
Bank of Asia (BOA)	18.95 (1.42)	17.74 (1.61)	24.89 (1.96)	23.17 (1.71)	18.88 (1.35)
Bank of Ayudhya (BAY)	12.42 (0.90)	12.32 (1.00)	9.29	7.09	20.70 (1.30)
First Bangkok City Bank (FBC)	24.58 (1.67)	17.91 (1.40)	17.66 (1.36)	16.00 (1.19)	19.90 (1.25)
Krung Thai Bank (KTB)	7.66	9.24 (0.87)	11.16 (1.00)	9.13 (0.91)	28.97 (1.74)
Laem Thong Bank (LTB)	19.70 (1.29)	10.89 (0.99)	18.05 (1.38)	17.92 (1.32)	17.14 (1.29)
Nakornthon Bank (NTB)	19.84 (1.30)	18.44 (1.54)	27.12 (1.89)	15.12 (1.22)	19.32 (1.40)
Siam City Bank (SCB)	18.95 (1.46)	11.04 (1.04)	10.87 (1.04)	9.21 (0.86)	18.78 (1.25)
Siam Commercial Bank (SBB)	11.73	15.19 (1.15)	15.85 (1.32)	9.15 (0.89)	18.31 (1.34)
The Thai Danu Bank (TDB)	9.35	11.15 (0.96)	10.34 (0.91)	14.12	19.79 (1.35)
Thai Farmers Bank (TFB)	10.88 (0.86)	11.04 (0.99)	11.04 (1.06)	5.03 (0.59)	11.95 (1.00)
Thai Military Bank (TMB)	17.47	13.25 (1.12)	14.74 (1.18)	11.52 (0.97)	19.83 (1.31)
Union Bank of Bangkok (UBB)	38.05 (2.17)	14.56 (1.23)	21.05 (1.60)	9.38	17.85 (1.33)
Average	12.95	11.72	14.02	8.76	17.67

Estimates of deposit insurance as a percent of deposits correspond to results in Table A2, Appendix A. Model was estimated with total liabilities. Standard errors of estimates in parentheses. When no standard error is listed, the constraint that σ is greater than zero is binding. Note: Bangkok Bank of Commerce and Bangkok Metropolitan Bank are not listed on this table because deposit data for these banks is not available. The estimates of deposit insurance for these banks as a percent of liabilities are in Table A2.

6. Evaluating the Results

In this section, I analyze the estimates of the deposit guarantees to determine whether the subsidy values can distinguish between safe and unsafe banks and explain why the Thai banking crisis occurred. In particular, do the subsidy estimates match the “marginal” and “bad” banks of Tables 2 and Table 3? Are the guarantee values correlated with those banks that failed in 1998? Do the subsidy values and estimated asset values uncover the exploitation of the government guarantee by certain banks? Would reported balance sheet information lead to the same conclusions?

In Table 8, I list the banks in descending order according to their average estimated deposit insurance subsidy as a percent of liabilities over 1992 to 1996.²⁴ The calculations used to construct Table 8 can be found in Table A3 in Appendix A. The eight banks listed in bold correspond to the “bad” banks listed in Table 3. The seven banks listed in italics had slightly lower insurance subsidies and correspond to the “marginal banks” listed in Table 2. These rankings are based on the results using total liabilities for the guarantee. However, the same banks are picked as the worst banks if the estimated insurance subsidies employing total deposits are used.²⁵

Table 8: Banks Ranked by their Deposit Insurance Subsidies in Descending Order

BANK	OUTCOME OF THAI BANKS IN 1998
First Bangkok City Bank	Nationalized by Central Bank
Union Bank of Bangkok	Nationalized by Central Bank
Bank of Asia	Bought by foreign owners
Bangkok Bk of Commerce	Nationalized by Central Bank
Nakornthon Bank	About to be bought by foreign owners
Laem Thong Bank	Nationalized by Central Bank
<i>Thai Military Bank</i>	Will be recapitalized by Central Bank
<i>Krung Thai Bank</i>	Has been recapitalized by Central Bank
<i>Siam Commercial Bank</i>	Will be recapitalized by Central Bank
<i>Bank of Ayudhya</i>	Will be recapitalized by Central Bank
Bangkok Metropolitan Bk	Nationalized by Central Bank
Siam City Bank	Nationalized by Central Bank
<i>The Thai Danu Bank</i>	Bought by foreign owners
<i>Thai Farmers Bank</i>	Recapitalized by issuing new shares to foreign firms
<i>Bangkok Bank</i>	Recapitalized by issuing new shares to foreign firms

Banks are ranked in descending order of average deposit insurance subsidy over 1992 –96. Estimates of the deposit insurance subsidy as a percent of liabilities are from Table A2, which uses total liabilities.

Table 8 describes the actions taken towards the banks in 1998. The “bad” banks have all been nationalized by the government or bought by foreign owners. The “marginal” banks, with the exception of The Thai Danu Bank, are able to participate in the government’s recapitalization program. Only Bangkok Bank and Thai Farmers Bank have recapitalized without government assistance by selling a minority stake to foreign owners.

²⁴ The analysis uses deposit insurance as a percent of total liabilities so that all banks could be compared, including the two without deposit data. The ratio of deposit insurance a percent of equity was not used because equity is more volatile than liabilities. However the rankings using deposit insurance as percent of equity find the 5 banks with the highest subsidy values are **BBC, LTB, UBB, BMB, and FBC**.

²⁵ The rankings using the estimated value of deposit insurance from Table 5 are: **BOA, NTB, FBC, LTB, UBB, KTB, SBB, TMB, TDB, BAY, SCB, BBL, and TFB**.

Siam City Bank and Bangkok Metropolitan Bank are the only banks not grouped with the other “bad” banks; however they are lumped in a middle group of banks with Siam Commercial Bank, Thai Military Bank, Bank of Ayudhya, and Krung Thai Bank. In several of these middle banks political factors may have played a role in their outcomes: Krung Thai Bank is owned by the government, Siam Commercial Bank is largely owned by the royal family, and Thai Military Bank is largely owned by the military. Thus, the estimates of the deposit insurance subsidy over 1992 to 1996 match the outcomes of Thai banks, both in terms of their profits (losses) in 1997 and the actions taken against them in 1998.

In order to examine the ability of the insurance subsidy to classify the banks into two groups prior to the crisis, I carried out the same analysis using the average deposit insurance subsidy from 1992 to 1995. Whether total deposits or total liabilities are used, the average subsidy value divides the banks into similar groupings as in Table 8.²⁶ (See Table A3). Moreover, the estimates of the insurance subsidy could be used on a yearly basis to identify the worst banks. Table A3 indicates the worst banks for each year. Prior to 1996, with a few exceptions, the values of deposit insurance routinely identify the group of “bad” banks.

In contrast, examining the profit-to-asset ratios in 1996 would not reveal the same distinction between banks as it did in Tables 2 and 3. With the exception of Laem Thong Bank and Union Bank of Bangkok, the remaining banks all had profits ranging from 1% to 2.7% of assets.²⁷ Therefore, while the profit results at the end of 1997 are able to make a distinction between “bad” and “marginal” banks, reported profits prior to the crisis provide no such information.

The estimated insurance values were large prior to 1996 and then increased sharply in that year. Banks may have attempted to maximize the size of this subsidy either by expanding their insured liabilities or by financing riskier projects. White (1991) showed that the failed S&Ls grew at faster rates and had more nontraditional loans and investments than those thrifts that did not fail. The data available on Thailand’s banking

²⁶ Using total liabilities the ranking becomes: **FBC, UBB, BOA, BBC, NTB, LTB, TMB, SBB, BMB, SCB, BAY, BBL, TDB, TFB**, and *KTB*. Using total deposits the ranking becomes: **UBB, BOA, FBC, NTB, LTB, TMB, SBB, SCB, BBL, BAY, TDB, KTB**, and *TFB*.

²⁷ The profit to asset ratios are: 2.7% BBL, 1.7% BAY, 2.0% KTB, 2.2% SBB, 1.4% TDB, 2.6% TFB, 1% TMB, 2% BOA, 2.5% FBC, 0.7% LTB, 1.5% NTB, 2% SCB, 0.3% UBB.

sector does not separate investments and loans into different categories, so a similar, detailed analysis is not possible.

In Table A4 and Table A5, in Appendix A, I present selected indicators from bank balance sheets for the “marginal” and “bad” banks, respectively. The growth rate of assets while fairly large, is not substantially different between groups.²⁸ The division of assets among investments, loans, and bad debt reserves is also fairly constant among banks. Also, listed in Tables A4 and A5 are the q-ratios across banks. The q-ratio indicates the equity value of the bank per baht of paid in capital. Prior to 1997, the q-ratio is above one for most banks, indicating that the stock market viewed banks as a good investment. However, a large portion of this stock market value can be attributed to the deposit insurance subsidy. I have also included in Tables A4 and A5 the estimated insurance subsidy as a percent of assets to be used as a comparison. Thus, using a traditional approach to examine the banks’ balance sheets would not distinguish between bank types.

Tables 9 and 10 list the capital-to-asset ratios, the market-value to asset ratios, and the corrected-market-value to asset ratios for the “marginal” and “bad” banks, respectively. Using the capital-to-asset ratios to examine the Thai banking system would generate the wrong conclusion: that all banks were relatively healthy. The capital-to-asset ratios do not even show deterioration in bank capital in 1997 (with the exception of FCB and SCB whose capital was written down at the end of 1997). Bangkok Bank of Commerce does have the lowest capital-to-asset ratios over the period, indicating that regulators must have been aware of its weak condition in 1994-95. Despite capital-to-asset ratios below the BIS norm of 8% for several banks, Thai banking regulators may have been misled by the high market-value to asset ratios. The large market value of the bank could reflect the franchise or future value of the bank. Regulators may have believed that given the high market capitalization values, banks would eventually be able to raise their paid-in capital.

²⁸ The “bad” banks average growth rate of assets was 21% and for “marginal” banks asset growth averaged 20%.

Table 9: Asset Ratios For "Marginal" Banks

Bangkok Bank	1992	1993	1994	1995	1996	1997
Capital / Assets	6.81%	8.55%	8.67%	8.95%	9.29%	7.27%
Mkt. Value / Assets	13.66%	25.32%	22.15%	21.16%	16.80%	6.08%
Corrected MV / Assets	4.84%	18.18%	10.02%	16.51%	9.50%	
Bank of Ayudhya	1992	1993	1994	1995	1996	1997
Capital / Assets	8.56%	8.53%	6.78%	6.01%	7.26%	5.31%
Mkt. Value / Assets	13.67%	18.61%	13.41%	13.56%	8.07%	2.02%
Corrected MV / Assets	3.07%	8.32%	5.79%	7.56%	-8.90%	
Krung Thai Bank	1992	1993	1994	1995	1996	1997
Capital / Assets	5.55%	5.36%	5.88%	7.01%	7.07%	5.79%
Mkt. Value / Assets	10.90%	21.99%	19.81%	24.24%	11.06%	1.83%
Corrected MV / Assets	4.23%	13.91%	10.56%	17.11%	-12.48%	
Siam Commercial Bk.	1992	1993	1994	1995	1996	1997
Capital / Assets	7.05%	8.05%	8.22%	7.78%	7.52%	5.82%
Mkt. Value / Assets	14.48%	22.79%	20.88%	21.30%	12.38%	3.40%
Corrected MV / Assets	5.26%	10.58%	8.93%	14.39%	-1.12%	
Thai Danu Bank	1992	1993	1994	1995	1996	1997
Capital / Assets	6.04%	7.00%	6.77%	6.66%	9.74%	6.99%
Mkt. Value / Assets	10.71%	15.61%	13.86%	10.53%	9.28%	3.65%
Corrected MV / Assets	3.45%	7.02%	6.69%	0.74%	-4.32%	
Thai Farmers Bank	1992	1993	1994	1995	1996	1997
Capital / Assets	7.42%	8.07%	9.17%	9.01%	9.62%	7.14%
Mkt. Value / Assets	15.40%	21.01%	27.20%	24.06%	16.10%	6.03%
Corrected MV / Assets	6.53%	12.00%	18.45%	20.05%	6.43%	
Thai Military Bank	1992	1993	1994	1995	1996	1997
Capital / Assets	6.09%	7.53%	7.02%	7.42%	7.25%	5.72%
Mkt. Value / Assets	11.50%	21.14%	16.91%	15.76%	13.23%	1.76%
Corrected MV / Assets	-3.11%	10.55%	5.36%	6.98%	-2.10%	

Capital-to-Asset ratios and Market-Value to Asset ratios are from reported balance sheet data from Datastream. The Corrected-Market-Value to Asset ratio was calculated by subtracting the insurance subsidy (from Table 6) from the market value of the bank and dividing by total assets.

The corrected-market-value to asset ratios subtract off the portion of the market value of the bank attributable to the insurance subsidy (Table 6). The corrected-market-value to asset ratios more accurately capture the true franchise value of the banks. In 1995, all of the banks that were later nationalized by the central bank or bought by foreign entities had corrected-market-value to asset ratios below 6.5%, with the exception of Siam City Bank. The remaining banks all had corrected-market-value to asset ratios above this figure. Examining the ratios, four banks: First Bangkok City Bank, Union Bank of Bangkok, Bangkok Bank of Commerce, and Bangkok Metropolitan Bank had corrected-market-value to asset ratios below their reported capital-to-asset ratios for all 5 years. The remaining “bad” banks, with the exception of Siam City Bank, had corrected

market value-to-asset ratios below their capital-to-asset ratios for 4 years. This suggests that these banks were undercapitalized and had little franchise value. As a result, it was unlikely that these banks would eventually grow out of their problems. With the exceptions of Bangkok Bank and Thai Farmers Bank, all Thai banks had negative corrected-market-value to asset ratios for 1996.

Table 10: Asset Ratios For "Bad" Banks

Bank of Asia	1992	1993	1994	1995	1996	1997
Capital / Assets	7.04%	7.35%	7.71%	7.09%	8.91%	5.92%
Mkt. Value / Assets	13.59%	30.02%	23.59%	20.47%	12.29%	3.21%
Corrected MV / Assets	0.25%	18.05%	7.58%	3.45%	-0.70%	
First Bangkok City Bk.	1992	1993	1994	1995	1996	1997
Capital / Assets	7.14%	8.42%	10.70%	11.67%	10.61%	-2.51%
Mkt. Value / Assets	16.30%	21.44%	20.41%	15.27%	8.90%	2.85%
Corrected MV / Assets	-2.72%	7.42%	6.74%	3.16%	-6.43%	
Laem Thong Bank	1992	1993	1994	1995	1996	1997
Capital / Assets	6.88%	5.79%	6.25%	8.74%	8.53%	6.01%
Mkt. Value / Assets	7.25%	16.22%	14.12%	10.74%	11.23%	5.02%
Corrected MV / Assets	-9.27%	7.58%	0.32%	-2.32%	-1.18%	
Nakornthon Bank	1992	1993	1994	1995	1996	1997
Capital / Assets	6.48%	5.77%	6.69%	6.63%	7.48%	5.70%
Mkt. Value / Assets	14.55%	24.69%	18.99%	16.93%	14.25%	
Corrected MV / Assets	-0.91%	11.73%	0.91%	6.21%	0.14%	
Siam City Bank	1992	1993	1994	1995	1996	1997
Capital / Assets	6.98%	7.36%	7.31%	7.07%	6.65%	-0.05%
Mkt. Value / Assets	17.21%	20.86%	21.47%	15.07%	6.29%	1.06%
Corrected MV / Assets	3.12%	12.45%	13.31%	8.25%	-7.26%	
Union Bk of Bangkok	1992	1993	1994	1995	1996	1997
Capital / Assets	5.12%	7.23%	7.77%	6.07%	5.10%	1.65%
Mkt. Value / Assets	11.98%	16.46%	14.95%	9.94%	10.09%	3.54%
Corrected MV / Assets	-16.33%	5.49%	0.27%	3.76%	-2.75%	
Bangkok Metropolitan Bk	1992	1993	1994	1995	1996	1997
Capital / Assets	9.06%	7.71%	8.36%	7.74%	7.60%	-4.19%
Mkt. Value / Assets	12.99%	16.28%	15.95%	11.52%	5.25%	0.98%
Corrected MV / Assets	1.37%	7.59%	5.31%	3.23%	-6.54%	
Bangkok Bk of Commerce	1992	1993	1994	1995	1996	1997
Capital / Assets	5.00%	4.38%	4.89%	6.89%	8.39%	-1.32%
Mkt. Value / Assets	13.08%	8.17%	4.65%	9.03%	12.76%	
Corrected MV / Assets	1.59%	-21.87%	-2.55%	-0.69%		

Capital-to-Asset ratios and Market-Value to Asset ratios are from reported balance sheet data from Datastream. The Corrected-Market-Value to Asset ratio was calculated by subtracting the insurance subsidy (from Table 6) from the market value of the bank and dividing by total assets.

7. Conclusion

This paper empirically examines the effect of deposit insurance as a contributing factor in emerging market banking crises. When the franchise value of a bank is small, the bank can extract the insurance subsidy by issuing more deposits, undertaking riskier loans, or paying out large dividends to stockholders. Previous work on balance of payments and banking crises in developing countries has used a macroeconomic framework. In these models, the banking system is a recipient of the crisis through shocks to the economy.

In this paper, I use a microeconomic approach that emphasizes that incentives and institutions present in the banking system create conditions over several years to trigger banking crises. Using the established result that deposit insurance can be modeled as a put option on the value of bank assets, I maximize a likelihood function which relates the observed market capitalization of the bank to the unobserved asset values implied by the put option. The estimates of deposit insurance show that the size of the subsidy to the banking system was large both as a percent of deposits and equity. Moreover, from as early as 1992-93, the distribution of the subsidy routinely identified the worst banks. The size of this subsidy, coupled with lax regulatory oversight, made the Thai banking crisis nearly inevitable. The central bank now has control of eight of Thailand's banks, has agreed to the sale of three banks to foreign entities, and has planned for the eventual need to recapitalize the remaining five banks.

This paper has wider implications for other emerging markets. Implicit deposit insurance systems are present in most developing economies. Furthermore, multilateral organizations are emphasizing the need to formalize deposit insurance arrangements. Clearly, more research is needed to extend this approach to other emerging markets and to extend the methodology into a predictive model. Additionally, in many emerging markets, nontraded banks predominate. Therefore, an important extension would be the incorporation of non-equity information into the put-option approach.

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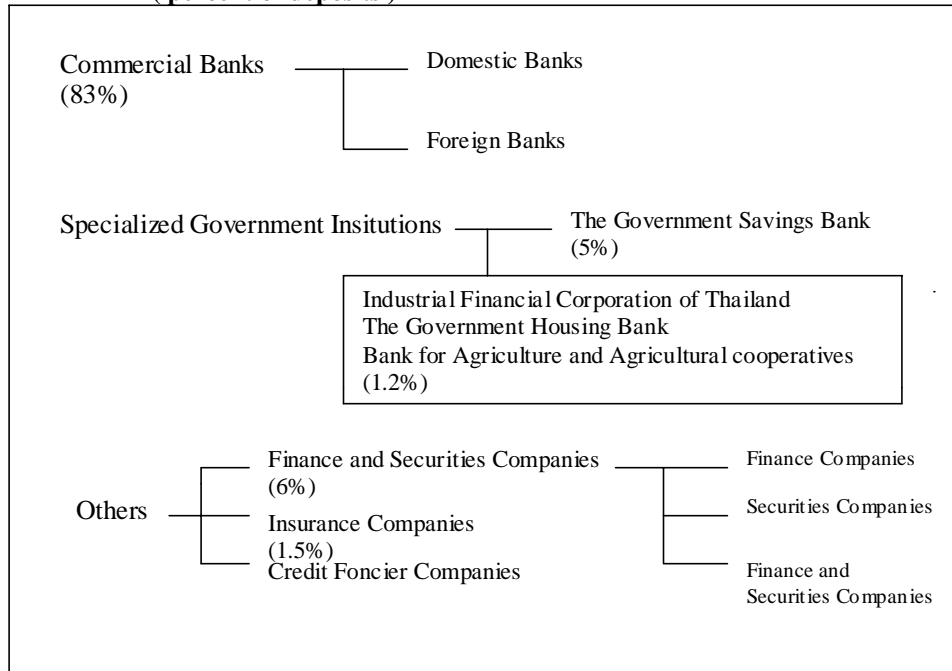
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Appendix A – STATISTICAL APPENDIX

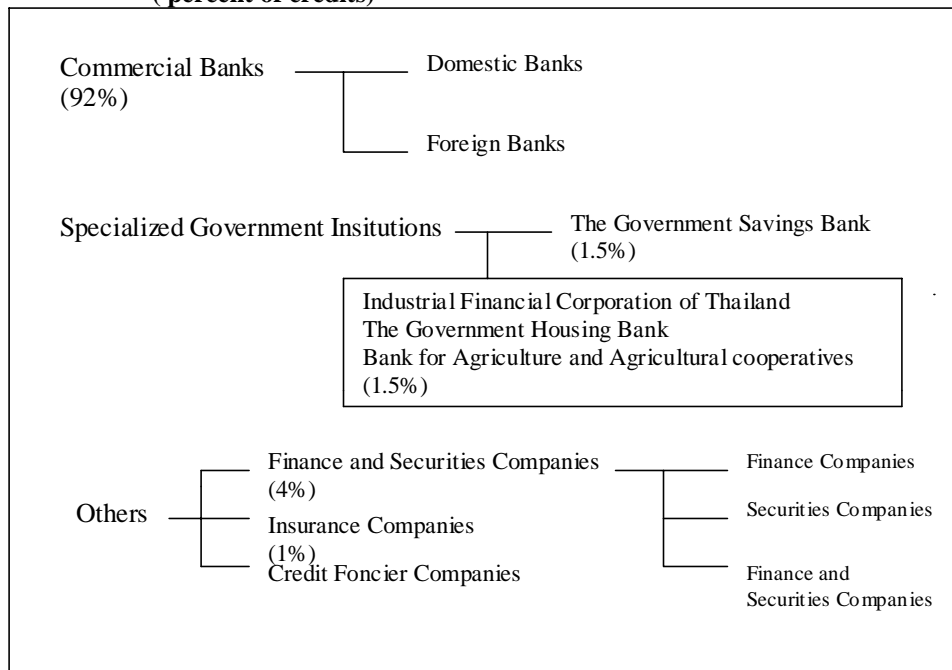
Figure A1 – Composition of the Financial System in Thailand, 1997
(percent of deposits)



Source: Financing Foreign Operations , 2/98.

Note: Numbers do not sum to 100% because the remaining 3.3% represent deposits from the 56 closed finance companies.

Figure A2 – Composition of the Financial System in Thailand, 1997
(percent of credits)



Source: Financing Foreign Operations , 2/98.

Table A1: Estimates of Deposit Insurance for Thai Banks using Deposits

Bangkok Bank	1992	1993	1994	1995	1996
Equity	90999.94	197999.94	200033.31	220280.44	195248.56
Deposits	498753.80	583746.56	653635.07	766849.54	841931.01
μ	0.03 (0.02)	0.06 (0.02)	0.00 (0.03)	0.01 (0.02)	-0.01 (0.02)
σ	0.29 (0.01)	0.39 (0.02)	0.48 (0.02)	0.30 (0.01)	0.33 (0.01)
V	553641.22 (5935.07)	739042.02 (6408.44)	769492.25 (5202.92)	951535.18 (5303.00)	973492.48 (9938.29)
Insurance as % of Deposits	10.51 (1.19)	8.80 (1.10)	15.02 (0.80)	5.72 (0.69)	9.06 (1.18)
Insurance as % of Equity	57.59 (6.52)	25.94 (3.24)	49.07 (2.60)	19.90 (2.41)	39.08 (5.09)
Bank of Asia	1992	1993	1994	1995	1996
Equity	7623.00	20944.00	19658.81	22198.66	15541.58
Deposits	39470.13	47071.42	53602.77	79660.30	87002.86
μ	0.04 (0.03)	0.08 (0.04)	-0.02 (0.04)	0.01 (0.04)	-0.02 (0.02)
σ	0.43 (0.02)	0.61 (0.03)	0.66 (0.03)	0.56 (0.02)	0.37 (0.02)
V	41021.76 (706.52)	60929.33 (750.37)	62148.66 (749.90)	86935.12 (817.26)	91425.89 (1254.09)
Insurance as % of Deposits	17.18 (1.79)	15.95 (1.59)	21.52 (1.40)	20.94 (1.03)	16.31 (1.44)
Insurance as % of Equity	88.97 (9.27)	35.86 (3.58)	58.69 (3.81)	75.13 (3.68)	91.31 (8.07)
Bank of Ayudhya	1992	1993	1994	1995	1996
Equity	23800.00	37400.00	38400.00	49999.99	33500.00
Deposits	148557.36	167922.43	234828.11	312440.32	340151.04
μ	0.02 (0.02)	0.03 (0.02)	0.00 (0.01)	0.01 (0.01)	-0.02 (0.02)
σ	0.25 (0.01)	0.32 (0.01)	0.23 (0.01)	0.21	0.33 (0.01)
V	163408.05 (1701.43)	192535.35 (1175.19)	260782.42 (2390.07)	348839.21	318962.32 (3544.14)
Insurance as % of Deposits	11.81 (1.15)	11.68 (0.70)	8.59 (1.02)	6.69	19.58 (1.04)
Insurance as % of Equity	73.71 (7.15)	52.43 (3.14)	52.53 (6.22)	41.79	198.86 (10.58)
First Bangkok City Bk.	1992	1993	1994	1995	1996
Equity	20671.38	32714.70	36669.21	33217.99	22432.93
Deposits	98116.62	119416.05	139115.31	164608.74	194191.94
μ	0.05 (0.03)	0.03 (0.03)	0.01 (0.03)	-0.01 (0.02)	-0.02 (0.02)
σ	0.52 (0.02)	0.47 (0.02)	0.44 (0.02)	0.35 (0.02)	0.30 (0.01)
V	99293.56 (1388.84)	135548.06 (1491.88)	158175.70 (1403.85)	181004.72 (1567.26)	192253.25 (3904.62)
Insurance as % of Deposits	22.79 (1.42)	16.69 (1.25)	16.39 (1.01)	14.61 (0.95)	18.23 (2.01)
Insurance as % of Equity	108.18 (6.72)	60.93 (4.56)	62.18 (3.83)	72.42 (4.72)	157.84 (17.41)

Table A1, cont.

Krung Thai Bank	1992	1993	1994	1995	1996
Equity	39528.30	93442.69	110248.94	155347.44	79153.19
Deposits	315706.11	371490.56	461377.02	500280.32	581628.67
μ	0.02 (0.01)	0.05 (0.02)	0.01 (0.02)	0.03 (0.02)	-0.04 (0.03)
σ	0.21	0.34 (0.01)	0.36 (0.02)	0.37 (0.02)	0.50 (0.02)
V	337840.15	437952.37 (3390.84)	530115.61 (4480.05)	621173.93 (5878.20)	515447.96 (5797.55)
Insurance as % of Deposits	9.67	8.95 (0.91)	10.63 (0.97)	8.44 (1.17)	27.17 (1.00)
Insurance as % of Equity	77.26	35.58 (3.63)	44.48 (4.06)	27.19 (3.78)	199.62 (7.32)
Laem Thong Bank	1992	1993	1994	1995	1996
Equity	1030.00	3080.00	3300.00	3427.43	4616.53
Deposits	11916.47	15065.57	17870.26	23256.32	29774.02
μ	-0.01 (0.02)	0.05 (0.02)	0.00 (0.03)	0.00 (0.02)	0.01 (0.02)
σ	0.35 (0.02)	0.36 (0.02)	0.44 (0.02)	0.39 (0.02)	0.38 (0.02)
V	10652.36 (151.85)	16559.93 (173.53)	18235.41 (247.60)	22974.24 (280.16)	29912.61 (348.53)
Insurance as % of Deposits	19.25 (1.27)	10.52 (1.15)	16.92 (1.39)	16.82 (1.20)	15.98 (1.17)
Insurance as % of Equity	222.73 (14.74)	51.48 (5.63)	91.62 (7.50)	114.14 (8.17)	103.08 (7.55)
Nakornthon Bank	1992	1993	1994	1995	1996
Equity	4232.80	9090.89	8495.66	9628.00	9185.00
Deposits	22661.09	25860.96	29815.68	40317.46	47056.21
μ	0.04 (0.02)	0.06 (0.12)	0.00 (0.04)	0.01 (0.03)	0.00 (0.02)
σ	0.34 (0.02)	0.54 (0.04)	0.57 (0.08)	0.39 (0.02)	0.41 (0.02)
V	24608.08 (694.33)	31259.92 (1329.12)	32568.43 (310.25)	45726.03 (435.81)	49611.83 (541.42)
Insurance as % of Deposits	13.50 (3.06)	21.05 (5.14)	21.70 (1.04)	13.27 (1.08)	15.62 (1.15)
Insurance as % of Equity	72.30 (16.40)	59.88 (14.62)	76.17 (3.65)	55.57 (4.53)	80.03 (5.89)
Siam City Bank	1992	1993	1994	1995	1996
Equity	17280.00	26208.00	34848.00	30350.50	14724.50
Deposits	74639.94	95687.12	121927.06	149134.56	168947.36
μ	0.05 (0.03)	0.03 (0.03)	0.02 (0.03)	-0.01 (0.02)	-0.03 (0.02)
σ	0.48 (0.02)	0.40 (0.02)	0.40 (0.02)	0.31 (0.01)	0.31 (0.01)
V	79796.11 (841.07)	112657.60 (954.51)	145214.72 (918.69)	168018.80 (1189.41)	157388.80 (1752.25)
Insurance as % of Deposits	17.64 (1.13)	10.39 (1.00)	10.17 (0.75)	8.52 (0.80)	17.13 (1.04)
Insurance as % of Equity	76.21 (4.87)	37.92 (3.64)	35.58 (2.64)	41.86 (3.92)	196.49 (11.90)

Table A1, cont.

Siam Commercial Bk	1992	1993	1994	1995	1996
Equity	39824.00	74099.94	76759.94	96564.13	67021.25
Deposits	216079.81	261553.49	277295.36	342191.10	399291.14
μ	0.03 (0.02)	0.04 (0.02)	0.00 (0.03)	0.02 (0.02)	-0.02 (0.02)
σ	0.26 (0.01)	0.35 (0.02)	0.45 (0.02)	0.34 (0.02)	0.39 (0.02)
V	243823.82 (2799.23)	317339.58 (3266.39)	319202.83 (2530.75)	416683.77 (3229.72)	408310.89 (3498.04)
Insurance as % of Deposits	13.48 (1.30)	11.16 (1.25)	14.53 (0.91)	8.33 (0.94)	16.55 (0.88)
Insurance as % of Equity	73.12 (7.03)	39.39 (4.41)	52.47 (3.30)	29.51 (3.34)	98.59 (5.22)
The Thai Danu Bank	1992	1993	1994	1995	1996
Equity	4424.00	7980.00	9394.00	9191.00	11102.00
Deposits	32066.70	39379.87	46981.79	60518.18	82235.12
μ	0.02 (0.01)	0.03 (0.02)	0.01 (0.02)	0.00 (0.02)	0.01 (0.02)
σ	0.21	0.32 (0.01)	0.29 (0.01)	0.27 (0.01)	0.36 (0.02)
V	34872.06	44082.60 (324.54)	53072.25 (345.31)	65106.68 (735.02)	81239.51 (887.82)
Insurance as % of Deposits	7.13	10.34 (0.82)	9.06 (0.73)	11.80 (1.21)	17.63 (1.08)
Insurance as % of Equity	51.71	51.03 (4.07)	45.30 (3.68)	77.69 (8.00)	130.57 (8.00)
Thai Farmers Bank	1992	1993	1994	1995	1996
Equity	55999.98	92800.00	138399.94	140800.00	103999.94
Deposits	296562.69	360421.89	403315.20	466573.31	522813.18
μ	0.03 (0.02)	0.03 (0.02)	0.03 (0.03)	0.00 (0.02)	-0.02 (0.02)
σ	0.25 (0.01)	0.36 (0.02)	0.42 (0.02)	0.29 (0.01)	0.33 (0.01)
V	336828.03 (3361.60)	423914.24 (4015.22)	507026.65 (2772.35)	589899.61 (2994.61)	579231.82 (6799.10)
Insurance as % of Deposits	9.96 (1.13)	10.43 (1.11)	10.41 (0.69)	4.69 (0.64)	11.28 (1.30)
Insurance as % of Equity	52.73 (6.00)	40.53 (4.33)	30.33 (2.00)	15.54 (2.13)	56.71 (6.54)
Thai Military Bank	1992	1993	1994	1995	1996
Equity	17646.40	40888.00	38520.80	44905.59	44135.75
Deposits	128347.42	154687.55	178514.00	217228.86	257979.87
μ	0.02 (0.02)	0.05 (0.02)	0.00 (0.02)	0.01 (0.02)	-0.02 (0.02)
σ	0.24 (0.01)	0.39 (0.02)	0.38 (0.02)	0.31 (0.01)	0.34 (0.02)
V	137412.50 (2076.70)	181013.92 (1606.15)	197358.98 (1618.70)	245564.10 (2101.17)	273846.74 (2005.58)
Insurance as % of Deposits	15.84 (1.62)	12.36 (1.04)	13.63 (0.91)	10.44 (0.97)	13.04 (0.78)
Insurance as % of Equity	115.23 (11.77)	46.77 (3.93)	63.15 (4.20)	50.48 (4.68)	76.25 (4.54)

Table A1, cont.

Union Bk. of Bangkok	1992	1993	1994	1995	1996
Equity	4349.99	6809.52	6825.65	6075.00	7425.00
Deposits	27011.82	31152.64	31833.42	40278.43	52918.67
μ	-0.02 (0.04)	0.03 (0.03)	-0.01 (0.03)	0.00 (0.02)	0.01 (0.02)
σ	0.67 (0.03)	0.43 (0.02)	0.51 (0.02)	0.28 (0.01)	0.39 (0.02)
V	22243.28 512.83	33658.98 360.15	32475.45 458.53	42815.88 (441.99)	51463.55 (686.93)
Insurance as % of Deposits	34.71 (1.90)	13.81 (1.16)	19.42 (1.44)	8.78 (1.10)	16.78 (1.30)
Insurance as % of Equity	215.52 (11.79)	63.19 (5.29)	90.59 (6.72)	58.23 (7.28)	119.60 (9.25)

Equity is the end-of-year market value of equity in millions of baht, Deposits are the end-of-year level of total deposits in millions of baht, μ is the expected return on bank assets, σ is the standard deviation of the return on bank assets, V is the end-of-year value of the bank's assets in millions of baht. The value of deposit insurance is expressed as a percent of end-of-year total deposits and end-of-year equity. Standard errors of parameter estimates are in parentheses. When no standard error is listed, the constraint that σ is greater than zero is binding.

Table A2: Estimates of Deposit Insurance for Thai Banks using Liabilities

Bangkok Bank	1992	1993	1994	1995	1996
Equity	90999.94	197999.94	200033.31	220280.44	195248.56
Liabilities	620673.00	714986.00	824732.00	947799.00	1054000.00
μ	0.03 (0.01)	0.05 (0.02)	0.00 (0.03)	0.00 (0.02)	-0.01 (0.02)
σ	0.23 (0.01)	0.33 (0.01)	0.40 (0.02)	0.25 (0.01)	0.27 (0.01)
V	674233.67 (4727.80)	868153.09 (5613.63)	933827.00 (9115.19)	1130239.36 (5292.96)	1180916.00 (7798.35)
Insurance as % of Liabilities	9.47 (0.76)	7.81 (0.79)	13.28 (1.11)	5.11 (0.56)	8.05 (0.74)
Insurance as % of Equity	64.57 5.20	28.20 (2.84)	54.76 (4.56)	22.00 (2.40)	43.47 (3.99)
Bank of Asia	1992	1993	1994	1995	1996
Equity	7623.00	20944.00	19658.81	22198.66	15541.58
Liabilities	52158.00	64639.00	76924.00	100778.00	115159.00
μ	0.03 (0.02)	0.07 (0.03)	-0.01 (0.03)	0.01 (0.03)	-0.02 (0.02)
σ	0.34 (0.01)	0.47 (0.02)	0.50 (0.02)	0.46 (0.02)	0.30 (0.01)
V	53301.00 (559.88)	77852.95 (756.69)	83909.34 (1049.92)	106882.85 (1361.84)	118638.82 (1176.19)
Insurance as % of Liabilities	14.34 (1.07)	12.92 (1.17)	17.34 (1.36)	18.31 (1.35)	14.26 (1.02)
Insurance as % of Equity	98.14 (7.34)	39.86 (3.61)	67.86 (5.34)	83.14 (6.13)	105.69 (7.57)

Table A2, cont.

Bank of Ayudhya	1992	1993	1994	1995	1996
Equity	23800.00	37400.00	38400.00	49999.99	33500.00
Liabilities	159198.00	183861.00	267017.00	346527.00	384766.00
μ	0.02 (0.01)	0.02 (0.02)	0.00 (0.01)	0.01 (0.01)	-0.01 (0.02)
σ	0.23 (0.01)	0.30 (0.01)	0.21	0.20	0.30 (0.01)
V	173949.49 (1340.80)	208216.16 (1675.32)	292667.38	382667.45	361789.80 (4428.07)
Insurance as % of Liabilities	11.59 (0.84)	11.25 (0.91)	8.17	6.39	18.30 (1.15)
Insurance as % of Equity	77.52 (5.63)	55.31 (4.48)	56.83	44.29	210.17 (13.22)
First Bangkok City Bk.	1992	1993	1994	1995	1996
Equity	20671.38	32714.70	36669.21	33217.99	22432.93
Liabilities	117766.00	139763.00	160409.00	192173.00	225405.00
μ	0.04 (0.03)	0.03 (0.03)	0.01 (0.02)	-0.01 (0.02)	-0.02 (0.02)
σ	0.44 (0.02)	0.42 (0.02)	0.39 (0.02)	0.31 (0.01)	0.27 (0.01)
V	117942.82 (1635.35)	155161.40 (1675.82)	178724.04 (1886.43)	207841.76 (1958.26)	222527.33 (2430.30)
Insurance as % of Liabilities	20.48 (1.39)	15.30 (1.20)	15.31 (1.18)	13.71 (1.02)	17.15 (1.08)
Insurance as % of Equity	116.69 (7.91)	65.37 (5.12)	66.98 (5.14)	79.31 (5.90)	172.29 (10.83)
Krung Thai Bank	1992	1993	1994	1995	1996
Equity	39528.30	93442.69	110248.94	155347.44	79153.19
Liabilities	342346.00	402236.00	523874.00	596026.00	665328.00
μ	0.02 (0.01)	0.04 (0.02)	0.01 (0.02)	0.02 (0.02)	-0.04 (0.03)
σ	0.19	0.31 (0.01)	0.32 (0.01)	0.32 (0.01)	0.45 (0.02)
V	364313.00	468223.66 (3239.80)	591405.13 (4610.60)	715254.86 (4551.43)	591100.48 (10096.45)
Insurance as % of Liabilities	7.07	8.54 (0.81)	9.82 (0.88)	7.67 (0.76)	25.33 (1.52)
Insurance as Deposits	61.19	36.75 (3.47)	46.68 (4.18)	29.42 (2.93)	212.89 (12.76)
Laem Thong Bank	1992	1993	1994	1995	1996
Equity	1030.00	3080.00	3300.00	3427.43	4616.53
Liabilities	13234.00	17889.00	21902.00	29123.00	37591.00
μ	-0.01 (0.02)	0.04 (0.02)	0.00 (0.02)	0.00 (0.02)	0.01 (0.02)
σ	0.32 (0.01)	0.31 (0.01)	0.37 (0.02)	0.32 (0.01)	0.31 (0.01)
V	11916.77 (154.25)	19328.01 (148.86)	22089.41 (246.15)	28650.16 (306.23)	37476.37 (382.95)
Insurance as % of Liabilities	17.74 (1.17)	9.17 (0.83)	14.73 (1.12)	14.31 (1.05)	13.58 (1.02)
Insurance as % of Equity	227.89 (14.97)	53.28 (4.83)	97.76 (7.46)	121.56 (8.93)	110.54 (8.29)

Table A2, cont.

Nakornthon Bank	1992	1993	1994	1995	1996
Equity	4232.80	9090.89	8495.66	9628.00	9185.00
Liabilities	27212.00	34701.00	41738.00	53094.00	59647.00
μ	0.03	0.05	0.00	0.01	0.00
	(0.02)	(0.03)	(0.03)	(0.02)	(0.02)
σ	0.29	0.42	0.44	0.31	0.34
	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)
V	29063.67	39801.51	43850.53	58211.64	61731.09
	(295.60)	(398.55)	(564.47)	(493.42)	(659.00)
Insurance as	16.53	13.75	19.38	11.48	15.25
% of Liabilities	(1.09)	(1.15)	(1.35)	(0.93)	(1.10)
Insurance as	106.24	52.47	95.20	63.30	99.00
% of Equity	(6.98)	(4.38)	(6.64)	(5.12)	(7.17)
Siam City Bank	1992	1993	1994	1995	1996
Equity	17280.00	26208.00	34848.00	30350.50	14724.50
Liabilities	93382.00	116416.00	150438.00	187167.00	218641.00
μ	0.04	0.02	0.02	-0.01	-0.03
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
σ	0.39	0.34	0.34	0.26	0.25
	(0.02)	(0.01)	(0.02)	(0.01)	(0.01)
V	97889.03	132939.54	173108.09	205387.67	205262.66
	(1091.58)	(995.89)	(1267.80)	(1283.02)	(2111.14)
Insurance as	15.15	9.08	8.81	7.34	14.51
% of Liabilities	(1.17)	(0.86)	(0.84)	(0.69)	(0.97)
Insurance as	81.87	40.31	38.02	45.28	215.51
% of Equity	(6.32)	(3.80)	(3.64)	(4.23)	(14.34)
Siam Commercial Bk.	1992	1993	1994	1995	1996
Equity	39824.00	74099.94	76759.94	96564.13	67021.25
Liabilities	255693.00	298916.00	337449.00	418095.00	500539.00
μ	0.02	0.04	0.00	0.01	-0.02
	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)
σ	0.22	0.31	0.39	0.29	0.32
		(0.01)	(0.02)	(0.01)	(0.01)
V	283100.78	354128.07	377162.32	491506.25	505135.58
		(3016.73)	(3648.36)	(3031.60)	(5346.18)
Insurance as	9.92	13.29	13.02	7.49	14.61
% of Liabilities		(1.01)	(1.08)	(0.73)	(1.07)
Insurance as	63.67	53.60	57.25	32.43	109.08
% of Equity		(4.07)	(4.75)	(3.14)	(7.98)
The Thai Danu Bank	1992	1993	1994	1995	1996
Equity	4424.00	7980.00	9394.00	9191.00	11102.00
Liabilities	38828.00	47544.00	63184.00	81444.00	107949.00
μ	0.02	0.02	0.01	0.00	0.01
	(0.01)	(0.02)	(0.01)	(0.01)	(0.02)
σ	0.18	0.27	0.23	0.20	0.28
		(0.01)	(0.01)		(0.01)
V	41598.12	52129.74	69077.31	85774.83	106139.92
		(377.39)	(425.28)		(1113.17)
Insurance as	7.72	9.23	7.69	10.49	15.08
% of Liabilities		(0.79)	(0.67)		(1.03)
Insurance as	67.74	55.01	51.71	92.99	146.58
% of Equity		(4.73)	(4.53)		(10.03)

Table A2, cont.

Thai Farmers Bank	1992	1993	1994	1995	1996
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Equity	55999.98	92800.00	138399.94	140800.00	103999.94
Liabilities	336627.00	405966.00	462120.00	532468.00	583879.00
μ	0.03	0.03	0.03	0.00	-0.02
	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)
σ	0.23	0.32	0.38	0.26	0.30
	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)
V	376591.89	468563.65	564566.23	654995.73	638482.47
	(2548.04)	(3554.63)	(4265.15)	(2747.08)	(5214.20)
Insurance as	9.59	9.80	9.63	4.40	10.70
% of Liabilities	(0.76)	(0.88)	(0.92)	(0.52)	(0.89)
Insurance as	57.63	42.87	32.17	16.65	60.05
% of Equity	(4.55)	(3.83)	(3.08)	(1.95)	(5.01)

Thai Military Bank	1992	1993	1994	1995	1996
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Equity	17646.40	40888.00	38520.80	44905.59	44135.75
Liabilities	144051.00	178819.00	211801.00	263775.00	309340.00
μ	0.02	0.04	0.00	0.01	-0.02
	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)
σ	0.21	0.34	0.33	0.26	0.29
		(0.02)	(0.01)	(0.01)	(0.01)
V	152980.75	204656.91	229743.72	291391.63	293461.82
		(1735.05)	(2103.59)	(2102.92)	(3369.03)
Insurance as	15.57	11.46	12.42	9.49	16.53
% of Liabilities		(0.97)	(0.99)	(0.80)	(1.09)
Insurance as	127.07	50.12	68.30	55.73	115.88
% of Equity	64.39	(4.24)	(5.46)	(4.68)	(7.63)

Union Bk of Bangkok	1992	1993	1994	1995	1996
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Equity	4349.99	6809.52	6825.65	6075.00	7425.00
Liabilities	34437.00	38388.00	42109.00	57389.00	69836.00
μ	-0.02	0.02	-0.01	0.00	0.01
	(0.03)	(0.02)	(0.03)	(0.01)	(0.02)
σ	0.54	0.36	0.40	0.21	0.31
	(0.02)	(0.02)	(0.02)		(0.01)
V	28869.97	40660.38	42234.47	59683.93	67812.53
	586.49	384.13	508.64		(704.95)
Insurance as	29.84	11.82	15.91	6.59	13.53
% of Liabilities	(1.70)	(1.00)	(1.21)		(1.01)
Insurance as	236.27	66.63	98.16	62.22	127.25
% of Equity	(13.48)	(5.64)	(7.45)		(9.49)

Bangkok Metropolitan Bk	1992	1993	1994	1995	1996
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Equity	11584.95	18268.57	21354.24	19520.88	10062.5
Liabilities	81094	103574	122711	156280	176999
μ	0.039115	0.020346	0.009466	-0.005329	-0.019497
	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)
σ	0.34	0.31	0.35	0.26	0.23
	(0.02)	(0.01)	(0.02)	(0.01)	(0.01)
V	82314.17	112250.16	130221.48	162347.53	164944.82
	(825.35)	(871.72)	(1184.54)	(1202.78)	(1536.95)
Insurance as	12.78	9.41	11.61	8.98	12.77
% of Liabilities	(1.02)	(0.84)	(0.97)	(0.77)	(0.87)
Insurance as	89.47	53.37	66.70	71.93	224.58
% of Equity	(7.12)	(4.77)	(5.55)	(6.16)	(15.27)

Table A2, cont.

Bangkok Bk of Commerce	1992	1993	1994	1995	1996
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Equity	13233.97	9885.61	6700.00	16600.00	
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Liabilities	96102.00	115678.00	137067.00	171207.00
μ	0.04 (0.02)	(0.01) (0.03)	(0.01)	0.02 (0.02)
σ	0.32 (0.01)	0.51 (0.02)	0.16	0.25 (0.01)
V	97711.09 (935.16)	89220.13 (1952.55)	133388.16	169932.90 (1413.34)
Insurance as % of Liabilities	12.10 (0.97)	31.42 (1.69)	7.57	10.44 (0.83)
Insurance as % of Equity	87.84 (7.07)	367.64 (19.75)	154.91	107.68 (8.51)

Equity is the end-of-year market value of equity in millions of baht, Liabilities are the end-of-year level of liabilities in millions of baht, μ is the expected return on bank assets, σ is the standard deviation of the return on bank assets, V is the end-of-year value of the bank's assets in millions of baht. The value of deposit insurance is expressed as a percent of end-of-year total liabilities and end-of-year equity. Standard errors of parameter estimates are in parentheses. When no standard error is listed, the constraint that σ is greater than zero is binding.

Table A3: Rankings of Banks using Estimated Subsidy as a Percent of Liabilities

BANK	1992	1993	1994	1995	1996	Average 1992-96	Average 1992-95
First Bangkok City Bk	20.48%	15.30%	15.31%	13.71%	17.15%	16.39%	16.20%
Union Bank of Bangkok	29.84%	11.82%	15.91%	6.59%	13.53%	15.54%	16.04%
Bank of Asia	14.34%	12.92%	17.34%	18.31%	14.26%	15.44%	15.73%
Bangkok Bk of Commerce	12.10%	31.42%	7.57%	10.44%		15.38%	15.38%
Nakornthon Bank	16.53%	13.75%	19.38%	11.48%	15.25%	15.27%	15.28%
Laem Thong Bank	17.74%	9.17%	14.73%	14.31%	13.58%	13.90%	13.99%
<i>Thai Military Bank</i>	15.57%	11.46%	12.42%	9.49%	16.53%	13.09%	12.23%
<i>Krung Thai Bank</i>	7.07%	8.54%	9.82%	7.67%	25.33%	11.68%	8.27%
<i>Siam Commercial Bank</i>	9.92%	13.29%	13.02%	7.49%	14.61%	11.66%	10.93%
<i>Bank of Ayudhya</i>	11.58%	11.25%	8.17%	6.39%	18.30%	11.14%	9.35%
Bangkok Metropolitan Bk	12.78%	9.41%	11.61%	8.98%	12.77%	11.11%	10.70%
Siam City Bank	15.15%	9.08%	8.81%	7.34%	14.51%	10.98%	10.09%
<i>Thai Danu Bank</i>	7.72%	9.23%	7.69%	10.49%	15.08%	10.04%	8.78%
<i>Thai Farmers Bank</i>	9.59%	9.80%	9.63%	4.40%	10.70%	8.82%	8.36%
<i>Bangkok Bank</i>	9.47%	7.81%	13.28%	5.11%	8.05%	8.74%	8.92%

Deposit insurance values as a percent of liabilities are from Table A2 which used total liabilities as the strike price. The banks listed in bold correspond to the "bad" banks of Table 3 and the "marginal" banks listed in italics correspond to the banks of Table 2. For each year, the six banks with the highest insurance subsidy values are listed in bold.

Table A4: Selected Indicators for "Marginal" Banks

Bangkok Bank	1992	1993	1994	1995	1996	1997
asset growth		17.39%	15.50%	15.28%	11.62%	21.86%
investments / assets	5.23%	5.27%	6.11%	6.27%	6.86%	4.76%
net loans / assets	86.43%	84.55%	82.96%	82.92%	82.39%	72.95%

bad debt reserve / assets	2.26%	2.35%	2.43%	2.43%	2.59%	4.10%
insurance / assets	7.87%	6.57%	10.87%	4.21%	6.57%	
q-ratio	2.01	2.96	2.56	2.36	1.81	-0.07
Bank of Ayudhya	1992	1993	1994	1995	1996	1997
asset growth		15.45%	42.49%	28.72%	12.53%	19.03%
investments / assets	5.95%	5.18%	4.59%	4.89%	4.53%	3.54%
net loans / assets	83.21%	86.59%	85.69%	83.21%	85.34%	81.61%
bad debt reserve / assets	0.63%	0.61%	0.64%	0.75%	0.95%	2.22%
insurance / assets	10.08%	9.75%	7.04%	5.67%	16.06%	
q-ratio	1.60	2.18	1.98	2.26	1.11	-0.02
Krung Thai Bank	1992	1993	1994	1995	1996	1997
asset growth		17.25%	30.97%	15.15%	11.71%	10.49%
investments / assets	5.27%	4.29%	4.14%	4.31%	4.22%	2.95%
net loans / assets	84.71%	84.12%	83.12%	85.97%	85.15%	84.69%
bad debt reserve / assets	1.71%	2.03%	1.94%	2.02%	2.22%	4.39%
insurance / assets	8.42%	7.82%	8.81%	6.59%	22.07%	
q-ratio	1.96	4.10	3.37	3.46	1.56	0.32
Siam Commercial Bank	1992	1993	1994	1995	1996	1997
asset growth		18.18%	13.10%	23.31%	19.38%	32.51%
investments / assets	6.89%	6.07%	6.23%	6.17%	5.70%	5.30%
net loans / assets	82.14%	80.36%	81.57%	83.35%	84.90%	78.08%
bad debt reserve / assets	1.14%	1.14%	1.29%	1.24%	1.15%	2.53%
insurance / assets	10.59%	8.98%	10.96%	6.29%	12.21%	
q-ratio	2.05	2.83	2.54	2.74	1.65	0.58
Thai Danu Bank	1992	1993	1994	1995	1996	1997
asset growth		23.70%	32.58%	28.74%	37.07%	8.92%
investments / assets	5.14%	5.65%	7.79%	7.18%	6.86%	2.53%
net loans / assets	83.50%	82.98%	82.43%	84.67%	83.88%	88.01%
bad debt reserve / assets	1.05%	1.06%	1.14%	1.08%	1.18%	2.74%
insurance / assets	5.54%	7.97%	6.28%	8.18%	12.12%	
q-ratio	1.77	2.23	2.05	1.58	0.95	0.52
Thai Farmers Bank	1992	1993	1994	1995	1996	1997
asset growth		21.45%	15.21%	15.03%	10.39%	23.12%
investments / assets	7.46%	5.62%	5.48%	5.71%	6.63%	4.93%
net loans / assets	82.57%	81.86%	85.13%	85.86%	85.43%	74.25%
bad debt reserve / assets	0.99%	1.11%	1.19%	1.30%	1.53%	3.36%
insurance / assets	8.12%	8.52%	8.25%	3.74%	9.13%	
q-ratio	2.08	2.60	2.97	2.67	1.67	0.84
Thai Military Bank	1992	1993	1994	1995	1996	1997
asset growth		26.08%	17.79%	25.08%	17.05%	16.50%
investments / assets	5.99%	5.54%	4.71%	4.75%	4.77%	3.31%
net loans / assets	84.33%	83.76%	85.29%	85.43%	84.82%	77.18%
bad debt reserve / assets	1.81%	1.68%	2.43%	2.27%	1.84%	2.29%
insurance / assets	13.26%	9.89%	10.68%	7.96%	10.09%	
q-ratio	1.89	2.81	2.41	2.12	1.83	0.31

Data from Datastream.. The estimate of insurance as a percent of assets uses total liabilities (Table A2). The q-ratio measures the market capitalization of the bank per baht of paid-in capital.

Table A5: Selected Indicators for "Bad" Banks

Bank of Asia	1992	1993	1994	1995	1996	1997
asset growth		24.34%	19.47%	30.14%	16.55%	25.18%
investments / assets	8.71%	6.18%	6.63%	13.23%	7.55%	5.08%
net loans / assets	84.05%	83.62%	87.07%	80.91%	85.74%	84.20%
bad debt reserve / assets	1.88%	1.74%	1.62%	1.38%	1.45%	2.19%

insurance / assets	12.09%	10.76%	13.84%	15.38%	11.23%	
q-ratio	1.93	4.09	3.06	2.89	1.38	0.54
First Bangkok City Bank	1992	1993	1994	1995	1996	1997
asset growth		20.33%	17.70%	21.12%	15.90%	14.07%
investments / assets	4.34%	4.55%	4.39%	4.35%	4.19%	2.65%
net loans / assets	83.86%	83.91%	86.42%	86.25%	88.72%	89.87%
bad debt reserve / assets	1.18%	1.18%	1.29%	0.89%	0.91%	14.11%
insurance / assets	17.63%	13.06%	12.69%	11.06%	14.04%	
q-ratio	2.28	2.55	1.91	1.31	0.84	-1.13
Laem Thong Bank	1992	1993	1994	1995	1996	1997
asset growth		33.61%	23.03%	36.59%	28.79%	24.29%
investments / assets	4.41%	4.20%	4.33%	4.98%	3.92%	1.57%
net loans / assets	76.06%	77.34%	76.98%	77.11%	82.33%	88.18%
bad debt reserve / assets	2.78%	2.00%	2.08%	1.50%	0.99%	0.99%
insurance / assets	16.14%	8.35%	12.94%	12.26%	11.58%	
q-ratio	1.05	2.80	2.26	1.23	1.32	0.83
Nakornthon Bank	1992	1993	1994	1995	1996	1997
asset growth		26.56%	21.46%	27.13%	13.37%	14.40%
investments / assets	4.15%	4.61%	4.99%	6.37%	5.60%	4.56%
net loans / assets	85.67%	84.66%	83.45%	83.34%	85.55%	80.60%
bad debt reserve / assets	1.01%	0.99%	0.98%	0.88%	0.95%	2.25%
insurance / assets	10.52%	14.78%	14.47%	9.41%	11.40%	
q-ratio	2.25	4.28	2.84	2.55	1.90	0.20
Siam City Bank	1992	1993	1994	1995	1996	1997
asset growth		25.18%	29.15%	24.09%	16.29%	12.82%
investments / assets	5.78%	6.20%	6.69%	9.00%	7.41%	3.18%
net loans / assets	83.60%	84.09%	84.17%	82.12%	81.51%	81.90%
bad debt reserve / assets	1.60%	1.71%	2.48%	2.23%	2.63%	8.77%
insurance / assets	13.12%	7.91%	7.64%	6.31%	12.35%	
q-ratio	2.47	2.83	2.94	2.13	0.95	-22.36

Table A5, cont.

Union Bank of Bangkok	1992	1993	1994	1995	1996	1997
asset growth		14.00%	10.34%	33.82%	20.44%	5.39%
investments / assets	6.05%	6.68%	6.63%	5.95%	6.61%	4.47%
net loans / assets	83.10%	82.00%	83.30%	83.96%	83.93%	82.59%
bad debt reserve / assets	0.85%	0.92%	1.25%	1.18%	1.05%	4.78%
insurance / assets	28.32%	10.97%	14.67%	6.19%	12.84%	
q-ratio	2.34	2.28	1.92	1.64	1.98	2.14
Bangkok Metropolitan Bk	1992	1993	1994	1995	1996	1997
asset growth		25.86%	19.31%	26.51%	13.08%	-0.66%
investments / assets	5.54%	6.37%	5.02%	4.78%	4.23%	1.70%
bad debt reserve / assets	1.35%	1.44%	1.58%	1.69%	1.89%	14.72%
insurance / assets	11.62%	8.69%	10.64%	8.29%	11.80%	
q-ratio	1.43	2.11	1.91	1.49	0.69	-0.23
Bangkok Bk of Commerce	1992	1993	1994	1995	1996	1997
asset growth		19.59%	19.13%	27.59%	-11.04%	-9.54%
investments / assets	5.01%	6.73%	12.97%	14.99%	10.34%	57.08%
bad debt reserve / assets	0.30%	0.54%	1.21%	1.76%	16.61%	166.99%
insurance / assets	11.49%	30.04%	7.20%	9.72%		
q-ratio	2.62	1.87	0.95	1.31	1.52	-0.14

Data from Datastream. The estimate of insurance as a percent of assets uses total liabilities (Table A2). The q-ratio measures the market capitalization of the bank per baht of paid-in capital. Data on loans is missing for Bangkok Metropolitan Bank and Bangkok Bank of Commerce.

Appendix B

CHRONOLOGY OF EVENTS²⁹

- 1/1992 – The Bank of Thailand instructs six banks (Bangkok Metropolitan Bank, Bangkok Bank of Commerce, Bank of Asia, Siam City Bank, and Union Bank of Bangkok) to increase their capital-asset-ratios to the BIS norm of 8 percent.
- 1/1992 – The Bank of Thailand instructs two banks (Bangkok Metropolitan Bank and Union Bank of Bangkok) to increase their equity capital.
- 3/1992 – The National Assembly passes a bill removing loan rate ceilings.
- 3/1992 – The Securities Exchange Commission Bill is passed allowing for the creation of a Securities Exchange Commission.
- 5/1992 – Protests of the installation of a non-elected military Prime Minister ends violently with the deaths of numerous protestors.
- 9/1992- The government approves legislation to launch the offshore banking facility, Bangkok International Banking Facility (BIBF).
- 11/1992 – A Thai trader is arrested for stock manipulation after buying 20% of the shares of Bangkok Bank of Commerce. The trader had accumulated a Bt 16 billion fund for trading from loans from finance companies. Following the arrest of the trader, the Thai stock exchange falls dramatically. In response, the government makes Bt 15 billion available to support the market. The government relaxes for one year the restriction that banks could only hold 20 percent of investments in stocks.
- 3/1993 – The Bank of Thailand intervenes in a finance company, First City Investments, which has a large number of nonperforming loans. The Rehabilitation and Development Fund (FIDF) launched a rescue effort to save the company's shareholders, which included the daughter of the former Democrat leader. After the Fund took 80.5% of an issue of Bt 200 million in new shares, the company was listed again on the Exchange in April 1993.
- 3/1993 – In order to encourage competition in the banking system, the Bank of Thailand awarded 47 licenses to banks to establish operations at the Bangkok International Banking Facility (BIBF). Fifteen of these licenses go to domestic Thai banks.
- 4/1994 – The Bank of Thailand instructs Union Bank of Bangkok to withhold its shareholders' dividends in order to increase its provisions and paid-in capital. Bangkok Bank of Commerce, having trouble raising its debt provisions, asks to extend the deadline for such actions.

²⁹ Information for this section comes from the Economist Intelligence Unit for material prior to 1996 and from the Dow Jones News Service after 1996, unless otherwise noted.

- 5/1994 – 40 finance companies apply to open the first-ever finance company branches. The branches must be located outside of Bangkok and are limited to lending activities.
- 6/1994 – The Bank of Thailand relaxes restrictions on commercial banks. Banks can invest up to 20% of their capital in stocks and up to 10% in one company. Banks can also freely open branches in areas with few banks. To better compete with banks, finance companies can hold a higher proportion of their capital in foreign currencies.
- 9/1994 – Finance and security companies are being encouraged to split their businesses so that eventually finance companies will be able to upgrade to full bank status.
- 3/1995 – To spur competition, the government approves a plan to offer 5 new commercial banking licenses for the foreign BIBF banks. The 14 foreign banks already established in Thailand, as well as the foreign BIBF banks, will also be allowed to open 2 branches outside of Bangkok. The government also agrees, for the first time in 20 years, to offer 5 new commercial banking licenses for domestic banks.
- 6/1995 – The new government and new finance minister announce that operations of new banks would not start before April 1997, and plans for foreign banks to open branches are also on hold.
- 10/1995 – The Bank of Thailand, the Finance Ministry, and the Stock Exchange of Thailand create a Bt 30 billion rescue fund to restructure margin credits owed by small investors.
- 1/1996 – Bids for the new foreign and domestic banking licenses are made. The central bank plans to announce the winners in May.
- 5/1996 – Bank runs begin on Bangkok Bank of Commerce (BBC) and the Bank of Thailand injects Bt13 billion into BBC from the Rehabilitation Fund for a 32% stake. Details of the bank's problems surface when the opposition in the government release documents that indicate the bank had been insolvent for two years.
- 5/1996 – The central bank misses the deadline to announce the new banking licenses.
- 6/1996 – Bank of Thailand reveals that BBC's questionable loans totaled Bt 77 billion. Top management borrowed 1/3 of the bank's loans for a total of Bt 57 billion and politicians borrowed Bt 7 billion in loans with little collateral. One of the borrowers was the deputy finance minister.
- 7/1996 – Governor of Bank of Thailand resigns.
- 7/1996 – Plans to issue new banking licenses are on hold.

- 8/1996 – Moody’s downgrades the country’s short-term debt in response to Thailand’s high exposure to short-term debt.
- 9/1996 – The Bank of Thailand announces that provisions for bad loans fell sharply in the first half of 1996 and that only Bangkok Bank had adequate provisions.
- 10/1996 – 7 BIBF banks were upgraded to full branch status.
- 2/1997 – Civil charges are dropped against the President of BBC when the Bank of Thailand “accidentally” allowed the statute of limitations to file charges to expire.
- 3/1997 – Three top administrators of the central bank are suspended.
- 3/1997 – For the first time, finance firms and credit fonciers will have to provide provisions equal to 20%, and banks equal to 15% of nonperforming loans.
- 4/1997 – The Industrial Financial Corporation of Thailand assumes control of BBC.
- 5/1997 – The finance ministry launches another probe into the Bank of Thailand’s handling of BBC.
- 6/1997 – Finance One, Thailand’s largest finance company collapses and 15 other finance companies are suspended.
- 7/1997 – Under intense pressure, the Bank of Thailand abandons the peg of the Baht.
- 7/1997 – 42 more finance companies are suspended. Assets of 58 suspended finance companies represent 1/5 of the finance sector total.
- 7/1997 – Governor of Bank of Thailand resigns.
- 8/1997 – Thailand and the IMF agree to a \$17.2 billion bailout package.
- 9/1997 – The central bank increases the required capital-to-asset ratio for finance companies to 8% from 7.5%.
- 10/1997 – The central bank raises the required capital-to-risk asset ratio to 8.5% for commercial banks, with 5.5% in Tier I capital.
- 10/1997 – The government announces its financial restructuring package. The provisions include:³⁰
- i) The creation of two agencies: the Financial Restructuring Agency (FRA) and the Asset Management Corporation (AMC) to supervise the rehabilitation or liquidation of the 58 finance companies and to restructure and sell off the assets of the closed finance companies, respectively.

³⁰ This description of the October 14th packages uses material from EIU Country Report, 4th Quarter 1997.

- ii) The introduction of new loan classification standards and provisioning rules. Reduced the period from 12 months to 6 months after which loans must be declared as nonperforming if no interest is paid. Also, the borrower must repay the entire 6 months interest before the revenue can be booked instead of a partial payment as before.
- iii) Foreigners may now purchase a majority position in commercial banks and finance companies; previously foreigners had been limited to a 25% stake. After 10 years however, foreign investors will not be able to purchase any new shares in the banks.
- iv) The country's 15 banks and remaining 33 finance companies are guaranteed from closure by the Financial Institutions Development Fund (FIDF). The loans and deposits of the country's 15 banks and remaining 33 finance companies are guaranteed by the Financial Institutions Development Fund (FIDF).

11/1997 – 56 of the 58 finance companies are closed.

11/1997 – Prime Minister Resigns.

12/1997 – Moody's downgrades Thai bank ratings to Ba1, which is junk bond status.

12/1997 – DBS Bank of Singapore takes a 50.3% stake in the Thai Danu Bank (TDB).

1/1998 – Under the agreement with the IMF, all banks must submit recapitalization plans. The Bank of Thailand will write down capital and replace management of all banks unable to raise capital.

2/1998 – The Bank of Thailand writes-off shareholder's equity and assumes control of First Bangkok City Bank (FBC), Siam City Bank (SCB), Bangkok Metropolitan Bank (BMB), and BBC.

3/1998 – Laem Thong Bank (LTB) voluntarily writes down $\frac{3}{4}$ of its equity and plans to sell new shares to Hong Kong and Saudi Arabian investors.

3/1998 – ABN Amro of the Netherlands buys a 75% stake in the Bank of Asia (BOA).

3/1998 – Radasim Bank opens as a new state-owned bank with the assets of the 56 closed finance companies.

4/1998 – The Bank of Thailand reduces the period from 6 months to 3 months after which loans must be declared as non-performing if no interest is paid. Bank of Thailand also increases the amount of provisions that must be put aside; namely provisions for performing (up-to-date loans) will equal 1% of loans, provisions for special mention loans (less than 3 months) will equal 2% of loans, provisions for substandard loans (less than 6 months) will equal 20%, provisions for doubtful (less than one year) will equal 50%, and provisions for bad loans (more than one year) will equal 100%. Rules to go into effect in the second half of 1998.

4/1998 – The FIDF has Bt1.1 trillion in debt outstanding of which Bt400 billion was

- borrowed from short-term money markets.
- 4/1998 – Thai Farmers Bank (TFB) issues new shares giving foreign investors 49% of its equity.
- 4/1998 – Bangkok Bank (BBL) issues new shares giving foreign buyers a 40% stake in the bank.
- 5/1998 – Executive decrees are announced and include bringing the FIDF under the control of the finance ministry to allow it to borrow long term. The Finance Ministry is expected to issue \$3-5 billion in bonds.
- 5/1998 – Governor of the Bank of Thailand is replaced.
- 5/1998 – The first insurance company is closed.
- 5/1998 – Bank of Thailand takes control of another 5 finance companies.
- 8/1998 – Bank of Thailand writes-off shareholder's equity and assumes control of Union Bank of Bangkok (UBB) and Laem Thong Bank (LTB) and 5 more finance companies. The Governor of the Bank of Thailand announces that the institutions the central bank intervened in had loans outstanding from the FIDF amounting to over twice shareholders' equity.
- 8/1998 – The government announces a \$7.5 billion financial system rehabilitation plan. This included the passage of four decrees by Thailand's Lower House to implement the plan. The decrees:
- i) Allow the Finance Ministry to issue Bt500 billion in domestic bonds to swap for preferred shares or subordinated bonds of commercial banks and finance companies.
 - ii) Amend the 1962 Commercial Banks Act to facilitate mergers between banks by preventing depositors or creditors from blocking the transfer of assets between banks.
 - iii) Amend the 1979 Finance Companies Act to facilitate mergers between finance companies.
 - iv) Allow commercial banks to set up asset management companies to administer problem loans.

Given these new powers the government's plan includes:

- i) For the six strongest banks (BBL, KTB, TFB, SBB, BAY, and TMB), they will be able to swap preferred shares and bad loans for government bonds. However, if banks chose this option they must increase provisions to 100% of nonperforming loans calculated on a three-month basis. Otherwise, if these banks can recapitalize on their own, the 100% provisioning will be phased in through January 2000.
- ii) Gives foreign investors who invest in the banking system a five-year guaranteed minimum yield. The Thai Finance Minister announced that the restructuring plan

- requires roughly \$5 billion in new private foreign capital. The government hopes to find buyers for NTB, BMB, and SCB.
- iii) The government announced the forced mergers of previously nationalized FBC with the government-owned Krung Thai Bank (KTB). Also, the good assets of BBC will be merged with KTB. UBB, the 5 finance companies suspended in May 1998, the 5 finance companies suspended in August 1998, and the two remaining suspended finance companies from July 1997, will be merged with Krungthai Thanakit, the government-owned finance company. LTB will be merged with the new state-owned Radhanasin Bank. BBC will be turned into an asset management company and will cease to exist. The government plans to recapitalize BMB and SCB and sell them to the private sector.
- 9/1998 – Problem loans of the Thai financial system amount to Bt 1.72 trillion.
- 9/1998 – Siam Commercial Bank announces it will take part in the government’s recapitalization plan.
- 9/1998 – Nakornthon Bank signs a “memorandum of understanding” to sell a majority stake in the bank.
- 9/1998 – Krung Thai Bank announces it will raise 18.5 billion new shares at Bt 10 a share to prepare for the merger with First Bangkok City Bank and Bangkok Bank of Commerce. The FIDF will buy the shares.
- 10/1998 – The Finance Ministry issues Bt 201 billion out of the approved Bt 500 billion to replenish the FIDF and recapitalize the remaining banks.
- 10/1998 – The World Bank announces it will issue another \$400 million tranche out of a \$1.5 billion package in January 1999. The loan will be used to improve the central bank supervision of financial institutions and to set up a deposit insurance agency.
- 10/1998 – The central bank Governor announces that problem loans of the entire financial system are expected to be at least 40% of total loans.

Appendix C

RESOLUTION OF CRISIS FOR THAI BANKS

Bangkok Bank

In April 1998, BBL sold 25 million new shares to foreign buyers to recapitalize the bank. The Bt 2.32 billion share issue represented 40% of the bank's equity. BBL reported NPLs at 22.6% of total loans for end-1997 using a 3-month past due standard.

Bangkok Bank of Commerce

In May 1996, the Bank of Thailand injected Bt 13 billion from the Rehabilitation Fund into the bank for a 32% stake. In February 1998, the Bank of Thailand wrote-off shareholders equity and assumed control of the bank. In August 1998, the good loans and deposits of BBC were merged with KTB. BBC left with only bad assets, was made an asset management corporation and ceased to exist as a bank.

Bangkok Metropolitan Bank

In February 1998, government wrote-down shareholders' equity making the banks' Bt 10 par-value shares worth Bt.01 a share. The Tejapaibul family's holdings fell by Bt 11.011 billion to Bt 11 million giving the Bank of Thailand 99% of the bank. In August 1998, the government announced it plans to privatize BMB.

Bank of Asia

In April 1998, ABN AMRO Holdings NV of the Netherlands purchased a 75% stake in Bank of Asia by injecting \$187 million in capital.

Bank of Ayudhya

If the Bank of Ayudhya cannot raise new capital, the bank will have to participate in the government's August 1998 recapitalization plan.

First Bangkok City Bank

In February 1988 the Bank of Thailand took over and wrote down most of the equity of First Bangkok City Bank giving the central bank 99.9% ownership. The FIDF injected Bt 32 billion into the bank and wrote down capital from Bt 10 per share to Bt 0.01 per share. This action raised the capital adequacy of FBC to 10%. In August 1998, the Bank of Thailand announced FBC would be merged with Krung Thai Bank.

Krung Thai Bank

KTB is the government owned bank. In December 1997, it is announced that KTB will issue notes to cover the 42 finance companies closed in August 1997. In September 1998, KTB announced it will sell 18.5 billion new shares at Bt 10 a share to the FIDF. The bank is participating in the government's recapitalization plan in order to ready itself for the acquisition of First Bangkok City Bank and the good assets of Bangkok Bank of Commerce.

Laem Thong Bank

In February 1998, LTB shareholders voluntarily wrote down $\frac{3}{4}$ of the bank's equity and planned to raise Bt 6 billion in fresh capital overseas. After being unable to raise new

capital, the Bank of Thailand assumed control of LTB in August 1998. LTB's Bt 10 par-value shares were written down to Bt 0.01 a share. The FIDF took over LTB by swapping its loans for equity in LTB. Later in August, it was announced that LTB would be merged with the state-owned Radhanasin Bank.

Nakornthon Bank

Standard Chartered Bank and Bank of Nova Scotia are interested in purchasing a controlling stake in NTB. In September 1998, NTB signed a "memorandum of understanding" to sell a majority stake in the bank.

Siam City Bank

In February 1998, the Bank of Thailand took over Siam City Bank and wrote off most of its capital. SCB's paid up capital of Bt 6.16 billion was decreased to Bt 1 per share from Bt 10 par-value shares. The FIDF converted its loans to SCB to equity and bought all of the shares in a Bt 20 billion capital increase. This raised the capital adequacy of the bank to 10% and gave the Bank of Thailand 97% ownership of the bank. In August 1998, the government announced it plans to privatize bank.

Siam Commercial Bank

The largest shareholder of SBB is the Thai royal family's Crown Property Bureau. SBB announced its NPLs equaled 14.7% of total loans at end-1997 using a 3-month standard. SBB is likely to participate in the government's August 1998 recapitalization program.

Union Bank of Bangkok

The Bank of Thailand wrote-down shareholders equity from Bt 10 par-value shares to Bt 0.01 a share and assumed control of UBB in August 1998. Later in August, UBB was merged with Krungthai Thanakit, the state-owned finance company.

Thai Danu Bank

In December 1997, the Development Bank of Singapore Ltd. announced it would purchase a 50.3% stake in TDB. TDB announced that its NPLs equaled 26.7% of total loans at end-June 1998.

Thai Farmers Bank

By April 1998, TFB had sold new equity to foreigners giving them 49% ownership of the bank. In May 1998, the bank announced its NPL at end-1997 were 22.2% of total loans using a three-month standard.

Thai Military Bank

The Thai military is the largest shareholder in TMB. In October 1998, TMB announced its plan to issue Bt 6 billion in new equity to raise the bank's capital-to-risk-assets ratio to 10.5%. If the bank cannot complete the sale by June 1999, they will participate in the government's August 1998 recapitalization plan.