

The Degree of Competition in the Thai Banking Industry before and after the East Asian Crisis

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Abstract

This paper analyzes the influence of the East Asian crisis and the subsequent reforms on the oligopolistic nature of the Thai banking industry. Since the crisis, there have been substantial changes in competitive environment, including a decline in the family ownership of banks as well as the arrival of new entrants. How did these changes affect a banking industry in which the six largest local banks accounted for over 70 percent of market share? The estimated Lerner index from Bresnahan's [1989] conjectural variation model indicates the possibility of a decline in the degree of competition.

Keywords: Thai banking industry, degree of competition, Lerner index

JEL classification: G21, L13

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1. Introduction

The purpose of this paper is to investigate how the 1997-98 East Asian crisis and the subsequent reforms affected the degree of competition in the Thai banking industry.

Through the reforms, the industry has undergone substantial changes in terms of the ownership of banks and of regulations. In many banks, family ownership has been replaced by state and foreign ownership. The banking sector saw several entrants during the reforms, a phenomenon that had been absent for more than 20 years before the crisis. Despite these developments, a casual observation of loan market share suggests that the oligopolistic nature of the industry remains unchanged¹. Before as well as after the crisis, the six largest banks accounted for 70 percent of total loans of the consolidated banking sector. The rather stable market share of the large banks, despite the reforms, forms the background of the present analysis on the behavior of leading Thai banks.

To estimate the degree of competition, we apply the method devised by Bresnahan

¹ See Vichyanond [1994] for the structure of the Thai banking industry before the East Asian crisis.

[1989]. Using estimation models based on microeconomic foundations, this method allows us to derive the index of the firms' market power that is calculated as the deviation of the market price from the marginal cost. Several studies have applied this method to the analysis of the banking industry, and these have often found that the banking industries cannot be regarded as being in perfect competition. One of the earliest studies is that of Shaffer [1993] on the Canadian banking industry. She used time series data for the aggregated banking sector, and estimated an average degree of competition over a long period of time². Bikker and Haaf [2002] applied the same method to the banking industries of the European countries. While the estimation based on time series data yields only an average degree of competition for a long period, panel data from the financial statements of individual banks allows us to estimate the industry-wide average degree of competition and to evaluate its year-by-year evolution. The latter method has been applied by Angelini and Cetorelli [2003] to the Italian banks, and by Uchida and Tsutsui [2005] to the Japanese banks³. Our study, also, employs panel data, in our case data relating to the Thai commercial banks during the period 1992-2004. By estimating parameters of a market power index for consecutive

² A similar study is that of Shaffer and DiSalvo [1994], which deals with the time series data of two Canadian banks.

³ Apart from these, Berg and Kim [1994] used the cross-section data of the Norwegian banks, and estimated a degree of competition for a particular year.

years before and after the crisis, we evaluate the year-by-year evolution of the degree of competition.

The present paper contributes to the empirical literature on the Thai banking sector. Among existing studies, in contrast to the abundant literature that outlines the financial reform measures that followed the 1997-98 East Asian crisis⁴, there are relatively few quantitative analyses of the structural changes that have occurred in the banking industry. Among the few existing studies, Anuchiworawon et al. [2003] and Polsiri and Wiwattanakantang [2005] describe the decline of family ownership of banks from the perspective of corporate governance. In their study relating to foreign bank penetration through the reforms, Okuda and Rungsomboon [2004b] analyze the effects of foreign bank entry on the banking industry, and find that an increased presence of foreign banks in terms of number of banks is associated with a rise in overhead costs, a decline in profits, and an increase in the interest spread of local banks.⁵ In contrast to the narrow focus of Okuda and Rungsomboon [2004b] on the effects of foreign bank entries, we consider the effects of the reforms, including changes in the ownership structure, on the degree of competition.

The organization of this paper is as follows. In the next section, we describe

⁴ For example, Vichyanond [2000].

⁵ Apart from this, Okuda and Rungsomboon [2004a] estimate cost functions of foreign and local commercial banks in Thailand and evaluate changes in cost efficiencies.

changes in the Thai banking industry during the crisis and reforms that might affect the degree of competition. We present our econometric model in Section 3, and discuss the results of estimation in Section 4. In Section 5, we summarize the analysis and offer some concluding remarks.

2. Changes in the competitive environment of the Thai banking industry

2.1 Structure of the financial sector

The financial sector in Thailand consists of commercial banks, finance companies and government-owned specialized financial institutions. Commercial banks comprise banks incorporated in Thailand, and branches of foreign banks. At the end of 2004, there were 3,911 branches of locally incorporated banks, while each of 18 foreign banks has been allowed to open one branch within Thailand. Finance companies are institutions that are not permitted to accept deposits, and raise funds by issuing debt instruments instead. Government-owned specialized financial institutions include the Government Savings Bank, the Government Housing Bank, and the Bank for Agriculture and Agricultural Cooperatives. Apart from the above-listed financial institutions, there are savings cooperatives and agricultural cooperatives. The average size of these cooperatives and their aggregated share in the financial sector are small.

Table 1 summarizes the size of the respective categories of financial institutions.

Table 1, here.

Table 1 shows that the high concentration of market share by the six largest local banks remains a salient feature of the Thai financial sector. The total loans of these banks account for about a half of the whole financial sector before as well as after the East Asian crisis. Before the crisis, their share at one time declined because of a surge in the loans of the finance companies. The lending practices of most of these finance companies were reportedly bold, and 56 finance companies were closed and liquidated in 1997 due to a severe non-performing loans (NPLs) problem. In the subsequent financial restructuring period, the share of large commercial banks has been relatively low as their loan assets declined sharply as a result of NPLs. As the restructuring settled down, their share picked up. This was partially because some leading banks merged or succeeded to the viable assets of closed smaller banks and finance companies. On balance, the banking industry remained more or less oligopolistic.

2.2 Changes in the competitive environment

We can observe two changes in the competitive environment that might have affected the degree of competition in the banking industry. First, there were significant changes in the ownership structure of financial institutions during the reforms. The government not only nationalized and liquidated a number of distressed banks, but also abolished the restriction on the foreign ownership of commercial banks in order to invite foreign banks and investors to recapitalize the distressed banks. Hitherto, foreign ownership had been restricted to less than 25 percent of the equity capital of each financial institution, and it was this regulation that was lifted for a specified period. As a result, foreign banks now own majority shares in four small and medium banks. As of 1996, founding families were the largest shareholders in five of the eight largest banks. By 2003, foreign investors were the largest shareholders in two banks, including the largest one. Two other banks have been either nationalized or liquidated, and there remains only one bank in which the largest shareholder is the founding family (Polsiri and Wiwattanakantang 2005).

Table 2, here.

Second, there has also been a significant change in the attitudes of the financial

authorities towards entry to the banking sector. There had been no new entry and only one exit between 1980 and 1996, whereas five banks exited through liquidations and mergers during the recent reforms, and two state owned banks were established to succeed to part of the assets and liabilities of the closed banks. Furthermore, a private finance company was upgraded to commercial bank status in 2004 by the issuance of a brand-new banking license, the first such initiative in the last two decades.

Such changes in ownership structure as well as entry and exit in the industry may affect the degree of competition. In practical terms, these changes may make it difficult to maintain collusion, if any, between banks, and this in turn might well lead to an intensification of competition within the industry.

2.3 Changes in the performance of banks

In order to analyze the degree of competition among banks, we have to take into account changes in their performance as well as in the structure of their revenues and expenses. First, there has been a notable fluctuation in the profitability of the banks. In Figure 1, we present a summary of selected indices concerning the performance of the banking industry using data compiled from the income statements of the consolidated commercial banks in Thailand (excluding branches of foreign banks). One of the

reasons for the fluctuation in profitability is the problem of non performing loans (NPLs). The ratio of NPLs to total loans rose to around 45 percent in 1999. The NPLs problem lowered profitability in two ways. First, the banks incurred huge expenses in the form of loan loss provisions for the disposal of NPLs (depicted as the dotted line in Figure 1). Moreover, NPLs, either classified or non-classified, reduced interest income from these assets, thus bringing about an abrupt decline in net interest income in 1998 (depicted as the fine continuous line in Figure 1). It was not until 2001 that the net profits of the banks became positive again.

Figure 1, here.

Changes in interest rates have also been remarkable. Figure 2 illustrates lending and deposit interest rates and the interest margin between two rates. While both the lending and deposit interest rates fell considerably in the reform process, the spread widened to more than four percent in the 2000s from around three percent before the crisis. This widening margin partially accounts for the rising net interest income in recent years (see Figure 1).

Figure 2, here.

Changes are also apparent in both revenue and cost structures. Figure 3 portrays the structure of revenues and expenses as a percentage of total assets for the consolidated commercial banks (excluding branches of foreign banks). So far as the changes in the structure of revenues are concerned, we can see a sharp drop in ‘interests on loans and deposits’⁶ in 1999, which corresponds to the decline in the lending interest rate (see also Figure 2). Another significant change is the increase in ‘other interests and dividends revenue’ after 1998. In particular, there was an increase in the interest revenue from government bonds. As a restructuring scheme, the government injected capital into some distressed banks, and these banks received government bonds. As a result, the portfolio pattern of these banks was modified, leading to an increase in the interest revenue from government bonds.

As regards changes in the structure of expenses, the effect of the declining deposit interest rate is reflected in a drop in interest expenses. In addition, a decline in personnel expenses is apparent. Another important change is the rise in the ‘contribution to the Financial Institution Development Fund (FIDF)’. The FIDF is an

⁶ Deposits here refer to banks’ deposits at other financial institutions.

institution affiliated to the Bank of Thailand (the central bank), and it has been providing an implicit blanket guarantee for depositors of financial institutions. The contribution of banks to FIDF can be regarded as a premium for deposit insurance. The rate was raised in late 1997 from 0.1 percent of total deposit per annum to 0.4 percent, causing a marked increase in expenses relating to this item.

Figure 3, here.

3. Analytical Framework and Data

3.1 Analytical framework

As our analytical framework, we adopt Bresnahan's [1989] conjectural variation model of competition. Specifically, we consider a loan market in which banks face a demand function $p \equiv p(Q, z)$, with $Q = \sum_i q_i$ $i = 1, 2, \dots, n$, where p is the lending interest rate, q_i is the individual banks' loan supply, and z is the vector of exogenous factors affecting the demand for loans. In the existing empirical literature on the banking industry, there has been a controversy over whether deposits should be treated as an input or output. In line with most of the empirical studies of the degree of competition, we treat both labor and deposits as factor inputs, and loans as banks' sole

output. Thus, Bank i 's maximization problem is

$$\max \pi_i = p(Q, z) \cdot q_i - C(q_i, \omega_i), \quad (1)$$

where $C(q_i, \omega_i)$ is Bank i 's cost function, with ω_i being the vector of the prices of its factor inputs.

The first order condition is

$$\frac{\partial \pi_i}{\partial q_i} = p + q_i \cdot \frac{\partial p}{\partial Q} \cdot \frac{\partial Q}{\partial q_i} - \frac{\partial C_i}{\partial q_i} = 0. \quad (2)$$

Rearranging (2) yields

$$p - MC_i = \left(-Q \cdot \frac{\partial p}{\partial Q} \right) \cdot \left(\frac{\partial Q}{\partial q_i} \cdot \frac{q_i}{Q} \right) = \frac{\theta_i}{\eta}, \quad (3)$$

where MC_i is the marginal cost, and $\eta \equiv (-\partial Q / \partial p) / Q$ is the semi-elasticity of loan demand to the lending interest rate. $\theta_i \equiv (\partial Q / \partial q_i) / (Q / q_i)$ is Bank i 's conjectural elasticity of total loan of the banking industry with respect to its own loans, that is, Bank i 's expectation on how other banks react to its output change. This term indicates the bank's market power – i.e. the extent to which the bank can manipulate the loan supply and the lending interest rate by collusion with other banks. When the market is in perfect competition, θ_i takes the value of zero for all banks. In a monopoly, θ_i equals one.

There are two ways of estimating the degree of competition using Equation (3).

One method is to obtain θ_i by identifying it separately from the semi-elasticity of

demand, η . However, insofar as we assume a homogeneous loan market, we have only one observation per year for the aggregate loan demand⁷. Thus, we cannot obtain annual estimates of η , but an estimate of average semi-elasticity over a long period of time, so that we cannot retrieve annual estimates of θ_i . The second method is to estimate θ_i/η as one parameter (Angelini and Cetorelli [2003]). In the latter case, dividing both sides of Equation (3) by p , we obtain a Lerner index,

$$L_i \equiv \frac{p - MC_i}{p} = \frac{\theta_i / \eta}{p}. \quad (4)$$

This Lerner index, $L \in [0,1]$, measures the mark-up of price over marginal cost, indicating the market power of a bank. We estimate a cross-sectional average of θ_i/η for each year and derive an industry-wide average Lerner index to see how it has evolved before and after the crisis.

Rearranging Equation (3) yields

$$R_i = q_i \cdot MC_i + \frac{\theta}{\eta} \cdot q_i, \quad (3')$$

where R_i refers to Bank i 's interest income⁸. To calculate the marginal cost, we consider the following translog cost function;

⁷ Uchida and Tsutsui [2005] estimate the demand equation for each year with the assumption that each bank faces heterogeneous loan demand, which is contradictory to the formulation of the supply equation with loans of banks as a homogeneous product.

⁸ If we estimate Equation (3) without this rearrangement, the dependent variable is the lending interest rate. Discrepancies in the lending rates among banks contradict the formulation of the demand function that assumes loans of all banks are a homogeneous product. By multiplying both sides of the equation with the quantity of loans, we can transform the lending interest rate in the left hand side to the interest income. This allows us to avoid this theoretical contradiction.

$$\ln C_i = \beta_0 + \beta_1 \ln q_i + \frac{\beta_2}{2} (\ln q_i)^2 + \sum_{k=1}^2 \gamma_k \ln \omega_{k,i} + \sum_{k=1}^2 \phi_k \ln q_i \ln \omega_{k,i} + \frac{1}{2} \sum_{k=1}^2 \gamma_{kk} (\ln \omega_{k,i})^2 + \gamma_{12} \ln \omega_{1,i} \ln \omega_{2,i} \quad (5)$$

where $\ln \omega_{1,i}$ and $\ln \omega_{2,i}$ stand for the deposit interest rate and wage, respectively.

Differentiating (5) with respect to q_i yields the following marginal cost as below:

$$MC_i = \frac{C_i}{q_i} \left[\beta_1 + \beta_2 \ln q_i + \sum_{k=1}^2 \phi_k \ln \omega_{k,i} \right]. \quad (6)$$

Substituting it into (3') completes the supply equation.

As an empirical strategy, we estimate the bank's supply function (3') simultaneously with the cost function (5) on the assumption that estimating the supply function simultaneously with the cost function will improve the precision of estimation. We basically follow Angelini and Cetorelli [2003] in the formulation of the estimation equations. One difference is that we add a control variable, $\ln(npl_i)$ in the cost equation, with npl_i referring to the amount of NPLs. Since the sample span includes the period of the crisis, including notably the abrupt rise in non-performing loans (NPLs) and the associated decline in the net amount of loans, this term is expected to control such shocks. Thus, the formulation of the estimation equations is as follows;

$$\ln C_i = \beta_0 + \beta_1 \ln q_i + \frac{\beta_2}{2} (\ln q_i)^2 + \sum_{k=R,W} \gamma_k \ln \omega_{k,i} + \sum_{k=R,W} \phi_k \ln q_i \ln \omega_{k,i} + \frac{1}{2} \sum_{k=R,W} \gamma_{kk} (\ln \omega_{k,i})^2 + \gamma_{12} \ln \omega_{1,i} \ln \omega_{2,i} + \rho \ln(npl_i) + \varepsilon_i \quad (7)$$

$$R_i = \beta_1 C_i + \beta_2 C_i \ln q_i + \sum_{k=R,W} \phi_k C_i \ln \omega_{k,i} + \sum_m (\bar{\theta}/\eta)_m \cdot q_i + \nu_i \quad (8)$$

In Equation (8), $(\bar{\theta}/\eta)_m$ ($m= 1993, 1994, \dots, 2004$) stands for the degree of competition for each year, from which we construct the Lerner index.

3.2 Data

Our data set covers the six largest commercial banks for the period 1992-2004.⁹ We select these banks according to the following criteria: (i) banks which existed throughout the period of analysis; (ii) banks that maintained more than three percent of the bank loan market share throughout the period of analysis, and (iii) banks which were not majority-owned by foreign investors. With regard to the first criterion, those banks which were liquidated or merged with other banks have been eliminated from the data set since the cost structure of these banks may differ from others due to their bad lending practice. The third criterion is based on the questionnaire survey of Okuda [2004] which showed that the target customers of the foreign-owned banks differ from those of other locally incorporated banks, and that there is possible market segmentation.

The data we employ have been derived from the annual reports of individual banks, *Statistical Data on Commercial Banks in Thailand*, published annually by

⁹ These are Bangkok Bank, Krung Thai Bank, Kasikornbank (formerly Thai Farmers Bank), The Siam Commercial Bank, TMB Bank (formerly Thai Military Bank), and Bank of Ayudhaya.

Bangkok Bank, and *Thailand's Commercial Banks*, Nov. 25, 1997 by Thai Investment and Securities Public Company Limited.

We provide the definition of variables and their descriptive statistics in Table 3. With regard to output, we use 'net earning assets', which comprise loans as well as investments. As we have seen in the last section, after the crisis, banks shifted their portfolios towards securities. Using 'net loans' as the volume of output leads to an underrating of banking operations in recent years. Second, interest rates are *ex post* values, that is, interest incomes (expenses) divided by net earning assets (total liabilities). Therefore, the lending interest rate gets lower than the nominal *ex ante* lending rate when the 'net earning assets' comprises unclassified NPLs, this being particularly the case in 1998-99. Third, we define the costs and the deposit interest rate in two ways. In the basic definition of the costs (C_i), we count only the interest expenditure and personnel expenses because these items are two main variable components of ordinary expenditure. In the alternative definition, given the marked increase in 'contribution to FIDF' in recent years, we include this expenditure item in the costs, (C_{2i}). Accordingly, the deposit interest rate, $\omega_{R2,i}$, is calculated by dividing the sum of the interest costs and the contribution to FIDF with total liabilities.

Table 3, here.

4. Estimation Results

4.1 Results

We estimate Equations (7) and (8) simultaneously by three-stage least squares (3SLS) regressions, using the pooled data of the six largest commercial banks for 1993-2004¹⁰.

As for instrumental variables, in addition to the exogenous factor prices and the amount of NPLs, we employ the lagged variables of the terms that include q_i and C_i .

We first estimate Equation (7) and (8). The estimated parameters of the cost function do not fulfill the condition of monotonicity (not reported). Considering the small sample size, we might need a more parsimonious specification of the cost equation. In fact, we test the null hypothesis that the cost equation takes the form based on the Cobb-Douglas production function, and cannot reject the null hypothesis. Accordingly, we estimate the system with the restrictive specification of the cost function as below¹¹.

¹⁰ The data set covers the period 1992-2004. As we use some lagged variables for instruments, the sample is shortened to 1993-2004.

¹¹ The wrong signs of the parameters of the translog cost equation are also observable in previous studies including Angelini and Cetorelli [2003] and Uchida and Tutsui [2005]. Instead of a problematical cost equation, we opt for a cost function, albeit

$$\ln C_i = \beta_0 + \beta_1 \ln q_i + \gamma_1 \ln \omega_{R,i} + \gamma_2 \ln \omega_{W,i} + \rho \ln(npl_i) + \sum \delta_k \cdot bank_k + \varepsilon_i \quad (7')$$

$$R_i = \beta_1 C_i + \sum_m (\bar{\theta}/\eta)_m \cdot q_i + v_i \quad (8')$$

Also, we include intercept dummies for individual banks, $bank_k$ ($k=2, 3, 4, 5, 6$), to account for possible differences in cost efficiencies.

Table 4 reports the results of estimation. In general, the fit of the cost function is satisfactory. All the estimated coefficients have the expected signs. $\beta_1 < 1$ suggests economies of scale in the banking industry. With regard to the differences in cost efficiencies among banks, a Wald test rejects the null hypothesis of no differences. We also perform a Hausman specification test, which also is in favor of the model that includes the bank dummies. On the other hand, whether or not the contribution to FIDF is included in the costs does not much affect the results of the estimation. Thus, we put forward the analysis based on the estimation result of model (3) in Table 4.

Table 4, here.

To construct the Lerner index, we divide $(\bar{\theta}/\eta)_m$ for each year by an average of the *ex post* lending interest rates of six banks for the corresponding period. We depict

restrictive, with appropriate properties.

the derived index in Figure 4. As can be seen, the Lerner index swung down considerably in 1998-1999. However, we do not consider this is due to intensified competition among banks. On the contrary, the low score of the Lerner index is related to non-filed NPLs in the earning assets. As the loan classification was still loose in the late 1990s, banks had a considerable amount of non-filed NPLs on their balance sheets. Non-filed NPLs lowered the *ex post* lending interest rate, which resulted in the low score of the Lerner index. On the other hand, a more interesting finding from Figure 4 is the rise in the Lerner index in the post-crisis period. How can we interpret this change? We devote the rest of the analysis to discussion of this question.

Figure 4, here.

4.2 Discussion

The rise in the Lerner index in recent years implies that, despite changes in the competitive environment of the banking industry in terms of ownership structures and regulations, competition in the industry might have declined during the 2000s. In this regard, we cannot perform a statistical analysis to regress the derived Lerner index on some relevant state variables because of the shortness of the sample period. Instead, we

list some points that might be related to the rise in the Lerner index.

One factor that might account for the rising trend of the Lerner index is the business cycle. In the conditions of slowdown that have been evident in the economy since the financial crisis, both lending and deposit interest rates have declined markedly in recent years. Moreover, the moderate decline of the lending interest rate in relation to the deposit interest rate, and the widening interest margin might be indicative of a decline in the creditworthiness of borrowers. However, a quantitative evaluation of these changes is beyond the scope of this present paper.

Second, we look at loan demand elasticity. The Lerner index is composed of the semi-elasticity of loan demand to the lending interest rate, and the conjectural elasticity. Thus, the increase in the Lerner index in recent years might be due to the decline in the semi-elasticity of loan demand. Temporarily suspending the assumption that the loans of all banks are homogeneous products, we estimate, as a tentative exercise, the following loan demand function with fixed effects regression.

$$\ln q_{i,t} = \alpha_0 + \alpha_1 \cdot \ln Y_t + \alpha_2 \cdot \ln Y_{t-1} + \sum_i \eta_i \cdot p_{i,t} + (\nu_i + \varepsilon_{i,t}), \quad (9)$$

$q_{i,t}$ in this estimation refers to the loans of Bank i , net of allowance for doubtful accounts. $p_{i,t}$ and Y_t stand for the *ex post* lending interest rate for Bank i and the Gross Domestic Product (GDP), respectively. η_i is the industry-wide average

semi-elasticity of loan demand. We summarize the result of estimation in Table 5. We have to note that this is possibly a biased estimation because of missing explanatory variables. Taking this into account, we compute the conjectural elasticity, θ , and depict it in Figure 5. In this figure, though tentative, we can confirm the trend of rising θ . Thus, the results from the preliminary estimation of demand function do not deny the possibility of a decline in the banking competition since the financial crisis.

Table 5, here.

Figure 5, here.

If the degree of competition really is declining, what are the possible reasons for such a behavioral change among the banks? One possible explanation is that the banks need to increase net interest income to make up for the losses from the disposal of NPLs. As can be seen in Figure 1 in Section 2, despite the rising net interest income, the return on assets still remains much lower than the pre-crisis level. Such a condition might be related to a possible decline in banking competition.

5. Concluding remarks

In this article, we have estimated the degree of competition in the Thai banking

industry in order to evaluate how the 1997-98 East Asian crisis and the subsequent reforms affected the structure of the banking industry. In particular, applying the method of Bresnahan's [1989] conjectural variation model, we have derived a Lerner index which measures the mark-up of price over marginal cost.

In spite of changes in the competitive environment of the banking industry in terms of ownership structures and regulations, the Lerner index showed a rising trend in the post-crisis period. During the post-crisis reforms, family ownerships in a number of banks were replaced with state and foreign ownerships. There were also new entrants to the industry, a phenomenon that had been absent for a long period. These changes may make it difficult to maintain collusion, if any, between banks. However, preliminary estimation results reveal the possibility of a decline in competition.

The present analysis is limited in the sense that we cannot perform statistical analysis on the causes of a change in the degree of competition due to the shortness of the sample period. Nonetheless, it is hoped that this paper can be regarded as a useful contribution to the empirical literature on the Thai banking sector until such time as an accumulation of quantitative studies makes it possible to undertake more in-depth policy analyses.

There remain several outstanding issues arising from our analysis. First, the

sample period is short, which not only affect the robustness of estimations, but also makes it difficult to judge the effects of the financial reforms on the degree of competition as the effect may have not yet have fully worked its way through. Second, the assumption of the quantity competition among banks in a static framework may be restrictive, especially for the crisis and reform period. We leave the resolution of these problems as a task for future research.

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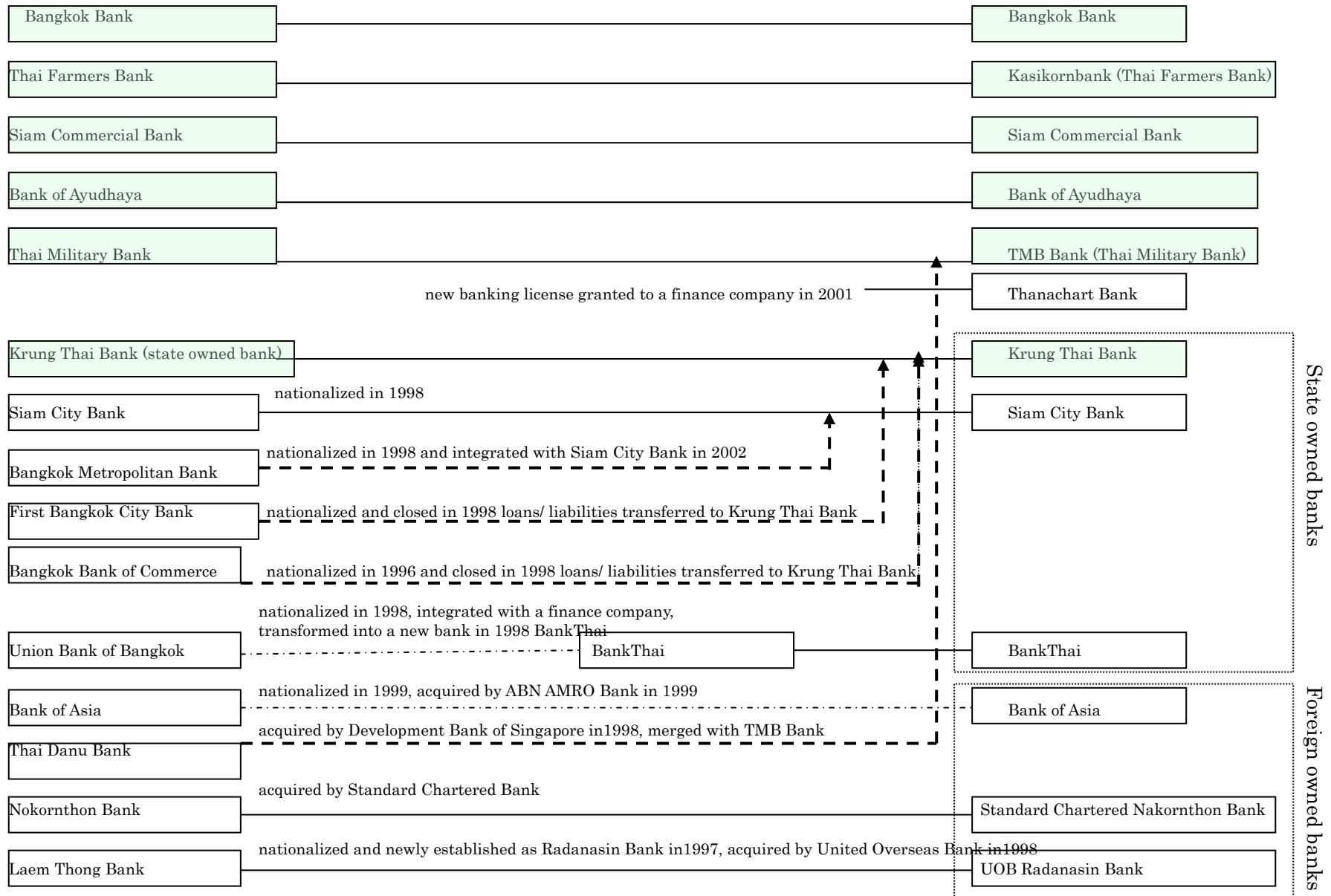
Table 1: Credit Extended by Financial Institutions (FIs) and Number of FIs

Credit extended by Financial Institutions	1992		1996		2000		2004	
	millions of baht	share(%)	millions of baht	share(%)	millions of baht	share(%)	millions of baht	share(%)
Commercial banks	2,161,945	74.4	4,825,057	69.8	4,585,931	76.9	5,081,346	77.0
<i>of which 6 largest locally incorporated banks</i>	1,659,760	57.1	3,086,243	44.7	2,597,864	43.6	3,607,270	54.7
<i>of which foreign bank branches</i>	111,639	3.8	376,992	5.5	467,387	7.8	454,164	6.9
Finance companies	547,710	18.8	1,488,188	21.5	449,856	7.5	281,129	4.3
Credit-foncier (mortgage loan) companies	5,123	0.2	6,742	0.1	3,327	0.1	1,080	0.0
Life insurance companies	21,206	0.7	30,204	0.4	39,931	0.7	45,014	0.7
Government-owned financial institutions	170,275	5.9	561,760	8.1	883,118	14.8	1,189,575	18.0
Total	2,906,259	100.0	6,911,951	100.0	5,962,163	100.0	6,598,144	100.0

Number of Financial Institutions				
Commercial banks				
local banks	15	15	13	12
foreign banks	14	14	21	18
Finance companies	92	91	21	18
Credit-foncier (mortgage loan) companies	18	12	10	5
Government-owned financial institutions	5	6	6	5

Source: Economic and Financial Statistics (various issues), Bank of Thailand
 Statistical Data on Commercial Banks in Thailand (various issues), Bangkok Bank

Table 2: Reorganization of the Thai Banking Industry



Source: Compiled from data in Table 2:2 of Polsiri and Wiwattanakantang [2005]

Table 3: Definition of variables and descriptive statistics

Table 3. (A) Definition

Variable	definition
q_i	Total earning assets, net of allowance for doubtful accounts
p_i	Interest income/ Total earning assets
R_i	Interest income
npl_i	Non performing loans
C_i	The sum of interest expenses and personnel expenses
C_{2i}	The sum of interest expenses, personnel expenses, and contribution to FIDF
$\omega_{R,i}$	Interest expenses/ Total liabilities
$\omega_{R2,i}$	[Interest expenses+ contribution to FIDF]/ Total liabilities
$\omega_{w,i}$	Personnel expenses/ Number of employees

Source: Author

Note: FIDF = Financial Institution Development Fund (see text for explanation)

Table 3. (B) Descriptive statistics

	q	p	R	npl	C	C(2)	$\omega(R)$	$\omega(R2)$	$\omega(W)$
	mil. baht	percent	mil. baht	mil. baht	mil. baht	mil. baht	percent	percent	baht
Average	539,996	8.88	45,488	79,780	34,379	36,001	5.23	5.46	357,115
Maximum	1,129,362	14.51	133,010	533,106	113,447	117,739	11.47	11.85	682,427
Minimum	136,088	3.03	14,754	1,297	8,913	10,395	0.89	1.25	184,471
Standard Deviation	251,935	3.30	25,315	108,807	21,170	21,431	2.60	2.53	107,997

Source: Author's calculation

Table 4: Results of estimation (cost and supply equations)

	(1)		(2)		(3)		(4)	
	without FIDF contribution with bank dummies		without FIDF contribution without bank dummies		with FIDF contribution with bank dummies		with FIDF contribution without bank dummies	
	coefficient	p-value	coefficient	p-value	coefficient	p-value	coefficient	p-value
β_0	2.0929	0.000	-0.7133	0.334	2.5163	0.004	-0.6825	0.258
β_1	0.8176	0.000	0.9324	0.000	0.8105	0.000	0.9428	0.000
γ_1	0.8308	0.000	0.1555	0.000	0.8502	0.000	0.8665	0.000
γ_2	0.1692	0.000	0.8445	0.000	0.1498	0.000	0.1335	0.000
δ	0.0226	0.033	0.0158	0.110	0.0258	0.000	0.0170	0.034
bk2	-0.0769	0.008			-0.0801	0.002		
bk3	-0.1232	0.000			-0.1319	0.000		
bk4	-0.1515	0.000			-0.1611	0.000		
bk5	-0.1906	0.000			-0.2006	0.000		
bk6	-0.0540	0.021			-0.0579	0.005		
(θ/η)93	0.0047	0.000	0.0379	0.000	0.0478	0.000	0.0370	0.000
(θ/η)94	0.0467	0.000	0.0388	0.000	0.0472	0.000	0.0380	0.000
(θ/η)95	0.0481	0.000	0.0382	0.000	0.0484	0.000	0.0370	0.000
(θ/η)96	0.0483	0.000	0.0383	0.000	0.0488	0.000	0.0373	0.000
(θ/η)97	0.0476	0.000	0.0372	0.000	0.0482	0.000	0.0361	0.000
(θ/η)98	0.0273	0.000	0.0146	0.000	0.0280	0.000	0.0132	0.000
(θ/η)99	0.0147	0.000	0.0063	0.023	0.0153	0.000	0.0058	0.018
(θ/η)00	0.0230	0.000	0.0169	0.000	0.0233	0.000	0.0163	0.000
(θ/η)01	0.0239	0.000	0.0189	0.000	0.0242	0.000	0.0184	0.000
(θ/η)02	0.0232	0.000	0.0190	0.000	0.0232	0.000	0.0187	0.000
(θ/η)03	0.0231	0.000	0.0199	0.000	0.0232	0.000	0.0198	0.000
(θ/η)04	0.0258	0.000	0.0235	0.000	0.0263	0.000	0.0234	0.000
No. of observations	72		72		72		72	
R-squared								
Cost equation	0.9922		0.9890		0.9934		0.9899	
Supply equation	0.9981		0.9981		0.9981		0.9981	
Wald test	19.28	0.002			27.81	0.000		
Hausman test	19.30	0.000			26.64	0.000		

Source: Author's calculation

Note: The system of equation estimated is

$$\ln C_i = \beta_0 + \beta_1 \ln q_i + \beta_2 \ln \omega_{r,i} + \beta_3 \ln \omega_{w,i} + \delta \ln(npl_i) + \varepsilon_i$$

$$R_i = \beta_1 C_i + \sum_m (\bar{\theta}/\eta)_m \cdot q_i + v_i$$

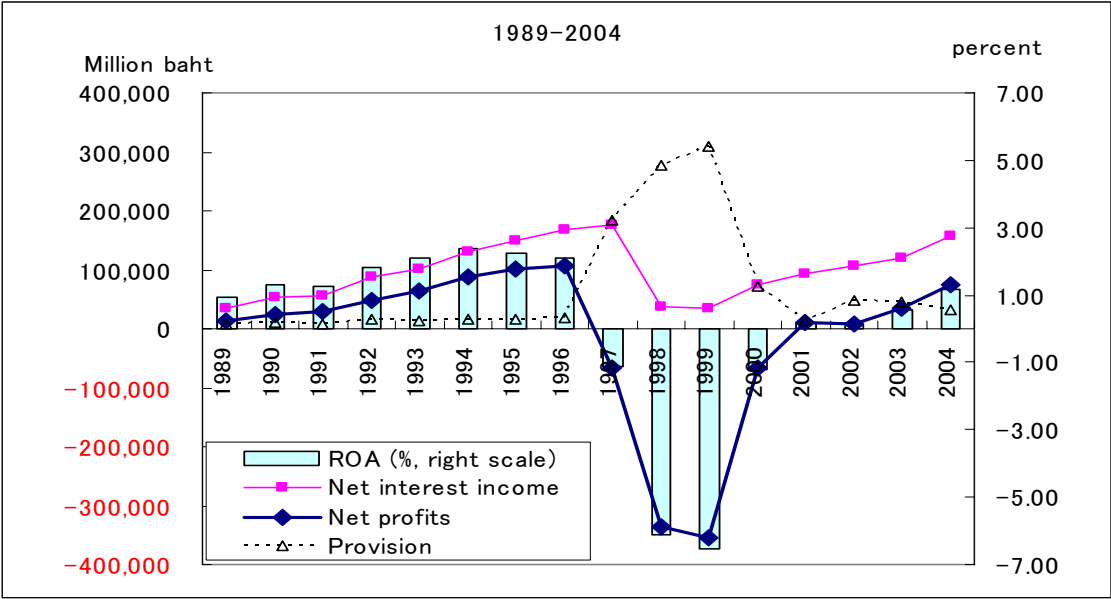
Following variables are used as instrumental variables. (1) Exogenous variables: $\ln \omega_{r,i}$, $\ln \omega_{w,i}$, $\ln(npl_i)$ and dummy variables for each year. (2) Lagged variables of endogenous variables: $\ln q_i$, C_i , and q_i .

Table 5: Results of estimation (demand equation)

	coefficient	p-value
$\alpha 0$	10.1064	0.437
$\alpha 1$	2.7843	0.352
$\alpha 2$	-0.7821	0.845
$\eta 93$	-3.6498	0.650
$\eta 94$	-4.8330	0.548
$\eta 95$	-5.1097	0.352
$\eta 96$	-5.2843	0.099
$\eta 97$	-4.0918	0.004
$\eta 98$	-3.7849	0.023
$\eta 99$	-8.0929	0.001
$\eta 00$	-12.0817	0.000
$\eta 01$	-15.2108	0.000
$\eta 02$	-19.0561	0.000
$\eta 03$	-24.4087	0.000
$\eta 04$	-27.5423	0.006
No. of observations	72	
R-squared		
within	0.8219	
between	0.1479	
overall	0.1595	

Source: Author's calculation

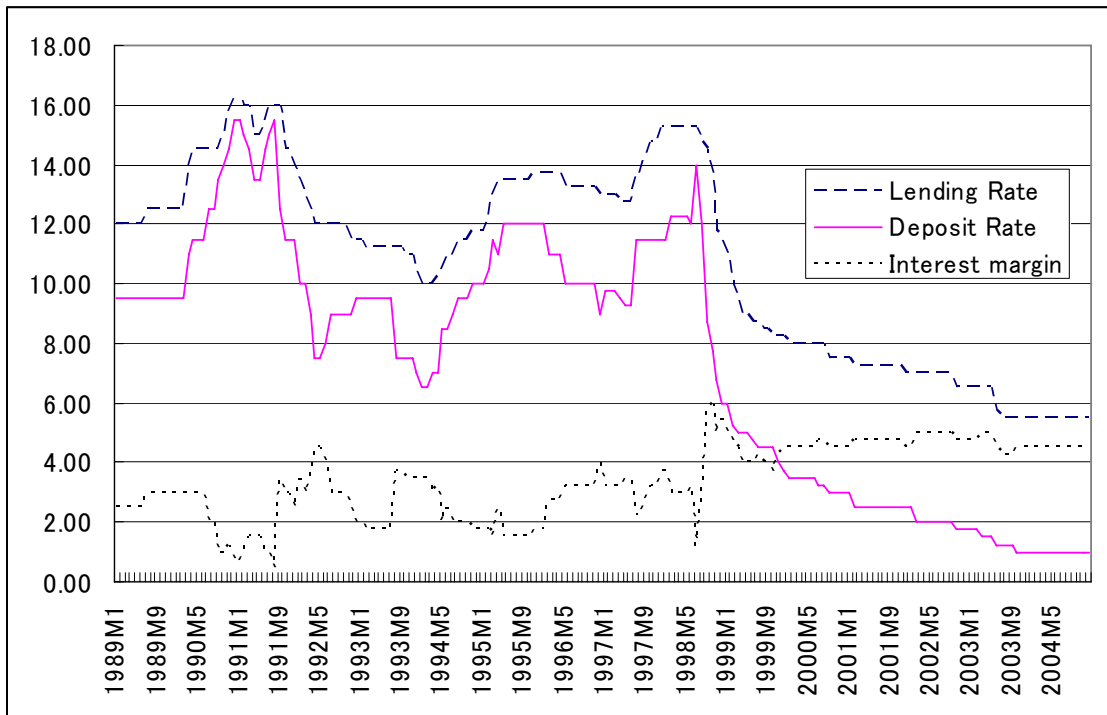
Figure 1: Selected indices of performance of commercial banks, 1989-2004



Source: *Statistical Data on Commercial Banks in Thailand*, various issues.

Note: ROA = return on assets

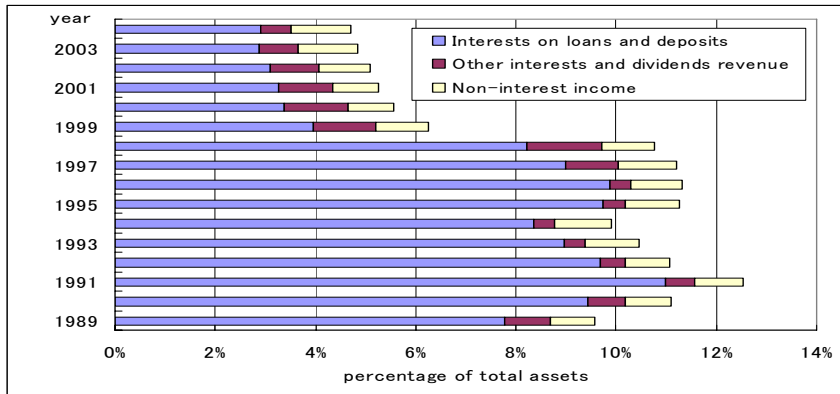
Figure 2: Interest rates and interest margin, 1989-2004



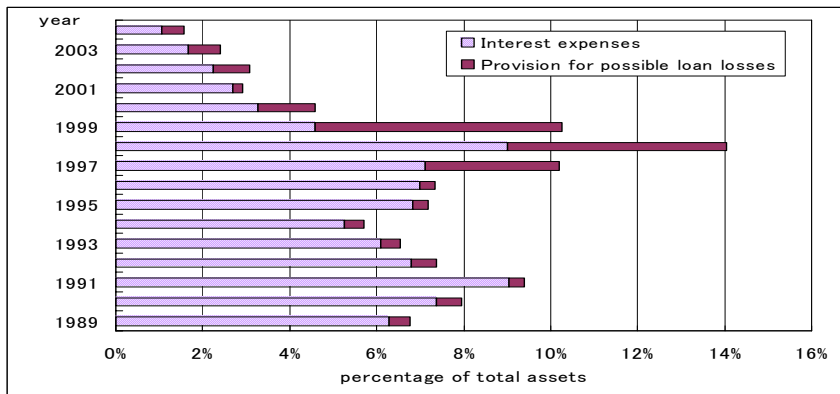
Source: *International Financial Statistics CD-ROM, International Monetary Fund.*

Figure 3: Structure of expenses of commercial banks, 1989-2004

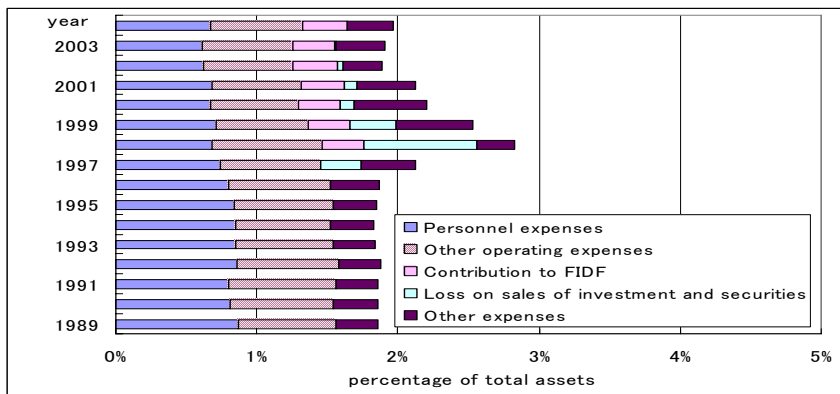
(A) Interest and non-interest income



(B) Interest expenses and provision for possible loan losses



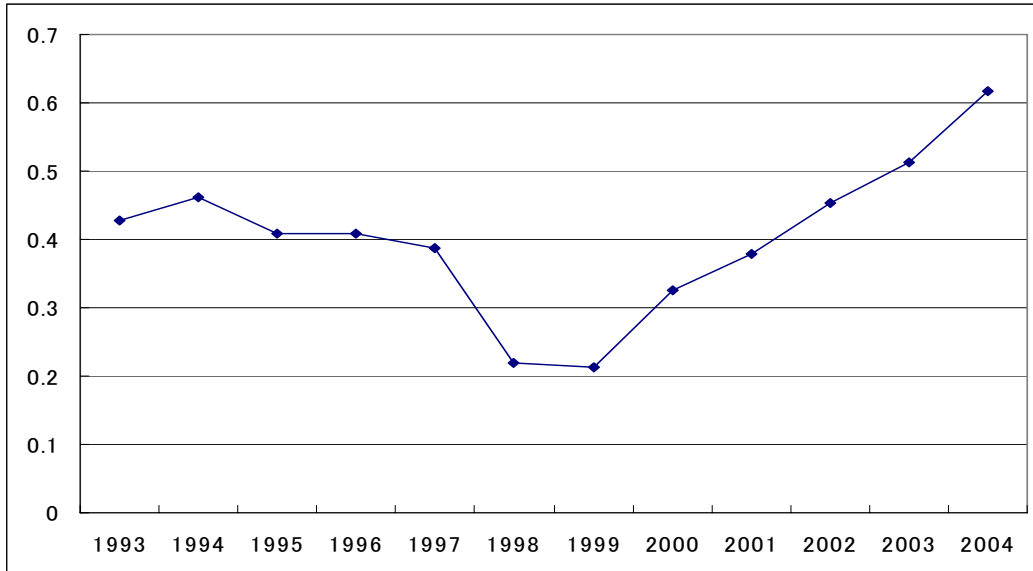
(C) Non-interest expenses



Source: *Statistical Data on Commercial Banks in Thailand*, various issues.

Note: 'Other operating expenses consist of 'premises and equipment', 'taxes and duties', and 'directors' remuneration'. Until 1997, 'Contribution to FIDF' and 'Loss on sales of investment and securities' are counted in 'Other expenses'.

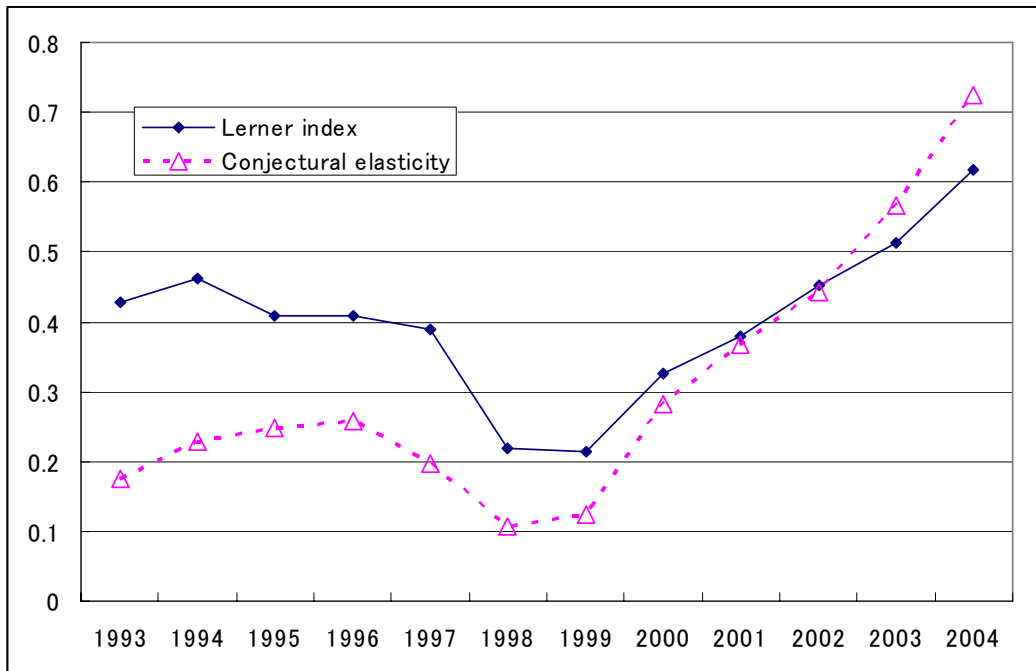
Figure 4: Lerner index



Source: Author's calculation

Note: The Lerner index is calculated using the following formula: $L_m = (\bar{\theta} / \eta)_m / \bar{p}_m$, $m=1993, 1994, \dots, 2004$. $(\bar{\theta} / \eta)_m$ is obtained from the estimation result (4) in Table 4. \bar{p}_m is an average of the *ex post* lending interest rates of the six banks for the corresponding year.

Figure 5: Conjectural elasticity of loan supply



Source: Author's calculation