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Discussion Paper No. 2007-E-3

IMES

INSTITUTE FOR MONETARY AND ECONOMIC STUDIES

BANK OF JAPAN

C.P.O BOX 203 TOKYO
100-8630 JAPAN

IMES Discussion Paper Series 2007-E-3
March 2007

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Abstract

This paper empirically investigates the determinants of subordinated debt issuance by Japanese regional banks during the period 2000–2005 using a probit model. The empirical results suggest the following: (i) Throughout the period, Japanese regional banks with a lower capital/asset ratio have a higher incentive to issue subordinated debts because they are counted as Tier 2 capital under the Basel Accord. (ii) During the period of instability in the Japanese banking system (2000–2003), investors tended to intensively use financial variables such as the non-performing loan ratio, ROA, and total deposits outstanding to screen good banks for their investments in the subordinated debts. (iii) During the period after the banking system regained stability (2004–2005), investors tended to pay less attention to the above variables due mainly to the mitigated default risk of these banks.

Keywords: subordinated debt; Japanese banks; Basel Accord; market discipline; non-performing loan problem

JEL classification: G21, G28

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The authors are grateful to Makoto Saito and a number of staff members at the Bank of Japan for useful comments and suggestions. The remaining errors are solely our responsibility. Views expressed in this paper are those of the authors and do not necessarily reflect the official views of the Bank of Japan.

1. Introduction

This paper empirically investigates the determinants of subordinated debt issuance by Japanese regional banks during the period 2000–2005. There are several studies on this issue for U.S. banks. To the best of our knowledge, however, only Ito and Sasaki [2002] have examined this issue for Japanese banks.[1] In Japan, a restructuring of the banking industry has been in progress. Due mainly to mergers, the number of city and regional banks decreased to 117 in April 2006 from 140 in March 1994.[2]

Through this process, subordinated debt has begun to attract public attention as a potential tool for disciplining banks. Since the mid-1980s, a number of proposals that would require large banks to issue subordinated debt on a mandatory basis have been made in the United States.[3] Subordinated debt is a fixed-income instrument that is unsecured and senior only to common equity when a failed bank is liquidated. Thus, yields on subordinated debts in the secondary market should be the most sensitive to the banks' default risk among debts because those bank creditors are likely to lose part of their principal and interest in the case of a failure.

In fact, many studies have used the spread of subordinated debts issued by U.S. banks over Treasury bonds to investigate whether subordinated debt investors are sensitive enough to the credit risks. Relatively early studies, including Avery, Belton, and Goldberg [1988] and Gorton and Santomero [1990], show that (excessive) risk-taking by bank managers was not priced into subordinated debt spreads in the 1980s. Evidence from 1991 onward, on the other hand, which

[1] Birchler and Hancock [2004] and Covitz, Hancock, and Kwast [2004a,b] empirically examine the issuance decision of subordinated debts by U.S. banks using a probit model. On the other hand, Ito and Sasaki [2002] examine how the risk-based capital standards imposed by the Basle Accord affected major Japanese banks' issuance of subordinated debts in the early 1990s. They find a significant effect of the risk-based capital ratio on the change in the subordinated debt ratio, but they do not control for any other variables apart from time dummies.

[2] Because the number of category 1 regional banks did not change, the decrease in bank numbers comes from city banks and category 2 regional banks.

[3] Board of Governors of the Federal Reserve System and U.S. Treasury Department [2000] summarizes more than 10 subordinated debt proposals.

corresponds to the post FDICIA period, shows the opposite result: credit risk premiums can be extracted from U.S. subordinated debt spreads. In particular, Flannery and Sorescu [1996] argue that the no-pricing of credit risk until the 1980s was a rational response of investors to a "too-big-to fail" policy along with well-established perceptions of forbearance from bank closure, and once such an institutional framework was eliminated, subordinated debt investors began to price credit risk.[4]

Unlike the case of large U. S. banks, however, until recently, Japanese banks found it very difficult to issue subordinated debts. Hence, an alternative approach to the Japanese case is to examine whether the primary debt market may discipline banks' management instead of the secondary market.[5]

This paper investigates the determinants of subordinated debt issuance by Japanese regional banks, focusing on the role of the primary market for subordinated debts in disciplining banks. If subordinated debt investors in the primary market properly discipline banks, then the banks that take on excessive risk or manage their assets poorly would have difficulty issuing subordinated debts.[6] In analyzing the determinants of the issuance decision, we pay particular attention to the following two aspects that are more likely to apply to the recent Japanese situation.

First, banks face the capital ratio regulation following the Basel Accord under which banks with (without) overseas operations need capital/asset ratios of at least eight (four) percent. Under the regulation, capital consists of (i) Tier 1 (shareholder equity and other forms of core capital),

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[4] Covitz, Hancock, and Kwast [2004] find that U.S. subordinated debt spreads were significantly risk-sensitive after 1985 using a two-step Heckman approach. Covitz and Harrison [2004] also report a "positive selection" attribute in that issuance tends to be timed with positive news announcements such as rating upgrades.

[5] In this regard, even in the United States, Covitz, Hancock, and Kwast [2004] show that the decision of U.S. banks to issue new subordinated debts depends on the market's perception of banks' default risk.

[6] Theoretically, if expected costs from issuing subordinated debts are sufficiently sensitive to banks' default risk, then riskier banks may be less likely to issue subordinated debts. Moreover, as suggested by Birchler and Hancock [2004], the informed investor hypothesis tells us that a bank would issue subordinated debt upon the receipt of "good" news, while the bank would issue senior debt upon the receipt of "bad" news. Using this strategy, the bank attempts to separate investors using different, yet unobservable, beliefs on the default probability.

Tier 2 (supplementary capital), and Tier 3 (quasi-supplementary capital). Tier 2 is counted as capital up to the amount of the core capital and can be raised by issuing subordinated debts. Thus, banks with a lower capital/asset ratio are expected to have a higher incentive to issue subordinated debts. Because Japanese banks generally have had a lower capital/asset ratio than other advanced nations' banks, this tendency is more likely to be observed in Japanese banks' behavior.

Second, during our sample period, the Japanese banking system experienced large ups and downs in terms of their financial standing. Specifically, the Japanese banking system had been unstable until 2003 after the bursting of the asset bubbles in the early 1990s. In particular, around 2000-2002, Japanese financial authorities required banks to dispose of their non-performing loans (NPLs) under low capital buffer and thus default risk was heightened in financial markets such as the equity market. Since 2004, however, the NPL ratio has declined significantly for a number of Japanese banks because of intensive disposal of the NPLs, and equity prices have risen substantially with recovery of the Japanese economy.[7] Recovery of banks' soundness made it possible for many small regional banks that had struggled with the NPL problem to access debt and equity markets to enhance their still weak capital bases. In fact, the issuance number of subordinated debts has increased substantially since fiscal 2004.

The rest of the paper is organized as follows. Section 2 describes the empirical methodology and data. Section 3 reports the empirical results of the determinants of subordinated debt issuance by Japanese banks. Section 4 concludes the paper.

[7] According to the Bank of Japan [2005], during the period from the early 1990s to 2003, losses from the disposal of NPLs exceeded or was almost equal to the net operating profits from core business on an aggregate basis for both city and regional banks. In fiscal 2004, however, the losses decreased to almost half the level of the latter, due mainly to the disposal of NPLs.

2. Empirical Methodology and Data

2.1 Empirical Methodology

We use a probit model in which the dependent variable Issue_{it} is a binary variable that equals one if bank i issued subordinated debt in period t and zero otherwise. Specifically, the probit model can be written as:

$$\text{Prob}(\text{Issue}_{it}=1)=\Phi[\boldsymbol{\beta}\mathbf{X}_{it}] \quad \text{and} \quad \text{Prob}(\text{Issue}_{it}=0)=1-\text{Prob}(\text{Issue}_{it}=1),$$

where Φ is the standard normal cumulative distribution function, $\mathbf{X}_{it}$ is the matrix of explanatory variables, and $\boldsymbol{\beta}$ is the vector of parameters to be estimated.

2.2 Data

We use yearly data from fiscal 2000 to 2005. We exclude city, trust, and long-term credit banks from our sample. The reason is that most of them experienced mergers during this period. Thus, we focus on regional banks in the analysis below.[8] In addition, we exclude the issuance of subordinated debts with provisions of conversion into equity, focusing on the determinants of straight subordinated debt issuance by the Japanese regional banks.[9] As a result, the number of issuances in each fiscal year from 2000 to 2005 is 5, 2, 2, 3, 11, and 19, respectively.

Another important point to note here is that most of the subordinated debts were issued in the last few months of each fiscal year. From a purely econometric point of view, we should use the balance sheet data as of the end of the previous fiscal year to avoid endogeneity problems. In reality, however, whether banks are able to issue subordinated debts is likely to be crucially dependent on the financial standing of banks just before the issuance. Thus, the use of the previous fiscal-year-end data may cause bias in the results because of the elimination of necessary

[8] The banks that were merged or went bankrupt in the period 2000–2005 are excluded from the sample.
[9] The debt with provisions of conversion to equity, in general, softens banks' constraint to issue subordinated debts with potential benefits for investors, a so-called sweetener, as well as higher yields of straight subordinated debts.

information. Taking account of this trade-off, we use both (i) the data as of the end of the previous fiscal year and (ii) average data between the previous and the current fiscal year.

The explanatory variables are described in Table 1.[10] We roughly divide those variables into the following three categories.[11] The first category variables attempt to capture the needs for banks to issue subordinated debts for the enhancement of their Tier 2 capital under the Basel Accord. This category includes the capital/asset ratio on a book-value basis (X1) and the allowance ratio for credit losses (X2).[12] A lower value of X1 and a higher value of X2 imply a higher need for the banks to issue subordinated debts.[13]

The second category variables are used as screening devices for investors to discern between good and bad banks. These variables are essentially independent of the Basel Accord. This category includes the NPL ratio (X3), ROA and ROE (X4 and X5), growth rate of total deposits and loans (X6 and X7), and bank size measured by total deposits outstanding (X8). Particularly in the Japanese case during the period of financial instability, investors were likely to use the NPL ratio as a major risk indicator for Japanese banks. Thus, the NPL ratio is expected to take on a negative sign. On the other hand, other variables are expected to take on a positive sign. A higher

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[10] Birchler and Hancock [2004] and Covitz, Hancock, and Kwast [2004a,b] use the indicator variables of the composite supervisory ratings as proxies for pressure from regulatory supervisors, in addition to the proxies for banks' default risk and their profitability, bond market conditions, and so on. They find that total assets, the indicator variable for successive issuances, and implied stock volatility are consistent determinants of U.S. bank's issuance decisions on subordinated debts.

[11] Another possible classification of the explanatory variables is whether each one is a demand-side or supply-side variable. Because of the identification problem between these two types of variables, we do not follow this kind of classification.

[12] Birchler and Hancock [2004] and Covitz, Hancock, and Kwast [2004a,b] use the capital/asset ratio as one of the proxies for default risk in that the higher the capital/asset ratio, the lower the leverage ratio and thus default risk. In this case, the expected sign of the capital/asset ratio is positive. In our analysis, on the other hand, the capital/asset ratio is used to measure the need to issue subordinated debts by banks and banks' default risk is captured the NPL ratio from the consideration of the real-life behavior of Japanese banks.

[13] Bank of Japan [2005] mentions that the business model of Japanese regional banks seems to put priority on relationship banking. This implies these banks have incentives to forbear from prompt liquidation of damaged firms, which leads to a higher allowance ratio. These banks may need more capital buffer for potential write-offs of the NPLs with high allowance ratios. The expected sign of X2, therefore, is positive. Another possible interpretation of X2 is that a higher value of X2 implies an improved financial soundness of banks, given the level of the capital/asset ratio under the Basel Accord. If we follow this interpretation, the expected sign of X2 might be negative.

value of ROA and ROE (X4 and X5) indicates higher profitability for banks. The growth rate of total deposits (X6) is likely to be associated with the market discipline of depositors and the growth rate of total loans (X7) represents the overall growth potential of banks. Total deposits outstanding (X8) represents the overall size and thus the stability of bank management. Total deposits outstanding also aims to capture the publicity effect in that the larger the size of the bank, the more familiar investors are with that bank.

The last category variables aim to control for market conditions in deciding whether or not the bank issues subordinated debts. We use the year-on-year absolute rate of change in the stock price of each individual bank (X9) and the year-on-year rate of change in the stock price of each bank relative to the TOPIX (X10). The absolute rate of change in stock prices (X9) changes the capital/asset ratio on a market-value basis, as well as reflects stock market conditions. On the other hand, the relative rate of change reflects only stock market conditions. We use X9 and X10 as interaction terms with the capital/asset ratio (X1).

The underlying hypotheses associated with the interaction terms can be summarized as follows. First, a higher value of both X9 and X10 indicates favorable stock market conditions for issuing subordinated debts. This hypothesis is closely related to the market timing argument by Baker and Wurgler [2002]. If this hypothesis is accepted, then the interaction terms X1*X9 and X1*X10 should be negative, given that the sign of X1 is significantly negative. Second, a lower (higher) value of X9 indicates a lower (higher) capital/asset ratio on a market-value basis that is likely to raise (lower) the incentive to further issue subordinated debts. Thus, if this hypothesis is true, then the interaction term X1*X9 should have a positive sign. The expected signs of all the explanatory variables are shown in Table 2. Note that the expected sign of X1*X9 is indeterminate, while the expected sign of X1*X10 is negative, given that the sign of X1 is negative.

Table 3 reports the mean and standard deviation of each variable classified in the first and

second categories for the following four periods; (i) full sample (2000–2005), (ii) 2000–2003, (iii) 2004–2005, and (iv) 2003–2004. The period 2000–2003 corresponds to the period of instability in the Japanese banking system because of the NPL problem and the period of 2004–2005 corresponds to the recovery phase from system instability. The period 2003–2004 corresponds to the transition period between these two distinct periods.

It should be noted here that most of the second category variables, used as proxies for screening devices, experienced improvement in means and a decline in standard deviations. This result suggests that bank's access to the primary market of subordinated debts becomes easier during the latter period than during the former period.

3. Empirical Results

Tables 4 and 5 report the results of the pooled probit model.[14] Because of high correlations between ROA and ROE (X4 and X5), and the growth rates of total deposits and loans (X6 and X7), we take the following strategy.[15] First, we divide the models according to whether ROA (X4) or ROE (X5) is used as a proxy for profitability, and then specify the model (i) using the growth rate of total deposits (X6) or loans (X7), and (ii) with or without interaction terms between the capital/asset ratio (X1) and stock prices (X9 and X10).

First, let us look at the full sample estimation shown in Tables 4 (i) and 5 (i). We use robust standard errors corrected for heteroskedasticity clustering for each bank. For all of the specifications, the sign of X1 is significantly negative, while the allowance ratio for credit losses

[14] We also estimated a random effects probit model, but the results of the likelihood test significantly rejected the random effects probit model against a pooled probit model. We further tried yearly dummies to control for macroeconomic factors that are common to every bank, but no significant results were obtained. Thus, we report the results from the pooled probit model.

[15] The correlation between X4 and X5 and between X6 and X7 is 0.42 and 0.92, respectively, in the case of the previous-year data, and 0.69 and 0.84, respectively, in the case of the average data.

(X2) is insignificant.[16] This result suggests a strong incentive for the Japanese regional banks with a lower capital/asset ratio to issue subordinated debts by taking advantage of the current Basel Accord where the subordinated debts are counted as Tier 2 capital.

Another interesting point here is the asymmetric effects of the absolute and relative changes in the stock prices for banks on the issuance decision, represented by the third category variables. Specifications 3, 4, 7, and 8 include these variables as interaction terms with X1. As is clearly shown by the average data, X1*X9 and X1*X10 have a significantly positive and negative sign, respectively.[17] This result shows that if the market timing effect X1*X10 is controlled for, the sign of X1*X9 becomes significantly positive, which indicates the relevance of the hypothesis described in section 2. In summary, we find that a lower capital/asset ratio works as a strong incentive for banks to issue subordinated debts, and the magnitude of this incentive depends highly on both absolute and relative stock prices.

Next, some of the second category variables show the expected results for the NPL ratio (X3), ROA (X4), and the total deposit outstanding (X8) in both data sets. ROE also has a significantly positive sign in the case of the average data. The NPL ratio (X3) with a significantly negative sign in almost all of the specifications suggests that investors pay considerable attention to that variable in assessing banks' default risk. Besides, ROA (X4) has a significantly positive effect on the issuance decision of subordinated debts, and the coefficient for total deposits outstanding (X8) has a significantly positive sign. On the other hand, the growth rates of total deposits and loans (X6 and X7) do not have a significant effect on the issuance condition in all cases.

Second, let us look at the subsample estimation results. From Tables 4 and 5 ((ii) and (iii)), we can see that in both periods, X1 has a significantly negative sign for all of the specifications, but

[16] Our estimation result for the capital/asset ratio (X1) is in marked contrast to the results for U.S. banks by Covitz, Hancock, and Kwast [2004a,b] and Birchler and Hancock [2004], who do not find any significant relationship between the capital/asset ratio and the issuance decision of subordinated debts.

[17] Similar results are obtained using the end-of-previous-fiscal-year data, too, although the estimated coefficients are less significant.

stock prices do not have consistent effects on the issuance decision. Regarding the second category variables, on the other hand, the results are totally different between 2000–2003 and 2004–2005. Particularly for the average data in the period 2000–2003, all of these variables except the growth rate of total loans are significant and of the expected sign. In the period 2004–2005, however, none of the variables have a significant expected sign. A similar result is observed for the end-of-previous-fiscal-year data in the later period. The data in the former period shows only the NPL ratio (X3) and total deposits outstanding (X8) have a significant expected sign.[18]

This distinct difference in the results for the second category variables between these two periods may be interpreted in terms of the banks' constraint to finance their Tier 2 capital via subordinated debt markets, which results from higher default risk and uncertainty as to the degree of risk. As we mentioned in the introduction, the Japanese banking system was very unstable following the bursting of the asset bubbles in the early 1990s until 2003 because of the NPL problem. Since 2004, however, NPL ratios have declined significantly and Japanese banks have regained stability. These structural changes are likely to exert influence on investors' awareness and uncertainties about banks' default risk. Indeed, as shown in Table 3, almost all of the second category variables have smaller standard deviations in the latter period, which implies a lower degree of uncertainty in this period.

Another interesting point to note is that stock prices have a significant effect on issuance decision through the capital/asset ratio in the full sample estimation, particularly for the average data, while they have much less effect in both subperiods 2000–2003 and 2004–2005. This result implies that stock prices matter for the issuance decision of subordinated debts only when these two distinct periods overlap. Stock prices of Japanese banks had been on a consistent downtrend

[18] A larger number of the second category variables that have a significant expected sign when we use the average data suggest that investors use recent information about banks' financial standings in assessing banks' default risk.

since late 1999, hitting bottom in early 2003, and then rising sharply toward the end of 2005. Thus, it seems that stock prices matter for the issuance decision around the turning point from a downtrend to uptrend, which is confirmed by the results for the transition period 2003–2004 reported in Tables 4 (iv) and 5 (iv). In other words, the sub-periods of 2002–2003 and 2004–2005 are too short to investigate the effects of stock price developments on the issuance decision.

4. Concluding Remarks

This paper has empirically investigated the determinants of subordinated debt issuance by Japanese regional banks during the period 2000–2005 using a probit model. The empirical results suggest the following.

(i) Throughout the sample period, Japanese regional banks with a lower capital/asset ratio have a higher incentive to issue subordinated debts because they are counted as Tier 2 capital under the Basel Accord.

(ii) During the period of instability in the Japanese banking system (2000–2003), investors tended to intensively use financial variables such as the NPL ratio, ROA, and total deposits outstanding to screen good banks from a pool of a number of both good and bad banks. The screening worked as a barrier to subordinated debt finance for bad banks. In this regard, market discipline worked in the Japanese banks' subordinated debt primary market during this period of instability.

(iii) During the period after the banking system regained stability (2004–2005), investors tended to pay less attention to the above variables due mainly to the mitigated uncertainties regarding banks' default risk. It seems relatively easy for Japanese regional banks to issue subordinate debts in this circumstance. This is likely to be the reason why many more banks issued subordinate debts in this period than in the preceding period.

Let us conclude this paper by discussing one possible concern that may be read from our result in the recent years (2004–2005). In this period, because interest rates have remained very low from a historical perspective in most of the industrialized economies, various types of investors have significantly increased their demand for "yields" particularly in Japan. This movement first began in credit instruments with relatively high credit ratings and then proceeded to those with lower credit ratings or subordinated debts. As a result, Japanese credit spreads with a BBB rating have barely covered *ex post* default risks, as shown by Baba et al. [2005]. The so-called "search for yield" behavior by Japanese investors might have obscured the true state of banks' default risk in the subordinated debt primary market. In such a circumstance, inclusion of subordinated debts in the Tier 2 capital might soften the budget constraint of banks and lead to overlending, as argued by Hosono and Sakuragawa [2003], for instance.

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Table 1: Definition of Variables

Category	Name		Definition	Source
1	X1	Capital/asset ratio	Shareholders' equity / total assets on a book-value basis (%)	Financial statements
	X2	Allowance ratio for credit losses	Allowance for credit losses divided by non-performing and past due loans (%)	Financial statements
2	X3	Non-performing loan (NPL) ratio	Non-performing and past due loans divided by loans and bills discounted (%)	Financial statements
	X4	Return on assets (ROA)	Operating income / total assets (%)	Financial statements
	X5	Return on equity (ROE)	Operating income / shareholders' equity (%)	Financial statements
	X6	Growth rate of total deposits	Year-on-year growth rate of loans and bills discounted (%)	Financial statements
	X7	Growth rate of total loans	Year-on-year growth rate of loans and bills discounted (%)	Financial statements
	X8	Total deposits outstanding	Natural logarithm of total deposits outstanding	Financial statements
3	X9	Absolute rate of change in stock price	Year-on-year rate of change in stock price for each bank (%)	Bloomberg
	X10	Relative rate of change in stock price	Year-on-year rate of change in stock price for each bank minus that of TOPIX (% point)	Bloomberg

Notes: 1. Data is on a nonconsolidated basis.

2. The gross number of regional banks over the sample period 2000–2005 is 498, of which 42 (456) are issuance (nonissuance) banks. Including X9/X10 decreases the number of sample banks to 391, of which 36 (355) are issuance (nonissuance) banks.

Table 2: Expected Signs of Explanatory Variables

Category	Name	Expected sign
1	X1(Capital/asset ratio)	Negative
	X2(Allowance ratio for credit losses)	Positive
2	X3(NPL)	Negative
	X4(ROA)	Positive
	X5(ROE)	Positive
	X6(Growth rate of total deposits)	Positive
	X7(Growth rate of total loans)	Positive
	X8(Total deposits outstanding)	Positive
3	X1*X9(Absolute rate of change in stock price)	Positive or negative
	X1*X10(Relative rate of change in stock price)	Negative (given the negative sign of X1)

Table 3: Summary Statistics of Balance Sheet Variables

(i) Capital/asset ratio

	Mean		Standard deviation	
Full Sample: 2000–2005	4.677	4.732	1.094	1.085
Subsample: 2000–2003	4.619	4.651	1.087	1.038
Subsample: 2004–2005	4.794	4.895	1.101	1.161
Subsample: 2003–2004	4.603	4.701	1.070	1.075

(ii) Allowance ratio for credit losses

	Mean		Standard deviation	
Full Sample: 2000–2005	34.928	33.967	12.881	11.323
Subsample: 2000–2003	35.910	34.161	13.489	11.548
Subsample: 2004–2005	32.947	33.576	11.340	10.878
Subsample: 2003–2004	31.998	32.440	11.163	10.918

(iii) NPL ratio

	Mean		Standard deviation	
Full Sample: 2000–2005	6.985	6.946	2.788	2.658
Subsample: 2000–2003	7.190	7.375	2.962	2.761
Subsample: 2004–2005	6.572	6.080	2.353	2.202
Subsample: 2003–2004	7.642	7.115	2.696	2.472

(iv) ROA

	Mean		Standard deviation	
Full Sample: 2000–2005	0.618	0.635	0.246	0.254
Subsample: 2000–2003	0.584	0.612	0.250	0.257
Subsample: 2004–2005	0.687	0.680	0.222	0.243
Subsample: 2003–2004	0.651	0.688	0.261	0.224

(v) ROE

	Mean		Standard deviation	
Full Sample: 2000–2005	14.241	14.158	12.338	7.120
Subsample: 2000–2003	13.760	13.807	14.375	7.036
Subsample: 2004–2005	15.211	14.865	6.451	7.256
Subsample: 2003–2004	14.939	15.536	7.247	6.605

(vi) Growth rate of total deposits

	Mean		Standard deviation	
Full Sample: 2000–2005	1.033	1.014	2.953	2.358
Subsample: 2000–2003	0.829	0.826	3.199	2.492
Subsample: 2004–2005	1.446	1.392	2.335	2.017
Subsample: 2003–2004	1.049	1.209	2.700	2.000

(vii) Growth rate of total loans

	Mean		Standard deviation	
Full Sample: 2000–2005	–0.308	0.009	3.175	2.529
Subsample: 2000–2003	–0.752	–0.463	3.133	2.406
Subsample: 2004–2005	0.588	0.962	3.077	2.509
Subsample: 2003–2004	–0.154	0.181	3.368	2.530

(viii) Total deposits outstanding

	Mean		Standard deviation	
Full Sample: 2000–2005	14.141	14.146	0.874	0.876
Subsample: 2000–2003	14.131	14.135	0.871	0.873
Subsample: 2004–2005	14.162	14.168	0.883	0.885
Subsample: 2003–2004	14.146	14.153	0.885	0.885

Note: The left-hand side figure uses the end-of-previous-year data and the right-hand side figure uses the average data between the end of previous fiscal year and current fiscal year.

Table 4: Probit Models (End-of-Previous-Fiscal-Year Data)

(i) Full Sample: 2000–2005

	Using ROA as proxy for profitability				Using ROE as proxy for profitability			
Specification	1	2	3	4	5	6	7	8
X1(Capital/asset ratio)	–0.540***	–0.541***	–0.575***	–0.586***	–0.491***	–0.485***	–0.546***	–0.555***
	[0.093]	[0.089]	[0.095]	[0.094]	[0.107]	[0.102]	[0.118]	[0.117]
X1*X9(Absolute return of stock)			0.001	0.001			0.002*	0.001*
			[0.001]	[0.001]			[0.001]	[0.001]
X1*X10(Relative return of stock)			–0.001**	–0.001**			–0.001**	–0.001**
			[0.001]	[0.001]			[0.001]	[0.001]
X2(Allowance ratio)	–0.001	–0.000	–0.004	–0.003	–0.001	–0.001	–0.005	–0.004
	[0.006]	[0.007]	[0.007]	[0.008]	[0.007]	[0.007]	[0.008]	[0.008]
X3(NPL ratio)	–0.103**	–0.108**	–0.118**	–0.121**	–0.079*	–0.086**	–0.086	–0.092*
	[0.042]	[0.042]	[0.048]	[0.049]	[0.043]	[0.043]	[0.053]	[0.051]
X4 (ROA)	1.113***	1.144***	1.286**	1.268**				
	[0.418]	[0.405]	[0.514]	[0.514]				
X5 (ROE)					0.001	0.001	–0.002	–0.001
					[0.006]	[0.006]	[0.006]	[0.006]
X6(Growth rate of total deposits)	0.043		0.035		0.053		0.042	
	[0.033]		[0.033]		[0.032]		[0.033]	
X7(Growth rate of total loans)		0.019		0.027		0.025		0.035
		[0.026]		[0.027]		[0.026]		[0.027]
X8 (Total deposits outstanding)	0.202**	0.212**	0.114	0.130	0.272**	0.286***	0.207	0.224*
	[0.095]	[0.095]	[0.109]	[0.111]	[0.105]	[0.105]	[0.128]	[0.127]
Constant	–1.928	–1.991	–0.360	–0.489	–2.571*	–2.696*	–1.164	–1.317
	[1.327]	[1.338]	[1.492]	[1.514]	[1.400]	[1.412]	[1.666]	[1.658]
Num. of Obs	498	498	391	391	498	498	391	391
Log likelihood	–122.793	–124.306	–99.388	–99.437	–127.125	–127.856	–103.590	–103.557
Pseudo R-squared	0.148	0.144	0.173	0.172	0.117	0.112	0.138	0.138

(ii) Subsample: 2000–2003

	Using ROA as proxy for profitability				Using ROE as proxy for profitability			
Specification	1	2	3	4	5	6	7	8
X1(Capital/asset ratio)	–0.770***	–0.678***	–0.752***	–0.710***	–0.788***	–0.700***	–0.821***	–0.781***
	[0.203]	[0.194]	[0.186]	[0.180]	[0.204]	[0.203]	[0.196]	[0.185]
X1*X9(Absolute return of stock)			–0.001	–0.002			–0.001	–0.001
			[0.002]	[0.002]			[0.002]	[0.002]
X1*X10(Relative return of stock)			0.000	0.001			–0.000	0.001
			[0.001]	[0.001]			[0.001]	[0.001]
X2(Allowance ratio)	0.003	–0.000	0.001	0.000	0.004	–0.001	0.002	0.001
	[0.011]	[0.012]	[0.014]	[0.014]	[0.011]	[0.013]	[0.015]	[0.015]
X3(NPL ratio)	–0.196**	–0.212**	–0.167**	–0.207***	–0.176*	–0.193**	–0.134**	–0.173**
	[0.094]	[0.094]	[0.082]	[0.074]	[0.095]	[0.097]	[0.084]	[0.075]
X4 (ROA)	0.738	0.806	0.637	0.796				
	[0.673]	[0.681]	[0.687]	[0.701]				
X5 (ROE)					–0.004	–0.005	–0.008*	–0.009*
					[0.005]	[0.005]	[0.005]	[0.005]
X6(Growth rate of total deposits)	0.068		0.067		0.075		0.074	
	[0.066]		[0.066]		[0.063]		[0.060]	
X7(Growth rate of total loans)		–0.055		–0.064		–0.057		–0.064
		[0.056]		[0.056]		[0.054]		[0.053]
X8 (Total deposits outstanding)	0.588**	0.587**	0.580**	0.550*	0.700**	0.727**	0.716**	0.726**
	[0.239]	[0.248]	[0.286]	[0.288]	[0.286]	[0.297]	[0.337]	[0.351]
Constant	–6.402**	–6.550**	–6.379*	–5.903	–7.598**	–8.060**	–7.818*	–7.814
	[2.765]	[2.861]	[3.757]	[3.899]	[3.438]	[3.604]	[4.520]	[4.827]
Num. of Obs	333	333	262	262	333	333	262	262
Log likelihood	–36.147	–36.139	–32.716	–32.629	–36.940	–36.589	–32.646	–32.640
Pseudo R-squared	0.300	0.300	0.283	0.285	0.287	0.292	0.285	0.285

Notes: 1. *, **, and *** denote significance at the 10, 5, and 1% level, respectively.
2. Figures in square brackets are robust standard errors corrected for heteroskedasticity clustering for each bank
3. See Table 1 for the definition of variables.

(iii) Subsample: 2004–2005

	Using ROA as proxy for profitability				Using ROE as proxy for profitability			
Specification	1	2	3	4	5	6	7	8
X1(Capital/asset	–0.543***	–0.540***	–0.504***	–0.503***	–0.493***	–0.489***	–0.414**	–0.420**
ratio)	[0.118]	[0.116]	[0.130]	[0.129]	[0.149]	[0.147]	[0.162]	[0.160]
X1*X9(Absolute			–0.004*	–0.004*			–0.004*	–0.004*
return of stock)			[0.002]	[0.002]			[0.002]	[0.002]
X1*X10(Relative			0.001	0.001			0.001	0.001
return of stock)			[0.001]	[0.001]			[0.001]	[0.001]
X2(Allowance	0.003	0.002	0.005	0.005	0.003	0.002	0.005	0.004
ratio)	[0.011]	[0.011]	[0.012]	[0.012]	[0.011]	[0.011]	[0.012]	[0.012]
X3(NPL ratio)	–0.028	–0.033	–0.025	–0.034	–0.029	–0.033	–0.023	–0.031
	[0.057]	[0.056]	[0.063]	[0.060]	[0.058]	[0.057]	[0.066]	[0.062]
X4 (ROA)	0.385	0.385	0.757	0.715				
	[0.563]	[0.561]	[0.623]	[0.637]				
X5 (ROE)					0.014	0.014	0.025	0.023
					[0.023]	[0.023]	[0.026]	[0.027]
X6(Growth rate	0.031		0.044		0.031		0.043	
of total deposits)	[0.050]		[0.049]		[0.050]		[0.050]	
X7(Growth rate		0.008		0.029		0.008		0.028
of total loans)		[0.038]		[0.042]		[0.037]		[0.043]
X8 (Total deposits	0.194	0.199	0.138	0.144	0.198	0.203	0.157	0.163
outstanding)	[0.138]	[0.139]	[0.161]	[0.163]	[0.136]	[0.137]	[0.158]	[0.159]
Constant	–1.422	–1.405	–0.774	–0.711	–1.648	–1.635	–1.326	–1.222
	[1.965]	[1.999]	[2.310]	[2.296]	[1.947]	[1.972]	[2.237]	[2.197]
Num. of Obs	165	165	129	129	165	165	129	129
Log likelihood	–68.808	–68.969	–52.023	–52.064	–68.876	–69.035	–52.299	–52.331
Pseudo R-squared	0.121	0.118	0.180	0.179	0.120	0.117	0.175	0.175

(iv) Subsample: 2003–2004

	Using ROA as proxy for profitability				Using ROE as proxy for profitability			
Specification	1	2	3	4	5	6	7	8
X1(Capital/asset	–0.573***	–0.590***	–0.825***	–0.865***	–0.391**	–0.393**	–0.660***	–0.687**
ratio)	[0.186]	[0.187]	[0.220]	[0.252]	[0.178]	[0.173]	[0.237]	[0.275]
X1*X9(Absolute			0.001	0.001			0.001	0.001
return of stock)			[0.002]	[0.002]			[0.002]	[0.002]
X1*X10(Relative			–0.005***	–0.005***			–0.005***	–0.005***
return of stock)			[0.001]	[0.001]			[0.001]	[0.001]
X2(Allowance	–0.000	0.001	–0.001	0.003	–0.000	0.001	0.001	0.003
ratio)	[0.013]	[0.013]	[0.015]	[0.016]	[0.013]	[0.014]	[0.015]	[0.016]
X3(NPL ratio)	–0.055	–0.039	–0.028	–0.017	–0.067	–0.053	–0.035	–0.030
	[0.068]	[0.070]	[0.103]	[0.107]	[0.069]	[0.071]	[0.105]	[0.104]
X4 (ROA)	1.024**	1.054**	1.057	0.968				
	[0.487]	[0.484]	[0.758]	[0.867]				
X5 (ROE)					0.045**	0.050***	0.043	0.046
					[0.018]	[0.018]	[0.026]	[0.031]
X6(Growth rate	0.059		0.082		0.057		0.082	
of total deposits)	[0.047]		[0.051]		[0.047]		[0.051]	
X7(Growth rate		0.065		0.134**		0.069		0.136**
of total loans)		[0.050]		[0.058]		[0.048]		[0.056]
X8 (Total deposits	0.457***	0.469***	0.747***	0.835***	0.450***	0.460***	0.771***	0.842***
outstanding)	[0.168]	[0.169]	[0.284]	[0.284]	[0.167]	[0.168]	[0.291]	[0.277]
Constant	–5.793**	–6.005**	–9.505**	–10.678***	–6.452**	–6.752***	–10.519**	–11.560***
	[2.484]	[2.555]	[4.629]	[4.354]	[2.540]	[2.599]	[4.866]	[4.419]
Num. of Obs	164	164	128	128	164	164	128	128
Log likelihood	–38.368	–37.976	–28.841	–26.936	–38.136	–37.576	–28.803	–26.744
Pseudo R-squared	0.198	0.206	0.314	0.359	0.203	0.215	0.315	0.364

Notes: 1. *, **, and *** denote significance at the 10, 5, and 1% level, respectively.

2. Figures in square brackets are robust standard errors corrected for heteroskedasticity clustering on each bank.

3. See Table 1 for the definition of variables.

Table 5: Probit Models (Average Data)

(i) Full Sample: 2000–2005

	Using ROA as proxy for profitability				Using ROE as proxy for profitability			
Specification	1	2	3	4	5	6	7	8
X1(Capital/asset ratio)	–0.612*** [0.102]	–0.616*** [0.099]	–0.761*** [0.105]	–0.750*** [0.105]	–0.426*** [0.125]	–0.431*** [0.120]	–0.603*** [0.146]	–0.588*** [0.141]
X1*X9(Absolute return of stock)			0.007*** [0.002]	0.006*** [0.002]			0.007*** [0.002]	0.006*** [0.002]
X1*X10(relative return of stock)			–0.009*** [0.002]	–0.008*** [0.003]			–0.009*** [0.002]	–0.008*** [0.003]
X2(Allowance ratio)	0.001 [0.008]	0.002 [0.008]	–0.002 [0.010]	–0.003 [0.010]	0.000 [0.008]	0.002 [0.008]	–0.003 [0.010]	–0.003 [0.010]
X3(NPL ratio)	–0.160*** [0.051]	–0.154*** [0.050]	–0.135** [0.062]	–0.153** [0.063]	–0.166*** [0.052]	–0.159*** [0.051]	–0.139** [0.064]	–0.155** [0.064]
X4 (ROA)	1.198** [0.524]	1.194** [0.515]	1.113* [0.590]	1.140* [0.561]				
X5 (ROE)					0.047** [0.020]	0.047** [0.020]	0.042* [0.024]	0.043* [0.023]
X6(Growth rate of total deposits)	0.058 [0.044]		0.083 [0.048]		0.059 [0.044]		0.083* [0.048]	
X7(Growth rate of total loans)		0.052 [0.035]		0.028 [0.046]		0.054 [0.035]		0.032 [0.046]
X8 (Total deposits outstanding)	0.204** [0.103]	0.224** [0.104]	0.262* [0.144]	0.246* [0.139]	0.213** [0.104]	0.234** [0.104]	0.281* [0.145]	0.266* [0.140]
Constant	–1.406 [1.410]	–1.692 [1.438]	–1.719 [1.882]	–1.286 [1.866]	–2.238 [1.390]	–2.539* [1.417]	–2.572 [1.861]	–2.185 [1.848]
Num. of Obs	498	498	391	391	498	498	391	391
Log likelihood	–116.801	–116.721	–85.451	–86.494	–116.836	–116.670	–85.927	–86.939
Pseudo R-squared	0.189	0.190	0.289	0.280	0.189	0.190	0.285	0.277

(ii) Subsample: 2000–2003

	Using ROA as proxy for profitability				Using ROE as proxy for profitability			
Specification	1	2	3	4	5	6	7	8
X1(Capital/asset ratio)	–0.982*** [0.223]	–0.792*** [0.201]	–0.849*** [0.194]	–0.768*** [0.207]	–0.762*** [0.253]	–0.584*** [0.200]	–0.572*** [0.237]	–0.503*** [0.209]
X1*X9(Absolute return of stock)			0.001 [0.004]	–0.001 [0.004]			0.002 [0.004]	–0.000 [0.004]
X1*X10(relative return of stock)			–0.003 [0.004]	–0.002 [0.003]			–0.003 [0.004]	–0.002 [0.003]
X2(Allowance ratio)	–0.001 [0.014]	–0.003 [0.015]	–0.010 [0.016]	–0.010 [0.015]	–0.001 [0.015]	–0.002 [0.015]	–0.010 [0.017]	–0.009 [0.016]
X3(NPL ratio)	–0.306*** [0.116]	–0.278** [0.118]	–0.232** [0.107]	–0.248** [0.103]	–0.294** [0.117]	–0.265** [0.117]	–0.224** [0.106]	–0.236** [0.102]
X4 (ROA)	1.804*** [0.574]	1.699*** [0.478]	1.987*** [0.604]	1.911*** [0.497]				
X5 (ROE)					0.052** [0.023]	0.049*** [0.018]	0.067** [0.027]	0.063*** [0.021]
X6(Growth rate of total deposits)	0.262** [0.115]		0.263** [0.110]		0.265** [0.116]		0.227** [0.109]	
X7(Growth rate of total loans)		0.021 [0.086]		0.016 [0.081]		0.027 [0.085]		0.025 [0.078]
X8 (Total deposits outstanding)	0.596*** [0.170]	0.497*** [0.180]	0.624*** [0.196]	0.437** [0.207]	0.672*** [0.191]	0.569*** [0.207]	0.693*** [0.208]	0.498** [0.224]
Constant	–5.851** [2.358]	–4.752** [2.294]	–7.047*** [2.767]	–3.964 [3.198]	–7.599*** [2.693]	–6.426** [2.658]	–9.045*** [3.033]	–5.825* [3.429]
Num. of Obs	333	333	262	262	333	333	262	262
Log likelihood	–29.345	–33.688	–25.807	–29.589	–30.255	–34.658	–26.452	–30.416
Pseudo R-squared	0.432	0.348	0.435	0.352	0.414	0.329	0.420	0.334

Notes: 1. *, **, and *** denote significance at the 10, 5, and 1% level, respectively.
2. Figures in square brackets are robust standard errors corrected for heteroskedasticity clustering on each bank.
3. See Table 1 for the definition of variables.

(iii) Subsample: 2004–2005

	Using ROA as proxy for profitability				Using ROE as proxy for profitability			
Specification	1	2	3	4	5	6	7	8
X1(Capital/asset	–0.572***	–0.574***	–0991***	–0.974***	–0.481***	–0.494***	–0.903***	–0.891***
ratio)	[0.114]	[0.116]	[0.293]	[0.308]	[0.143]	[0.144]	[0.310]	[0.320]
X1*X9(Absolute			0.018	0.017			0.017	0.016
return of stock)			[0.011]	[0.012]			[0.011]	[0.012]
X1*X10(relative			–0.020	–0.019			–0.019	–0.019
return of stock)			[0.012]	[0.013]			[0.012]	[0.013]
X2(Allowance	0.003	0.005	0.001	0.002	0.003	0.004	0.001	0.002
ratio)	[0.011]	[0.011]	[0.012]	[0.012]	[0.011]	[0.011]	[0.012]	[0.012]
X3(NPL ratio)	–0.049	–0.028	–0.042	–0.022	–0.057	–0.035	–0.044	–0.023
	[0.072]	[0.073]	[0.088]	[0.085]	[0.073]	[0.074]	[0.092]	[0.088]
X4 (ROA)	0.552	0.487	0.593	0.557				
	[0.612]	[0.621]	[0.692]	[0.719]				
X5 (ROE)					0.025	0.022	0.023	0.021
					[0.024]	[0.024]	[0.029]	[0.030]
X6(Growth rate	0.009		0.024		0.006		0.023	
of total deposits)	[0.059]		[0.064]		[0.058]		[0.064]	
X7(Growth rate		0.043		0.050		0.041		0.051
of total loans)		[0.049]		[0.055]		[0.049]		[0.055]
X8 (Total deposits	0.226	0.237	0.172	0.177	0.226	0.236	0.182	0.188
outstanding)	[0.159]	[0.164]	[0.184]	[0.182]	[0.156]	[0.161]	[0.178]	[0.177]
Constant	–1.675	–1.993	–0.468	–0.736	–2.022	–2.291	–0.908	–1.154
	[2.214]	[2.271]	[2.658]	[2.561]	[2.107]	[2.160]	[2.483]	[2.406]
Num. of Obs	165	165	129	129	165	165	129	129
Log likelihood	–69.077	–66.777	–51.491	–51.210	–66.937	–66.651	–51.560	–51.269
Pseudo R-squared	0.143	0.146	0.188	0.193	0.144	0.148	0.187	0.192

(iv) Subsample: 2003–2004

	Using ROA as proxy for profitability				Using ROE as proxy for profitability			
Specification	1	2	3	4	5	6	7	8
X1(Capital/asset	–0.640***	–0.638***	–1.090***	–1.013***	–0.450*	–0.478**	–0.652**	–0.674**
ratio)	[0.192]	[0.191]	[0.296]	[0.290]	[0.230]	[0.229]	[0.281]	[0.289]
X1*X9(Absolute			0.020**	0.018**			0.019**	0.017**
return of stock)			[0.008]	[0.008]			[0.008]	[0.008]
X1*X10(relative			–0.025***	–0.023***			–0.025***	–0.022***
return of stock)			[0.008]	[0.008]			[0.008]	[0.008]
X2(Allowance	–0.001	–0.001	0.001	0.002	–0.002	–0.001	0.000	–0.001
ratio)	[0.014]	[0.014]	[0.015]	[0.014]	[0.014]	[0.014]	[0.016]	[0.015]
X3(NPL ratio)	–0.080	–0.059	–0.071	–0.069	–0.088	–0.064	–0.104	–0.099
	[0.078]	[0.085]	[0.126]	[0.128]	[0.083]	[0.089]	[0.122]	[0.125]
X4 (ROA)	1.280	1.095	2.433**	1.881**				
	[0.807]	[0.802]	[0.950]	[0.918]				
X5 (ROE)					0.050	0.042	0.113***	0.090**
					[0.036]	[0.035]	[0.041]	[0.039]
X6(Growth rate	0.103		0.192**		0.102		0.193*	
of total deposits)	[0.069]		[0.082]		[0.068]		[0.084]	
X7(Growth rate		0.090		0.148*		0.091		0.147*
of total loans)		[0.065]		[0.079]		[0.063]		[0.077]
X8 (Total deposits	0.434**	0.475**	0.683**	0.654**	0.449**	0.489**	0.719*	0.670**
outstanding)	[0.208]	[0.216]	[0.368]	[0.317]	[0.208]	[0.215]	[0.383]	[0.320]
Constant	–5.241*	–5.771*	–9.165	–8.269	–6.149**	–6.560**	–11.539*	–9.979*
	[2.962]	[3.070]	[6.370]	[5.265]	[2.875]	[2.925]	[6.850]	[5.389]
Num. of Obs	164	164	128	128	164	164	128	128
Log likelihood	–37.270	–37.219	–26.942	–26.997	–37.445	–37.353	–26.666	–26.761
Pseudo R-squared	0.221	0.222	0.359	0.358	0.217	0.219	0.366	0.364

Notes: 1. *, **, and *** denote significance at the 10, 5, and 1% level, respectively.

2. Figures in square brackets are robust standard errors corrected for heteroskedasticity clustering on each bank.

3. See Table 1 for the definition of variables.