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Prediction of Bank Failures Using Combined Micro and Macro Data

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Abstract

This research is to combine micro and macro approaches as a modified early warning system to make it possible to monitor the individual banking distress of five severely crisis-hit Asian countries, namely, Indonesia, Malaysia, Thailand, Korea and the Philippines. The suggested robust micro indicators are non-interest expenses over total assets and ROA, and the fragile micro indicator is equities over total assets. The indicator of non-performing loans, which is typically believed to be a useful indicator for bank failure, is non-informative for outsiders. Concerning the macro indicators, the distinctive robust macro variables are the growth rates of the GDP and the exchange rate, whereas the fragile indicators are bank lending and the short-term external debt. The M2 over foreign reserves is non-informative though it has been proven to be a useful indicator in other studies.

Keywords: bank failure, CAMEL, early warning system, robust indicator, fragile indicator

1 Introduction

During the past two decades, many countries have experienced significant distress in the financial sector, a phenomenon which perhaps was highlighted by the unforeseen eruption of the Asian crisis in 1997. This has raised considerable doubts about the current financial warning system. Typically, there are two types of warning systems has been considered to predict banking vulnerability. The first type is the micro approach which examines data on specific banks retrospectively in an effort to explain why they have failed. The probability of banking distress mainly depends on the conduct of business within banks: inadequate accounting and auditing practices, insufficient internal controls and poor management, among others. Regulators apply CAMEL[1] to monitor these micro predictors of bank failures.[2]

The macro approach, the second warning system, is another strand of research that is employed to predict a banking crisis.[3] The first systematic cross-country study, by Demirgüç-Kunt and Detragiache (1998), considered the role of macroeconomic and institutional variables in 65 industrialized and developing countries. They found that the risk of a banking crisis is heightened by macro imbalances (slow growth, credit boom) and inadequate market discipline (unduly deposit insurance, fast liberalization). Given the accessibility of macro data, the cross-country studies have most commonly been conducted. Eichengreen and Arteta (2000) have recently provided a survey of studies that have employed the macro approach and suggest that there is a need to distinguish the

[1] CAMEL denotes Capital, Asset, Management, Earnings, and Liquidity, respectively. See next section for details.

[2] Literature that uses micro data abounds. For example, see Thomson (1991), Barker and Holdsworth (1993), Berger, Davies and Flannery (2000), Cole and Gunther (1998), DeYoung, Flannery, Lang and Sorescu (1998), Flannery (1998), Hirtle and Lopez (1999), Berger and Davies (1998), DeYoung, Hughes and Moon (2001), Gilbert, Meyer and Vaughan (1999, 2002) and others.

[3] Literature that uses macro data also abounds. For example, see Calvo (1996), Gavin and Hausmann (1996), Mishkin (1996), Sachs, Tornell and Velasco (1996), Caprio and Klingebiel (1996b), Honohan (1997), Hardy and Pazabaşioğlu (1998), Demirgüç-Kunt and Detragiache (1998, 1999a, 1999b), Kaminsky and Reinhart (1999), Eichengreen and Arteta (2000), Sunderarajan et al. (2002) and others.

robust from fragile macro indicators, where the former remain unchanged despite any specification changes, whereas the latter are generally elusive and sensitive to the model design. Robust indicators reportedly include rapid domestic credit growth, large bank liabilities relative to reserves and deposit-rate decontrol, while fragile indicators are made up of the exchange-rate regime, financial liberalization and deposit insurance. Both micro and macro approaches are widely found in the literature, but they may only explain some of the facts. The use of a macro approach, for example, fails to recognize the fact that although all of the banks in a country are hit by the same macroeconomic shock, by and large, not all of them fail. The use of micro data, on the other hand, can hardly answer the question as to why different banks with the same financial ratios fail during different periods of time.

Although increasingly convinced that banking crises are brought about by changes in both micro factors and the macro environment, few researchers have conducted empirical studies which systematically examine their concurrent contributions. Nevertheless, González-Hermosillo (1999) has been a pioneer in this type of research, but her research has been limited to Mexico, Columbia and three different regions of the U.S.A. The reason that few studies have combined the two approaches on a broader cross-country scale is that banking default/failure information is lacking for every country. That is, while researchers may be familiar with their own country's banking defaults, non-trivial "micro information gaps" are present in other countries' individual banking failures. Thus, researchers tend more to study either their own country's cases, which they know well, or international cases using only macro data, which are easily accessible. Studying the two approaches concurrently, albeit invaluable, is, in reality, not easy.

Policy-makers also notice this difference. Yue (2001) from the Hong Kong Monetary Authority notes that,

``There is a need for crisis prevention mechanisms that enable the authorities to detect vulnerabilities and distress in the financial system and take remedial action early in the day. Such vulnerabilities could arise from the "micro dimension"—at the level of individual institutions – or from the "macro dimension" – imbalances in the economy or speculative excesses of the market."

To illustrate the point further, the Bank of International Settlement (BIS) held a meeting in their 2000 annual conference with the topic "Marrying the macro- and micro-prudential dimensions of financial stability", thus drawing attention to the potential of combining the two approaches. The BIS finds that some central banks mainly rely on aggregate macroeconomic and prudential data, while others make extensive use of supervisory data on individual financial institutions. Since each of the two approaches only explains part of the fact, it is hoped that the two approaches could be combined.

The purpose of this paper, therefore, is to combine micro and macro approaches as a modified early warning system to make it possible to monitor the individual banking distress of five severely crisis-hit Asian countries, namely, Indonesia, Malaysia, Thailand, Korea and the Philippines. The "micro information gap" mentioned above is reduced to the minimum by first using Bongini, Clasessens, and Ferri's (2001) as well as Laeven's (1999) selected distressed banks in Asian counties as our benchmark. They have provided studies of the efficiency of the failed banks before the Asian crisis. Then, the relevant web sites of the selected countries' authority are searched. Besides this, Bankscope, a data bank compiled by Thomson BankWatch is used to collect the real time information of the newly defaulted or closure banks, thereby ensuring that enough distressed bank data are collected. Then, the robust macro and micro prudential indicators as well as the fragile indicators *á la* Eichengreen and Arteta (2000) can be re-examined.

2. Review of the Micro and Macro Approaches

2.1 Micro Approach

Most commonly CAMEL is employed in the micro approach to evaluate bank default probability. A rating system which assesses a bank's overall financial status and its compliance with safety and soundness covenants, CAMEL is a composite of five separate performance components: capital adequacy (C), asset quality (A), management or administration (M), earnings (E) and liquidity (L). In the U.S., examiners have determined the C, A, E and L ratings based mostly on such quantifiable measures of financial performances as capital ratios, profitable ratios, earning retention, non-accruing and non-performing loans and deposit volatility. In contrast, the M rating is, to a large

degree, based on the examiners' subjective evaluation of non-quantifiable phenomena (DeYoung, Hughes and Moon, 2001).

Several studies have examined whether private supervisory information, as determined by CAMEL ratings, is useful in the supervisory monitoring of banks and if so, to what extent. The results have been conflicting. For instance, Barker and Holdsworth (1993) find that CAMEL is useful in predicting bank failure, and though Cole and Gunther (1998) have shown their agreement, they argue that the prediction accuracy decays quickly. Meanwhile, Hirtle and Lopez (1999) have reported that private supervisory information is mere useful in the supervisory monitoring of bank conditions. While, at about the same time, Gilbert, Meyer and Vaughan (1999, 2002) compared the on-site and off-site examinations of bank failures, where the latter is based on CAMEL and their findings suggest that off-site examinations offer a better prediction of bank failures than do on-site examinations. Overall, the conclusion drawn from the past studies is that CAMEL does, indeed, help to monitor banking conditions.

Monitoring aside, CAMEL can offer additional information with respect to debt and equity markets. For example, DeYoung et al., (1998) found that a CAMEL rating adds significant explanatory power for subordinated debt yield and that the release of CAMEL also has an impact on equity prices. Using an event study, Berger and Davies (1998) pointed out that CAMEL downgrades provide stock markets with unfavorable private information about a bank's financial condition. Berger, Davies and Flannery (2000), on the other hand, have confirmed that information from CAMEL is complementary to that gathered by stock market investors. It is true that most studies support the view that CAMEL generates additional useful information beyond what is publicly available but Flannery (1998), on a more negative note, suggested that further studies are still needed owing to the limited available evidence. Rojas-Suárez (1998) also reported that CAMELs are ill-suited to emerging markets, in general, and not at all suitable for Latin American countries, in particular; instead, he demonstrated that interest differentials, credit boom and debt growth are informative.

2.2 Macro Approach

Employing macro data to study the determinants of a banking crisis involves the use of two broad dimensions of variables: quantifiable indicators, including aggregate banking and conventional macroeconomic variables as well as qualified indices, including transparency, the legal system, deposit insurance, liberalization and so on. The two categories are not in rival but rather are complementary to each other. Researchers often consider both in their studies of banking crisis when using the macro approach. Besides this, the dates of bank crises are identified in literature based on subjective judgment, unlike that on micro studies, where crises are determined by balance sheets.

In the past, theory predicted shocks that adversely affected the economic performance should be positive correlated with banking crises. Gavin and Hausman (1996) and Sachs, Tornell and Velasco (1996), for example, suggested that lending booms have typically preceded banking crises in Latin America; and this is verified by Kaminsky and Reinhart (1999) in their sample of 20 emerging markets. However, Caprio and Klingebiel (1996b) found little evidence of a link between lending booms and banking crises. Mishkin (1996) emphasized declines in equity prices, while Calvo (1996) postulated that, on the basis of his analysis of Mexican crisis in 1994, the ratio of broad money to foreign reserves may be useful in explaining a financial crisis. Later, using a sample of 24 countries, where 18 of them had suffered a banking crisis and six of them had not, Honohan (1997) demonstrated that a higher loan-to-deposit ratio, a higher foreign borrowing-to-deposit ratio and a higher growth rate in credit were all related to a macroeconomic-type of crisis In addition to these findings, Hardy and Pazabaşioğlu (1998) and Sunderarajan et al. (2002) provide a list of aggregate banking indicators which are crucial in predicting a banking crisis.

More systematically, Demirgüç-Kunt and Detragiache (1999a) found that recent liberalization further increased the likelihood of a banking crisis, and in their another study (1999b), they focused on Asian countries and reached a similar conclusion. Rossi's (1999) conclusions regarding the impact of domestic financial liberalization (proxied by the level of domestic interest rates), however, contradict those of Demirgüç-Kunt and Detragiache (1999a), finding that that it is a negative sign, which suggests that liberalization reduces crisis risk. The reason that different authors obtain different results

of the liberalization is probably due to differences in the dating crisis, as suggested by Eichengreen and Arteta (2000).

Eichengreen and Arteta (2000) have clearly determined a need exists to distinguish the robust from the fragile findings to explain the causes of a banking crisis. Their robust causes include rapid domestic credit growth, large M2/foreign reserve, and deposit-rate control, whereas the fragile findings are the exchange-rate regime, financial liberalization and deposit insurance.

2.3 Combining Both Micro and Macro Factors

The micro approach focuses on an individual banking failure, while the macro approach concentrates on the country's bank crisis, but owing to the information gap mentioned earlier, the utilization of macro data to predict individual bank failures is rare.

The gap can be reduced, however, when the study is restricted to different geographical areas in a country. In this case, "macro" denotes the aggregate data of those geographical areas but does not represent the conventional macro data of a country. González-Hermosillo (1999), for example, combined micro and macro factors in five recent episodes of banking system problems in Mexico, and Colombia and three different regions of the U.S.A (Southwest, Northwest and California). She finds that low capital equity and a low coverage ratio are leading indicators of bank distress, thus signaling a high likelihood of near-term failure. Taking a similar approach, González-Hermosillo, Pazabaşioğlu, and Billings (1997) only focused on the case of Mexico. Berger, Kyle and Scalise (2000) also incorporated the various state conditions in the US into their CAMEL model, though their focus was on credit conditions. Caprio (1998), meanwhile, extended the model and proposed a CAMELOT to assess banking distress, where O denotes the operation environment and T denotes transparency. While Caprio (1998) did not use bank specific data to explore the possibility of combining the both approaches, his CAMELOT is in fact close to this concept.

2.4 Asian Banking Failure

The five crisis-hit East Asian countries investigated here suffered tandem banking and currency crises that produced sharp reductions in economic growth and subsequent ongoing domestic financial distress. Research has focused on the signaling effects of macro financial ratios before the crisis, but few studies have used the micro bank data to pursue the same issue[4].

Laeven (1999), however, provides an analysis to estimate the inefficiencies of the banks in the same five countries, and in doing so, he creates a risk measure with an explanatory power in terms of predicting which banks would be restructured after the 1997 crisis. He also reported that compared with state-owned banks, private banks are more efficient and, among foreign banks are even more efficient.[5] Bongini, Claessens, and Ferri (2001) also studied distress in the Asian banking industry. They investigated the occurrence of distress and closure decisions for a sample of 186 banks from the same five crisis-affected East Asian countries, namely Indonesia, Korea, Malaysia, the Philippines and Thailand, and reported that CAMEL helped to predict subsequent distress and closure. Also found was that "connection" with industrial groups or influential families increased the probabilities of banking distress, suggesting that supervisors had granted selective prior forbearance from prudential regulations.

3. Bank Failures and Methodology

3.1 Bank Failures

The definition of a bank failure is elusive because the closure of a bank is ambivalent for both bank directors and policy-markers. The closure/reconstruction of an insolvent bank may eliminate the moral hazard problem, on the one hand, but may cause a bank run, on the other, thus raising the possibility of systematic risk. Closing a bank is

[4]Many articles and books discuss the Asian Banking Crisis, such as Chang and Velasco (1998), the International Monetary Fund (1998), Goldstein (1998), Krugman (1998), Kwack (1998, 2000), Letiche (1998), Moreno, Pasadilla and Remolona (1998), Radelet and Sachs (1998), the World Bank (1998) and Corsetti, Pesenti and Roubini (1999a, 1999b). However, they do not direct their focus on micro bank failures.

[5] Karim (2001) pursues the issue of bank efficiency before the Asian crisis, but he did not study the bank crisis.

more of a political issue than a business decision. The authority typically adopts the forbearance policy to save a bank from closing. In particular, the lower degree of transparency and accountability in Asian countries makes the closing of banks suspicious to outsiders who question their financial stability. Banks continue to operate even though their net worth is substantially below zero. Simply put, a de jure sounded bank may actually be de facto insolvent in Asian countries.

Three different definitions of banking failure are discussed, starting with the strictest definition and progressing to the loosest. The first definition involves a bank that is liquidated or closed. Failed banks in this category are often announced by the authority (for example, posted on their web sites) and can also be referred to as "announced failed banks". Only Indonesia, Korea and the Philippines adopt this policy in the sample countries here.

The next definition of a bank failure involves a bank that is suspended, recapitalized or restructured, which is referred to as the "quasi-failed banks". Banks that received assistance from the central depository insurance corporation also fall into this category.[6] González-Hermosillo (1999), for example, claims that banks are considered to fail if they are liquidated or if they received assistance from the FDIC (Federal Depository Insurance Corporation). Gajewsky (1990), Demirgüç-Kunt (1991), Thomson (1991, 1992), Laeven (1999) and Bongini et al. (2001) combine both of these strictest and the second strictest definitions to identify a bank failure.

The third definition is based on the coverage ratio, whereby the equity capital and loan loss reserves minus the non-performing loans divided by total assets is taken to evaluate the soundness of a bank. A high non-performing loan indicates a small coverage ratio, and clearly shows the fragility of the bank. Demirgüç-Kunt and Detragiache (1998, 1999a, 1999b) as well as Rojas-Suárez (1998) suggest using non-performing loans to assess a banking crisis. However, simply using these risks ignoring those banks, which have sufficient loan loss reserves. González-Hermosillo (1999) thus claims that the coverage ratio may be a better alternative. As she suggested, a bank is classified as being

[6] Banks which belong to this category are often announced on the authority's web sites or are available

in distress if its coverage ratio is less than 1.5.[7] We refer to these banks as "economic failed banks".[8]

This paper refers to the first two types of bank failures as "announced failed banks" and the third as the "economic failed banks". We merge the first two types of banks because they may, de facto, mean the same thing. For example, a deteriorated balance sheet in a restructured bank in Malaysia may differ insignificantly from that in a closed bank in Korea. Furthermore, combining the first two types of banks expands our sample size since in our sample countries, only Indonesia, Korea and the Philippines have ever closed or liquidated banks, but all five countries have had the quasi-failed banks.

While these two types of banking failures are discussed at the same time, one does not imply the other. A bank with high coverage ratio may fail on account of the liquidity risk. Alternatively, a bank with low coverage ratio may survive well if it is backed up by government. Thus, studying their micro and macro prudential indicators may be completely different.

3.2 Econometric Model—Benchmark Models

Our econometric model is a probit model with the dependent variable being equal to one if a bank fails and zero otherwise. The first equation considers only micro data, whereas the second considers both micro and macro data. Thus,

$$\text{(A1)}\quad Y_{ijt} = F\left(\beta_0 + \alpha_1 Micro_{ijt} + \varepsilon_{ijt}\right),$$

$$\text{(A2)}\quad Y_{ijt} = F\left(\beta_0 + \beta_1 Micro_{ijt} + \beta_2 Macro_{ijt} + \varepsilon_{ijt}\right)$$

where $i = 1,\ldots,5$; $t = 1,\ldots, T$; i includes Indonesia, Korea, Malaysia, the Philippines and Thailand; j is the jth bank in ith country; t ranges from 1993 to 2000; and F denotes the

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from the World Bank.

[7] The threshold of this ratio is zero when applied to the US banks, 1.5 to the Mexican and Colombian banks reflecting the accounting transparency. Because the quality of balance sheets in Asian countries are less reliable, 1.5 is suggested by González-Hermosillo (1999).

[8] Worth noting is that while we use the term economic failed bank, the low coverage ratio of a bank does not immediately imply that a bank fails but may simply reflect the worsening balance sheet. The high coverage ratio may also imply a too aggressive loan policy, causing the bank to have too few loan loss reserves.

probit function used here. A bank is classified as failed when $Y_{ijt} = 1$, and as non-failed (normal) when $Y_{ijt} = 0$.

Micro denotes micro prudential indicators, including the components of CAMEL, which consists of Equity/TA, LLR/NPL, NonInt/TA and ROA based on the studies of Lane et al. (1986), Berger, King and O'Brien (1991), Gilbert (1993), Hempel et al. (1994) as well as Gunther and Moore (2000). The meaning of each explanatory variable matches each component of CAMEL, except for liquidity. Namely, Equity/TA denotes the C in CAMEL and is a bank's equity/total assets, which simply is the uniform capital adequacy. An increase in the ratio indicates sufficient capital. Hence, the higher the ratio is, the lower is the probability that a bank will fail, suggesting a negative coefficient for this variable. Lane et al. (1986) and Hempel et al. (1994) and González-Hermosillo (1999) have explained that a high level of capital represents a cushion to absorb shocks.

LLR/NPL is the proxy for A in CAMEL, and is the loan loss reserves/non-performing loans. Berger, King and O'Brien (1991), Gilbert (1993) along with Gunther and Moore (2000) all determined that the quality of the assets can be detected, to some extent, by examining this ratio. Because LLR is the deduction of assets, it is used to absorb the loss from bad loans. Two opposing views as to the impact of this ratio on bank soundness are commonly reported. One claims that a high ratio is indicative of sufficient provisions to write off bad loans, suggesting that the probability of failing is low. The other argues that a bank maintains high reserves relative to NPL when a high NPL is expected, pointing to the vulnerability of banks. The coefficient of this ratio is, therefore, uncertain.

Two additional issues are raised when LLR/NPL is employed as a proxy for asset quality. Because reporting NPL by banks is not compulsory, many banks choose not to. [9]Thus, banks not reporting this ratio are temporarily removed from the sample, which almost cuts our sample size in half. This also raises the issue of selection bias since only

[9] Even if they are available, the fact that different accounting standards are used across different countries in the construction of NPL is notorious. For example, a non-performing loan in Taiwan and Thailand is defined as a loan, where the interest is not paid for over six months, but as one in the U.S which is not paid for only three months.

NPL-reporting banks are selected. The conventional method to solve the selection bias cannot be applied here because there is no a systematic pattern for non-reporting NPL. We attempt to use various specifications to investigate the sensitivity of these problems. For example, we implement a regression without considering LLR/NPL, thereby maintains the original sample size. Alternatively, we only use LLR to perform the same regression. The selection bias problem is found to be insignificant.

NonInt/TA is the proxy for M in CAMEL and is measured as non-interest expenses/total assets, where the numerator contains the non-interest rate expenses. The lower this ratio is, the better the management is expected to be and the lower the probability is that the banks will fail. Thus, the coefficient is expected to be positive.

ROA denotes E in CAMEL and is the average net income/total assets, where the numerator is the sum of one year's and the following year's incomes divided by two. The higher this ratio is, the lower the probability is that the bank will fail. The coefficient should also be negative.

Macro denotes the macro variables, including Credit/GDP, STD/FR, M2/FR, spread, exchange rates and the growth rate in the GDP, in accordance with the studies of Rojas-Suárez and Weisbrod (1994), Gavin and Hausmann (1996) and Chang and Velasco (1998), Demirgűç-Kunt and Detragiache (1998, 1999a, 1999b), and Kaminsky and Reinhart (1999). Both current and previous periods are attempted.

Term Credit/GDP is the proxy for a credit boom and is the "claim to the private sector by the commercial bank/GDP" in the IFS data bank. Rojas-Suárez and Weisbrod (1994), Gavin and Hausmann (1996) and more argued that fast Credit/GDP expansion is the major reason for the deterioration of a bank's asset quality. When the economy is booming, inducing fast banking lending, the screening device becomes lenient. Marginal customers, who were previously rejected, can also obtain loans. Eichengreen and Arteta (2000) have shown that a credit boom is a robust cause of a banking crisis. A credit boom, consequently, is expected to positively affect a bank crisis.

STD/FR is the short-term external debts/foreign reserves and measures the ability of

a country to pay back external debts within a short period. The ratio is often used as an indicator of short-term liquidity. Chang and Velasco (1998), for example, argued that a nontrivial STD /FR is the major reason for an emerging market to be caught when foreign banks do not roll over their debt. A larger ratio implies a higher probability of a crisis, suggesting a positive sign.

M2/FR measures the convertibility of the local currency into dollars, or a bank's liabilities with respect to its reserves. The ratio is low if a country has sufficient foreign reserve but high otherwise. Demirgűç-Kunt and Detragiache (1998) suggested using this ratio to assess the optimal level of foreign reserves a country holds, and Eichengreen and Arteta (2000) found this ratio is another robust cause of a banking crisis. The higher the M2/FR is, the more likely it is that a bank will fail, indicative of a positive indicator of a banking crisis.

The spread is the measure of the competitiveness of the banking industry. First, a narrow spread implies tight competition, and, under such circumstances, banks tend to loan to marginal customers who otherwise be rejected. Secondly, it means that banks' profits are also reduced. The factors imply that the coefficient is expected to be negative. Rojas-Suárez (1998), Kaminsky and Reinhart (1999), and Brock and Rojas-Suárez (2000) suggest that a large spread is a good indicator of a bank's health.

Both the exchange rate and the GDP growth rate are important in affecting the soundness of banks. Kaminsky and Reinhart (1999) reported that devaluation of the local currency increases the probability of a banking crisis, which is dubbed "the twin crisis". Real GDP growth may, in fact, be the most important factor affecting banking soundness. Studies have observed that the quality of bank loans deteriorates when the business cycle is in a downtrend.

4. Source of Data and Basic Statistics

4.1 Data Source

The failed and quasi-failed banks used in our sample come from three sources. First,

we adopt the same failed and quasi-failed banks as those used in Bongini et al. (2001) and Laeven (1999). Next, we review the web sites of each country's supervisory and regulatory authorities.[10] We also take into account the information provided by *BankScope,* published by the Bureau van Dijk. Once the failed and quasi-failed banks are identified, their financial ratios are retrieved from the balance sheets and income statements, as reported by *BankScope*. The ownership structure of each bank is also taken from *BankScope* and Laeven (1999).

To be noted is that the number of failed and quasi-failed banks used in the current research is not exactly equal to that reported by each country's authority since some of them are identified by the World Bank but are not listed in the authorities' web sites, while others are listed on the web sites but cannot be found in *BankScope.* We delete those banks which cannot be found in *BankScope*, although this further reduces our sample size.

4.2 Number of Bank Failures

Table 1 lists the total number of banks in the five Asian five countries investigated across the sample years of 1993-2000. The ownership features are also reported. Important to note is that the number of banks each year is different because of the frequent exit and entry of banks. Closed or restructured banks, for instance, are de-listed after 1997 in some countries, making the total number of banks drop in 1997 and 1998. However, de nova banks are included, leading to the opposite effect. Furthermore, the number of banks dropped substantially in 2000 because at the time of this study bank data were not yet released. Thus, the size of the total sample banks varies across years.

As for the total number of banks, Indonesia and Malaysia have the highest at 115 and 106, respectively, followed by Korea at 61 and the Philippines at 54. Thailand has the fewest number of banks at around 45. Besides this, Indonesia has the highest number of state-owned banks at around 18, far higher than the second highest of 5 in Thailand. Indonesia also has the highest number of family-owned banks at around 10, followed by

[10] For example, we search over the following web sites: Indonesian Restructuring Agency, Korea's KAMCO, Malaysia's Danaharta Nasional Berthad and Thailand's Financial Sector Restructuring Authority.

the Philippines at 8.5. This is in sharp contrast to Korea and Thailand, which have no family-own banks. Finally, Indonesia and Malaysia have the maximum number of foreign banks at around 15 and 12, respectively. The Philippines has 5 foreign banks, on average. Again, Thailand and Korea have the smallest number of foreign banks at only 5 and 3, respectively.

Table 2 presents the number of failed banks (closed and liquidated banks), owned by state, private and family in the sample countries from 1993 to 2000. As we mentioned above, closed or liquidated banks are only found in Indonesia, Korea and the Philippines. Indonesia, which closed 16 banks in 1997, 10 in 1998, 38 in 1999 and 1 in 2000 is the country that most actively adopted the closed bank policy. Korea also closed 8 in 1997, compared with the Philippines, which closed only one in 1998. Contrary to the intuition that family-owned banks may suffer severely during the crisis, we found that the number of family-owned banks closed is much less than that of independent private banks.

Table 3 reports the number of quasi-failed banks (suspended or re-capitalized). Korea had the highest number of quasi-failed banks, amounting to 24 in 1995 and 1996 but only 18 in 1997. Indonesia again had a nontrivial number of quasi-failed banks roughly around 20 in 997. Malaysia had 14, but the Philippines had only 1. The table shows number of quasi-failed banks in Thailand was 9 before 1996 but zero afterwards.

Table 4 reports the economic failed banks using the coverage ratio (CR) 1.5 as the cutoff. Recall that this ratio may not be available since some banks choose not report the NPL. We report two values in this table to exhibit the number of banks report the NPL. The first denotes those banks among the reporting ones that have CRs lower than 1.5, and they are put on the left of slash (/). The second reports those banks reporting NPL, which are put after the slash (/). Thus, 14/20, for example, means that 20 banks report NPL and 14 out of them have less 1.5 CR. As shown in the table, among the sample countries, fewer banks report NPL in Korea and Indonesia, making the calculation of CR difficult in these countries. By contrast, Malaysia and the Philippines have around 70 and 35 banks reporting NPL, respectively, and more than half of them have CRs of less than 1.5.

4.3 Micro- and Macro-economic Variables

Table 5 reports the basic statistics of the micro bank variables used in this paper. The statistics include the mean, standard deviation and the maximum as well as minimum of each variable and are presented in the percentage form. The first micro variable is Equity/TA, ranging from 8.2 for Thailand to 19.0 or the Philippines. The standard deviation is large, being almost equal to the mean. The LLR/NPL varies substantially across countries, from 2.6 in Indonesia to 1,312 in Thailand. As the definition and requirements of NPL in each country may differ non-trivially, the large differences in the ratio may be reflective of the accounting system and regulatory requirements than the banking conditions. The Nonint/TA, ranging from 2.6 to 6.7, shows a rather uniform result. The simple mean of the ROA, ranging from –1.8 (Thailand) to 1.6 (the Philippines) may suggest that the banking industries in our sample countries are not profitable.

Table 6 reports the basic statistics of the macro variables used in this paper. With respect to the average of credit/GDP, Thailand has the highest credit ratio of 100, followed by Malaysia of 93. In contrast, the Philippines has the lowest ratio of 41. Variations in this ratio across years are small since the standard deviation is only around 10~13. The M2/FR is typically high in Asian countries, ranging from 296 (Malaysia) to 569 (Korea). This implies that the foreign reserves may not be high enough with respect to bank liabilities, proxied by the domestic money supply. The standard deviation of this variable, however, is also high, approximating 100. The lowest STD/FR falls on Malaysia, which is only 41, but it increases to 157 for Indonesia and 153 for Korea. Also the maximum value of STD/FR in each country centers on the year 1997. The average GDP growth rates, ranging from 3% (Indonesia) to 6% (Korea), provide little information since the standard deviations almost mirror those numbers. The minimum GDP growth in each country concentrates on the year 1998, right after the Asian crisis. The Spread is small in our sample period, and the changes in the exchange rates are negative meaning that the currencies are in depreciation.

Detailed definitions and the source of the micro- and macro- economic variables are given in appendix.

4.4 Ownership Dummy Variables

The control variables used in this research are not just made up micro and macro economic variables, but also include banks' ownership structure. Three sets of dummy variables are constructed, namely foreign-owned, private-owned and family/ conglomerate-owned banks.

Claessens, Djankov and Lang (2000)、Bongini, Claessens and Ferri (2001), following La Porta et al. (1999) define state-owned banks as those which are at least 50% owned by the government or stated-owned institutions. And family/conglomerate-owned banks are defined as those, which are at least 20% owned by a family or a conglomerate**.** If the control power belongs to foreigners, then the bank is classified as a foreign-owned bank.

Table 7's A and B, respectively, show the ownership structure of our sample countries in 1996 (before the crisis), and in 2000 (after the crisis). With the exception of Indonesia, the proportions of state-owned banks to total banks decline substantially between before and after 1997. To illustrate this, in Malaysia, Korea, the Philippines and Thailand, respectively, 20.31%, 18.97%, 11.11% and 18.42% of all banks are state-owned before the crisis, but the proportion drop to respective lows of 1.89%, 6.56%, 5.56% and 15.56% afterwards.

Also, the proportions of foreign assets increase in Indonesia, Korea and Thailand, but slightly drops in Malaysia and the Philippines. Before the crisis, Malaysia has the highest ratio of 13.38%, followed in descending order by Korea (11.88%), Thailand (4.89%), Indonesia (2.71%) and finally the Philippines (1.37%). After the crisis, the proportion of foreign bank assets soars to 36.30% in Korea, 3 times the earlier reported ratio. Also, the same ratio in Thailand climbs to 16.81%, or 4 times that in 1996. The proportional changes in foreign assets reflect different reconstructive policies after the Asian crisis, when Korea and Thailand were more willing to accept foreign banks, thereby providing them with more foreign assets. Malaysia, being less willing to accept foreign banks, has fewer foreign assets. Caprio (1998) claims that the higher ratio of

foreign bank assets is associated with the higher degree of financial liberalization, which makes the policies more transparent. This implies that financial reformation in Korea and Thailand might be more open than in the other three countries.

5. Probit Estimation Results—Benchmark Model

Table 8 shows the results using only micro variables and announced failed banks by implementing different proxies of asset quality to examine sensitivity. The first column reports the estimated results using LLR/NPL, which cuts our sample size to 617 observations. It is rather encouraging that all of the coefficients show the expected negative sign. That is, increases in the equity ratios, non-interest expense ratio, LLR/NPLs and ROAs clearly reduce the probability of bank failures. With the exception of LLR/NPL, all coefficients significantly deviate from zero. The second column reports the estimated results without LLR/NPL. The sample size increases from 617 to 1,748, which is expected to increase the efficiency of estimation. The coefficients still show the expected signs and they display higher levels of significance than those reported in column one. The third column considers LLR/TA, and results are not changed. A similar conclusion is reached when the proxy is NPL/TA, suggesting that the results are robust to different proxies of the asset quality.[11]

The above results demonstrate that the robust micro indicators of predicting bank failures include Equity/TA, Nonint/TA and ROA. To our surprise, the asset quality, which is anticipated to be a good indicator, shows no correlation with the announced bank failures regardless which proxies we used. The reason has been discussed in the data section that the report of that value is not compulsory thus bad banks tend to avoid reporting it. Also, there is substantial discretionary space to manipulate non-performing loan, distorting the reports in terms of timing and values when a country's accounting discipline is weak. If the asset quality is indeed an important factor in reality but cannot identified empirically, it can be sure to say that the "information quality" of the proxies for asset quality is poor in the bank financial statements.

11 The use of LLR/NPL, rather than the elimination of it, is on account of the significant likelihood ratio (LR) test. The log likelihood function increases from –275 when no proxy is used and becomes –114 when

Table 9 reports the estimated results using the announced and the economic failed banks as dependent variables. Also, we only report the results using LLR/NPL and LLR/TA as the proxy of asset quality to save space. Both equations (A1) and (A2) are estimated. The first column uses micro variables alone, which has already been discussed in Table 8, is reported here for the purposes of comparison. The second column employs both the micro and macro variables show additional results. First, previously significant Equity/TA becomes insignificant, whereas NonINT/TA and ROA remain significant. Second, both the growth rates of the GDP and the exchange rates are significantly negative, strongly suggesting that the slow economic growth and the devaluated currency will increase the probability of bank failure. Next, the credit boom, the spread and M2/FR are all insignificantly different from zero. Particularly surprising is the insignificant credit boom, which has been found to be an important factor in explaining banking crises in many studies. Third, the STD/FR is found to have a significantly negative effect on bank failure, contradicting our intuition. This negative impact is a sharp indication that high short external debt is a good indicator of a macro-banking crisis but may not be an indicator for micro-bank distress. This issue will be discussed shortly.

The last two columns of Table 9 report the estimated results using economic failed banks determined by the coverage ratio, but they yield slightly different results. First, ROA becomes insignificant. This may seem reasonable, as a high ROA may be associated with either a high or low coverage ratio. For example, a profitable bank may have high equity and high reserves to cover loan losses, resulting in a high coverage ratio. However, a bank may lose its profits by changing off NPL, also resulting in a high coverage ratio. Thus, ROA cannot be considered as a robust indicator for economic failed banks. Next, the Credit/GDP becomes significantly positive, consistent with our intuition. That is, increased lending makes it possible for marginal customers who were previously rejected obtain loans, hence increasing the non-performing loan.

There is no question that employing the micro and macro prudential indicators concurrently provides a better in-sample fit. With respect to the announced failed banks, the log likelihood value is –115 for the micro variable equation and is –95 for the

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LLR/NPL is added in. The LR test is thus 320, rejecting the null of no effect.

combined micro and macro variable equation, yielding the likelihood ratio of 39. With regard to the economic failed banks, the log likelihood ratio is –366 for the micro variable equation and a close –338 when both the micro and macro variables are combined, which produces the likelihood ratio of 56. Of particular interest is that both likelihood ratios reject the null of using only micro variables.

Table 10 has the same specifications as those of Tables 8 and 9 except that LLR/TA, rather than LLR/NPL, is used as the proxy for asset quality. There are similarities and dissimilarities between Tables 8 and 9 as well as 10. The similarities are that Equity/TA, NonINT/TA and ROA remain the same as previously reported.[12] Also, the growth rates in the GDP and in the exchange rates remain significantly positive even though new asset quality is adopted. The dissimilarity is that STD/FR changes its sign from the "wrong" negative in Table 9 to the "right" positive here. Besides this, Credit/GDP becomes highly significantly positive, consistent with our earlier anticipations.

Our results on the basis of the benchmark model (equations (A1) and (A2)) can be highlighted as follows. Concerning the announced failed banks, the robust micro prudential indicators include Equity/TA, NonINT/TA and ROA, which are consistent with IMF's reports made by Sundararajan et al. (2002).[13] Much to our surprise, the non-performing loans, which have often been suggested in the literature as a useful indicator for bank failures, yield no information here. As we argued above, this is probably because the observed proxied do not reflect true information of asset quality. The robust macro prudential indicators are the growth rates of the GDP and the exchange rates. The fragile macro prudential indicators are Credit/GDP and STD/FR. These macro prudential results are somewhat different from those of Eichengreen and Arteta's (2000), where our two fragile macro indicators are robust in their study. The differences can probably be attributed to that they are good indicators for the prediction of macro-bank crisis but are too sensitive for the prediction of the micro-bank crisis here. Another possible reason is the small country sample here.

[12] Results of using only micro variables are not reported since they remain similar as those reported in Tables 8 and 9. They are, however, available upon request.

[13] Sundararajan et al. (2002) conduct an extensive survey in which they asked bankers' opinion as to the most useful financial soundness indicators. The responses are consistent with our findings.

With regard to economic failed banks, the robust micro prudential indicator is Equity/TA and the robust macro indicator is STD/FR. It appears that the prediction of economic bank failure is more difficult. One reason is that the coverage ratio is related to bank earning management and thus is less affected by conventional CAMEL and macro factors.[14]

6 Sensitive Tests

This section examines whether the results obtained from the benchmark model are sensitive to the Asian crisis and the ownership structure.

6.1 Asian Crisis Effect

We separate the sample before and after the crisis as shown in (B1) and (B2):

$$\text{(B1)}\quad Y_{ijt} = F(\beta_0 + \alpha_1 Micro_{ijt} D_{crisis} + \gamma_1 Micro_{ijt}(1 - D_{crisis}) + \varepsilon_{ijt}),$$

$$\text{(B2)}\quad Y_{ijt} = F(\beta_0 + (\beta_1 Micro_{ijt} + \beta_2 Macro_{ijt}) D_{crisis} + (\theta_1 Micro_{ijt} + \theta_2 Macro_{ijt})(1 - D_{crisis}) + \varepsilon_{ijt})$$

where $D_{CRISIS} = 0$, if $1993 \le \text{Year} \le 1996$, before the crisis;

$= 1$, if $1997 \le \text{Year} \le 2000$, after the crisis.

The intuition of the new specifications can be illustrated using (B2). The model becomes $Y_{ijt} = F(\beta_0 + \theta_1 Micro_{ijt} + \theta_2 Macro_{ijt})$ before the crisis, and $Y_{ijt} = F(\beta_0 + \beta_1 Micro_{ijt} + \beta_2 Macro_{ijt})$ after it.

Because most announced failed banks occurred after 1997, the binary dependent variable Y_{ijt} shows little variation before 1997. As a consequence, the estimation using the announced failed bank before the crisis is less interesting since it is fully explained by

[14] Because banks tend to smooth their earnings, the LLR and NPL are often manipulated. See Wall and Koch (2000) and references therein for the discussions of how LLR/LLP and NPL are related to earning

the constant. We therefore only estimate the model of announced failed bank using the post-crisis sample. Both periods are taken for economic failed banks. Besides this, we only report those results using LLR/NPL since results of using LLR/TA reach the similar conclusion and thus are not reported here.

Table 11 reports the estimated results with asset quality proxied by LLR/NPL. The same micro robust indicators are identified but the robust macro prudential indicators change slightly. The previous fragile macro indicator STD/FR becomes significant here but previous robust GDP growth rate becomes insignificant. Thus, it is expected that the determinants of the announced failed banks are different before and after the crisis.

The use of economic failed banks as dependent variable also shows different results in the macro indicators. The term (Cre/GDP) becomes significant before and after the crisis. STD/FR is also significant after the crisis. As a consequence, the macro prudential indicators seem to vary using different sample periods, which cannot be uncovered if only macro-bank crisis study is conducted.

6.2 State-Owned and Private-Owned Bank

We next examine whether state-owned and private-owned banks change our results.

(C1) $Y_{ijt} = F(\beta_0 + \alpha_1 Micro_{jt} D_P + \gamma_1 Micro_{jt}(1 - D_P) + \varepsilon_{ij},$

(C2) $Y_{ijt} = F(\beta_0 + (\beta_1 Micro_{jt} + \beta_2 Macro_{ijt}) D_P + (\theta_1 Micro_{jt} + \theta_2 Macro_{ijt})(1 - D_P) + \varepsilon_{ijt})$

where D_P = 1 if it is a private-owned bank

= 0 if it is a non-private- (state-) owned bank

Table 12 reports the estimated results. Interesting to note is that all CAMEL indicators become insignificant when the dummy of the state-owned bank takes charge. This result is consistent with the general intuition that the state-owned banks are implicitly ensured by government not to default even though their financial ratios are worsening. This argument can be sided by using results obtained from economic failed banks in the state-owned banks, where NonINT/TA and ROA are significant. Therefore,

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management.

CAMEL cannot explain the announced failures of the state-owned banks but can explain the economic failure. The announced failures of state-owned banks are probably determined by political or social considerations, rather than the market factors identified here.

In contrast to case of the state-owned bank, the private-owned banks show a different scenario. Namely, NonINT/TA and ROA, the previously identified robust micro indicators, do have influence on announced bank failures. Equity/TA is not significant here. Also, in addition to previous robust macro indicators, that is, the growth rates in the GDP and, the exchange rate, the STD/FR also becomes effective. Thus, studying the micro and macro prudential indicators for the state-owned banks seems futile but is useful for the private-owned banks.

6.3 Family-Owned and Non-Family Owned Banks

$$\text{(D1)}\quad Y_{ijt} = F(\beta_0 + \alpha_1 Micro_{ijt} D_F + \gamma_1 Micro_{ijt}(1 - D_F) + \varepsilon_{ijt})$$

$$\text{(D2)}\quad Y_{ijt} = F(\beta_0 + (\beta_1 Micro_{jt} + \beta_2 Macro_{ijt}) D_F + (\theta_1 Micro_{jt} + \theta_2 Macro_{ijt})(1 - D_F) + \varepsilon_{ijt})$$

where D_F = 1 if it is family-owned banks

= 0 if it is non-family-owned banks

While we separate the sample into family and non-family owned banks, the estimation of the family-owned banks becomes less interesting since few family-owned banks failed.[15] Thus, when announced failed banks are used, only non-family owned banks are considered.

Table 13 shows that Equity/TA, NonINT/TA and ROA remain informative for the announced failure of the non-family owned banks when only micro variables are employed. The latter two columns remain significant when both micro and macro variables are employed. Variables STD/FR, GDP growth rate and exchange rate are significant. With regard to economic failed banks, the useful micro indicators again change slightly since only Equity/TA and LLR/NPL are significant. The useful macro

[15] There are 24 family banks, making up only 6.29% of the total sample. And in the sample, the numbers of family-owned banks failed are far fewer than non-family-owned banks.

indicators are the same as those of announced failed banks

7. Conclusions

In this paper, we combine both micro and macro prudential indicators to predict bank failures. We differentiate the robust from the fragile indicators, where the former are informative even when specifications change; the information of the latter, however, do change when specifications change.

Our results below are applied to private- or non-family-owned banks only. The suggested robust micro indicators are non-interest expenses over total assets and ROA, and the fragile micro indicator is equities over total assets. The indicator of non-performing loans, which is typically believed to be a useful indicator for bank failure, is non-informative for outsiders, probably because banks either not want to report it or report it with manipulations. Concerning the macro indicators, the distinctive robust macro variables are the growth rates of the GDP and the exchange rate, whereas the fragile indicators are bank lending and the short-term external debt. The M2 over foreign reserves is non-informative though it has been proven to be a useful indicator in other studies.

One interesting observation is that the failures of state-owned banks are found not to be affected by either micro or macro factors. In other words, both sets of variables are futile to predict the failures of state-owned banks since their failures are probably determined by political or social considerations, rather than the market factors identified here. Along the same line, family-owned banks are also less affected by macro factors.

In closing, though we definitely demonstrate that the concurrent use of micro and macro variables help us to identify which specific variables predict bank failures, it might be said that our results are dependent on the sample countries used. It will be interesting, therefore, to pursue this issue using more country data in the future to confirm our findings

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Table 1: Number of Financial Institutions in Five Asian Countries

	Total number of banks used	1993	1994	1995	1996	1997	1998	1999	2000
Indonesia									
State	18	15	18	18	17	12	9	8	0
Private	97	59	66	73	79	60	59	57	2
Family	13	11	12	13	13	9	6	6	0
Foreign	15	14	14	13	14	12	14	14	1
Total	115	74	84	91	96	72	68	65	2
Korea									
State	4	4	4	4	4	4	4	4	3
Private	57	31	40	49	51	38	28	22	9
Family	0	0	0	0	0	0	0	0	0
Foreign	3	2	2	3	3	3	3	3	3
Total	61	35	44	53	55	42	32	26	12
Malaysia									
State	2	1	2	2	3	3	2	2	0
Private	104	11	57	91	94	90	93	78	15
Family	1	0	1	1	1	1	1	1	0
Foreign	12	0	8	11	12	12	12	12	2
Total	106	12	59	93	97	93	95	80	15
Philippines									
State	3	2	2	3	3	3	3	3	0
Private	51	25	28	31	36	45	44	33	6
Family	9	6	8	8	8	9	8	5	2
Foreign	7	1	2	2	5	5	5	5	1
Total	54	27	30	34	39	48	47	36	6
Thailand									
State	7	5	5	5	5	6	4	4	5
Private	38	15	23	27	29	16	19	19	9
Family	1	0	0	0	0	0	0	0	0
Foreign	5	3	3	3	3	4	5	5	3
Total	45	20	28	32	34	22	23	23	14

Note：Once the data are retrieved from *BankScope*, the total number of banks used is decided by the total observation samples during observation periods, which is 8 years. However, because not every bank provides complete financial ratios used here for each year, some NA does exist.

Table 2: Number of Announced Failed Banks in Five Asian Countries

	1993	1994	1995	1996	1997	1998	1999	2000
Indonesia								
State	1	2	2	2	1	1	1	-
Private	14	16	18	19	4	0	0	-
Family	2	3	3	3	0	0	0	-
Foreign	0	0	0	0	0	0	0	-
Total	15	18	20	21	5 (16)	1(10)	1(38)	(1)
Korea								
State	-	0	0	0	-	-	-	-
Private	-	5	7	8	-	-	-	-
Family	-	0	0	0	-	-	-	-
Foreign	-	0	0	0	-	-	-	-
Total	-	5	7	8	(8)	-	-	-
Philippines								
State	-	-	0	0	0	-	-	-
Private	-	-	1	1	1	-	-	-
Family	-	-	0	0	0	-	-	-
Foreign	-	-	0	0	0	-	-	-
Total	-	-	1	1	1	(1)	-	-

Note: The numbers in parentheses are the total number of failed banks reported by the each authority. However, due to data restrictions, not all of them are available.

Table 3: Number of Quasi-Failed Banks in Five Asian Countries

	1993	1994	1995	1996	1997	1998	1999	2000
Indonesia								
State	5	5	5	5	5	5	1	-
Private	15	15	16	16	16	14	11	-
Family	5	5	5	5	5	4	3	-
Foreign	0	0	0	0	0	0	0	-
Total	20	20	21	21	21	19 (1)	12 (22)	-
Korea								
State	2	2	2	2	2	2	2	2
Private	17	19	22	22	16	8	6	6
Family	0	0	0	0	0	0	0	0
Foreign	1	1	2	2	2	2	2	2
Total	19	21	24	24	18 (2)	10 (20)	8 (3)	8
Malaysia								
State	1	2	2	2	2	1	1	0
Private	2	11	12	12	12	13	12	2
Family	0	0	0	0	0	0	0	0
Foreign	0	1	1	1	1	1	1	2
Total	3	13	14	14	14	14 (15)	13 (1)	2
Philippines								
State	1	1	1	1	1	1	1	-
Private	0	0	0	0	0	0	0	-
Family	0	0	0	0	0	0	0	-
Foreign	0	0	0	0	0	0	0	-
Total	1	1	1	1	1	1 (1)	1	-
Thailand								
State	0	0	0	0	-	-	-	-
Private	5	9	9	9	-	-	-	-
Family	0	0	0	0	-	-	-	-
Foreign	0	0	0	0	-	-	-	-
Total	5	9	9	9	(56)	-	-	-

Note: The numbers in parentheses are the total number of quasi-failed banks reported by the each authority or the World Bank in the specific year. Malaysia did not close any bank. Instead it re-capitalized them. Thailand's FRA asked that 56 banks and finance companies be suspended in 1997. Therefore, banks which were re-capitalized or suspended are classified as quasi-failed banks.

Table 4: Number of Banks Reporting the Coverage Ratio

	1993	1994	1995	1996	1997	1998	1999	2000
Indonesia								
Non-Failed	-	-	0 / 2	0 / 4	0 / 10	14 / 20	12 / 24	-
Failed	-	-	-	-	-	-	-	-
Quasi-Failed	-	-	-	-	0 / 2	2 / 3	1 / 2	-
Total Economic Failed	-	-	0 / 2	0 / 4	0 / 12	16 / 23	13 / 26	-
Korea			-					
Non-Failed	-	-	-	1 / 2	1 / 3	3 / 4	1 / 2	1 / 1
Failed	-	-	-	-	-	-	-	-
Quasi-Failed	0 / 1	0 / 1	-	-	0 / 1	-	1 / 1	-
Total Economic Failed	0 / 1	0 / 1	-	1 / 2	1 / 3	3 / 4	2 / 3	1 / 1
Malaysia								
Non-Failed	7 / 9	31 / 41	45 / 66	42 / 70	32 / 67	43 / 69	40 / 58	11 / 12
Failed	NA	NA	NA	NA	NA	NA	NA	NA
Quasi-Failed	3 / 3	10 /13	10 / 14	8 / 14	6 / 14	3 / 13	7 / 13	2 / 3
Total Economic Failed	10 / 12	41 / 54	55 / 80	50 / 84	38 / 81	46 / 82	47 / 71	13 / 15
Philippines								
Non-Failed	14 / 25	15 / 29	14 / 29	12 / 32	9 / 40	3 / 45	3 / 34	0 / 6
Failed	-	-	0 / 1	0 / 1	0 / 1	-	-	-
Quasi-Failed	0 / 1	0 / 1	0 /1	0 / 1	0 / 1	0 / 1	0 / 1	-
Total Economic Failed	14 / 26	15 / 30	14 / 31	12 / 34	9 / 43	3 / 46	3 / 35	-
Thailand								
Non-Failed	0 / 1	0 / 3	0 / 7	1 / 11	11 / 16	18 (18)	16 / 18	10 / 11
Failed	NA	NA	NA	NA	NA	NA	NA	NA
Quasi-Failed	0 / 4	0 / 6	1 / 7	2 / 7	-	-	-	-
Total Economic Failed	0 / 5	0 / 9	1 / 14	3 / 18	11 / 16	18 / 18	16 / 18	10 /11

Note: The number before the slash (/) is the number of banks with the coverage ratio being less than 1.5 where the number after the slash (/) is the number of banks that report NPL (so that we can calculate coverage ratio). Coverage Ratio = [(Equity+ LLR-NPL)/Total Asset] *100

Table 5: Statistical Description of the Microeconomic Variables

	Non-Failed Banks				Quasi-Failed Banks (Rec./Merged/Sus.)				Announced Failed Banks (Closed)			
Variables	Mean	St. D.	Max	Min	Mean	St. D.	Max	Min	Mean	St. D.	Max	Min
Capital												
Equity / Total Assets (%)												
Indonesia	11.8	18.1	99.7	-129.2	3.2	20.6	28.2	-126.8	7.3	14.3	20.7	-84.6
Korea	9.5	10.1	57.4	0.5	5.3	2.7	18.9	-7.2	9.5	4.5	23.6	3.4
Malaysia	11.0	9.9	77.3	0.1	8.5	5.1	31.4	-4.7				
Philippines	19.0	15.8	98.9	4.2	9.8	2.2	13.5	7.3	16.4	3.6	20.3	13.2
Thailand	8.2	5.1	26.6	-6.5	9.6	2.2	14.1	5.2				
Assets												
Loan Loss Reserve / Non-Performing Loans (%)												
Indonesia	2.6	1.1	4.0	1.0	1.9	1.1	4.0	1.0	na	na	na	na
Korea	42.7	40.9	145.1	2.0	45.9	13.3	58.0	31.7	na	na	na	na
Malaysia	92.4	149.0	1118	14.5	388.2	2317	16767	10.4				
Philippines	128.2	512.4	5095.1	2.2	49.2	5.8	55.8	45.1	na	na	na	na
Thailand	1312	6742	39198	5.2	42.3	54.6	288	4.9				
Management												
Non Int Exp / Avg Assets (%)												
Indonesia	6.7	12.0	132.6	-15.8	7.8	11.3	74.1	1.9	4.9	7.2	68.0	1.7
Korea	3.2	2.7	14.7	0.0	2.9	1.8	10.4	-4.0	1.3	0.8	3.4	0.0
Malaysia	2.6	1.7	11.6	0.0	2.9	2.3	20.7	0.7				
Philippines	5.0	2.0	17.8	0.8	5.1	2.1	8.2	3.5	5.5	1.8	7.1	3.5
Thailand	4.6	5.1	29.1	-21.2	2.7	0.5	4.0	2.2				
Earnings												
Return on Avg Assets (ROAA) (%)												
Indonesia	-0.5	11.4	71.3	-95.0	-4.4	15.7	8.8	-100.4	0.0	8.0	2.7	-70.7
Korea	-0.3	3.3	7.0	-28.7	-0.3	1.9	1.6	-10.5	0.6	0.3	1.5	0.1
Malaysia	1.0	2.9	14.9	-18.7	0.2	3.1	3.1	-24.0				
Philippines	1.6	1.8	8.4	-8.7	0.0	2.9	2.6	-4.9	0.8	0.2	1.1	0.6
Thailand	-1.8	6.3	18.5	-34.2	1.5	1.0	4.1	0.0				

Source: *BankScope* --Bureau van Dijk & and the authors' calculations

Table 6: Statistical Description of the Macroeconomic Variables

	Mean	St. D.	Max (Year)	Min (Year)
1. CRE/GDP (%): Claim to Private Sectors/GDP (source: IFS)				
Indonesia	45.71	14.83	60.82 (1997)	20.29 (1999)
Korea	70.64	10.86	90.66 (2000)	57.91 (1993)
Malaysia	93.34	13.66	109.20 (1998)	74.84 (1993)
Philippines	41.05	10.16	56.53 (1997)	26.41 (1993)
Thailand	100.05	13.74	122.55 (1997)	79.78 (1993)
2. M2/FR (%): Broad Money/Foreign Reserves (source: IFS)				
Indonesia	509.82	145.78	690.04 (1995)	267.91 (1999)
Korea	569.65	117.22	686.49 (1993)	339.87 (2000)
Malaysia	296.40	77.20	422.14 (1998)	187.79 (1993)
Philippines	466.73	103.61	574.63 (1995)	309.03 (1999)
Thailand	400.58	119.77	691.76 (1998)	241.91 (1999)
3. STD/FR (%): Short-term debts/Foreign Reserves (source: IFS and BIS)				
Indonesia	157.86	46.13	232.18 (1997)	80.55 (1999)
Korea	153.39	81.39	325.30 (1997)	46.42 (2000)
Malaysia	40.72	20.90	80.45 (1997)	24.34 (1994)
Philippines	105.57	42.01	188.42 (1997)	70.90 (1999)
Thailand	102.28	37.17	162.15 (1997)	49.90 (1999)
4. GDP (%): Real GDP Growth Rate (source: IFS)				
Indonesia	3.30	6.86	8.23 (1995)	-13.70 (1998)
Korea	5.93	5.11		10.90 (1999)
Malaysia	6.29	5.63	9.36 (1995)	-7.40 (1998)
Philippines	3.60	2.05	5.85 (1996)	-0.60 (1998)
Thailand	3.71	6.01	8.84 (1995)	-10.17 (1998)
5. Spread: Lending Rate minus Deposit Rate" (source: IFS)				
Indonesia	2.27	3.89	6.04 (1993)	-6.91 (1998)
Korea	0.82	0.69	1.96 (1998)	0.00 (1993, 1994)
Malaysia	2.33	0.67	3.41 (2000)	1.70 (1995)
Philippines	4.75	1.22	6.29 (1995)	2.60 (2000)
Thailand	3.17	0.90	4.54 (2000)	1.67 (1995)
6. EXCH (%): Change of Exchange Rate (source: IFS)				
Indonesia	-10.46	25.96	27.48 (1999)	-70.95 (1998)
Korea	-3.41	13.99	17.88 (1999)	-32.12 (1998)
Malaysia	-4.27	10.69	4.80 (1995)	-28.32 (1998)
Philippines	-6.04	10.80	4.60 (1999)	-27.93 (1998)
Thailand	-4.93	10.52	9.39 (1999)	-24.18 (1998)

For detailed data source and definitions, please refer to Appendix I.

Table 7: Ownership Structure of the Financial Institutions

A: Before the Crisis (1996)

	Indonesia	Korea	Malaysia	Philippines	Thailand
State-Owned	10 (11.49%)	11(18.97%)	13 (20.31%)	4 (11.11%)	7 (18.42%)
Private-Owned	77	47	51	32	33
Family-Owned	52 (52.78%)	18 (31.03%)	36 (56.25%)	23 (63.88%)	1 (2.63%)
Foreign- Owned	18	16	17	8	4
% of total sample	(20.69%)	(27.59%)	(26.56%)	(22.22%)	(10.53%)
% of total assets	(2.71%)	(11.88%)	(13.38%)	(1.37%)	(4.89%)
Total Number	87	58	64	36	38

B: After the Crisis (2000)

	Indonesia	Korea	Malaysia	Philippines	Thailand
State-Owned	18 (15.65%)	4 (6.56%)	2 (1.89%)	3 (5.56%)	7 (15.56%)
Private-Owned	97	57	103	51	38
Family-Owned	13 (11.30%)	0	1 (0.94%)	9 (16.67%)	1 (2.22%)
Foreign-Owned	15	3	12	7	5
% of total sample	(13.04%)	(4.92%)	(11.32%)	(12.96%)	(11.11%)
% of total assets	(3.62%)	(36.30%)	(11.71%)	(1.09%)	(16.81%)
Total Number	115	61	106	54	45

Note: The numbers in parentheses indicate the percentage of the total sample number unless specifically defined.

Source: The data of 1996, before the Asian financial crisis, are from Bongini, Claessens and Ferri (2001) but the ratios of foreign banks to total financial institutions are authors' calculations. And the data of 2000, after the Asian financial crisis, are retrieved from *BankScope* and the authors' calculations.

Table 8: Probit Regression: Micro Variables Only

(A1) $Y_{ijt} = F\left(\beta_0 + \alpha_1 Micro_{ijt} + \varepsilon_{ijt}\right)$,

Using only Announced Failed banks.

	Micro	Micro	Micro	Micro
Constant	-0.7785***	-1.2876***	-1.2418***	-0.7817***
	(-3.191)	(-13.241)	(-12.132)	(-3.208)
Equity/TA	-0.0241*	-0.0162**	-0.0166**	-0.0236*
	(-1.795)	(-2.765)	(-2.784)	(-1.675)
LLR/NPL	-0.0009			
	(-0.689)			
LLR /TA			-0.0005	
			(-0.125)	
NPL/TA				-0.0103
				(-1.238)
NonINT/ TA	-0.1535***	-0.0922***	-0.0967***	-0.1642***
	(-2.953)	(-4.599)	(-4.679)	(-3.246)
ROA	-0.0985**	-0.0672***	-0.0695***	-0.1224***
	(-2.439)	(-3.995)	(-3.912)	(-2.990)
No. of Obs.	617	1748	1641	794
Log Likelihood	-114.80	-275.19	-267.28	-119.95
LR	320.78		-294.66	

Note:

Values in the parentheses are the *t*-values; ***, ** and * represent the 1%, 5% and 10% level of significance.

LR: The likelihood ratio = -2 (Ln L_R – Ln L_U)

Table 9: Benchmark Model (I): Micro and Combined Models (Asset Quality: LLR/NPL)

(A1) $Y_{ijt} = F\left(\beta_0 + \alpha_1 Micro_{ijt} + \varepsilon_{ijt}\right)$

(A2) $Y_{ijt} = F\left(\beta_0 + \beta_1 Micro_{ijt} + \beta_2 Macro_{ijt} + \varepsilon_{ijt}\right)$

	Y_{ijt} : Announced Failed Banks		Y_{ijt} : Economic Failed Banks	
	Micro	Micro + Macro	Micro	Micro + Macro
Constant	-0.7785***	-0.2526	0.9242***	-0.1551
	(-3.191)	(-0.229)	(6.405)	(-0.251)
Equity/TA	-0.0241*	-0.0188	-0.0965***	-0.0886***
	(-1.795)	(-1.177)	(-8.569)	(-7.147)
LLR/NPL	-0.0009	-0.0007	-0.00004*	-0.00004
	(-0.689)	(-0.521)	(-1.726)	(-1.614)
NonINT/ TA	-0.1535***	-0.1163*	-0.00008	0.0466*
	(-2.953)	(-1.818)	(-0.004)	(1.879)
ROA	-0.0985**	-0.0890*	-0.0127	0.0213
	(-2.439)	(-1.757)	(-0.846)	(1.069)
$(Cre/GDP)_{t-1}$		0.0025		0.0093***
		(0.421)		(3.028)
M2 /FR		-0.0018		0.0009
		(-1.021)		(0.993)
$(STD/FR)_{t-1}$		-0.0115**		-0.0054***
		(-2.192)		(-3.163)
$\dot{GDP}$		-0.0807**		-0.0142
		(-2.862)		(-0.939)
Spread		0.1744		0.0399
		(1.491)		(1.172)
$\dot{EXCH}$		-0.0263**		-0.0106*
		(-2.371)		(-1.869)
No. of Obs.	617	603	613	599
Log Likelihood	-114.80	-95.11	-365.61	-337.55
LR	39.38		56.12	

Note: Values in the parentheses are the *t*-values; ***, ** and * represent the 1%, 5% and 10% level of significance.

LR: The likelihood ratio = -2 (Ln L_R – Ln L_U)

Table 10: Benchmark Model (II): Micro and Combined Models (Asset Quality: LLR/TA)

(A1) $Y_{ijt} = F\left(\beta_0 + \alpha_1 Micro_{ijt} + \varepsilon_{ijt}\right)$

(A2) $Y_{ijt} = F\left(\beta_0 + \beta_1 Micro_{ijt} + \beta_2 Macro_{ijt} + \varepsilon_{ijt}\right)$

	Y_{ijt} : Announced Failed Banks		Y_{ijt} : Economic Failed Banks	
	Micro	Micro + Macro	Micro	Micro + Macro
Constant	-1.2418***	-2.2813***	1.1193***	1.0295**
	(-12.132)	(-3.809)	(8.895)	(2.025)
Equity/TA	-0.0166**	-0.0167**	-0.1036***	-0.0975***
	(-2.784)	(-2.717)	(-10.050)	(-8.776)
LLR/TA	-0.0005	-0.0068	0.0088	0.0043
	(-0.125)	(-1.042)	(1.269)	(0.592)
NonINT/ TA	-0.0967***	-0.0792***	-0.0211	0.0196
	(-4.679)	(-3.588)	(-1.092)	(0.856)
ROA	-0.0695***	-0.0458**	-0.0121	0.0087
	(-3.912)	(-2.562)	(-0.780)	(0.475)
$(Cre/GDP)_{t-1}$		0.0152***		0.0031
		(3.562)		(1.179)
M2 /FR		-0.0014*		0.0004
		(-1.736)		(0.479)
$(STD/FR)_{t-1}$		0.0032**		-0.0069***
		(2.056)		(-4.502)
$\dot{GDP}$		-0.0073		-0.0234*
		(-0.509)		(-1.657)
Spread		-0.0290		0.0257
		(-0.737)		(0.851)
$\dot{EXCH}$		-0.0124**		-0.0093*
		(-2.593)		(-1.749)
No. of Obs.	1641	1496	871	829
Log Likelihood	-267.28	-229.38	-515.56	-471.98
LR	75.80		87.16	

Note: Values in the parentheses are the *t*-values; ***, ** and * represent the 1%, 5% and 10% level of significance.

LR: The likelihood ratio = -2 (Ln L_R – Ln L_U)

Table 11: Sensitivity Test (I): Before and After the Crisis (Asset Quality: LLR/NPL)

(B1) $Y_{ijt} = F(\beta_0 + \alpha_1 Micro_{ijt} D_{crisis} + \gamma_1 Micro_{ijt}(1 - D_{crisis}) + \varepsilon_{ijt}$,

(B2) $Y_{ijt} = F(\beta_0 + (\beta_1 Micro_{ijt} + \beta_2 Macro_{ijt}) D_{crisis} + (\theta_1 Micro_{ijt} + \theta_2 Macro_{ijt})(1 - D_{crisis}) + \varepsilon_{ijt})$

D_{crisis} = 0, if $1993 \leq$ Year ≤ 1996 (Pre-Crisis)

=1, if $1997 \leq$ Year ≤ 2000 (Post Crisis)

	Y_{ijt} : Announced Failed Banks		Y_{ijt} : Economic Failed Banks			
	Micro	Micro + Macro	Micro		Micro + Macro	
	After Banking Crisis	After Banking Crisis	Before Banking Crisis	After Banking Crisis	Before Banking Crisis	After Banking Crisis
Constant	-0.577**	1.084	0.9501		-0.0841	
	(-2.257)	(1.039)	(6.497)		(-0.163)	
Equity/TA	-0.0284**	-0.0185	-0.1065***	-0.0934***	-0.1198***	-0.0915***
	(-2.094)	(-1.161)	(-3.369)	(-8.017)	(-3.046)	(-6.595)
LLR/NPL	-0.0005	-0.0006	-0.00003	-0.00007	-0.00003	-0.00006
	(-0.441)	(-0.391)	(-1.361)	(-0.794)	(-1.099)	(-0.603)
NonINT/ TA	-0.155***	-0.127*	0.0910	-0.0069	0.0015	0.0354
	(-2.893)	(-1.918)	(1.198)	(-0.328)	(0.012)	(1.381)
ROA	-0.0847**	-0.0949*	-0.1608	-0.0127	-0.1483	0.0166
	(-2.071)	(-1.836)	(-1.089)	(-0.827)	(-0.923)	(0.878)
$(Cre/GDP)_{t-1}$		-0.0072			0.0123**	0.0134***
		(-0.965)			(2.665)	(3.876)
M2 /FR		--			-0.0015	--
					(-0.348)	
$(STD/FR)_{t-1}$		-0.0140**			-0.0099***	-0.0014
		(-2.601)			(-3.544)	(-0.817)
• GDP		-0.0255			0.0548	0.0095
		(-1.037)			(0.387)	(0.615)
Spread		0.0139			0.4718**	-0.0028
		(0.116)			(2.572)	(-0.075)
• EXCH		-0.0170**			-0.0582	0.0004
		(-2.004)			(-1.344)	(0.099)
No. of Obs.	617	603	613		599	
Log Likelihood	-104.70	-86.09	-363.35		-320.05	
LR	37.22		86.60			

Values in the parentheses are the *t*-values; ***, ** and * represent the 1%, 5% and 10% level of significance.

LR: The likelihood ratio = -2 (Ln L_R – Ln L_U)

Table 12: Sensitivity Test (II): Ownership--State and Private (Asset Quality: LLR/NPL)

(C1) $Y_{ijt} = F(\beta_0 + \alpha_1 Micro_{ijt} D_P + \gamma_1 Micro_{ijt}(1 - D_P) + \varepsilon_{ijt})$

(C2) $Y_{ijt} = F(\beta_0 + (\beta_1 Micro_{ijt} + \beta_2 Macro_{ijt}) D_P + (\theta_1 Micro_{ijt} + \theta_2 Macro_{ijt})(1 - D_P) + \varepsilon_{ijt})$

D_P =1， if private-owned bank
= 0， if state-owned bank

	Y_{ijt} : Announced Failed Banks				Y_{ijt} : Economic Failed Banks			
	Micro		Micro + Macro		Micro		Micro + Macro	
	State	Private	State	Private	State	Private	State	Private
Constant	-0.8386***		-1.4424		0.9217***		0.2968	
	(-3.194)		(-1.136)		(6.190)		(0.681)	
Equity/TA	-0.0903	-0.0189	-0.1286	-0.0093	-0.0527	-0.0992***	-0.1197	-0.0953***
	(-1.592)	(-1.375)	(-1.624)	(-0.541)	(-1.446)	(-8.252)	(-1.316)	(-7.037)
LLR/NPL	0.0105	-0.0007	0.0219	-0.0008	0.0029	-0.00004*	0.0244	-0.00004
	(0.889)	(-0.577)	(0.894)	(-0.525)	(0.257)	(-1.741)	(0.513)	(-1.607)
NonINT/ TA	0.0512	-0.1715***	0.0350	-0.1489*	-0.2107**	0.0083	-0.0955	0.0700**
	(0.343)	(-2.999)	(0.207)	(-1.856)	(-1.973)	(0.351)	(-0.637)	(2.427)
ROA	0.1330	-0.1138**	0.1668	-0.1256**	-0.2608**	-0.0074	-0.0422	0.0285
	(0.829)	(-2.628)	(0.912)	(-2.034)	(-2.119)	(-0.474)	(-0.204)	(1.334)
$(Cre/GDP)_{t-1}$			-0.0133	0.0160			0.0864	0.0071**
			(-0.749)	(1.237)			(1.484)	(2.449)
M2 /FR			0.0064	--			-0.0217	--
			(0.708)				(-0.988)	
$(STD/FR)_{t-1}$			-0.0111	-0.0210**			0.0105	-0.0052***
			(-1.145)	(-2.812)			(0.668)	(-3.398)
$\bullet$ GDP			-0.1796*	-0.0685**			0.1839	-0.0239*
			(-1.818)	(-2.438)			(1.286)	(-1.886)
Spread			0.1988	-0.0379			-0.5319	0.0775**
			(0.903)	(-0.178)			(-1.530)	(2.342)
$\bullet$ EXCH			-0.0248	-0.0499***			-0.0167	-0.0086**
			(-1.387)	(-4.177)			(-0.762)	(-2.126)
No. of Obs	617		603		613		599	
Log Likelihood	-110.89		-86.23		-362.84		-326.72	
LR	49.32				72.24			

Note: Values in the parentheses are the *t*-values; ***, ** and * represent the 1%, 5% and 10% level of significance.

LR: The likelihood ratio = -2 (Ln L_R – Ln L_U)

Table 13: Sensitivity Test (III): Ownership--Family and Non-Family (Asset Quality: LLR/NPL)

(D1) $Y_{ijt} = F(\beta_0 + \alpha_1 Micro_{ijt} D_F + \gamma_1 Micro_{ijt}(1 - D_F) + \varepsilon_{ijt})$

(D2) $Y_{ijt} = F(\beta_0 + (\beta_1 Micro_{ijt} + \beta_2 Macro_{ijt}) D_F + (\theta_1 Micro_{ijt} + \theta_2 Macro_{ijt})(1 - D_F) + \varepsilon_{ijt})$

D_F = 1, if family-owned bank
= 0， if non family-owned bank

	Y_{ijt} : Announced Failed Banks		Y_{ijt} : Economic Failed Banks			
	Micro	Micro + Macro	Micro		Micro + Macro	
	Non Family	Non Family	Non Family	Family	Non Family	Family
Constant	-0.799***	-7.7051***	0.9214***		-2.4578	
	(-3.294)	(-9.412)	(6.326)		(-0.301)	
Equity/TA	-0.0235*	-0.0200	-0.0955***	-0.1297	-0.0876***	-0.2053
	(-1.773)	(-1.238)	(-8.331)	(-1.099)	(-6.912)	(-0.959)
LLR/NPL	-0.0009	-0.0009	-0.00004*	0.0258**	-0.00004*	0.0324**
	(-0.698)	(-0.555)	(-1.734)	(2.546)	(-1.675)	(2.153)
NonINT/ TA	-0.142***	-0.1132*	0.0002	-0.3810	0.04470*	-0.3715
	(-2.754)	(-1.759)	(0.012)	(-1.254)	(1.788)	(-0.748)
ROA	-0.0905**	-0.0842*	-0.0133	0.0979	0.0207	-0.1620
	(-2.253)	(-1.668)	(-0.883)	(0.246)	(1.043)	(-0.199)
$(Cre/GDP)_{t-1}$		0.0033			0.0103***	-0.0141
		(0.554)			(3.447)	(-0.357)
M2 /FR		--			0.0080	--
					(0.309)	
$(STD/FR)_{t-1}$		-0.0143***			-0.0042**	0.0215
		(-2.847)			(-2.770)	(0.558)
• GDP		-0.0652***			-0.0209*	0.0769
		(-2.888)			(-1.692)	(0.122)
Spread		0.1742			0.0434	0.4450
		(1.459)			(1.373)	(0.984)
• EXCH		-0.0349***			-0.0073*	0.0445
		(-4.269)			(-1.906)	(0.550)
No. of Obs.	617	603	613		599	
Log Likelihood	-113.56	-94.96	-357.25		-323.21	
LR		37.20		68.08		

Values in the parentheses are the *t*-values; ***, ** and * represent the 1%, 5% and 10% level of significance.

LR: The likelihood ratio = -2 (Ln L_R – Ln L_U)

Appendix: Sources and Definitions of Variables

Micro Variables	Definition	Source
Equity/TA	100* (Equity / Total Assets)	*BankScope*
LLR/NPL	100* (Loan Loss Reserves / Non-Performing Loans)	*BankScope*
LLR/TA	100* (Loan Loss Reserves / Total Assets)	*BankScope*
NPL/TA	100* (Non-Performing Loans / Total Assets)	*BankScope*
NonINT/TA	100* (Non Interest Expenditures/ Total Assets)	*BankScope*
ROA	100* (Net Income / Average Total Assets)	*BankScope*
Macro Variables		
$(Cre/GDP)_{t-1}$	Credit Claim to private sector / GDP;	(IFS Line 32d/ Line 99b)
M2/FR	(Quasi-Money+Money) / Foreign reserve;	(IFS Line (34+35)/Line 1L.d)(with exchange transformation)
STD/FR	Short-Term External Debt / Foreign Reserve;	Short-term debt is retrieved from the external indebtedness joint released by IMF-World Bank-BIS-OECD. Foreign reserve is from IFS Line 1L.d
$\dot{GDP}$	Real GDP Growth based on the official report of each country.	IFS
Spread	Spread = Lending Rate – Deposit Rate;	(IFS Line 60P- Line 60L)
$\dot{EXCH}$	Change of Foreign Exchange = $100*(1/EXCH_t - 1/EXCH_{t-1})/1/EXCH_{t-1}$	IFS