CAPITAL ADEQUACY STANDARDS: ARE THEY SUFFICIENT?

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Abstract

During the last two decades many countries have liberalised their financial markets. They have attempted to eliminate government intervention in setting interest rate ceilings, erecting entry barriers, interfering in credit allocation decisions, and have begun to privatise their financial institutions (FIs). However, recent banking crises have indicated a link between liberalisation and financial fragility and the subsequent trade-off between the benefits of liberalisation and the costs of increasing financial fragility in developing markets. Recent experiences in Asia have highlighted the importance of the soundness of domestic financial systems especially the need for a prudential regulatory, supervisory, and accounting framework before undertaking financial sector liberalisation. The object of the paper is to provide a link between the relative level of an individual bank's adequacy and its effects on the fragility of the banking system. Specifically, the probability of a banking crisis is modelled using the characteristics of individual banks – namely, their capital adequacy ratios. The paper concentrates on the importance of distinguishing between cosmetic and effective changes to capital adequacy ratios to avoid the systemic threats which can grow out of microeconomic weaknesses in domestic banking systems as witnessed in Asia.

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1. Introduction

During the last two decades many countries have liberalised their financial markets. They have attempted to eliminate government intervention in setting interest rate ceilings, erecting entry barriers, interfering in credit allocation decisions, and have begun to privatise their financial institutions (FIs). Numerous countries went as far as developing their own stock markets as well as encouraging foreign institutions to intermediate in the accumulation of local capital. Much of this general trend towards financial liberalisation was advocated by the earlier work of McKinnon and Shaw who suggested that developing countries could stimulate domestic savings and growth and reduce their dependence on foreign capital flows through financial liberalisation (McKinnon, 1973, and Shaw, 1973). However, recent banking crises have indicated a link between liberalisation and financial fragility, and the subsequent trade-off between the benefits of liberalisation and the costs of increasing financial fragility in developing markets. These costs have been drastic enough to force some to question the benefits of moving away from a financially repressed system before an economy's market institutions are ready to do so. Recent experiences in Asia have further highlighted the importance of the soundness of domestic financial systems, especially the need for a prudential regulatory, supervisory, and accounting framework before undertaking financial sector liberalisation. Moreover, the speed at which the recent Asian crisis spread attracted even greater attention to the systemic nature of the aforementioned costs inherent in present day markets. Consequently, the efficacy of standardised regulations which extend beyond national boundaries has been questioned, given that countries risk attracting systemic threats even during crises in other parts of the world. This paper examines the responses of banks to one such universal standard, i.e., capital adequacy, and its effects on the probability of crises which occurred in Thailand, Indonesia, and Korea.

During financial liberalisation, banks encounter greater competition and expose themselves to greater risks. The timely implementation of prudential supervision becomes essential to maintain the systemic health of the financial industry, including the sound management of individual FIs. Prudential policies can limit the risk exposure of the financial industry by ensuring that individual institutions are managed properly. Controlling credit risk through the implementation of a minimum capital adequacy standard has been a key prudential supervisory measure. In this light, many countries have started or already adopted the capital adequacy standards set by the Basle Committee of the Bank for International Settlements (BIS) in 1988 to strengthen domestic regulation. An analysis of whether banks have responded to risk-based capital adequacy requirements through cosmetic adjustments rather than effective changes is crucial to determining future supervisory policies. If banks are able to rely heavily on cosmetic responses to capital requirements, the efficacy of the BIS guidelines is limited, especially in some developing countries where macroeconomic conditions can be especially volatile in the absence of prudential accounting standards.

The object of the paper is to provide a link between the relative level of an individual bank's adequacy and its effects on the fragility of the banking system. Specifically, the probability of a banking crisis is modelled using the characteristics of individual banks – namely, their capital adequacy ratios. Banks are first separated based on these characteristics, and then tested categorically against various macroeconomic, institutional, and financial factors. Although there has been much evidence on the link between financial development and economic growth, the connection between financial liberalisation and financial fragility at a microeconomic level has been rare. This paper not only attempts to fill this gap, but it also highlights the importance of microprudential regulations during the financial liberalisation process. It is hypothesised that after liberalisation, banks are pressured due to greater competition within the financial sector from home and abroad. As a result, capital adequacy regulations need to be improved to preclude over-exposure to different types of risk,

and to reduce the probability of a system-wide crisis. Although in many cases these improvements might imply more stringent quantitative standards, greater attention must be paid to the quality of capital banks hold in their portfolios. While it is generally agreed that there were some obvious regulatory failures during the Asian crisis, this paper examines the precise nature of the possible sources of failure in the capital adequacy requirement including its lack of transparency, ineffective accounting standards, and a weak institutional framework. The next section will include a closer examination of the link between financial liberalisation and financial fragility and a review of capital adequacy regulation. In the succeeding sections, the methodology and the actual model will be tested. The final sections will discuss the importance of distinguishing between cosmetic and effective changes to capital adequacy ratios, to avoid the systemic threats which can grow out of microeconomic weaknesses in domestic banking systems as witnessed in Asia.

2. Background

2.1. Financial liberalisation

The positive effects of financial liberalisation on capital accumulation advocated by McKinnon and Shaw, as well as the increase in future growth rates suggested by King and Levine, have been overshadowed by recent increases in financial fragility (McKinnon, 1973 and Shaw, 1973; King and Levine, 1993). Banking sectors in many parts of the world have suffered from numerous problems, many of which turned into systemic crises as indicated in recent studies (Lindren, Garcia, and Saal, 1996). In many of these countries banking sector problems became prevalent immediately after financial sector deregulation. These episodes further suggest that the benefits of financial liberalisation need to be weighed against the costs of increased financial fragility. In fact, a basic lesson emerging from some of these crises suggests that some degree of financial regulation might be preferred to premature liberalisation in developing countries (Stiglitz, 1994).

In financially repressed systems, bank interest rates are subjected to interest rate ceilings which disallow banks from charging high interest rates for riskier projects, making loans to these borrowers less profitable. After financial liberalisation, banks are able to finance these riskier projects for higher returns. Financial systems exist to facilitate the allocation of resources in an uncertain and imperfect informational environment between savers and investors. Financial systems not only collect and process the necessary information but also try to reduce overall risks in lending by diversifying their portfolios. Although these actions increase the productivity of deposits, greater competition also increases the vulnerability of the financial system to a systemic crisis. In many countries, the pursuit of accelerated liberalisation policies for greater efficiency in financial markets further emphasises the need for certain regulatory standards. These standards need to balance the productive benefits of increased liberalisation within the financial sector with the increased probability of a banking crisis. Prudential regulation aims to protect the stability of the financial system as well as all depositors. Although prudential macroeconomic regulation is often acknowledged as essential for systemic stability, it is the microeconomic regulatory standards which many liberalisation programmes have increasingly dismantled in some countries (Long and Vittas, 1992). For example, many countries began to remove controls on international capital flows as part of their liberalisation programmes. At a macroeconomic level, this allowance opened the way for local financial intermediaries to gain access to a greater volume of funds which were often required by local borrowers. However, it also exposed them to foreign exchange risk which prudential foreign currency exposure limits tried to curtail. Unfortunately, these limits were circumvented by local banks which continued to lend, except now they would do so in foreign currency to unhedged domestic borrowers. In this way, they would meet the foreign currency exposure limit by transferring their foreign exchange risk to credit risk. Consequently, it was no surprise that currency crises almost always preceded or accompanied banking crises (Kaminsky and Reinhart, 1996).

Financial liberalisation provided banks greater freedom and the opportunity to increase their exposure to risk. Although such measures might increase the productivity of funds, it can lead to a point where the level of risk might be greater than what is socially optimal. This condition is further complicated in the presence of perverse incentives, including moral hazard by state-backed insurance schemes. Effective prudential regulation and supervision needs to control such behaviour and realign appropriate incentives at both the macroeconomic and microeconomic level. Given that the probability of a systemic banking crisis might be greater in financially liberalised systems, the paper will examine whether there is a link between an individual bank's behaviour and the fragility of the banking system.

2.2. Post-liberalisation banking behaviour

The change in the post-liberalisation behaviour of banks usually increases banking risks and affects banking soundness, especially in the absence of a proper supervisory framework. Banking systems in many countries have experienced significant problems following liberalisation, with large capital inflows in the absence of adequate internal controls and prudential oversight to contain the increased risk of new and expanded activities.[1] The recent experience of many banks in East Asia proved the importance of having these regulatory measures in place prior to liberalisation, or risk systemic failure in the banking sector which could spread into an economy wide crisis.

In the 1990s, East Asian countries pursued a variety of liberalisation policies within the financial sector, including the removal of many barriers to entry, increasing the scope of bank activities, allowing foreign banking, and loosening foreign exchange controls. Thailand introduced the Bangkok International Banking Facility which attracted foreign borrowers through preferred interest rates. These lower rates not only increased competition amongst Thai banks and FIs, but it also squeezed the profit margins of other domestic banks, forcing them to enter into riskier activities. Indonesian liberalisation allowed the number of banks to increase from 64 in 1987 to almost

239 in 1997 (IMF, 1998). Korean policy allowed finance companies to become merchant banks so that they could begin lending and borrowing in foreign currency in which they had little experience. The number of Korean banks increased from 6 in 1993 to 30 in 1996 (Jae-Kwon, 1998). With an increase in the number of banks and FIs, there was a subsequent expansion in lending to the private sector at an ever increasing rate (Table 1). During 1990-1997, bank lending in real terms grew at 18% in Indonesia and Thailand and 12% in Korea (BIS, 1998).

This sudden and rapid growth in bank lending in itself implies that borrowers with even marginally viable projects were granted credit. Moreover, it stretched the capacities of banks to appraise and monitor borrowers, causing their portfolios to decline in asset quality. Other factors specific to Asian banks included a build-up of non-performing loans to industries targeted and supported by government policy. Further government intervention in the internal management of banks implied less regard for the interests of bank depositors than for prescribed government lending policies to specific sectors even if they were non-profitable. e.g., the average profit margins of *Chaebols* fell to negligible level in the mid 1990s and some even went bankrupt; government pressure forced banks to extend preferential loans to small and medium scale businesses in Indonesia, agricultural and rural industries in Thailand, and the Bumiputera community in Malaysia (Miller and Luangaram, 1998, Rahman, 1998). Furthermore, when these governance problems within the banks' corporate management were eventually known to depositors, the belief that financial institutions were protected by the government raised moral hazard issues. Consequently, market discipline failed to exert effective control since depositors had little incentive to monitor the management of financial institutions. Therefore, it is now accepted that the timely implementation of prudential policies is essential to avoid further economic instability during the financial liberalisation process. Among such policies, some involve better risk management measures at the microeconomic level, including those which monitor

foreign exchange exposure, restrict insider trading, and limit credit and exchange rate risk.

2.3. Capital adequacy

An important measure to control credit risk in recent years has been the widespread implementation of minimum capital adequacy standards. In 1988, the Basle Committee of the BIS agreed to require banks actively engaged in international transactions to hold capital equal to at least 8 percent of risk-weighted assets, trying to prevent banks from increasing credit risk through greater leverage. However, supervisors complained that the credit risk component of the 1988 Basle Capital Accord was too narrow to deal with the market, liquidity, and the operational risks which increased with the growth of banks' trading and derivative books. The original intention of the Basle Accord had been to prevent a slide in international capital ratios resulting from aggressive competition for market share by the leading banks during the mid 1980s. The Accord also hoped toharmonise the different levels and approaches to capital among the G-10 countries. Since its inception, the introduction of a risk-based structure for calculating capital ratios, which assigns different capital weights to fewer asset classes (both on and off-balance sheet), has been one of the Committee's greatest contributions. Their method not only marked a significant improvement from the previously used gearing ratio method used by national regulators, but it also created less incentive for off-balance sheet activities. Moreover, the Accord was designed with the intention of updating it with periodic amendments. In 1996, an amendment introduced capital requirements in respect of market risk and allowed banks to use VaR (Value at risk) and other models.

In drawing up capital standards, ratios are calculated on a consolidated basis. Capital includes both core capital (tier 1) and supplementary capital (tier 2); assets are weighted item by item to reflect credit risk. Off-balance sheet engagements are also included in risk-weighted assets after conversion using credit conversion factors.

Supplementary capital can be made up of revaluation reserves, gains on securities valuation, and general provisions for loan losses within the limits set in the Basle framework and subordinated term debts. Gains on securities valuation may be included up to a maximum of 45 percent, and general provisions for loan losses are limited to a maximum of 1.25 percent of risk-weighted assets. Total supplementary capital may not exceed total core capital. Risk weightings are largely determined by the asset transaction counterpart, i.e., 0 percent for government and central banks; 10 percent for domestic public sector institutions; and 20 percent for banks. A 50 percent weight is assigned to loans secured by mortgage on residential property and 100 percent for other claims. The Accord allows national supervisory authorities a certain degree of freedom from fixing the extent of supplementary capital, setting the magnitude for risk weights for assets, and dealing with other issues of risk assessment. In 1993, for instance, the European Union introduced the Capital Adequacy Directive (CAD) in conjunction with the BIS for market risk calculation; CAD II will add both internal risk management models and commodities risk. The latest version introduced by the Basle Committee incorporates market risk in response to the increased volatility of the exchange rate and interest rates as restrictions on capital flows are removed. The Basle Committee permits two measures of market risk: a standardised method proposed by the Committee, and banks' own internal risk management models.

Most countries have incorporated the Basle standards into their regulatory framework if at least to strengthen the soundness of their commercial banks, to raise their credit rating in international financial markets, and to achieve a universally recognised international standard. These countries understood that convergence with the Basle Accord was necessary to ensure capital adequacy as well as to stand on an equal footing with international banks in global financial markets. These standards were applied to commercial banks, including local and foreign bank branches. Local banks were included since further liberalisation meant that they were expected to become

more active in international business. The Basle Committee continues to update its rules by recognising other weaknesses, especially in the original credit risk approach which could distort incentives in bank risk taking, e.g., the securitisation of wholesale credit. It has also recognised the increasing competition in the financial services industry from banks, finance companies, and insurance agencies. This has meant that capital requirements need to go beyond the G-10 banks to include emerging markets in developing countries. The Accord's original methodology has occasionally proved inadequate for some of these markets, and the 8 percent minimum capital ratio has been criticised as being too low for their economic conditions. The Basle Committee continues to re-emphasise that the 8 percent should only be regarded as a minimum and should not be regarded as sufficient for all markets. The Basle Committee faces difficult challenges in the future. As regulators, they have recognised the possible distorted incentives of some of their original mandates, the increased competition in the financial services industry, and the notable effects of market risk on bank portfolios. In finding solutions, they not only have to address each of the former issues, but they need to account for the differences amongst their potential clients. Clearly a need exists for a risk assessment framework which is not only simple to apply but easily adaptable to different macroeconomic, institutional, and financial conditions.

3. Causes of Banking Sector Crises

There are several mechanisms which the literature cites as the causes of banking sector problems. Banks are financial intermediaries whose main liabilities are short term deposits, and whose assets are a mixture of both short and longer term loans. When the value of these assets falls short of the value of the liabilities, a bank becomes insolvent. The value of bank assets is reduced when borrowers are unable to service their debt. Banks attempt to reduce some of this credit risk through diversification, more efficient screening processes, and the use of collateral. However, there are costs involved with each of these, and there is therefore a limit to the amount of risk a bank can

reduce through such means. Banks further complement their diversification efforts by holding a certain level of equity and compulsory reserves to protect themselves against the aforementioned risk. Economic shocks which negatively affect the economic well-being of bank borrowers and whose effects cannot be off-set through any of the previous risk-reducing measures produce systemic threats to banks and the banking sector at large. Extant theory suggests that banking systems which are less capitalised are more vulnerable to these shocks., i.e., decline in asset prices, cyclical downturns, terms of trade deteriorations (Kaminsky and Reinhart, 1996, Gorton, 1988). One of the goals of this paper is to test whether this was the case for the three countries under consideration that is, whether banks with relatively higher capital reserves reacted more effectively than their lower reserve capital counterparts to changes in macroeconomic, financial, and institutional conditions.

3.1. Financial factors

Financial liberalisation can lead to high short-term interest rates as interest rate control measures are removed (Pill and Pradhan, 1995). Similarly, contractionary monetary policy, fiscal tightening, or even a general increase in international interest rates can raise short-term interest rates. Most banking crises in the U.S. were preceded by an increase in short term interest rates (Mishkin, 1996). Although bank balance sheets certainly deteriorate with an increase in the number of non-performing loans, their value can also subside when the rate of return they receive on assets is less than the corresponding rate they pay on liabilities. When short-term rates increase, banks need to pay their higher interest rates on their liabilities, i.e., to their depositors. Moreover, since bank assets mainly consist of loans of longer maturity at fixed interest rates, they do not necessarily receive the corresponding higher rates of return. The time needed for banks to re-adjust the assets in their portfolio can cause some delay and cut into bank profitability, even leading to possible losses. These losses are further compounded when there is an increase in real interest rates. Some borrowers are not able to sustain the new rates, and are to some

extent forced to surrender their loans further damaging the asset side of the balance sheet. Banks anticipate limited exposure to interest rate risk since the business of financial intermediation in itself typically involves products with different maturities. However, a sudden increase beyond rational expectations can cause severe damage to bank balance sheets and seriously threaten the whole banking system.

Financial liberalisation has also been known to cause an illiquidity crisis in domestic banks. Chang and Velasco have found that such illiquidity is almost always rooted in a previous bout of financial liberalisation measures which accentuate the maturity mismatch between international assets and foreign liabilities (Chang and Velasco, 1998). In addition, capital flows from abroad caused by an opening of the capital account and/or falls in world interest rates magnify the problem by making available large amounts of resources which can be intermediated by domestic banks. These problems are only worsened when these foreign loans are short in maturity as they were in the latter stages of the Asian crisis. Any increase in the number of these foreign loans only exacerbates the vulnerability of domestic banks so that a creditor's panic, that is a creditor's refusal to roll over these short term loans, can turn into a self-fulfilling bank run. In countries with fixed exchange rates, such banking problems may arise by speculative attacks against the currency. If a devaluation is expected, depositors suddenly withdraw their domestic currency deposits and convert them into foreign currency deposits abroad, leaving domestic banks illiquid.

3.2. Macroeconomic factors

Previous research has demonstrated that a weak macroeconomic environment is often associated with emerging banking crises (Gorton, 1988). Low GDP growth, high inflation, depreciation of the exchange rate, and high interest rates have been known to significantly increase the probability of systemic problems within the banking sector. Although these macroeconomic conditions play an important role, structural characteristics of the economy are also

significant. These characteristics are especially meaningful since all of the countries being considered had only recently undertaken financial liberalisation programmes. Under these conditions, the vulnerability of the system to sudden capital outflows is an important indicator of financial sector fragility (Calvo, 1994). The high real interest rates is a good proxy to examine the extent to which financial liberalisation has progressed in certain countries (Galbis, 1993). Banking sector problems may be the result of a country's success in balancing other aspects of the economy, e.g., taming high levels of chronic inflation. An inflationary environment has been known to foster an overblown financial sector, since banks are able to profit from the different spreads and float on payments. When countries are able to control these levels, bank revenues subside causing serious problems within the entire sector (English, 1996).

The effect of macroeconomic instability on bank balance sheets is also a major source of systemic risk to the banking sector.An increase in the number of non-performing loans is devastating and can be precipitated by a number of factors, including an increase in short term interest rates, an increase in real interest rates, and a sudden devaluation in the presence of a mismatch in foreign currency borrowing (liabilities) and local currency lending (assets). An unforeseen domestic currency depreciation reduces the value of the loans owed to banks, threatening their profitability. Some countries have tried to limit banks' level of exposure to such foreign exchange risk, but many banks circumvent the regulations by lending directly in foreign currency. Although such transfer of foreign exchange risk to the borrower might postpone the inevitable losses, the currency depreciation still threatens the banks' balance sheets when borrowers are unable to repay, thus increasing their non-performing loans.

3.3. Institutional factors

A key characteristic of financial liberalisation programmes is to reduce government intervention in lending and borrowing activities. Although tight control has often meant that many potentially

productive loans were deemed too risky by the authorities and thus ignored, there were some advantages, e.g., fewer moral hazard problems. Given the heavy influence of government interventions in bank operations, it was almost assumed that the government would support and insure bank deposits. However, after financial liberalisation, if deposits are not insured, the slightest deterioration in the quality of a bank's assets might trigger a panic as depositors begin to withdraw before the bank declares bankruptcy. Such panic runs create illiquidity and accelerate the onset of bank insolvency. In a situation of incomplete information, it is not long before depositors at other banks suspect similar risks and begin their withdrawal, leading to a systemic panic. Therefore, deposit insurance plays an important role to allay such fears and prevent contagion among the banking sector.

There is a common belief that as soon as private banks are released from tight government control, they pursue unnecessarily risky projects *ex ante* with the knowledge that insurance schemes will prevent them from failing; furthermore, in the case of failure, it is assumed that the insurance agent will compensate depositors for their losses. However, in most cases, liberalisation implies that banks purchase their own insurance policies with the government acting as an implicit guarantor. If the insurance premia paid by the banks do not fully reflect the level of risk banks undertake in their portfolios, moral hazard problems arise. In some ways the government creates serious incentives for taking on excessive risk and even subsidises such behaviour through implicit guarantees. Consequently, a well-designed and effective system of prudential regulation and supervision must accompany financial liberalisation. Otherwise, banks partake in excessive risks and banking crises occur as a result of the moral hazard problem.

4. Research Methodology and Data

4.1. Choice of variables

The choice of macroeconomic, financial, and institutional explanatory variables was based on the theory underlying previous explanations as well as data availability. For the financial effects the ratio of M2 to foreign exchange reserves, the ratio of bank cash and reserves to bank assets, and lagged variations of credit to GDP ratios. The M2/FOREX variable tests the sensitivity of the probability of banking crises to sudden capital outflows caused by sudden exchange rate variations. This ratio is known as a good predictor of a country's vulnerability to balance of payment crises (Calvo, 1996). The CASH/ASSETS variable is a liquidity measure and the $CRED_{t-n}$ variable measures the extent to which financial liberalisation has progressed in each country. From the previous explanation, it would seem that under a liberalised environment growth in credit to the private sector might be financing excessively risky loans.[2] For macroeconomic effects, the rate of growth of real GDP (GRO), the real interest rate (RINT), the rate of inflation (INF), and the rate of change of the exchange rate (DEP) are included, for reasons mentioned before. Although each of these macroeconomic variables indicates the extent of the liberalisation process, this analysis concentrates on their effects on bank balance sheets. Finally, the institutional effects are measured by using a dummy variable to indicate the existence of a deposit insurance scheme (INS). Furthermore, to examine the extent to which prudential supervisory measures exist within appropriate regulatory institutions in each country, GDP per capita is used as a control variable. It has been suggested that higher GDP per capita ratios indicate more effective governance and fewer moral hazard problems. Again, rather than simply considering the individual effects of each of the variables by themselves, the focus of this analysis is to examine whether there are different reactions of high and low capital adequacy banks within varying financial, macroeconomic, and institutional environments during the crisis.

The banking crisis dependent dummy variable was constructed by using definitions suggested in several studies (Caprio and Klingebiel, 1996; Kaminsky and Reinhart, 1996; Demirguc-Kunt and Detragiache, 1997). These studies played an important role in differentiating between periods of financial distress and those which could be classified as crises. It was important to distinguish between different episodes of banking sector fragility in each of the countries to properly account for the behavior of the individual banks during a crisis.[3] Using these guidelines, several banks in each of the countries suffered from severe crises in 1997. Korea, Thailand, and Indonesia witnessed a substantial deterioration in the quality of their bank portfolio. Estimates of non-performing bank loans were around 30-35% of outstanding loans in Indonesia and between 25-30% in Korea and Thailand (World Bank, 1999). The Indonesian authorities initially closed down 16 banks in 1997 and a further 10 in 1998 after the establishment of the Indonesian Bank Restructuring Agency. Korea was forced to close 16 out of 30 merchant banks and to support the operations of others through large capital injections and voluntary agreements for recapitalisation. Thailand closed 56 finance companies in 1997 and sustained the survival of others by converting central bank loans into equity.

4.2. Statistical model

In this study, the logit regression technique will be used to analyse the choice probabilities. Lo (1987) has already indicated the advantages in applying this type of model to multiple discriminant analysis. The logit model has the form:

$$P_i = \cfrac{1}{\left(1 + \cfrac{1}{e^{(B_0 + B_1 x_{i1} + B_2 x_{i2} + \ldots\ldots B_n x_{in})}}\right)}$$

P_i = probability of banking crisis in the ith country

X_{ij} = jth variable of the ith country

$$\text{Odds Ratio} = \frac{P_i}{1 - P_i} = e^{(B_0 + B_1 x_{i1})} = e^{B_0}(e^{B_1})^{x_{i1}}$$

The logit model is a non linear model. Estimation of β can be carried out by the method of non-linear maximum likelihood methods. This model will be used because it possesses a number of advantages over the linear regression model. First, it is well known that the linear regression model, if applied to a dichotomous dependent variable, will suffer from heteroscedasticity whereas the logit model will not. Second, extrapolation of the linear function would yield probabilities outside the (0,1) range. However, the logistic curve is bounded by the values 0 and 1. Third, the logit model is consistent with random utility maximisation as shown by Mcfadden (1973). On both statistical and theoretical grounds, the logit model is preferred here. Another feature of the logit model is the *odds ratio* which is a ratio of the probability of the event occurring, i.e., banking crisis, to the probability that it will not occur. This exponential relationship provides an interpretation for β: the odds increase multiplicatively by e^{β} for every single unit increase in x. To summarise, the coefficients give the change in the log of the odds ratio of a banking crisis per unit increase in the respective macroeconomic, institutional, and financial variables. Taking the antilog of this coefficient provides the percentage change in the odds per unit increase. However, to calculate the probability of a banking crisis itself per unit change in any single variable, the following equation is used:[4]

$$\frac{\partial P_i}{\partial x_i} = B_i P_i (1 - P_i)$$

Greater use of the odds ratio will be made later as it will help to show the marginal increases in the probability of bankruptcy as the different variables increase and decrease.

4.3. Data

The banks included in this sample are from Thailand, Korea, and Indonesia. The period under examination is 1996-97 and data sources included the *International Financial Statistics*, BIS Annual Reports, and various central banks reports. These included 18 Indonesian

banks from, 30 Korean banks, and 75 banks and finance companies from Thailand. As a general rule for the following analysis, there needs to be some system which can distinguish between banks in terms of quality. Both capital adequacy ratios and the ratio of non-performing loans to total loans have been used to reflect the portfolio quality; this study will rely primarily on capital adequacy. Relatively higher quality portfolios were defined as those with greater than mean capital adequacy ratios in each country. Table 2 shows the average capital adequacy (CA) ratio for all banks used in each country sample, as well as the distribution of these banks based on their CA ratios. Employing this division shows whether or not banks with low capital adequacy (Low CA) and high capital adequacy ratios (High CA) were susceptible to their expected weaknesses. 35%, 48%, and 67% of the banks were classified as Low CA in Thailand, Korea, and Indonesia respectively. The hypothesis for the present model implies that banks with higher capital adequacy ratios are less prone to negative macroeconomic, financial, and institutional shocks. Their lower ratio counterparts should be more likely to suffer from the negative effects of these variables, thus contributing to the faster rate at which these banks reach a crisis level.

It is also important for comparative purposes to account for country fixed effects so as not to overestimate or underestimate the magnitude of certain sovereign characteristics, since each country's banking sector has unique attributes. Furthermore, such effects are often included to allow for the possibility that the dependent variable may change cross-country independently of the explanatory variables included in the logistic regression. However, in logit estimations including country fixed effects would require the exclusion of any banks which did not suffer a crisis. In this particular sample, this would imply omitting a considerable amount of already limited information and to avoid such sample biases, the entire sample is examined albeit without fixed effects.

5. Results

The final model included nine variables as described earlier: rate of GDP growth (GRO), the real interest rate (RINT), the rate of inflation (INF), the rate of change of the exchange rate (DEP), the ratio of M2 to foreign exchange reserves (M2/FOREX), the ratio of bank cash and reserves to bank assets (CASH/ASSETS), lagged variations of credit to GDP ratios ($CRED_{t-n}$), a dummy variable to indicate the existence of a deposit insurance scheme (INS), and GDP per capita as a control variable (GDP/CAP). The coefficients and *t*-statistics are shown in Table 3. Tables 4, 5, and 6 then show the results of the specific countries under consideration. Banks which suffered a banking crisis were assigned a 1, and others were assigned a 0. Therefore, a negative coefficient suggested that an increase in any of the variables would reduce the probability of a crisis, whereas a positive coefficient suggested that there was a direct relationship between the probability of a banking crisis and an increase in the variable.

Table 3 shows results of the entire sample from all the countries as divided into three main categories: All, High Capital Adequacy (CA), and Low CA. In each of the three cases the probability of a banking crisis decreased with an increase in GDP growth, confirming the positive effects of the economy for avoiding systemic crises. The other significant macroeconomic variables include the real interest rate and inflation (RINT, INF), also confirming the negative effects of increases in nominal and real interest rates on both the quality of bank portfolios as well as the sector as a whole. In further examining the differences between high CA and low CA banks, there are some unexpected results within the macroeconomic variables. The positive effects of higher GDP growth in preventing a crisis is greater for low CA banks than their high CA counterparts by almost 6.3 percentage points, i.e., (22.6% - 16.3%). Similarly, the negative effects of inflation are greater on high CA banks than low CA banks by 1.2 percentage points. The earlier hypothesis had not only suggested that high CA banks ought to be more resistant to negative macroeconomic shocks but that they should also gain more from improvements in

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macroeconomic conditions than their low CA counterparts; in fact, these results suggest quite the opposite.

As predicted for the financial variables, external vulnerability measured by the M2/FOREX ratio significantly increases the probability of a crisis in all three categories, suggesting the high sensitivity of this probability to sudden capital outflows. Similarly, growth in credit ($CRED_{(t-2)}$) which proxies for the degree of financial liberalisation in each economy significantly increases the likelihood of a crisis, suggesting that a boom in private credit certainly precedes banking crises. For financial variables, the only significantcoefficient which did not follow the hypothesis was the M2/FOREX value. The negative effects of a high M2/FOREX ratio which increase the probability of a crisis are greater for high CA banks than low CA banks by 2 percentage points.

Finally, for institutional variables, the deposit insurance variable (INS) has significant positive values in all three categories. Therefore, it appears that the existence of an explicit deposit insurance scheme plays a significant role in promoting a crisis, possibly through moral hazard. Similarly, negative coefficients of the GDP/CAP variable which proxied as a control variable for effective governance measures suggests that an environment in which more effective supervision can be carried out is less likely to suffer from a crisis. Although the GDP/CAP variable confirmed one part of the hypothesis with its negative coefficient, it is, surprisingly, lower for low CA than high CA banks which ought to gain the most from an effectively regulated financial environment. In each of these cases, if high CA banks were intended to be better prepared to resist negative capital outflow shocks and increases in nominal and real interest rates while making more effective use of a positive macroeconomic and supervisory environment, these results suggest otherwise. Although such anomalous results are not the case for each variable in the aggregated sample, their behaviour certainly warrants a closer examination of each country sample.

Table 4 shows the results from Thailand. To begin, the average capital adequacy ratio for the sample was 9.3 – almost 1.3 percentage points higher than the required 8 percent. Banks with higher than 9.3 ratios were classified as high CA and the remaining as low CA. Regarding the macroeconomic variables, the RINT is an important determinant as indicated by the positive and significant coefficients for both types of banks. In some ways, the reasons for the significance of these real interest rates can be traced to recent liberalisation policies undertaken by the Thai government during the early 1990s. During this period, in its attempt to attract foreign capital, it abolished interest rate ceilings, relaxed foreign exchange controls, eased rules for finance companies, and expanded the scope of permissible capital market activities. The entry of foreign banks with the establishment of the Bangkok International Banking Facility (BIBF) increased competition for major clients including MNC's, which were attracted by the lower cost of funds on the BIBF. Such increased competiton reduced the profit margin of the domestic banks, forcing them to enter into even riskier activities. Subsequently, the rise in RINT further squeezed their already marginally profitable portfolios. The exchange rate (DEP) is also significant and positive for both high and low CA banks. Financial institutions in Thailand had borrowed heavily abroad in foreign currencies and lent to domestic borrowers in local currency, which exposed them to exchange rate losses soon after the Thai currency depreciated. 17% of domestic credit in Thailand comprised loans which had been funded by foreign currency borrowing by banks operating on the BIBF (Bank of Thailand, 1997). The total foreign currency liabilities of Thai banks and finance companies were 775% of their foreign currency assets in 1996, and amounted to nearly 35% of M2. However, again it appears that the negative effect of the exchange rate and the real interest rate on the probability of a crisis is surprisingly greater for high CA banks by 51.4 percentage points and 9.8 percentage points respectively.

The M2/FOREX coefficient is the only significant and positive financial variable for both high and low CA banks in Thailand. Its significance is especially noteworthy given that the proportion of

foreign bank lending intermediated by the domestic banking sector was falling in Thailand during this period. However, this decline in the share of the domestic banking sector in foreign borrowing was more than compensated for by the increasing importance of finance companies which were "not licensed to accept deposits from the public yet they issued promissory notes at terms comparable to time deposits at commercial banks" (IFS, 1998). Finally, for institutional variables, insurance (INS) is significant. The INS coefficient is significant and negative for low CA banks and positive for high CA banks. Again, this ought not to be the case since it implies that those banks holding higher than average CA ratios not only do not gain any advantage, but also may have been penalised for doing so. As perverse as these results seem, Thailand's treatment of recently troubled finance companies during the 1980s is somewhat revealing. More than half of these potentially insolvent financial institutions in Thailand were rescued by the Financial Institutions Development Fund. The Thai government also simultaneously established the Property Loan Management Organisation to purchase and re-structure non-performing property loans from banks. Furthermore, any international bank arranging a syndicated loan for a finance company was assured that the Central Bank would support the company in case of future problems (Bank of Thailand, 1997). These rescues may have sent the wrong signals to financial institutions, suggesting that as a bank's condition becomes worse, its rescue package becomes even better. Such experiences may have resulted in more financial institutions with lower CA ratios, since the opportunity cost of holding capital becomes even greater given the high expectation of government rescues.

Table 5 shows the results from Korea where the average capital adequacy ratio was 9.5, more than 1.5 percentage points higher than the required 8 percent. Using this average to distinguish between low and high CA banks, the following results were calculated. For the macroeconomic variables, the significant and negative coefficients for GRO indicate that the probability of a crisis decreased with an increase in GDP growth for both low and high CA banks. In fact, the

large predicted rate of growth of GDP may have even worked as an offsetting factor against the probability of a crisis, hence giving the coefficient its negative sign. The other significant macroeconomic variable is RINT whose positive coefficient indicates that it increased the probability of a crisis. Similar to other countries, the important role of real interest rates for Korea can be traced to parts of its liberalisation programme. Korea undertook deregulation of its financial sector in 1993 and eliminated many interest rate controls, removed restrictions on corporate debt financing, and allowed increased competition in financial services (World Bank, 1998).Such liberalisation also allowed many Korean finance companies to convert to merchant banks and to engage in foreign lending/borrowing activities in which they had very little experience[5]. This lack of expertise was evident in the rather risky lending decisions of these newly formed banks – a problem whose effects were only felt after real interest rates were forced to rise and many borrowers were unable to service their loans, subsequently reducing the quality of many loan portfolios.

For the financial variables, the CASH/ASSETS coefficient was significant and negative, indicating that a lack of liquidity lead to a higher probability of a crisis. Its significance is in no small part due to the overinvestment in both the corporate and real estate sectors, after which returns to investment fell and many loans continued to be extended to projects which were unreasonable from the outset. *Chaebols'* profit margins fell to minute levels in the mid 1990s and several went bankrupt (Miller and Luangaram, 1998). The lack of liquidity was the direct result of lending whichhad been collateralised by a highly inflated and unsustainable real estate market, as well as speculative activity on a similarly bloated stock market. As soon as equity and property prices fell, the ensuing liquidity crunch would contribute greatly to a possible crisis. Also, the mismatch of many Korean banks' short term liabilities with longer term assets helped incite the aforementioned liquidity crisis. The levels of short term debt to reserves ratios were substantially over 1 at the end of 1996, suggesting a financially fragile situation due to insufficient reserves if

foreign banks were unwilling to roll over the debt owed to them. Furthermore, the detrimental effect of low CASH/ASSETS, i.e., low liquidity, was worse for high CA than low CA banks, implying that banks with high CA ratios may have felt more justified in using less liquid assets, which although acceptable under CA accounting standards, were in fact not very liquid at all.

Finally, both institutional variables for high and low CA banks were significant. The INS coefficient was positive and significant for both high and low CA banks, possibly suggesting a moral hazard problem. Historically, many Korean loans had often been re-financed at preferential rates by the Central Bank or by special government funding schemes, which reduced the incentive for the lending bank to evaluate the creditworthiness of the borrower and monitor the performance of the loan (Folkerts-Landau, 1995). Similarly, the GDP/CAP was significant and negative for both high and low CA banks. However, it was lower for the low CA than high CA banks, suggesting that low CA banks gained more from an ineffective regulatory environment. This may have in many ways been the result of not only weak legislation but also weak enforcement and compliance measures (Reisen, 1998). The insider lending restrictions appear to have been difficult to supervise and enforce because of a lack of transparency in accounts and political pressure on regulators (Folkerts-Landau, 1995). This same political pressure was also exerted on banks in Korea to lend to specific corporate borrowers and to lend to these same borrowers even after they had run into difficulties (IMF, 1997). Finally, when these banks suffered financial distress themselves, supervisors exercised regulatory forebearance instead of insisting on remedial measures, e.g., the Central Bank in Korea relaxed the provisioning rules in 1996 in response to losses suffered by the banks due to falls in equity prices (IMF, 1997).

Table 6 indicates the results for Indonesia. The average capital adequacy was 11.9, which is comparatively the highest of all three countries. For the macroeconomic variables, the exchange rate (DEP) was significant and positive, suggesting that a rapidly depreciating

exchange rate increased the likelihood of a crisis. Of all the countries, Indonesia was very attractive to foreign investors not only because of its liberalisation of the capital account in the 1970s but also because of its use of a managed unitary exchange rate system associated with subsidies (Nasution, 1997). The following steps which included the lifting of restrictions on foreign investments and large privatisation programmes encouraged large capital flows in the early 1990s. These were mainly through foreign loans to the banking sector, which became even larger in the mid 1990s in light of the high interest rates and highly profitable equity market. After the speculative attacks on its currency in 1997, Indonesia decided to move from a managed float to a free float exchange rate, which would eventually require even more adjustments due to extreme pressure on their exchange rate. Therefore, the exchange rate played a crucial role in the probability of a crisis.

The M2/FOREX variable is significant and positive, indicating that a higher value increased the probability of a crisis for both types of banks. The high level of domestic M2 money deposits vis-à-vis international reserves prior to the crisis in Indonesia seems consistent with the predicted significance in the model. At the end of 1996, the M2/FOREX ratio was almost 7 in Indonesia. This evidence, which proxies the trends and levels of short term asset/liability positions of the Indonesian financial system vis-à-vis domestic depositors, also suggests that there may have been a problem of reserve illiquidity in Indonesia. Before the crisis in Indonesia, the magnitude of foreign currency reserves was clearly not sufficient to honour the outstanding stock of deposits at even the current exchange rate, much less after the drastic devaluation which would occur. The M2/FOREX variable was also higher for high CA banks than their low CA bank counterparts, suggesting that a lack of foreign reserves was more detrimental to the former type.

The INS and the GDP/CAP variables were significant for the low CA banks in both cases. The INS had a negative coefficient for low CA banks indicating that there may have been a serious moral hazard

problem especially for low CA banks. In the early 1990s, for instance, six banks were facing distress, five of which were recapitalised under the authority of the Indonesian government. Such high levels of insurance coverage for low quality banks seems to have reduced the probability of a crisis much more for them than their high CA counterparts. Finally, GDP/CAP is negative and significant for low CA banks, suggesting that lower quality banks thrived more under a lax and unsupervised regulatory environment. Although Indonesia had the Basle CA requirements in place, it lacked the loan loss provisioning rules and the foreign exchange exposure limits (Folkerts-Landau, 1995). Formal closure mechanisms for insolvent banks were not explicitly set out in the banking laws. But the results suggest an even more serious situation whereby low CA banks may have not only escaped regulatory scrutiny, but they may have also benefited from too much supervisory protection. Therefore, although CA ratios were readily observable, these failures may have been the result of more intangible aspects, including the degree to which regulations were enforced and the quality of bank supervision. Any examination of such qualities is inherently subjective and imprecise, but some attempts have been made as indicated in Table 7. Indonesia is ranked weak in both categories, which might help to explain the previous results.

6. Discussion

During the past few decades, systemic financial crises have plagued countries throughout the world, and the necessity to understand the links between weaknesses within the financial sector and the economy as a whole have become increasingly important. The object of the present exercise has been to provide at least one connection between the relative level of an individual bank's capital adequacy and its effects on the fragility of the banking system. To this end, banks from three countries plagued by the Asian crisis were selected and separated based on their capital adequacy ratios, and then tested categorically against various macroeconomic, financial, and institutional variables.

The role of the macroeconomic environment cannot be understated based on the model in this study. Low GDP growth is associated with increased risk to the banking sector for both high and low CA banks. As described earlier, some of the results even contradict the original hypothesis that high CA banks ought to gain more from improvements in GDP growth than their low CA counterparts; in fact, the results have suggested otherwise. Similarly, evidence shows that high rates of inflation (INF) and high real interest rates (RINT) increase banking sector problems. Again, the original hypothesis suggested that high CA banks should be more resistant to inflationary pressures than their low CA counterparts, but the results suggest the opposite. To further illustrate this point, it might be worth considering the plots of high and low CA banks for the entire sample vis-à-vis the logit function (Figure 1). The inflation rate will be used as the horizontal axis and the other variables will be set at their mean values.

The first point is that the high CA logit function rises much faster than the low CA function in the domain beyond 0. Furthermore, the high CA bank function reaches the 0.5 probability level – the last assumed feasible point at which a crisis is avoidable – when inflation is less than zero (-0.55) whereas with low CA banks the function approaches the 0.5 level at a positive inflation rate (0.38). This implies and confirms that for high CA banks to avoid the onslaught of a crisis, i.e., the 0.5 probability level, the inflation rate needs to be negative. Of course, the latter condition is rather unlikely in a recently liberalised environment, but it re-emphasises the importance of low inflation policies for high CA banks even though they were assumed to be better equipped to handle the situation; clearly, high CA banks have not lived up to their expectations, performing in this case worse than their low CA counterparts.

In considering the other variables which did not react as had originally been hypothesised, the presence of an insurance scheme increases the probability of a crisis. This suggests that problems of moral hazard behaviour exist to some degree. Furthermore, in an extreme case such as Thailand, the results indicate that low CA banks

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face a lower probability of a crisis under such insurance schemes with all other variables held constant. Figure 2 shows these results using a logit function.

Similar to Figure 1, the high CA banks reach the 0.5 probability level when insurance is less than zero (-7.5) whereas the low CA function approaches the 0.5 level at a positive insurance level (1.5). It is difficult to interpret the level of insurance coverage with pinpoint accuracy, but what is important here is the relative effects of each scheme on each type of bank for the probability of a crisis. For low CA banks, the curve shows that at 0.5 probability level, the insurance schemes can rise to 1.5 and not enter a crisis. Similarly, at the INS=0 level, a high CA bank has a 0.84 probability of a crisis while the low CA bank has a 0.43 probability. Clearly, the finding from these and previous functions in Figure 1 negate the original hypothesis that high CA banks are more resistant to macroeconomic shocks as well as more capable in an effectively regulated environment. The increase in the slopes of each function in Figures 1 and 2 after they pass the critical level of 0.5 is also noteworthy. The slope of the high CA banks in both figures approaches P=1 asymptotically at a much faster rate than the slopes of the low CA banks. Again, this suggests that if high CA banks were exposed to higher inflation and greater insurance after they passed the 0.5 level, they would face a crisis much sooner than their low CA counterparts. As mentioned these functions further demonstrate the invalidity of the hypothesis regarding the complete benefits of maintaining high capital adequacy ratios in this setting. However, before condemning the use of the ratio itself, it might be important to consider the ways in which different countries may have applied – or even misapplied – them to their portfolios.

6.1. Cosmetic vs. effective adjustments

The results suggest that the responses of many bank portfolios to the Basle capital adequacy requirements have not been standard by any means. Wall and Peterson (1996) divide country responses into two distinct categories – cosmetic and effective. Banks which manage to

increase their capital ratio with little or no effect on the probability of failure have implemented "cosmetic" changes while others which do reduce the aforementioned probability execute "effective" changes in their capital ratios.

Cosmetic changes in bank ratios are possible because of the rather imprecise nature of both capital and risk measures as proxies for the financial health of banks. That is, in many cases, banks are able to offset increases in capital ratios by increasing their risk exposure, given that managers have private information which is inaccessible to regulators. This situation arises when capital requirements do not adequately reflect the relative riskiness of assets. Kahane (1977), Koehn and Santomero (1980), and Kim and Santomero (1980) have indicated that a higher required capital ratio increases asset risk, which could lead to a higher probability of failure. In most cases, banks with minimally adequate capital reduce their risk exposure while well capitalised banks increase their risk exposure to offset the increase in risk. Calem and Rob (1996) have even gone as far as to show how a severely undercapitalised bank takes more risk in an attempt to meet adequate capital standards. Moreover, studies have also indicated that banks' credit responses to such capital requirements generally take longer at smaller banks; in some cases several years is needed to fully adjust their portfolios to the higher capital requirements.

Another way of making cosmetic changes is to exploit the difference between capital as measured for regulatory purposes, and the banks' true economic capital. Regulatory accounting generally records assets at historical costs rather than at their current market value. Thus, regulatory measures of capital may differ substantially from the economic capital needed for the bank's long term solvency. A bank can exploit these differences to increase its capital as measured by regulatory accounting criteria. As a result, at least one inexpensive way for banks to maintain or even increase their capital ratios is to avoid recognising losses on depreciated assets and accelerate recognition of gains on any assets which may have appreciated in

value. Some evidence in this particular study suggests that banks may have increased their regulatory capital by selling their appreciated assets while simultaneously delaying their recognition of losses. Moreover, as institutions which specialise in financial assets, banks can use gains and losses in securities to adjust their capital ratios. However, the market is more aware of such cosmetic attempts and banks do not always resort to this method. Empirical studies have shown that gains in trading are more often done to boost or smooth earnings fluctuations than to increase capital ratios.[6] In some cases where such earnings have been used to increase capital ratios, the market has been aware of the accounting tricks and has interpreted it as a signal of weakness in future earnings causing a reduction in the value of the bank.

Effective means by which banks can raise their capital ratios include reducing the volume of loan assets, increasing their retained earnings, issuing new securities, or shifting the focus of their portfolios to less risky assets. Analyses of reduction in the volume of credit during the 1980s and 1990s in most studies are inconclusive. Although, there does appear to be a slowdown in credit growth during this period in many countries, it is not certain that it was the impact of the new regulation, i.e., the introduction of the Basle standards in 1988, which constrained the volume of credit. Again, it is difficult to ascertain whether this slowdown was the result of more stringent capital requirements or general macroeconomic conditions. Banks can also improve their capital accounts by reducing their credit risk and re-allocating their portfolios from more to less risky assets. Such changes often involve moving away from lending to private borrowers to lending more securitised products which carry smaller capital charges. Finally, a rather costly but effective way to increase capital adequacy is to issue new securities. However, as with most public share offerings, the rate of return which banks must pay is higher than alternative products, i.e., bonds, deposits, and therefore most banks try to avoid this option at any cost. However, for those banks which are heavily undercapitalised, equity infusions are the

primary mechanism by which banks can re-capitalise themselves quickly.

7. Policy Implications

Inadequate preparation for financial liberalisation can contribute greatly to macroeconomic, institutional, and financial weaknesses in developing countries. Timely implementation of prudential supervision is essential to maintain the systemic health of the financial sector and the sound management of its institutions. The implementation of minimum capital adequacy standards has been an important initiative in this right. Changes in the composition and size of banks' portfolios to risk-based capital requirements are crucial for formulating appropriate regulatory policies. In this context, and given the possible sources of failures in the capital adequacy requirements during the recent Asian financial crisis, this paper considered specific weaknesses within the financial sector, especially in its lack of transparency, ineffective accounting standards, and inadequate institutional framework.

The data suggested that some banks in these countries may have utilised cosmetic adjustments to increased capital ratios. The evidence suggests that some banks may have increased their risky assets, utilised off-balance-sheet activities, or resorted to capital gains from selling capital assets, including real estate and securities, to boost their ratios. Some may have also re-valued their reserves during stock market booms to make the most of the huge capital inflows following liberalisation of their country's capital accounts. Although regulators cannot prevent all cosmetic changes to capital ratios, they should at least be able to adjust regulatory requirements to prevent banks from gaining benefits through cosmetic changes. Cosmetic changes to equity can be partially eliminated by requiring mark-to-market accounting for securities. Similarly, loan loss provisions created for credits of doubtful or estimated losses should be excluded from supplementary capital if they reflect an identified deterioration in asset values, and loan loss provisions should reflect declines in the

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economic value of banks' assets. Strengthening prudential supervision by preventing cosmetic changes and enhancing effective ways of increasing capital ratios seems to be essential for the sound management of banks and financial systems; additionally, similar efforts should be made to impose leverage restrictions.

When institutions in recently liberalised countries have not been allowed to develop, financial institutions in these settings are more easily able to make cosmetic adjustments because accounting principles, loan classification standards, and disclosure requirements are not as well developed. This has been the case particularly for the countries examined in this study, where banks carrying assets of questionable quality did not make sufficient provisions. Some of these banks then tried to reduce the amounts which ought to have been diverted to loan loss reserves through loan re-structuring or other devices. In fact, if these capital ratios had been adjusted taking into account the aforementioned under-provisioning, the ratios would have been much lower than they appear. The setting and monitoring of international banking standards helps to reduce such opportunities for cosmetic adjustments in capital ratios. New international banking standards need to set out clearly the criteria and rules for key adequacy ratios in conjunction with rules for classifying loans, provisions for loan losses, and illegal accounting devices. Finally, it is important to remember that supervision and regulation are neither infallible nor likely to prove sufficient to meet all the intended goals. The Basle standards, as optimal as they can be, cannot substitute for a bank's own internal scrutiny of the market participants, and the market's scrutiny of the banks. Therefore, every attempt ought to be made to increase the quantity and quality of such information from the regulated banks themselves.

Notes

1. Goldstein (1997) suggests that one of the causes of banking crises in developing countries is inadequate preparation for financial liberalisation. Kaminsky and Reinhart (1995) confirm this by reporting that the financial sector had been liberalised at some point during the previous five years in 18 out of 25 banking crises they looked at.

2. The *n* lag period will be chosen separately for each country based on the time when the liberalisation process started. Many studies have indicated that banking sector problems were preceded by strong credit growth (Pill and Pradhan, 1995).

3. Periods of distress in the banking sector were defined as crises when one of the following conditions were fulfilled:
    a. the ratio of non-performing assets to total assets exceeded 10%
    b. the cost of the rescue operation was at least 2% of GDP.
    c. extensive bank runs/emergency measures such as deposit freezes, prolonged bank holidays, or generalised deposit guarantees enacted by the government in response to the crisis.
    d. banking sector problems resulting in a large-scale nationalisation of banks.

4. This derivative shows that the rate of change in probability with respect to X involves both *B* and the level of probability from which the change is measured. This value is greatest when P=.5.

5. The number of merchant banks rose from 6 in 1993 to almost 30 in 1996 (Jae-Kwon, 1998).

6. Scholes, Wilson, and Wolfson (1990) examined the recognition of securities gains and losses for a sample of mostly very large banks. They found evidence that banks with lower capital ratios

are likely to have smaller recognised losses or larger recognised gains than banks with higher capital ratios. Carey (1994) examined securities sales from investment portfolios, and gains trading for a sample of more than 6000 commercial banks. He found that most gains trading is done to boost earnings or to smooth earnings. Relatively few banks appear to engage in gains trading to boost their capital account.

TABLES AND FIGURES

Table 1: Credit Growth in East Asian Countries 1990-1996 (%)

Country	Annual Growth of Loans	Loan Growth/ GDP Growth	Net Domestic Credit/GDP	
			1990	1996
Indonesia	20	122	45	56
Korea	14	123	68	79
Malaysia	13	134	80	136
Thailand	14	176	84	130

Source: World Bank (1998)

Table 2: Capital Adequacy Distribution of Banks in Thailand, Korea, and Indonesia (in percent)

Country	Average CA Ratio	Low CA	High CA
Thailand	9.3	35	65
Korea	9.5	48	52
Indonesia	11.9	67	33

Goldstein (1997); Central Bank Reports (1996, 1997)

Table 3: Entire Sample

	All		High CA		Low CA	
	ESTIMATED β (*t- statistic*)	*Exp (β)* (*% Odds Change*)	**ESTIMATED β** (*t- statistic*)	*Exp (β)* (*% Odds Change*)	**ESTIMATED β** (*t- statistic*)	*Exp (β)* (*% Odds Change*)
MACROECONOMIC						
GRO	-0.213***	0.808	-0.178**	0.837	-0.256***	0.774
	(1.83)	(-19.2)	(1.692)	(-16.3)	(2.32)	(-22.6)
DEP	0.003	1.02	0.012	1.01	-0.032	0.969
	(0.023)	(2.0)	(0.263)	(1.2)	(0.312)	(-3.1)
RINT	0.043*	1.04	0.023*	1.02	0.107*	1.11
	(0.792)	(4.4)	(0.862)	(2.3)	(0.732)	(11.3)
INF	0.032**	1.03	0.038**	1.04	0.027***	1.03
	(1.351)	(3.3)	(1.418)	(3.9)	(1.772)	(2.7)
FINANCIAL						
M2/FOREX	0.036**	1.04	0.041	1.04	0.022*	1.02
	(1.02)	(3.7)	(0.634)	(4.2)	(0.923)	(2.2)
CASH/ASSETS	-0.021	0.979	-0.008	0.992	-0.013	0.99
	(0.581)	(2.1)	(0.432)	(-0.8)	(0.192)	(-1.3)
CRED$_{(t-2)}$	0.032**	1.3	0.161**	1.17	0.204***	1.23
	(1.263)	(3.3)	(1.382)	(17.4)	(2.091)	(2.3)
INSTITUTIONAL						
INS	0.462**	1.59	0.612	1.84	0.531*	1.7
	(1.81)	(58.7)	(0.719)	(84.4)	(0.821)	(70)
GDP/CAP	-0.082***	0.921	-0.053***	0.95	-0.071**	0.931
	(2.13)	(-7.9)	(2.32)	(-5.2)	(1.938)	(-6.7)

***significance at .01 level, **significance at .05 level, *significance at .10 level

Table 4: Thailand

	High CA		Low CA	
	ESTIMATED β *(t- statistic)*	*Exp (β) (% Odds Change)*	**ESTIMATED** β *(t- statistic)*	*Exp (β) (% Odds Change)*
MACROECONOMIC				
GRO	-0.293	0.746	-0.036	0.965
	(0.182)	*(-25.4)*	*(0.132)*	*(-3.53)*
DEP	0.426***	1.53	0.017***	1.02
	(2.263)	*(53.1)*	*(2.189)*	*(1.7)*
RINT	0.216**	1.24	1.34**	1.14
	(1.532)	*(24.1)*	*(2.012)*	*(14.3)*
INF	0.336	1.39	0.621	1.86
	(1.032)	*(39.9)*	*(0.361)*	*(86.08)*
FINANCIAL				
M2/FOREX	0.073***	1.07	0.238*	1.27
	(2.031)	*(7.6)*	*(1.633)*	*(26.8)*
CASH/ASSETS	-0.216	0.805	-0.186	0.831
	(0.289)	*(-19.4)*	*(1.232)*	*(-16.9)*
CRED$_{(t-2)}$	0.146	1.16	0.431	1.54
	(0.732)	*(15.7)*	*(0.893)*	*(53.8)*
INSTITUTIONAL				
INS	0.712**	2.04	0.911***	0.042
	(1.621)	*(103)*	*(2.02)*	*(-59.8)*
GDP/CAP	-0.026	97.4	-0.012	0.989
	(0.762)	*(-2.56)*	*(0.281)*	*(-1.2)*

***significance at .01 level, **significance at .05 level, *significance at .10 level

Table 5: Korea

	High CA		Low CA	
	ESTIMATED β *(t- statistic)*	*Exp (β)* *(% Odds Change)*	**ESTIMATED** β *(t- statistic)*	*Exp (β)* *(% Odds Change)*
MACROECONOMIC				
GRO	-0.426**	0.653	-0.237***	0.789
	(1.26)	*(-34.7)*	*(2.01)*	*(-21.1)*
DEP	0.173	1.19	0.436	1.54
	(0.832)	*(18.9)*	*(1.07)*	*(54.7)*
RINT	0.233***	1.26	0.382**	1.46
	(2.31)	*(26.2)*	*(1.77)*	*(46.5)*
INF	0.621	1.86	0.823	2.28
	(0.776)	*(86.1)*	*(0.592)*	*(127)*
FINANCIAL				
M2/FOREX	0.393	1.48	0.792	(2.21)
	(1.32)	*(48.1)*	*(0.362)*	*(120)*
CASH/ASSETS	-0.223	0.801	-0.638**	0.53
	*(1.43)**	*(-19.9)*	*(1.96)*	*(-47.2)*
CRED$_{(t-2)}$	0.332	1.39	0.426	1.53
	(1.27)	*(39.4)*	*(0.89)*	*(53.1)*
INSTITUTIONAL				
INS	0.322	1.37	0.583	1.79
	(1.23)	*(37.9)*	*(2.17)*	*(79.1)*
GDP/CAP	-0.094***	0.91	-0.183***	0.833
	(2.36)	*(-8.9)*	*(1.921)*	*(-16.7)*

***significance at .01 level, **significance at .05 level, *significance at .10 level

Table 6: Indonesia

	High CA		Low CA	
	ESTIMATED β *(t- statistic)*	*Exp (β) (% Odds Change)*	ESTIMATED β *(t- statistic)*	*Exp (β) (% Odds Change)*
MACROECONOMIC				
GRO	-0.232	0.792	-0.019	0.981
	(0.872)	*(-20.7)*	*(0.739)*	*(-1.8)*
DEP	0.207	1.23	0.732	2.07
	(1.96)	*(22.9)*	*(1.78)*	*(108)*
RINT	0.423	1.52	0.718	2.05
	(1.21)	*(52.6)*	*(1.32)*	*(105)*
INF	0.196	1.22	0.673	1.96
	(0.932)	*(21.6)*	*(0.851)*	*(96.01)*
FINANCIAL				
M2/FOREX	0.531***	1.7	0.026**	1.03
	(2.02)	*(70.1)*	*(1.82)*	*(2.6)*
CASH/ASSETS	-0.003	0.997	-0.182	0.833
	(1.33)	*(-0.31)*	*(0.892)*	*(-16.6)*
CRED$_{(t-2)}$	0.173	1.18	0.521	1.68
	(1.261)	*(18.9)*	*(0.342)*	*(68.4)*
INSTITUTIONAL				
INS	-0.073*	0.929	-0.416***	0.659
	(0.821)	*(-7.04)*	*(2.31)*	*(-34.1)*
GDP/CAP	-0.182*	0.833	-0.261***	0.77
	(1.03)	*(-16.7)*	*(1.93)*	*(-22.9)*

***significance at .01 level, **significance at .05 level, *significance at .10 level

Table 7: Indicators of strength and quality of bank regulations in selected East Asian countries

Country	Enforcement of Regulations	Quality of Bank Supervision
Indonesia	Weak	Weak
Korea	Weak	Fair
Thailand	Fair	Weak

Source: Quality of Bank Supervision, Claessens and Glaessner (1998); for Enforcement of regulations (Reisen, 1998)

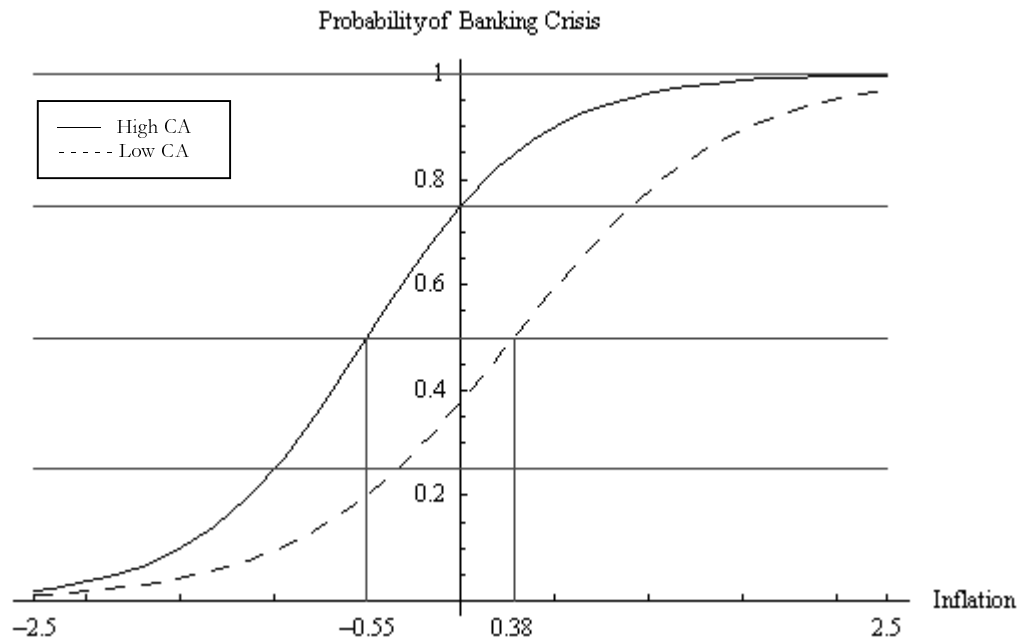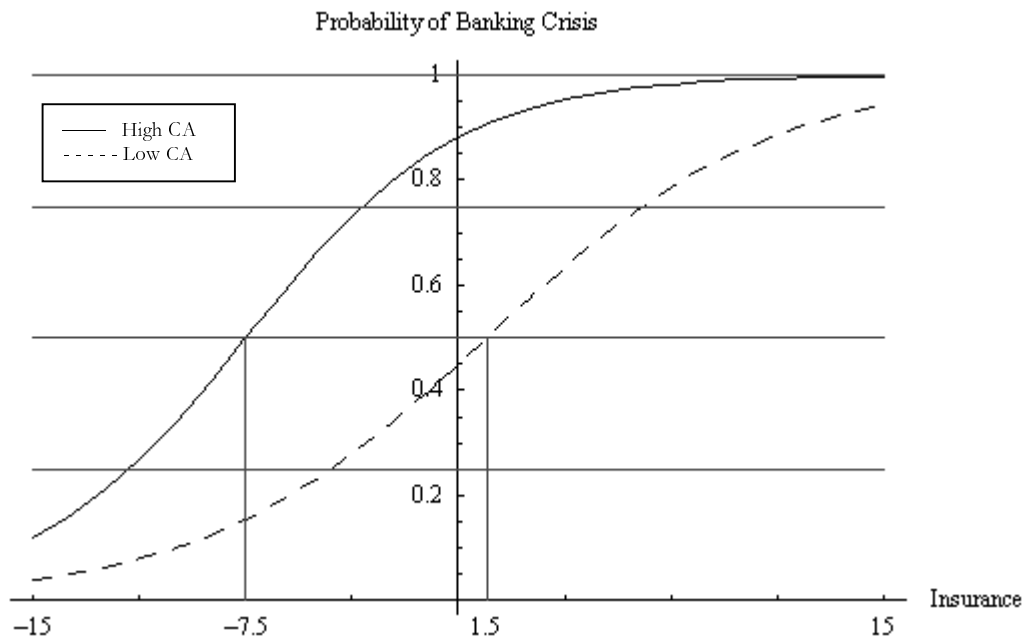**Figure 1: Plot of Estimated Probabilities as Functions of *INF* by using Low and High CA banks**

Probability of Banking Crisis

Figure 2: Plot of Estimated Probabilities as Functions of *INS* by using Low and High CA banks

Probability of Banking Crisis

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