Essays on Liquidity Risk and Banking Fragility, Dynamic Depositor Discipline and Information Disclosure: An Empirical Analysis on the East Asian Banks

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I certify that all material in this thesis which is not my own has been identified and that no material has previously been submitted and approved for the award of a degree by this or any other University.

Signature:.....

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Abstract

This thesis contains three empirical essays in banking. The empirical analyses focus on the role of information in banking. This will be done by analyzing the effectiveness of three types of signals that are sent by banks. The first signal is the CAMEL-type indicators that measure the soundness of the banks. The second signal is the price offered by banks in attracting deposits. The third signal is the amount of risk related information that banks disclose in their financial statements. This thesis aims to answer a few key questions that are relevant in banking. Firstly, it aims to find if CAMEL-type indicators are able to predict subsequent decisions by regulators to fail banks. This analysis will focus on the banks' liquidity ratio before and during crises in finding whether high liquidity holding and high reliance on external funding contribute towards the subsequent failure of the banks. Secondly, it aims to find if depositors discipline banks by focusing on depositors' reaction to the price signal from banks. Lastly, it aims to find if depositors react to the amount of risk-related information that banks disclose. The empirical issues are analyzed using the sample of financial institutions in five crisis led East Asian countries namely Indonesia, Korea, Malaysia, Philippines and Thailand. Among the striking findings in Chapter 2 are that the effect of liquidity on the probability of bank failure varies before and during a crisis. The results show the vulnerabilities of banks to failure declines as a result of higher liquidity holding. The results also show that banks' probability of failure increases as a result of high reliance on external funding. Findings in Chapter 3 confirm the endogenous relationship between the price and quantity of deposits in the depositor discipline model. Panel data analysis shows that depositors' behavior in East Asia is driven by bank fundamentals and risk aversion activities and also by price movements. Dynamic panel data analysis is carried out to account for the lagged dependency of the deposits growth variable and endogeneity of the price mechanism in

the depositor discipline model. The results show that depositors in East Asia do not demand a higher price for deposits. Analysis by subdividing the sample of banks into healthy and weak banks shows that the relationship between price and quantity is not non-linear. Healthy banks are not able to attract more deposits by raising price. Depositors do not discipline weak banks by demanding a higher return. Lack of responsiveness by depositors to price signals may be attributable to large the outflow of deposits that happened during the crisis period and regulations on interest rates. Analysis in Chapter 4 confirms that depositors are influenced by the content and also quantity of risk-related information disclosure. Panel data analysis shows that higher risk-related information disclosure enables banks to attract more funds only during the post-crisis period. Once the lagged dependency of the deposits growth variable and endogeneity of the price and disclosure mechanism is taken into account, estimation using dynamic panel data analysis shows that disclosure is a more effective signal in attracting deposits than price. These findings provide support to the proposition of the third pillar of the Basel II which aims to encourage market discipline by requiring banks to disclose more risk-related information. In line with the wake-up-call hypothesis, the findings show that depositors' responsiveness to the amount of information disclosure is higher during the post-crisis period. This study also finds that the effectiveness of disclosure signal varies according to the quality of banks. Depositors in East Asia reward good banks for disclosing more information but they do not discipline weak banks by demanding greater disclosure. Greater responsiveness of depositors to the disclosure signal of healthy banks compared to weak banks implies that disclosure is a more effective signal for healthy banks than for weak ones. Other issues analyzed in the thesis pertain to the relevance of the different type of econometric analysis used in carrying out the empirical analyses.

Chapter 1 Introduction

1.1 Introduction

A bank is a financial institution that accepts deposits from the public and issues loans to individuals and businesses. These functions distinguish a bank from other financial institutions. Due to the information asymmetry that exists in the financial market, a bank plays a role of a delegated monitor between lenders and borrowers. In addition to this, a bank also provides liquidity to lenders and borrowers. A bank's role as the delegated monitor and liquidity provider enables capital to be allocated efficiently in the economy. However, uncertainties in asset return and depositors' consumption preference make banks to vulnerable to a liquidity shock. Asymmetry of information may induce some depositors to make early withdrawals even though they do not need to consume early. Large and sudden withdrawals by depositors can increase a bank's vulnerability to a run.

A run on a single bank can have a contagion effect on the rest of the banking system through its inter-bank claims, payment systems linkages and information sharing (Allen and Gale, 2007). Diamond and Rajan (2001) shows that bank failures can cause systemic illiquidity through the contagion effect. Bank failures subtract liquidity from the system and this negative spillover effect raises the likelihood of other banks' failure. A banking crisis happens when a significant segment of the banking system becomes illiquid or insolvent. Even healthy banks with strong fundamentals can fail due to depositors' panic behavior.

Between the period from 1980 to 1995, 133 out of the International Monetary Fund's 181 member countries experienced some form of banking crisis (Lindgren et al., 1996). Historically, banking crises have been a common occurrence in United States. The Great Depression (1929-1933) had a significant impact on the banking system of the United States. The number

of bank failures in the US averaged over 2000 per annum in the period from 1930 to 1933[1][2]. In recent years, banking crisis has also become a common occurrence in the emerging markets. This can be seen in the 1995 Latin American crisis, the 1997 East Asian crisis and the late 1990s Russian crisis. Large numbers of bank failures also happened as a result of these crises. The crisis also brought a large scale of disruption in the economy through output losses. For example, the cumulative fiscal costs incurred in the resolution of the banking crises expressed as a percentage of GDP was as high as 50 to 55 percent in Indonesia and 42.3 percent in Thailand as the result of the 1997 East Asian crisis (Hoggarth et al., 2001).

Given the important role that banks play in the economy, the occurrence of banking crises brings forward the need for greater understanding of issues relating to banking fragility. Since bank runs are an essential part of banking crises, a good understanding of factors that influence deposits growth is also essential. Signaling theory posits that the information asymmetry that exists in the banking model can be reduced by the signal sent by the informed party to the uninformed (Moris, 1987). Banks that wants to attract deposits therefore have to signal to depositors that they are in good financial health. This is done by revealing information about the quality of their management and loan portfolios. This study looks at three types of signals that are often used by banks to reduce the informational asymmetry. The first is the CAMEL type indicators that regulators believe are good indicators of a bank's financial health. The second is the price signals that banks use to attract deposits. The third is the detailed risk related information that banks disclose in their financial statements.

1.1.1 Motivation

During the twentieth century formal economic decison-making models were derived based on the assumption of perfect information. Economists generally assumed that a market with

[1] Friedman and Schwartz (1963) explain that the bank failures during this time had an adverse effect on income mainly through a negative wealth effect for bank shareholders and through a contraction in the money supply.

[2] An approximately 40 percent drop in nominal prices in the United States from the period between 1929 to 1932 caused a debt deflation that lowered borrowers' net worth and increased the default rate (Bernanke,1983).

some information imperfections would function in a similar manner to a market with perfect information (Stiglitz, 2001). Akerlof's (1970) study on the market for used cars looks at the inefficiency that arises as a result of the information asymmetry that exists between the sellers and buyers. Sellers will be unable to receive a fair price for their car because it will be viewed as just another lemon. This results in an adverse selection problem whereby the good cars will be driven out from the market and only the bad cars will be offered for sale.

Credit market imperfections can result in under-lending. Stiglitz and Weiss (1983) asserts that credit rationing can happen because the probability of borrower default is linked to the rate of interest charged on the loan. As a result of this, a better-informed borrower (agents) with a relatively profitable project may not get financing while others with similar potential may get it. This may happen even when the borrowers are willing to pay a higher interest rate or increase their collateral. The banks (less-informed principal) would not be willing to lend above a certain threshold level of interest due to adverse selection problems and incentive effect. The former arises because borrowers who are willing to pay a very high rate may be willing to do so because they perceive that their probability of repaying the loan is small. The later happens because a higher interest rate provide incentive to borrowers to choose projects that are very risky.

In the markets for good and services, price clears the market and signals to the market information about resource scarcity. However, given the problem in the loan market, price may not always be used to clear the market. Price is used in credit markets to signal quality (Stigliz, 1987). Since the quality of the borrowers that banks attract changes as price changes, excess demand may persist without any tendency for price to move to correct the market imbalance. Banks may keep the loan rate low in order to get higher quality borrowers who will make repayments. This may cause the demand for loans to exceed the supply of loans at low interest rates. Unlike firms, which would prefer to sell as many products and services for a given price, banks would prefer to limit

the number of loans that they disburse. Credit needs to rationed and this may cause banks to use a non-price measure, like borrower quality or favoritism, to decide whom to finance. The threat of credit rationing may reduce borrowers' moral hazard.

Information asymmetry can be reduced in the credit market through the signal sent by the better informed party to the less informed one (Spence, 1973). In the presence of information asymmetry, good firms would want to signal their quality to the market. Managers can send signals about firms' value through their actions of issuing debt (Ross, 1977) and dividends (Bhattacharya, 1979). These models posit that only stronger firms can pay a better return over the long term. Firms with poor performance will not be able to make such payments. Hence, these signals are perceived by investors as a reliable communication of firms' quality.

The classic paper by Leland and Pyle (1977) shows that the type of financing that firms use will send a signal to market about the potential of the projects that the firm intends to undertake. Since the owners of the firm have private information about the prospect of the projects that they are investing in, by retaining a higher amount of equity the owners will send a signal to the market that the project's return is high. From the perspective of the banks, the quality of the projects that are financed through loans can be questionable as loan financing may send a signal to the banks that the returns of the projects are likely to be low. In light of this, existing literature emphasizes banks' role of screening borrowers by producing signals about their creditworthiness (Bhattacharya and Thakor, 1993). Banks have informational and cost advantages in monitoring borrowers[3]. The monitoring service provided by banks avoids the duplication of monitoring costs for investors (Diamond, 1984).

In the presence of information asymmetry about a borrower's credit quality between a bank that monitors the borrowers and individual investors that do not, the bank can raise lending rates because of either demand-side factors or supply-side factors. The former include the borrower's

[3] Demand deposits give banks access to private information that they can use to monitor borrowers.

credit risk (Berlin and Mester, 1992), differential screening capabilities among intermediaries which induce lending specialization (Daniels and Ramirez, 2008), relationship lending (Boot and Thakor (1994) and Sharpe (1990))[4] and the borrower's choice of debt and lenders (Kwan and Carleton, 2009). The latter, on the other hand, looks at the effects of the lender's financial position on loan pricing. Among other things, a decrease in a bank's capital adequacy can lead to an increase in the bank's lending rates (Holmstrom and Tirole, 1997) and worsening return in their own portfolio may lead the bank to write tighter loan contracts (Murfin, 2010). In addition to this, studies also have looked into how different shocks to lenders influence credit availability (Bernanke and Gertler, 1995 and Peek and Rosengren, 1997)[5].

A bank plays a very important and distinct role in the economy. In addition to providing lending services, a bank also provides deposit taking facilities. Handling the deposit accounts gives banks access to important information that facilitates their role of a delegated monitor. Banks' deposit contracts provide insurance to depositors against liquidity risk by promising to pay them on demand (Bryant 1980). Hence, in addition to providing liquidity to borrowers through the lending activities, a bank also provides liquidity to depositors through the issuance of demand deposit contracts (Kashyap et al., 1999). These requires a bank to hold adequate liquidity at all times. However, offering both services together allows a bank to have economies of scope between lending and deposit taking. This enables it to a retain smaller buffer than other institutions that can only offer these services separately.

Information asymmetry exists in the banking model because banks are not able to observe the true liquidity needs of the depositors while depositors are not able to observe banks assets' risk. This makes a bank vulnerable to liquidity shocks. Depositors have incentive to monitor banks due

[4] Boot and Thakor (1994) shows that loan interest rates should decrease as a relationship matures, while Sharpe (1990) shows that the rates will rise over time.

[5] Bernanke and Gertler (1995) shows that changes in monetary policy effect the supply of loans by banks, while Peek and Rosengren (1997)) finds that large size of Japanese bank lending operations in the United States caused the financial shock in Japan to effect the supply of bank lending in United States.

to the inherently fragile nature of banks as shown in the seminal work of Diamond and Dybvig (1983). The fractional reserve system allows banks to only keep a fraction of their deposits in reserve and lend out the remainder. Since banks have full obligation to redeem all deposits on demand, this system only works well when banks are able to fulfill this contractual obligation. Asymmetry of information may induce some depositors to make withdrawals even though they do not need to consume early. Stability of banks is threatened when private arrangements are unable to overcome the coordination problem among depositors.

The existence of informational asymmetry between depositors and banks is highlighted in the studies by Bryant (1980), Chari and Jagannathan (1984) and Jacklin and Bhattacharya (1988), Gorton (1988) and Allen and Gale (1998) as the reason that precipitates runs on banks. A run can either happen because of weak fundamentals or pure panic as shown by Chari and Jagannathan (1988). They illustrate a signal extraction problem where some depositors withdraw money for consumption purposes while others withdraw money due to the bank's weak fundamentals. They posit that when there are long lines to withdraw at banks, depositors will not able to distinguish whether the queue is due to high consumption needs or because informed depositors are getting out early due to receiving bad signal about banks' performance. In this case, a run on a bank can happen not only when the outlook is poor but also when liquidity needs are high despite no one receiving information on future returns.

A run on a bank that is due to weak fundamentals is an extreme form of depositor discipline. Calomiris and Kahn (1991) show that the threat of a bank run is always beneficial since they prevent the bank from engaging in high risk taking and allow the salvage of some of the bank's value. The existence of information cost and sequential service constraints gives depositors an incentive to monitor the bank. Allen and Gale (1998) shows that an information based run is efficient because it results in optimal risk sharing between depositors with immediate and late

consumption needs. However, a run on a bank due to pure panic can be inefficient as postulated by Diamond and Dybvig (1983), Waldo (1985), and Postlewaite and Vives (1987). Gorton and Winton (2002) define a panic as a systemic event in which consumers want to hold currency in exchange for their demand deposits. When this happens, banks that are not able to honor all their depositors may incur high liquidation costs. This may disrupt the production process and create negative externalities for the entire economy.

Depositors monitor banks in order to safeguard their interests. Depositors can discipline banks either by withdrawing their funds or by demanding higher returns (Freixas and Rochet, 2008). The threat of action by the depositors puts the management under heightened scrutiny. Disciplining action by the depositors encourages greater prudence and efficiency among bank managers. Early detection of weak banks enables the problems in a particular bank to be contained before they spread to the entire banking sector. Due to the informational asymmetry that is present between the borrowers and individual depositors, the bank needs to send a signal about the quality of its portfolio to attract deposits. The signal can either be through a price or a non-price mechanism. The latter can be done through disclosure of financial information while the former can be done through the interest rate mechanism.

Regulations are needed in banking due to the existence of market imperfections and negative externalities. They are also aimed at protecting the welfare of the unsophisticated investors. Bank regulators reduce the information gap between depositors and banks by creating minimum disclosure requirements. Regulators have traditionally relied on CAMEL framework in measuring the relative soundness of a bank. This framework measures the performance of a bank by means of five parameters, namely Capital, Assets, Management, Earnings and Liquidity[6]. Information disclosed in the financial statement enables depositors to distinguish between weak and strong banks.

[6] A sixth component, a bank's Sensitivity to market risk was added in 1997.

Apart from withdrawing their funds from weak banks, depositors may demand a "lemons premium" from these banks. Stronger banks, on the other hand, may be able to attract deposits at a cheaper price (Allen et al., 2009). They show that, in the absence of deposit insurance, holding a capital buffer enables banks to attract deposits at lower cost. This happens because a high capital buffer signals to investors that the bank will have more incentive to screen and monitor borrowers. Hence, depositors will be willing to accept a lower rate that is safe.

Diamond and Dybvig (1983) illustrate that inefficient bank runs can be prevented by the implementation of a deposit insurance scheme. Even though it is a component of a financial system safety net that is designed to promote financial stability, in actual fact it can do the opposite. This scheme reduces depositors' incentive in monitoring banks and, as a result, it may encourage banks to engage higher in riskier activities. However, empirical studies by Cook and Spellman (1994), Park and Peristiani(1998), Martínez Pería and Schmukler (1999), Calomiris and Powell (2000), Barajas and Steiner (2000) and Ungan et al. (2008) show that depositors disciplined banks in countries like United States, Argentine, Chile, Colombia, Mexico and Russia even in the presence of explicit deposit insurance schemes. This essentially shows that depositors may not assume insured deposits to be entirely safe as they may also be worried about banks' solvency and other safety nets in a banking sector (Berger and Turk-Ariss, 2011). The economic solvency and credibility of the insurer also matter (Cook and Spellman, 1994)[7]. This is more so in the case of developing countries where the doubt about the ability of the insurers to cover their guarantees is higher (Demirguc-Kunt and Kane, 2002).

1.1.2 Conceptual Framework

Broadly speaking, this thesis aims to address three important issues in banking: i) before and during a crisis does liquidity risk play an important role in causing bank failures? ii) do depositors

[7] Cook and Spellman (1994) find that even though the deposits of U.S. savings and loan associations (S&Ls) are fully insured, their interest rate is still related to the level of risk taken by the individual institutions. This happened mainly due to the weakening financial position of the federal guarantor at that time.

react to banks' price signals? and iii) should banks disclose more risk-related information?

Existing literature has relied on CAMEL-type indicators to help predict subsequent failure of financial institutions. This strand of literature focuses on the early identification of financial difficulties. These analyses are carried out by comparing the specific traits of financially troubled banks with those of the healthy banks. The fragility of banks has often been associated with insolvency. In line with this, Basel capital adequacy rules are aimed at ensuring that banks' fundamentals are sound. However, solvency alone cannot guarantee the soundness of a bank. Illiquidity in the banking sector can cause solvent but illiquid banks to be unable to source fresh funds from the capital market in order to repay their current obligations. This can damage a bank's capital adequacy and hinder the well functioning of the banking system. The severe consequences of liquidity risk to banks can be observed during the recent Global Financial Crisis (Allen and Carletti, 2008)[8]. This crisis highlights the importance of liquidity for the well functioning of the banking system and proves that liquidity risk is an important issue that needs to be looked into.

Liquidity risk also played a very important role in the East Asian crisis. Before the onset of the crisis, financial market liberalization policies caused a large inflow of international capital into the region. However, liberalization without a sufficient supervisory and regulatory framework encouraged banks to engage in high risk taking activities prior to the crisis. Even though existing studies offer different views on the causes of this crisis[9], most of these studies agree that it was triggered by a drastic outflow of international lending. A sudden and strong outflow of funds caused a liquidity crisis and subsequently caused depositors to run from weaker to stronger banks and from the banking system as a whole. Widespread banking failures happened in these countries

[8] Liquidity provision was affected by 1) the fall of the prices of AAA-rated tranches of securitized products below fundamental values 2) the effect of the crisis on the interbank markets for term funding and on collateralized money markets. 3) the fear of contagion in the event that a major institution fails.

[9] Scholars like Krugman (1998), Corsetti et al. (1999b) and Glick and Hutchison (2001) argue that the East Asian crisis is caused by weakening fundamentals while scholars like Radalet and Sachs (1998) and Stiglitz (1999) asserts that the extent of macroeconomic imbalances and financial sector weaknesses are not sufficient in explaining the magnitude of the crisis.

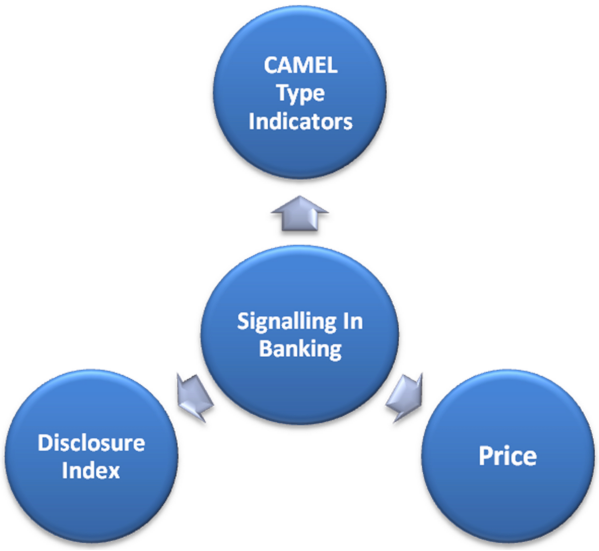

Figure 1.1: Signalling in Banking

as a result of the crisis (IMF, 1998). The abundance of liquidity before crisis and drastic drying up of liquidity during and after the crisis brings forward the case for analyzing the role of liquidity risk in the East Asian banking system. Hence, the following question analyzed in the second chapter of this thesis arises: does liquidity risk before and during a crisis play an important role in causing bank failures?

The third pillar of the Basel II emphasizes the role of market discipline. Depositor discipline is one form of market discipline. Depositors' ability to discipline banks makes risk taking costly for banks. This in turn could contribute to a more stable banking system. Depositor discipline can only take effect when depositors have sufficient information about banks' risk profile. Regulators require banks to disclose CAMEL-type indicators. Availability of such information facilitates depositors' decision making. In addition to relying on the information disclosed in the CAMEL-type indicators, depositors may base their decisions on other signals from banks.

Chapter 3 of this thesis aims to find if depositor discipline is present in the East Asian banking system. Depositors can discipline banks for high risk taking and poor performance by either withdrawing their funds or demanding a higher price. Worsening bank fundamentals may cause

depositor withdrawals. This raises the price of deposits. If depositor discipline is effective, depositors will require higher compensation from banks that have taken higher risk on-balance sheet portfolio and off-balance sheet activities. Banks may react to depositor withdrawals by raising price. Hence, worsening bank fundamentals may cause changes in both the quantity and price of deposits. This chapter aims to find if banks are able to use price signals in attracting more deposits. This will be done by controlling for the endogenous relationship between price and quantity of deposits.

In addition to using the information disclosed in the CAMEL-type indicators and price signals in attracting more funds, banks may also use detailed disclosure of risk related information in their financial statements as a signal to attract more deposits. Greater disclosure makes banks more transparent and this further facilitates market discipline. In line with this, chapter 4 of this thesis will examine the effectiveness of greater risk-related information disclosure in attracting more deposits. Disclosure Index will be used for this purpose. This index is constructed at the bank level using the amount of information available in banks' annual report on fifteen core disclosure items that relate to interest-rate risk, credit risk, liquidity risk, market risk, and capital.

In comparison to the CAMEL-type indicators which measures the soundness of banks, Disclosure Index measures the amount of risk related information that banks disclose. By disclosing more information, banks are effectively being more transparent about their financial conditions. Disclosure Index is used in this chapter in answering a very important question in banking: Should banks disclose more risk related information? Deteriorating bank fundamentals may cause changes in both quantities of deposits and the amount of risk related information that banks disclose. Hence, this study aims to analyse depositors' responsiveness to the amount of risk related information that banks disclose by accounting for the endogenous relationship between these two variables.

1.2 Outline of Thesis

This thesis consists of four additional chapters. Three chapters contain new empirical contributions. The final chapter summarizes the conclusions and policy recommendations. A brief overview of the various chapters and their main conclusions is given below.

Chapter 2 contains the empirical analysis on the role of a liquidity influx before a crisis and illiquidity during a crisis on banking fragility in East Asia. This study aims to shed light on whether banks in East Asia hold "too little" or "too much" liquidity before and during a crisis and how their vulnerabilities to failure change as a result of that. The IV method takes into account the fact that the probability of bank failure is influenced by the bank level liquidity risk variables which, in turn, are affected by international liquidity. The study finds that the effect of liquidity risk on the probability of bank failure varies before and during a crisis. The results show that higher holding of liquidity reduces banks' vulnerability to failure while higher reliance on external funding increases it. These findings bring forward the case for stronger regulation of banks' liquidity holdings, which can be brought forward by better liquidity management.

Chapter 3 empirically examines the existence of depositor discipline in the East Asian banking sector. It is mainly interested in investigating the reaction of depositors to the price signal of banks to find out if banks in East Asia are able to attract more deposits by offering higher interest rates. Panel data analysis confirms that depositor discipline is present in the East Asian banking system. It shows that depositors prefer banks that are solvent, big and offer an interest rate that are closer to the government debt rate. Further to this, dynamic panel data analysis is used to account for the endogeneity between price (interest rate) and quantity of deposits. The findings confirm the endogenous relationship between price and quantity of deposits. Once the endogeneity is controlled for, the study finds that deposits growth in the sample banks is driven by bank fundamentals but not price signals. In order to account for the possible non-linear relationship

between quantity and price of deposits, analysis is performed by dividing the sample of banks into healthy and weak categories. The results suggest that healthy banks are not able to attract more funds over time by raising their interest rate. The results also show that depositors in East Asia did not discipline weak banks by demanding a higher price. Lack of responsiveness by depositors to the price mechanism may be attributable to large outflows of deposits during the crisis period and regulations on interest rates.

Chapter 4 focuses on finding out whether greater risk-related information disclosure enables banks to attract more deposits. This is done by controlling for the soundness of banks using the CAMEL-type indicators and price mechanism using the deposits interest rate. Panel data analysis shows that banks are able to attract funds by disclosing more risk-related information during the post-crisis period. Dynamic panel data analysis confirms the endogeneity between the amount of information disclosure and quantity of deposits. Once this is controlled for, the study finds that deposits growth in the sample banks is driven by the CAMEL-type equity ratio, size and the quantity of risk-related information disclosure, but not price. This finding provides support to the proposition of the third pillar of Basel II which aims to encourage market discipline by requiring banks to disclose more risk-related information. In line with the wake-up-call hypothesis, this study finds that depositors are more responsive to the changes in information disclosure during the post-crisis period. The results also show that stronger banks are able to attract more funds by disclosing additional information but weaker banks are not able to do so. This implies that disclosure is a more effective signal for healthy banks than for weak ones.

Chapter 2 Liquidity Risk and Banking Fragility

2.1 Introduction

Banks have traditionally played a much larger role in the East Asian countries like Indonesia, Korea, Malaysia, Philippines and Thailand due to the underdevelopment of the debt and equity market. This can be seen by the rapid increase in the ratio of domestic credit provided by banking sector to GDP from 7.23 percent in 1995 to 14.83 percent in 1997 (Figure A.4). Scarcity of capital has caused these countries to rely more on external funding in financing their rapid economic development. A large percentage of capital inflows was channelled into these countries through the banks. This influenced the type and amount of liquidity held by the banks in East Asia. When a sudden and drastic outflow of international lending happened in 1997, banks were under great pressure to meet the withdrawal demands of depositors and international lenders. This triggered a liquidity crisis in the banking system and subsequently caused widespread bank failures. Existing studies by Rojas-Suarez (2001), Bongini et al, (2001), Bongini et al, (2002) and Arena (2008) show that banks that failed in East Asia were fundamentally weak ex-ante. Since illiquidity was at the heart of this crisis, this study will complement the existing ones by focusing on the role of liquidity risk in causing banking failures in East Asia.

The influx of international liquidity into the East Asian banking system prior to the crisis and the illiquidity of the banking system during the crisis expose banks to different types and degrees of liquidity risk. This study aims to shed light on the effect of international liquidity on individual banks' liquidity risk in East Asia. More specifically, this study aims to find how the liquidity influx before a crisis and international illiquidity during a crisis affects banks' vulnerability to failure. In addition to this, it also focuses on finding if banks in East Asia that relied more on external funding before and during the crisis are vulnerable to failure. A good understanding of

the extent and the type of liquidity risk that banks are exposed to before and during the crisis is important in confirming whether this action improves or worsens banks' probability of failure.

The central contribution of this study arises from the methodology that is used in the analysis. Two-stage equation models have been used in the existing studies on bank failure (Gajewski, 1988; Demirguc-Kunt, 1990; Thomson, 1992 and Godlewski, 2006) to separate the risk factors affecting bank solvency from other factors that influence a regulator's closure decisions[10]. In the present study, IV estimation is used to account for the endogeneity of liquidity risk variable. Sudden shifts in international investors' expectations that happen during the crisis are captured in the error term of the failure model. This effect not only increases the probability of bank failures, but it also may lead to higher liquidity risk. Estimating the above equation using logistic regression generally produces biased and inconsistent estimates due to the endogeneity of the liquidity risk variable.

This paper fills in the gap in the existing literature by using alternative liquidity risk measures such as the ratio of Deposits and Short-term Funds to Total Assets and the Financial Gap ratio as the proxies of banks' liquidity risk. These ratios focus on different aspects of liquidity risk that are relevant in the context of East Asian crisis. Firstly, the ratio of Deposits and Short-term Funds to Total Assets measures the sensitivity of banks to a possible run by depositors and short-term fund holders. Secondly, the Financial Gap ratio measures the effect of higher reliance on external funding on bank failures.

IV probit analyses using bank level data during a crisis (i.e. 1997) show that higher deposits and short-term base significantly reduces the probability of bank failure while higher reliance on external funding significantly increases the probability of bank failure. Probit analyses using crisis data (i.e. 1997) show that higher deposits and short-term base significantly reduce the probability

[10] Solvency risk is treated as an endogenous variable in the regulator's closure decisions model to allow distinction to be made between economic insolvency and administrative failure.

of bank failure. Differences in the findings of IV probit and probit estimation suggest that, once the endogeneity of bank specific liquidity measures is taken into account, the ability of higher deposits and short-term base in reducing the probability of bank failure diminishes. This change could be driven by the effect of international liquidity on the ratio of Deposits and Short-term Funds to Total Assets as shown in the reduced form estimation.

Analyses using probit and IV probit estimations shows that higher reliance on external funding increases the probability of bank failure. This finding is in line with Diamond and Rajan (2000)'s proposition which postulates that financial institutions' vulnerability to failure increases as a result of higher reliance on short-term funding. This could be due to the fact that external or wholesale funds like short-term debts are more volatile and costly to service compared to customer deposits and as a result banks that rely more on them are exposed to higher liquidity risks. Higher reliance on external funding also increases banks' exposure to both maturity and currency mismatch. When a large outflow of international funds happened during a crisis year, banks that relied more on external funding had to source domestic funding. Scarcity of funds raises banks' costs of funding. This, in turn, could have increased their probability of failure.

Analysis focusing only on the sample of commercial banks shows that their reliance on external funding before a crisis does not affect their probability of failure. But, analysis which includes other types of financial institutions shows that reliance on external funding before a crisis increases their probability of failure. A number of conclusions can be made based on these findings. Firstly, these findings may suggest that commercial banks' costs of funding external funds may have been lower than that of other financial institutions. Secondly, this may suggest that other financial institutions may have relied more on external funds before the crisis compared to commercial banks.

In conclusion, the findings of this study confirm that the effect of liquidity risk before and

during a crisis on the probability of bank failures in East Asia varies. This study highlights the greater benefits of having a higher deposits base and also the vulnerability of banks to failure as a result of high reliance on external funding. This brings forward the need for better liquidity management in the East Asian banking system. Overall, the findings of this study also implies that CAMEL-type indicators alone are not able to explain the large number of bank failures that happened in East Asia. Other banks specific variables, like size and ownership structure of the banks, also plays an important role in predicting failures. in addition to this, the institutional environment of these countries also strongly influences the fragility of banks.

The chapter is organized as follows. Section 2.2, describes the East Asian crisis by focusing on the role of international liquidity before the crisis and illiquidity during the crisis. Section 2.3 discusses the link between liquidity risk and banking fragility. The literature review in Section 2.4 focuses on the theory and empirical findings on bank failure. Section 2.5 describes the methodology and data used in the analysis. Section 2.6 reports and discusses the empirical results. Section 2.7 concludes.

2.2 The East Asian Crisis

Laeven and Valencia (2008) define a systemic banking crisis as an episode where there is a large number of defaults that result in the increase in non-performing loans, reduction in capital, depressed asset prices (such as equity and real estate prices) before the onset of the crisis, sharp rise in real interest rates, and a decrease or withdrawal of capital flows. A large number of bank failures is also one of the prominent features of banking crisis. Based on these descriptions, Laeven and Valencia (2008) classified five countries in East Asia namely Indonesia, Korea, Malaysia, Philippines and Thailand as countries that experienced a systemic banking crisis in 1997. In order to better understand the role of international illiquidity in triggering the crisis, this section provides a brief overview of the East Asian crisis.

2.2.1 Overview of the East Asian Crisis

In the 1980s, East Asian countries introduced financial and capital liberalization policies. These policies encouraged deregulation and increased competition in the market. Capital flow was also facilitated by favorable government policies. For example, the Bangkok International Banking Facility which was established by Thailand in March 1993 to deal in foreign-currency transactions received special tax breaks. This encouraged a "hot money" flow into Thailand amounting to USD31 billion up to the end of 1996 (Radelet and Sachs, 1998a and Khor, 1998). Similarly, Philippines reduced tax rate to 10 percent for onshore income from foreign exchange loans while other incomes were subject to a corporate income tax rate of 35 percent. Banks in Philippines did not have a reserve requirement policy on foreign-currency deposits but had a reserve requirement policy of 15 percent on peso deposits in 1996 (IMF, 1997). These encouraged more capital flow into Philippines. Malaysia liberalized its financial market by giving greater freedom for foreign funds to invest in the stock market and allowing conversion between foreign and local loans[11]. Even though Korea was hesitant in allowing short-term capital flows, it relaxed the rules in order to meet the requirements for entering the Organization for Economic Cooperation and Development (OECD) (Khor, 1998). This allowed its banks and firms to receive large inflows of short-term loans from international banks.

Changes in domestic policies in the Asian-5 countries went hand in hand with a more liberalized international capital market in causing the surge of capital flow into the region in the 1990s. The globalization of financial markets helped in reducing portfolio concentration and 'unreasonable' home bias in investment decisions. Literature on the determinants of international capital flows to emerging markets shows that economic cycles in lending countries (Jeanneau and Micu, 2002), a slowdown in US industrial production index and a drop in the US interest rate

[11] However, the Central Bank retained control on foreign-currency loans by private firms. Bank Negara Malaysia's Annual Report 1997 page 53 to 54 states that private fims wanting to borrow foreign-currency loans exceeding RM5 million need to obtain the Central Bank's approval. Firms are also prohibited from raising external borrowing to finance property purchase in the country (Bank Negara Malaysia, 1998).

(Calvo et. al, 1993; Chuhan et al, 1998 and World Bank, 2001) are among the push factors that have influenced the flow of international lending to these markets.

The net private capital flow into the Asian-5 countries doubled from 5.38 percent of GDP in 1994 to 11.10 percent in 1996 (Table A.1, A.2, A.3, A.4, A.5, A.6 and A.7)[12]. A substantial amount of net private capital inflow averaging $208.02 billion continued to enter the region in first half of 1997. The bulk of the capital inflow into these countries was in the form of bank lending. In total, foreign bank lending increased by 41.05 percent in 1995 and 21.70 percent in 1996. Foreign banks lending remained exceptionally high in Korea and Thailand. In the first and second quarter of 1997, total foreign bank lending increased by $10.62 billion and $12.77 billion respectively. This accounts for an average increase of 7.65 percent in the first half of 1997.

Rapid growth and large capital inflows in the Asian-5 countries were partly facilitated by the pegged exchange rate regime[13]. This caused limited variation in exchange rates. For example, Thai Baht movements ranged mostly between 25 and 27 baht to the US dollar for thirteen years (Edwards, 1999). This provided stability and functioned properly while the US dollar was relatively weak in international currency markets. The devaluation of the Chinese renminbi and the Japanese yen caused the strengthening of the US Dollar in mid 1996. Appreciation of US dollars against the yen posed upward pressure on the Asian-5currencies as result a of the peg (Figure A.2). This reduced the countries' export competitiveness and worsened the current account deficit.

Based on Goldman-Sachs' assessment, exchange rates were overvalued in all five countries in 1996 and mid 1997 (Edwards, 1999). Central banks in the Asian-5 countries reacted to the increased demand for domestic currencies by accumulating reserve holdings. The increase in the

[12] Net private capital flow is measured using Financial Account balance that records transactions in financial assets and liabilities between residents and non-residents.

[13] Nominal exchange rates in the Asian-5 countries were effectively pegged (de facto, pegged or quasi pegged) to US Dollars.

money supply caused liquidity to remain high as shown by the ratio of M2 as a percentage of Total Reserves (Figure A.3). Money supply expansion raised price levels and further eroded Asian-5 countries' export competitiveness.

A sharp decline in semiconductor prices reduced export revenues and caused the slowdown in economic activities. In 1996, things started worsening in Thailand as a result of a substantial decline in export growth. Investors were expecting a devaluation of Thai baht. However, the monetary authority refused to float or adjust the peg of the overvalued currency. Pressures in the foreign exchange market escalated concern on the sustainability of the peg and made the currency susceptible to speculative attacks. Thailand's central bank was not able to defend its currency due to the insufficient amount of reserve holding. This hindered its ability to act as a lender of last resort in the domestic financial market. The collapse of Thai baht in July 1997 instigated massive currency devaluations in the rest of the East Asian countries[14].

In 1997, exchange rates depreciated by an average of 32 percent against US dollar (measured in dollars per unit of Asian currency) in the Asian-5 countries with the highest drop recorded in Indonesia (95 percent) and lowest in Malaysia (12 percent) (Figure A.2)[15]. Drastic devaluation of the domestic currencies raised the effective value of existing external liabilities.

Exodus of international capital or sudden stops rather than simply deflation of asset values brought the underlying problem to the surface in Asian-5 countries[16]. Net private capital flow as shown by financial account balance fell from the high of $75 billion in 1996 to a low of -$13 billion in 1997. Capital inflow fell to $47.40 billion in the third quarter of 1997 before turning into

[14] In line with the "Wake-up call" hypothesis postulated by Goldstein (1998), problems faced by financial intermediaries in Thailand and the ineffectiveness of government's policy response made the foreign investors realize that they had a poor understanding of the working of these economies. This subsequently made them re-evaluate their investment decision in neighboring countries like Malaysia, Indonesia, Korea and Philippines.

[15] The Thai Baht's devaluation at the beginning of 1997 had a negative impact on Indonesia, Korea, Malaysia, and other countries' economies because it reduced their export competitiveness (Glick and Rose, 1999). This forced Thailand's trading partners to devaluate their currencies in order to remain competitive.

[16] Sudden stops are defined as a period during which there is an unexpected reversal of net private foreign capital flow and there is a request to pay back foreign loans that are maturing (Calvo, 1998).

a net outflow of $40.41 billion in the last quarter of 1997. A single-year capital flow fluctuation of $88 billion amounts to 10 percent of the 1996 total GDP of the Asian-5 countries.

2.2.2 The East Asian Banking Sector

The East Asian countries had a deeper financial system mainly due to the underdevelopment of the debt and equity markets[17]. Growth in the ratio of domestic credit to GDP was very high as shown in Figure A.4. For the period from 1995 to 1997, it averaged 10 percent. A high percentage of this credit was provided through the banking sector. Credit provided by banking sector ranged around 60 percent of GDP in Indonesia, Korea and Philippines. Malaysia and Thailand had an exceptionally large banking sector as the ratio of credit provided by banking sector to GDP was 185.82 percent and 148.98 percent respectively.

Prior to liberalization, ceilings on real interest rates and credit rationing are often imposed. After liberalization, interest rate spread widens and competition in the banking sector increases. Liberalization of the financial market in East Asia caused a rapid inflow of international funds into the banking system. Foreign bank lending was channelled to both domestic bank and non-bank corporate borrowers (Table A.8). Lending to the banking sector was higher in Korea while lending to the corporate sector was higher in the rest of the countries.

A high percentage of foreign bank lending that went into Indonesia, Korea and Thailand was on a short-term basis. This aggravates maturity mismatch in the balance sheet as funds borrowed abroad on a short-term basis was used to finance long-term assets domestically. In the event of a crisis, short term debts increase the possibility of coordination failure among lenders as they refuse to roll over their funding.

Domestic banks also had a substantial amount of foreign-currency borrowing (mostly in dollars) which was lent out at home in domestic currency. High Domestic Liability Dollarization

[17] The depth of the financial sector is measured by the value of Private Sector Ccredit to GDP, which is measured using the value of credits by deposit-taking institutions allocated to the private sector divided by GDP. It excludes credit issued by the central bank, credit to the public sector and inter-bank loans (Krozner, Laevan and Klingeniel, 2007).

(DLD) exposes the banking systems to increased risk in the event of a large depreciation in real exchange rates (Eichengreen et al.,2003)[18]. As a result, banks' balance sheets became vulnerable to currency mismatch. Even though the ratio of dollar liabilities to total liabilities was not large in the Asian-5 countries, their sizeable banking system caused DLD to have a significant effect on the economy (Calvo et al., 2008). DLD doubled from 13.72 percent in 1995 to 27.95 percent in 1997 for the Asian-5 countries (Figure A.5). Philippines and Thailand had an above-average DLD of 43.23 percent and 41.34 percent respectively.

Before crisis, Asian-5 banks recorded high deposit and short-term funding growth (Table A.9). In 1995, the growth of the short-term fund (46.32 percent) was almost double that of total deposits (24.36 percent)[19]. Growth of short-term funds and deposits slowed down to 11.46 percent and 15.41 respectively in 1996. Growth in the total amount of loans extended by banks was also in tandem with growth in deposits and short-term funds. Net loans increased by 29.65 in 1995 before slowing down to 16.12 percent in 1996. Similarly, banks' holding of liquid assets increased by 29.42 percent in 1995 before slowing down to 4.99 percent in 1996. Banking sector growth can also be observed by the expanding total assets. From 1994 to 1996, Asian-5 banks' total assets increased by 32.66 percent.

When the crisis happened, foreign bank position, as shown by Net Bank Liabilities, fell by $25.7 billion in 1997 (Table A.6). The outstanding amount of lending, extended by the Bank of International Settlement reporting countries to Asian-5 banks, dropped by $11.73 billion in the third quarter of 1997 and $24.90 billion in the last quarter of 1997 (Table A.8). Banks' external funding was reduced dramatically when foreign creditors refused to roll-over their short-term debt. This triggered illiquidity in the Asian-5 banking systems.

This caused maturity mismatch in the banking system. Drastic devaluation of domestic

[18] Domestic Liability Dollarization is a measured by adding up dollar deposits and domestic banks' foreign borrowing as a share of GDP.

[19] Based on the sample of banks used in this study.

currencies caused currency mismatch. The demand for liquidity in the banking system increased as a result. Banks increased their dependence on domestic funding. This subsequently raised the cost of external finance. For example, nominal interest rate in Indonesia surged by almost 60% per annum in January 1998 (Basurto and Ghosh, 2000).

Drastic outflow of capital from the Asian-5 countries caused all the stock markets to fall. By the beginning of 1998, all the indices had gone below 50 points and remained at that point until the middle of 1998 (Table A.13). A large portion of the market capitalization was wiped out as a result of the drastic drop in the stock markets. Investment in the stock markets was partly funded through margin financing that was provided by the financial institutions. This severely affected the financial standing of financial institutions in the Asian-5 countries that were overexposed to these sectors. The bubble in real estate also burst and property prices collapsed as a result. Prices of the commercial and residential property reached the bottom in the fourth quarter of 1997 (Table A.11 and A.12).

Within the same year, banks' credit expansion was curtailed. Total amount of loans (net) extended fell by 31.85 percent as a result (Table A.9). Total assets in the banking sector shrank by 35 percent while liquid assets dropped by 22.25 percent in 1997. The fall in asset values cause the level of Non Performing Loans (NPL) to rise. This lead to a further reduction in banks' profit. Negative net worth (liabilities exceed assets) causes banks' solvency risk to rise. The worsening of banks' fundamentals caused domestic depositors to run on the banks. This further aggravated banks' liquidity problems. Large number of bank failures happened as a result of this crisis.

2.3 Liquidity in Banking

The East Asian crisis highlights the importance of liquidity for the well functioning of the banking system. It also shows the vulnerabilities that arise as a result of high dependence on international liquidity. In order to better understand these issues, this section explains about the role of liquidity in banking. It also describes the type of funds that banks rely on and also the

Country	Underlying Problem	Roots of the Problem	Post shock problem	Policy response
Indonesia	- High percentage of short-term lending by foreign banks - Exchange rate overvalued - Overexposure of lending to property sector and stock market	- Liberalization of the financial sector	- Capital outflow exacerbate maturity mismatch - Currency depreciation exacerbates currency mismatch - Rise in NPL & bank run happened	- Liquidity injection - Introduce deposits insurance - Bank restructuring
Korea	- High percentage of short-term lending by foreign banks - Exchange rate overvalued - Overexposure of lending to property sector and stock market	-Relaxed rule on foreign capital inflow	- Capital outflow exacerbate maturity mismatch - Currency depreciation exacerbates currency mismatch - Rise in NPL	- Liquidity injection - Introduce deposits insurance - Bank restructuring
Malaysia	- Short-term lending by foreign banks - Exchange rate overvalued - Overexposure of lending to property sector and stock market	- Foreign funds allowed to invest in stock market - Allowed conversion between foreign and local loan	- Capital outflow exacerbate maturity mismatch - Currency depreciation exacerbates currency mismatch - Rise in NPL	- Liquidity injection - Introduce deposits insurance - Bank restructuring - Capital control
Philippines	- Short-term lending by foreign banks - Exchange rate overvalued - High domestic liability dollarization - Overexposure of lending to property sector and stock market	- Reduce tax for onshore income from foreign exchange loan - Did not impose reserve requirement for foreign currency deposit	- Capital outflow exacerbate maturity mismatch - Currency depreciation exacerbates currency mismatch - Rise in NPL	- Liquidity injection - Bank restructuring
Thailand	- High percentage of short-term lending by foreign banks - Exchange rate overvalued - High domestic liability dollarization - Overexposure of lending to property sector and stock market	- Establishment of Bank of International Banking Facility encouraged "hot money" inflow	- Capital outflow exacerbate maturity mismatch - Currency depreciation exacerbates currency mismatch - Rise in NPL & bank run happened	- Liquidity injection - Introduce deposits insurance - Bank restructuring

Table 2.1: Description about the East Asian Crisis

nature of these funds.

2.3.1 Liquidity Risk and Banking Fragility

In the context of economic literature, liquidity refers to the ability of an economic agent to exchange his or her existing wealth for goods and services or for other assets (Williamson, 2008). This definition encompasses the concept of flows and the ability in realizing these flows (Nikolaou, 2009). Funding liquidity is defined as the ability of banks to meet their liabilities, unwind or settle their positions as they become due (Drehmann and Nikolaou, 2009)[20]. Similarly, the IMF defines funding liquidity as the ability of solvent institutions to make agreed-upon payments in a timely fashion. Liquidity is inversely related to liquidity risk[21]. Liquidity ratio is used as one of the key elements is measuring banks' financial strength. Banks that have a higher level of liquidity would have lower liquidity risk. The Basel Committee on Banking Supervision (2000) defines liquidity risk as arising from a bank's inability to accommodate decreases in liabilities or to fund increases in assets at a reasonable cost, timely. In other words, liquidity risk can be defined as the risk resulting from the inability of a financial institution to source funds due to exceptionally high costs of liquidity transformation, or the inability to honor its debts and obligations when they are due because its not able to convert assets to cash.

Banks require liquidity for various reasons, among them are to compensate for net outflow of funds, as a buffer for the non-receipt of expected funds inflowing, as a source of funds when contingent liabilities become due and as a source of funds for engaging in new transactions when desirable. However, due to pure market failures, banks do not have incentives to keep a sufficient amount of liquid assets (IMF, 2008). These market failures arise as a result of several factors.

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[20] Existing literature has classified financial markets' liquidity into three different categories; market liquidity, funding liquidity and central bank liquidity. Market liquidity refers to the ability to "trade an asset at short notice, at low cost and with little impact on its price" while Central bank liquidity refers to the ability of the central bank to supply the needed liquidity to the financial market (Nikolaou, 2009).

[21] In the context of an agent's decision making, the term risk relates to random outcomes with known probabilities whereby agents have well defined preferences with regard to the random variable of interest (Machina and Rothschild,2008).

Firstly, holding a high liquidity ratio during a normal time is costly for banks since it is associated with lower return on assets without much offsetting benefit (Allen and Carletti, 2008)[22]. Secondly, the probability of a shortfall in liquidity does not happen regularly. Edwards (2005) finds that illiquidity that happens as a result of unexpected reversal of net private foreign capital flow happened in emerging-market countries every decade. Since the frequency of liquidity crisis in the banking sector is not high, banks do not find it justifiable or profitable to keep a high amount of liquid assets during a normal time. Thirdly, there is a general expectation that central banks will step in, in the form of the Lender Of Last Resort (LOLR) in providing liquidity for banks in the event of crisis[23].

Banks are normally able to accurately predict the consumption need of their investors and ensure that they have an adequate amount of low-cost funding that is available at short notice in meeting the withdrawal demands of the investors. Since most lenders do not need to use all their money at the same time, banks are able to act as a financial intermediary by lending out a large part of the funding that they receive in order to generate profit. A large amount of funds that are usually available at reasonable costs before the onset of crisis enables banks to engage in greater financial intermediation activities and earn a good return. Berger and Bouwman (2008), for example, finds that banking crises are preceded by a significant build-up of abnormal positive liquidity creation by banks[24].

However, an extreme form of funding liquidity risk arises during crisis time (Nikolaou, 2009). This causes bank runs to happen. Diamond and Dybvig's (1983) seminal work on bank runs highlight the existence of multiple equilibria in a banking model. A bank run is modelled as a

[22] Competition in the banking industry encourages banks to invest in long-term illiquid assets that yield higher return compared to short-term liquid assets. This is especially the case during good times when there are a large amount of deposits and short-term funding available. As long as there are no runs, banks that keep a high level of illiquid assets will be able to offer more attractive collateral compared to banks that are more prudent (Cao and Illing, 2009).

[23] Even though LOLR provides a safety net for the banks, it also creates a moral hazard problem for banks by reducing their incentives in keeping sufficient liquidity buffers (Repullo, 2005).

[24] The analysis is based on the aggregate liquidity creation of banks at the time before, during, and after five major financial crises in the U.S. from the first quarter of 1984 to the first quarter of 2008.

bad equilibrium whereby depositors decide to liquidate their deposits before the maturity of the investment, leading to increased demand for liquidity. Banks that do not hold a sufficient amount of liquid asset or are unable to raise new funds from the market will have a problem in honoring large amounts of deposit withdrawals that happen at the same time. This happens as a result of banks' adherence to the fractional reserve system and the imposition of the sequential service constraint that requires depositors to be served based on the first-come first-served basis. The prospect of a fire sale makes it optimal for the depositors to run on the banks if they expect others to run too since early liquidation lowers value and makes runs costly.

A bank run is contagious (Diamond and Rajan, 2005). A run on one bank can spread to the rest of the banking system and trigger system wide withdrawals. The following example gives a clear illustration as to how this can happen. Suppose an investor has provided deposit and short-term funding to banks A and B at the same time. Any untoward news about bank A causes this investor to reevaluate his or her investment prospect in bank B too. This is mainly the case if the investor perceives that the problem faced by bank A is not an isolated case, and that it can send ripples of shock into the rest of the banking system even though bad news about bank A would not directly affect any of the accounting data of bank B; it contributes toward the shift in the investor's expectations towards bank B. Naturally, when a large number of depositors and other short-term creditors pull their money out of the banking system, a liquidity crisis happens. A run on a single bank can also spread to the rest of the banking system through its inter-bank claims, payment systems linkages and information sharing (Allen and Gale, 2007).

2.3.2 Type of Funds

Banks' vulnerability to a run is related to the type of funds that they depend on. Since the behavioral attitudes of different types of lenders influence their sensitivity to credit risk and interest rates, this affects the flow of funds into banks (Duttweiler, 2009). Banks have traditionally relied more on retail funds provided by individual investors as their major source of funding.

Although retail funds continue to be a key liability funding source, many banks have experienced difficulty in attracting retail deposits. As a result, banks have supplemented their traditional funding sources with wholesale funds. These funds are typically provided by large corporations, banks and other financial institutions and government agencies (domestic and international). These funds are managed by professionals who are more informed and as a result more detailed and careful in assessing banks' performance compared to retail depositors who are relatively less informed and unsophisticated.

Wholesale funds are large in quantity and highly volatile (Dutweiler, 2009). As a result, any drastic and sudden withdrawal of funds by this group of investors can have a very damaging effect on banks. Even though liquidity risk has traditionally been linked to loss of demand deposits, withdrawals or non-renewals of short-term financing have been linked to liquidity risks in recent times as illustrated by Diamond and Rajan (2000). Wholesale funds like short-term debts are also more expensive to service compared to customer deposits (Saunders and Cornett, 2006). Hence, during normal times, banks that rely on this type of funds might be more inclined to engage in higher risk taking activities in order to generate a higher return.

Compared to wholesale funds, retail funds are considered to be a more stable and resilient source of funds for banks (Yorulmazer, 2008 and Dutweiler, 2009). For example, based on recent liquidity events such as the Russian default and the fall of Long Term Capital Management (LCTM), Gatev and Strahan (2006) finds that retail deposits are a more stable source of bank funding than wholesale funds for the U.S. banks. This means that retail depositors are less likely to withdraw their funds or fail to renew them, if there is some adverse development or bad news about the bank. This can be due to the high searching and switching costs that are incurred by this group of liability holders [25].

[25] For example, data obtained from the Financial Research Survey of the National Opinion Poll for the UK shows that a typical current account holder does not change banks during their lifetime, i.e. only change banks every 91 years (Gondat-Larralde and Nier, 2006).

2.4 Literature Review

2.4.1 Theory on Bank Failure

This section provides a brief overview of the literature on the theory of bank failure. Existing literature is divided on the causes of bank runs. The panic-based view suggests that depositors run on banks due to undesirable events that are unrelated to changes in the real economy (Kindleberger, 1978). Panic is described as a random exhibition of 'mob psychology' which is embedded in individual and collective psyches. In this case, irrespective of long-term solvency, depositors' self-fulfilling prophecies cause a run to happen. A modern version of this view is postulated by Bryant (1980), Diamond and Dybvig (1983), Waldo (1985), and Postlewaite and Vives (1987).

The fundamental-based view, on the other hand, asserts that bank failures happen as a result of fundamental changes in the economic activities that affect banks' solvency. Depositors react to this by withdrawing their funds from weaker banks. This view has been proposed by Gorton (1985), Chari and Jagannathan (1988), Jacklin and Bhattacharya (1988), Calomiris and Kahn (1991), Donaldson (1992) and Allen and Gale (1998). According to this view, bank failures are determined by banks' fundamentals, and as a result only weak and fragile banks fail.

Moris and Shin (1998) reconcile these two views in a currency attack model and achieve a unique equilibrium whereby even though agents' withdrawals happen indirectly due to the weakening of the fundamentals, the resulting panic-based run happens because agents believe that other agents are going to withdraw too. Goldstein and Pauzner (2005) apply this global-games theory in a bank run model and demonstrate that a panic-based run can happen when a bank's fundamentals are good enough that agents would not run had they believed that others would not. A run is, nonetheless, shown to happen if and only if the fundamentals of the economy are below some threshold level. Chui et al.(2000) illustrate this approach in the context of a model of sovereign liquidity crises, and find that shifts in investors' expectations and fundamentals interact

in causing illiquidity. Weaker economic fundamentals facilitate in making pessimistic investors' expectations self-fulfilling.

Chang and Velasco (1998, 2001) models the East Asian crisis as a liquidity crisis and shows that a bank run equilibrium can emerge in a banking system characterized by insufficient liquidity to fulfill short-term obligations. Their model shows that illiquidity of the banking system increases its vulnerability to exogenous shocks and shifts in expectations. Dekle and Kletzer (2001), on the other hand, uses an endogenous growth model that considers the dynamic relationship between international capital flow, domestic investment, firm debt and value, and also bank equity in analyzing the East Asian financial crisis. They show that the fragility of a banking system with information asymmetry increases in an economy characterized by imperfect prudential regulation and public sector loan guarantees when there is an expected reversal of capital flows. In their model, banks have the incentives to renegotiate the firm's debt when there is a firm-specific productivity shock. When the latter happens, the bank's exposure to risky assets increases the same time their foreign borrowing increases. In this case, a crisis emerges endogenously in their model due to the increase in bank fragility as a result of worsening portfolio and higher solvency risk.

2.4.2 Empirical Work on Bank Failure

Economic failure of the banks is one of the main reasons why regulators decide to fail banks[26]. Economic insolvency of banks happens when banks' net worth turns negative, or if they are unable to operate normally without incurring losses that result in negative net worth (Gonzalez-Hermosillo, 1996). Existing studies have used information in banks' financial statements in predicting bank failure. Financial standing of the banks, as reflected in their financial statements, essentially reflects the ex-post results of bank managers' decision making and also

[26] Banks operate in a very highly regulated industry. As such, Kane (1989) postulates that the decision to fail a bank is often made by the regulators based on public choice theory.

regulators' guidelines (e.g. the required level of capitalization). The information in banks' financial statements helps in identifying the extent of banks' leverage and asset risk by capturing the market, credit, operational and liquidity risk faced by banks (Sinkey, 1975).

Beaver (1966)'s study is one of the earlier studies that has used accounting data to forecast firms' solvency. The probability of the non-financial firms going bankrupt is forecasted using their financial ratios. Meyer and Pifer's (1970) study is the first to use financial statements in identifying bank failures. Among the methods that have been used in the existing literature are univariate analysis (Beaver, 1966), multiple discriminant analysis (Deakin, 1972 and Altman, 1977), logistic regression (logit and probit models) (Thomson, 1991; Gonzalez-Hermosillo, 1996; Estrella et al., 2000; Andersen, 2008 and Arena, 2008), survival model (Cox, 1972; Whalen, 1991; Wheelock and Wilson, 2000; Arena, 2008 and Mannasoo and Mayes, 2008), two-stage equations model (Gajewski, 1988; Demirguc-Kunt, 1990; Thomson, 1992; Bongini et al., 2001 and Godlewski, 2006) and neural network (Tam, 1991; Tam and Kiang, 1992 and Salchenberger et al. 1992).

Most of the earlier studies of bank failures are carried out using United States data. Failed banks have been found to exhibit poor loan quality, low earnings, high liquidity risk and inadequate capitalization (Altman, 1977; Martin, 1977; Rose and Scott, 1978; Wheelock and Wilson, 2000). One of the frameworks that is widely used by the governing authorities in assessing banks' financial standing is the CAMEL framework[27]. Studies by Thomson (1991), Wheelock and Wilson (2000), Molina (2002) and Arena (2008) confirm that the CAMEL framework is effective in predicting banking failure. Later studies by Whalen (1991) and Gonzalez-Hermosillo (1996) incorporated macroeconomic factors in predicting bank failures. This is based on the premise that in addition to being susceptible to their own financial solvency, banks are also exposed to adverse shocks in the economy. This creates a link between individual banks' fragility and the banking

[27] The five components of CAMEL framework are capital adequacy, asset quality, management, earning and liquidity.

systems vulnerability to crises.

Among the studies by that have looked into the determinants of bank failure in East Asia are Rojas-Suarez (2001), Bongini et al, (2001), Bongini et al, (2002) and Arena (2008). Bongini et al (2001) studies the closure decision on banks in Indonesia, Korea, Malaysia, Thailand and the Philippines in order to identify the effect of banks' "connections" to industrial groups or influential families, and of weak bank specific fundamentals on bank failure. They find that traditional CAMEL type variables like returns on assets (ROA), loan growth, the ratio of loan loss reserves to capital, net interest income to total income, and of loans to borrowings help in predicting subsequent distress and closure. Similarly, the size and ownership structure of the financial institutions also help to predict failure. They find that liquidity risk, as measured by the ratio Total Loans to Total Borrowing, does not influence bank distress, but it significantly reduces bank closure[28]. In addition to this, they also find that "connections" increase the probability of distress and make closure more likely. Bongini et al, (2002), on the other hand, compares the ability of three types of information (balance sheet, stock markets, and credit rating) in predicting bank distress in East Asia. Their findings show that balance sheet indicators coupled with banks' ownership structures are the most effective predictor of bank distress[29].

Rojas-Suarez (2001) evaluates the "true" riskiness of banks in six emerging-market countries (Korea, Malaysia, Thailand, Colombia, Mexico and Venezuela) based on markets that work rather than just relying on the traditional financial indicators that work well in industrial countries. Using a t-test and the 'signal to noise approach' methodology proposed by Kaminsky and Reinhart (1999) in studying currency crises, they find that the capital-to-asset ratio performed poorly as an indicator of banking problems in East Asia and Latin America while alternative indicators such as the interest rate paid on deposits, and interest rate spreads performed well. They also find that

[28] Bongini et al (2001) defines distressed banks as those that have been closed, merged, recapitalized or suspended.

[29] Credit rating information showed a much lower predictive power while stock market information reacted faster than the other two in incorporating new information sources.

weaker banks had a lower liquidity ratio before crisis.

Arena (2008) compares the determinants of banking fragility in East Asian and Latin American countries[30]. The results show that weaker banks ex-ante are more likely to fail ex-post in the crisis countries. More specifically, the findings show that higher ex-ante capital adequacy, liquidity and returns are associated with lower probability of failure while higher loan to total assets ratio is associated with higher probability of failure. The findings also show that bank structure significantly influences bank failures as bigger banks and foreign banks are less likely to fail.

Even though existing studies on the East Asian bank failures (Rojas-Suarez, 2001; Bongini et al, 2001; Bongini et al, 2002 and Arena, 2008) are extremely informative, they have a number of limitations as far as the objectives of this chapter are concerned. Firstly, they aim to identify whether failed banks were fundamentally weak ex-ante. However, this chapter aims to find the effect of a liquidity influx before a crisis and international illiquidity during the crisis on bank failures. This finding will help in identifying the amount and type of liquidity risk that banks are exposed to before and during crises. This information can be useful for policy makers in regulating the management of liquidity by banks.

Secondly, the existing studies have relied on traditional measures of liquidity risk like the ratio of Liquid Assets to Total Deposits (Rojas-Suarez, 2001), Total Loans to Total Borrowing (Bongini et al., 2001) and Liquid Assets to Total Liabilities (Arena, 2008)[31]. This paper fills in the gap in the existing literature by focusing on alternative liquidity risk measures namely the ratio of Deposits and Short-term Funds to Total Assets and the Financial Gap ratio to measure banks' liquidity risk. Using these ratios as proxies for liquidity risks allows this study to focus on different aspects of liquidity risks that are relevant in the context of the East Asian crisis.

Thirdly, existing studies (Bongini et al., 2001; Bongini et al., 2002 and Arena, 2008) use

[30] Their analysis for the East Asian countries includes countries that did not experience a banking crisis (Hong Kong, Singapore, and Taiwan).

[31] Bongini et al. (2002)'s study did not include liquidity risk as one of its determinants of bank failures.

cross-sectional logit analysis in finding the ex-ante determinants of bank failures[32]. However, the present study uses IV estimation to account for the endogeneity of liquidity risk variable. More specifically, this study takes into account of the fact that the probability of bank failure is influenced by bank specific liquidity which, in turn, is affected by international illiquidity. Existing studies on bank failure (Gajewski, 1988; Demirguc-Kunt, 1990; Thomson, 1992 and Godlewski, 2006) have used a two-stage equation model to allow separation to be made between risk factors affecting bank solvency and other factors that influence regulators' closure decisions[33]. Solvency risk is treated as an endogenous variable in the regulator's closure decisions model to allow distinction to be made between economic insolvency and administrative failure[34].

2.5 Methodology

2.5.1 Cross Sectional Probit and Logit Estimation

Binary choice model is one of the most common statistical models that are used in analyzing the probability of bank failure. This model estimates the probability that a given set of characteristics will be classified as default or no default. Accordingly, the dependent variable y in this model takes the value of 0 (no default) or 1 (default).

$$P(y_{1i}^{*} = 1 \mid x_i) = F(\beta_0 + x_{1i}\beta_1 + x_{2i}\beta_2 + ...u_i) \tag{2.1}$$

where x are the explanatory variables. $F(.)$ is the normal cumulative distribution function. The continuous dependent variable labelled y_{1i}^{*} is not directly observed. Instead y_{1i} is observed in only two possible states

$$y_{1i} = \begin{cases} 0 \; y_{1i}^{*} < 0 \\ 1 \; y_{1i}^{*} \geq 0 \end{cases}$$

[32] Since these studies focused on the ex-ante determinants of bank failures, 1996 financial statement variables are used to capture the changes in bank fundamentals.

[33] Demirguc-Kunt's uses a third equation to model bank's net value of the deposits insurance contribution.

[34] Using a two step method proposed by Maddala (1986), the first equation models net value of the bank (solvency) using OLS estimation while the second models the bank's failure (regulator's behavior) using a logit estimation.

As simple linear regression is not a best choice as it does not restrict the estimated value of y to be in the interval between 0 and 1[35]. A logit or probit model is commonly used in predicting bank failures. [36]. The estimates of the coefficients of the logit and probit model cannot be interpreted in the same manner as the normal regression coefficients because these coefficients give the impact of the independent variables on the latent variable y^*, not y itself. As such, marginal effect is computed in order to estimate the effect of changes in the independent variables on the probability of failure.

2.5.2 Instrumental Variable (IV) Estimation

In cross-sectional analysis, ordinary least squares is the simplest and oldest method. This approach assumes that the unobserved factors (u) involved in the regression function are not related in any systematic way to the observed factors (x) $(E[u|X] = 0)$. Then the only effect of x on y is a direct effect via the term x. However, there may be an association between regressors and errors under some situations. OLS regression generally produces biased and inconsistent estimates when there is a correlation between the unobserved factors (u) and the observed factors (x)[37]. The instrumental variable (IV) estimation method, which incorporates two-stage least squares (2SLS) analysis, provides a solution to this problem (Wooldridge, 2001 and Greene, 2008).

IV Probit estimation fits models with dichotomous dependent variables and endogenous regressors (i.e. when one or more of the regressors are correlated with the error term). The model is written as following:

$$y_{1i}^* = y_{2i}\beta + x_{1i}\gamma + u_i \tag{2.2}$$

[35] Compared to OLS, binary choice models constrain the estimated probabilities to be between 0 and 1, and relax the constraint that the effect of independent variables is constant across different predicted values of the dependent variable.

[36] The major difference between logit and probit models lies in their distributions. The probit model is based on the normal distribution while the logit model is based on the logistic distribution.

[37] Because it takes into account of the direct effect of x on y and indirect effect of x on y via u.

$$y_{2i} = x_{1i}\Pi_1 + x_{2i}\Pi_2 + v_i \tag{2.3}$$

where $i = 1, ..., N$, y_{2i} is a $1 \times p$ vector of endogenous variables, x_{1i} is a $1 \times k_1$ vector of exogenous variables and x_{2i} is a $1 \times k_2$ vector of additional instruments. The equation for y_{2i} is written in a reduced form.

IV estimation method uses the additional exogenous x_{2t} as instrument. This instrumental variable has a property that its changes are associated with changes in y_t but do not lead to changes in y_t^* (except indirectly via y_t). More specifically, a variable used as an instrument needs to fulfill two conditions; (1) it must be uncorrelated with the error; and (2) it must be correlated with the regressor. Based on these assumptions, the instrument cannot be a regressor in the structural model and there should be some association between the instrument and the endogenous variable. The use of an exogenous instrument separates the variance of the endogenous explanatory variable into endogenous and exogenous components, and the latter is then used in the structural estimation.

Even though the asymptotic variance of the IV estimator is usually larger than the asymptotic variance of the OLS estimators, IV estimation method allows consistent estimation to be obtained when the explanatory variables are correlated with the error terms (Wooldridge, 2001). The loss in efficiency that happens as a result of using IV estimation is justifiable if the OLS estimator is biased and inconsistent. IV estimation will be preferred to the OLS estimator if the selected instrument is moderately to highly correlated with the endogenous variable and there is a strong theoretical or practical argument that can justify why the instrument is considerably more exogenous than the endogenous regressor (Larcker and Rusticus, 2010). However, in the event that the correlation between the instrument and the x variable is low, and there are concerns about whether the instrument is truly exogenous, the OLS estimator is preferred to the IV estimator (in

terms of bias).

2.5.3 The Model

In the context of this study, the binary dependent variable $BFAIL_{it+1}$ takes the value of 1 if a bank fails during the year, and 0 if it survives. $BFAIL^*_{it+1}$ is the latent variable, which is not observable and assumed to depend on a number of explanatory variables. The latent variable is linked to the observable $BFAIL_{it+1}$ variable by a measurement equation. The latent variable $BFAIL^*_{it+1}$ is linked to the observable categorical variable as follows:

$$BFAIL_{it+1} = 1 \text{ if individual bank fails (if } BFAIL^*_{it+1} > 0) \tag{2.4}$$

$$BFAIL_{it+1} = 0 \text{ otherwise (if } BFAIL^*_{it+1} \leq 0) \tag{2.5}$$

The latent variable link to the explanatory variables as follows:

$$\begin{aligned} \text{Prob } (BFAIL^*_{it+1} &= 1) = F(\beta_0 + \beta_1 Capital_{it} + \beta_2 AssetQ_{it} + \beta_3 MgtQuality_{it} + \\ &\beta_4 Earnings_{it} + \beta_5 Liquidity_{it} + \beta_6 Ownership_{it} \\ &+\beta_7 \text{ Si } ze_{it} + \beta_8 GovIndicator_{jt} + \varepsilon_{it}) \end{aligned} \tag{2.6}$$

Where,

$BFAIL^*_{it+1}$: represents the latent variable, and its scale can not be determined.

ε_{it}: is a composite error term.

$Capital_{it}$, $AssetQ_{it}$, $MgtQuality_{it}$, $Earnings_{it}$, $Liquidity_{it}$: are vector of bank-specific CAMEL criteria variables in period t for bank i.

$Ownership_{it}$: is a bank-specific ownership variable in period t for bank i.

Si ze_{it}: is a bank-specific size variable in period t for bank i.

$GovIndicator_{jt}$: is a country specific Governance Indicator variable in period t for country j.

The above equation implies that the larger values of $BFAIL^*_{it+1}$ are observed as $BFAIL_{it+1} = 1$ (i.e. failed banks), while those with smaller values of $BFAIL^*_{it+1}$ are observed as $BFAIL_{it+1} = 0$ (i.e. non-failed banks). The coefficient of the independent variable measures the effects on the odds of failure of a unit change in the corresponding independent variables. Bank-level and country-level data during the crisis (i.e. 1997) will be used to analyze bank failures that happened in 1998 and 1999[38]. Analysis will also be carried out using before crisis data (i.e. 1996).

Empirical studies on bank failures have used financial statement information in predicting bank failures. The error term in the bank failure model embodies factors other than financial statement information that influence failures. Existing banking theory postulates that sudden a shift in investors' expectations during a crisis year causes a liquidity shock in the banking system. The review of the East Asian crisis in the earlier section shows that international illiquidity happened during the crisis year. This factor, which is embodied in the error term of a bank failure model, can cause a run on banks. The probability of bank failures increases as a result of this, and so does liquidity risk[39]. Hence, estimating bank failure using cross-sectional probit / logit analysis generally produces biased and inconsistent estimates[40]. As a result, the IV estimation method is used to account for the endogeneity of the liquidity risk variables.

Exogenous variables that are relevant in explaining liquidity risks of banks are identified. This includes included instruments and excluded instruments. Prior to the crisis, huge amounts of international funds were channeled to the East Asian region. High percentages of these funds were channeled through the banking system. Based on this condition, factors that influence the flow of international capital into these countries can be used as instruments. Two variables that strongly influence these flows are Interest Rate Difference and International Capital Control. The Interest

[38] A significant percentage of failures happened in 1998 and 1999.
[39] Liquidity risk increases when banks are unable to honour depositors' withdrawal demands.
[40] Because it takes into account the direct effect of x on y and indirect effect of x on y via u.

Rate Difference variable takes into account the difference in the money market rate between the respective East Asian countries and United States[41]. Studies on the determinants of international capital flow and bank lending to emerging markets have found interest rate differential to be a significant contributor to this flow (Jeanneau and Micu (2002)[42]. The International Capital Control variable, which is obtained from the Abiad et al.(2008) database on financial reform, accounts for the restrictions imposed on international financial transactions[43]. Higher restrictions are associated with stronger government control over the flow of international capital into the economy.

These two variables have direct effect on banks' liquidity risk because they influence the amount of external funds that enters the East Asian banking system. They should be uncorrelated with the error term in the bank failure model or exhibit a lower correlation with the error term in the bank failure model than the liquidity risk variable because their effect on bank failure can only happen through the endogenous liquidity risk variable. In order to control for the effect of international illiquidity that happens during crisis year on the liquidity risk variables, the lagged value of the Interest Rate Difference and International Capital Control variables are used as the excluded instrument in the reduced form equation.

Analysis is carried out using IV probit estimator [44] (see Appendix B). The structural equation of the bank failure model is shown in Equation 2.6. Liquidity risk, which is one of the major components of the CAMEL framework, is one of the determinants of bank failure. The reduced form equation where the endogenous liquidity risk variable is only a function of exogenous variables is given below:

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41 Money market rate is the rate on short-term lending between financial institutions. This data is taken from line 60b of International Financial Statistics.

42 Jeanneau and Micu (2002) provides the summary of the findings of studies on the determinants of international capital flows to emerging market countries.

43 These restrictions takes into account the existence of multiple exchange rates for various transactions, restrictions on capital inflows (whether banks are allowed to borrow from abroad freely) and outflows.

44 In Stata, the IV probit routine fits models with dichotomous dependent and continuous endogenous regressors and jointly estimates two equations using maximum likelihood estimator of Amemiya's generalized least squars estimator (as illustrated in Newey, 1987).

$$
\begin{aligned}
Liquidity_{it} \;=\; & \eta_{it} + \theta_1 Capital_{it} + \theta_2 AssetQ_{it} + \theta_3 MgtQuality_{it} + \\
& \theta_4 Earnings_{it} + \vartheta Ownership_{it} + \lambda \,\mathrm{Si}\, ze_{it} + \\
& \mu GovIndicator_{jt} + \pi IntDiff_{jt-1} \\
& + IntlCapControl_{jt-1} + \varepsilon_{it}
\end{aligned}
\tag{2.7}
$$

Probability of bank failure is influenced by bank-specific liquidity which, in turn, is affected by international liquidity. The IV method estimates the effect of liquidity risk during the crisis year on the probability of bank failures by taking into account of the endogeneity of the liquidity risk variable, while the probit / logit method estimates the effect of liquidity risk during the crisis year on the probability of bank failures without taking into account of the endogeneity of the liquidity risk variable. Comparison of the results using IV probit and probit / logit methods allows us to see how the coefficient on the liquidity risk variable changes direction or magnitude during a crisis as a result of the international illiquidity. To my knowledge, at present, there are no other studies[45] that have used IV estimation methods to account for the endogeneity of the bank specific liquidity risk variable in the bank failure model. The results of IV probit and probit / logit analyses using during crisis data are compared to the results of probit / logit using before crisis data.

A Wald test of exogeneity, under the null hypothesis that the instrumented variable is exogenous, is carried out to check for the correlation between the error terms in the structural equation of our bank failure model and the reduced-form equation of the endogenous liquidity risk variable. A rejection of the null hypothesis of exogeneity would mean that the error terms in the structural and the reduced-form equation are correlated and therefore, instrumenting the endogenous liquidity risk variable is the appropriate decision.

[45] Existing studies by Demirguc-Kunt (1990), Thomson (1992) and Godlewski (2004) have used IV estimation in order to account for the endogeneity of solvency risks, which was modelled as function of regulators' decision making, in bank failure models.

The assumption that the instruments are not correlated with the error term in the structural equation can be tested in an over-identified model (i.e. when the number of instruments exceeds the number of endogenous regressors). An over-identification test can be used to determine the validity of the instruments under the assumption that at least one of the instruments is valid (Hausman, 1978). This test should be performed before the Wald test of exogeneity (Hausman test) since the latter becomes invalid if the former rejects the validity of the instruments (Larcker and Rusticus, 2010). The validity of the instruments is checked using the Amemiya-Lee-Newey minimum chi-square statistic (Amemiya, 1978; Newey, 1987; Lee, 1992). The null hypothesis is that the error term is uncorrelated with the instruments (i.e. instruments are valid). This test statistic is obtained by regressing the structural equation's residuals on all exogenous variables. The residuals should be uncorrelated with all the exogenous variables. If the instruments are truly exogenous, the coefficients on the instruments should be close to zero.

For robustness, IV estimation is also carried out using two-stage least squares (2SLS) and generalized method of moments (GMM) estimation techniques. Robustness is also checked by removing mergers and acquisition (M&A) from the failure definition.

2.5.4 Bank Failure Definition

A bank closure happens when banking regulators acknowledge the insolvency of a bank by either liquidating or assisting it in different ways in order for it to continue operations (Gonzalez-Hermosillo, 1996). Regulators' decision to close banks does not happen at the same time as the economic failure. Studies by Bongini et al. (2001), Gonzalez-Hermosillo (1999) and Arena (2008) defines banking failure or closure as involving banks that are suspended, recapitalized, restructured, merged, acquired or receive assistance from relevant banking authorities. These descriptions encompass a wider scope of failures that has occurred in recent episodes of banking crisis.

Based on Arena (2008), the present study defines a financial institution as failed when:

Failure Status	Indonesia	Korea	Malaysia	Philippines	Thailand
Non-Failed	43	21	60	42	17
Suspended	9	2			6
Recapilatised	7	8	6		3
Closed	6	6		1	1
M&A	4	7	5	1	3
Total	69	44	71	44	30

1) Includes all financial institutions

Table 2.2: Summary of the Failure Status of the Financial Instituitions

(1) the government temporarily suspended or "froze" the financial institution's operations,
(2) the central bank or the relevant monetary authority recapitalized or injected liquidity into the financial institution in order to revive it,
(3) the government closed the financial institution,
(4) the financial institution was merged or acquired by another financial institution.

A financial institution is classified as failed if it falls in any of the above categories between 1998 and 1999. This classification is done by looking at Central Banks' annual reports and cross referencing two alternative databases assembled by Bongini et al.(2001) and Arena (2008). Banks that continued operation during this period are classified as non-failed.

2.5.5 Data Sources

Data for the 252 financial institutions used in this study has been obtained from BankScope, a comprehensive database provider for financial institutions across the world[46]. The coverage of the BankScope sample as of end 1996 and 1997 in terms of assets ranges from 80 to 100 percent for the five countries[47]. The breakdown of the financial institutions' data by countries shown in Table 4 : 69 in Indonesia; 44 in Korea; 71 in Malaysia; 44 in Philippines and 30 in Thailand. Based on this sample, the number of failed financial institutions in each country is: 26 in Indonesia; 23 in Korea; 11 in Malaysia; 2 in Philippines and 13 in Thailand.

2.5.6 Variables

2.5.6.1 Main Variables

The variables used to measure banks' liquidity risk are:

[46] BankScope collects annual reports and financial statements that are prepared according to the various national accounting standards and adjusts them in order to make them comparable across countries as much as possible.
[47] (Source: BankScope and countries' Central Bank statistics)

Deposits and Short-Term Funds to Total Assets This variable measures the level of deposits and external credit used to fund normal daily operations and long-term needs of the banks. Availability of a large amount of funding at a reasonable cost will enable banks to perform greater financial intermediation activities and as a result generate higher income. This may make banks to be less susceptible to failure. However, a high ratio of Deposit and Short-Term Funds to Total Assets may indicate a higher risk of a depositors' run and is therefore associated with higher probability of failure (van der Ploeg, 2010).

Financial Gap Ratio Following Saunders and Cornett (2006), Financial Gap ratio is used as an alternative way to measure banks' liquidity risks. This variable is measured as the difference between banks' loans and customer deposits[48]. Based on Shen et al. (2010), Financing Gap is standardized by dividing by total assets. Since customer deposits are considered as a relatively more stable and resilient source of funds for banks (Gatev and Strahan, 2006, Yorulmazer, 2008 and Dutweiler, 2009), this variable measures the amount of total loans that is financed through the more volatile source of funding as a percentage of total assets. Banks with a higher Financial Gap ratio must either use their cash, sell liquid assets or rely on an external source of funding to fill the gap. This results in higher liquidity risk and as a result is positively associated with the probability of bank failure.

2.5.6.2 Control variables

Capital Adequacy (C) Capital adequacy ratio is measured by the ratio of Total Equity to Total Assets. A sufficient capital adequacy enables banks to withstand shocks by absorbing losses. A higher ratio lowers the probability of bank failure. Bank with an adequate level of capital would be able to match their liabilities with their assets in the event of loan losses and declining asset

[48] Saunders and Cornett (2007) generally defines core deposits as demand deposits, negotiable order of withdrawal (NOW) accounts, money market deposit accounts (MMDAs), other saving accounts, and retail certificates of deposit (CDs). For the purpose of this study, customer deposit is used to proxy core deposits.

value. The capital adequacy requirement is regulated by Basel [49]. Wheelock and Willson (2000), Arena (2008), Mannasoo and Mayes (2009) find a negative relationship between capital adequacy ratio and bank failures.

Asset Quality (A) Asset quality is a measure of the quantity of existing, and potential future credit risk associated with the banks' assets. The ratio of Loan Loss Provisions to Total Loans is an ex-post measure of asset quality (Arena, 2008 and Mannasoo and Mayes, 2009)[50]. Since loans are one of the major assets of banks, higher provision ex-ante may indicate lower quality of the loan portfolio ex-post[51]. Hence, this ratio is expected to increase the probability of bank failure. However, higher provision can also indicate greater prudence by banks. In that case, it can be linked with lower probability of failure.

Management Quality (M) Mannasoo and Mayes (2009) and Wheelock and Willson (2000)) have used Cost to Income Ratio (CIR) as a proxy for management quality. This variable is measured using the ratio of operating expenses to operating income. High operating expenses in relation to relatively low operating income are not favorable and as a result are associated with higher failure probability.

Earning (E) Earning ratio measures a bank's ability to honor its creditors and shareholders and also absorb losses. This ratio is measured by Return on Assets (ROA) and Net Interest Margin (NIM). ROA is calculated using the ratio of average net income to total assets. This variable measures the efficiency and operational performance of banks. A higher ratio is preferred and as a result this variable is expected to exhibit a negative relationship with the probability of bank failure. Studies by Thomson (1991), Whalen (1991), Gonzalez-Hermosillo (1996), Bongini et al.

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[49] A broadly based international agreement on minimum bank capital requirements was reached in the Basel Accord of 1988 – Basel Committee on Banking Supervision (1988).

[50] Even though the ratio of non-performing loans to total loans is one of the traditional measure of asset quality, it is not used because it cannot be found consistently for all the selected countries. This measure varies widely across countries due to varying accounting standards.

[51] Bank managers may use accruals to convey their private information about future performance (Dechow, 1994).

(2001), Bongini et al. (2002), Arena (2008), Andersen (2008) and Mannasoo and Mayes (2009) have used this variable as a proxy for bank earnings. Following Gonzalez-Hermosillo (1996), Rojas-Suarez (2001), Arena (2008) and Andersen (2008), this study includes NIM as an additional variable that measures the earnings of the banks. This variable measures the difference between the yield on assets and the interest cost of liabilities, expressed as a fraction of total assets. A higher ratio can either signal lower cost of funding or higher margin. Higher value of NIM is associated with lower probability of bank failure.

Size Size of banks is measured using Log Value of Total Assets. This variable is expected to exhibit a negative relationship with the probability of failure. Large banks hold more assets, and as a result are better able to diversify their portfolio. This enables them to reduce their asset risks. 'Too big to fail' theory suggests that larger banks are less likely to fail as they are more likely to be bailed-out in the event of their having engaged in higher-risk taking activities. Studies by Gonzalez-Hermosillo (1996), Wheelock and Willson (2000), Bongini et al. (2001), Bongini et al. (2002) and Arena (2008) controlled for the size effect in predicting bank failure.

Foreign Ownership In order to account for the ownership structure of the banks, a dummy variable which takes the value of 1 if the financial institution is foreign owned and 0 otherwise is used. Foreign banks are likely to be better governed and more diversified. As a result, they are less likely to fail. Studies by Bongini et al. (2001), Bongini et al. (2002) and Arena (2008) have controlled for the ownership structure of the banks in predicting failures.

Governance Indicator Countries differ in terms of their regulations, institutional framework and political stability. In order to take this into account, the World Bank's Governance Indicator compiled by Kaufmann et al. (2004) is used[52]. This indicator is measured by adding the values

[52] The World Governance Indicator reflects the statistical compilation of responses on the quality of governance given by a large number of enterprise, citizen and expert survey respondents in industrial and developing countries, as reported by a number of survey institutes, think tanks, non-governmental organizations, and international organizations. The data is obtained from http://info.worldbank.org/governance/wgi/sc_country.asp

of four indicators: stability and absence of violence, regulatory quality, rule of law and control of corruption. Studies by Barth et al. (2009) and Houston et al. (2010) have used this indicator to capture the differences in the country's regulatory and institutional framework. Higher values, which correspond to better governance outcomes, implies a much better regulatory and institutional environment. As such, it should lower the probability of bank failure.

2.6 Results

2.6.1 Characteristics of Banks Before and During Crisis

The ratios given in banks' financial statements before and during a crisis are examined in order to see if there are any statistical differences between them. Comparison of 1997 bank-level data with 1996 data (Table 2.3) shows that the banks' average capital adequacy ratio was lower during the crisis year. An increase in the riskiness of loans in a crisis year can be observed by the higher ratio of Loan Loss Provisions to Net Loans. Banks' CIR is also higher, indicating that costs rise at a higher rate than income in the crisis year. The lower ROA that is recorded the during crisis year worsens banks' ability to raise capital.

The liquidity ratio of banks, as measured by the ratio of Liquid Assets to Total Assets and the ratio of Liquid Assets to Deposits and Short-term Funds, dropped significantly in the crisis year. The Financial Gap ratio of banks is higher, which suggests that reliance on external funding increased during the crisis year. Banks' Loan Growth and Deposits and Short-term Funds Growth dropped from an average of 32.8 and 30.23 percent in 1996 to an average of -23.92 and -20.72 percent respectively during the crisis year. This is in line with the massive withdrawals of funds that happened during the crisis year.

2.6.2 Characteristics of Failed and Non-Failed Banks

Financial statement information of the failed and non-failed banks are examined at the time before and at the onset of the crisis. Mean comparison tests only identify the statistical differences in the financial ratios between failed and non-failed banks. It does not show the contribution of

	1996	1997
Capital Adequacy		
Total Equity/ Total Assets	11.941	9.85***
Asset Quality		
Loan Loss Provisions / Net Loans	0.585	2.300***
Management		
Cost Income Ratio	53.659	57.789*
Earnings		
Return on Average Assets	1.389	0.295***
Net Interest Margin	4.145	4.227
Liquidity		
Liquid Assets / Total Assets	20.72	17.976***
Liquid Assets / Deposits & Short-term Funds	30.82	28.074**
Total Deposits & Short-term Funds / Total Assets	71.71	70.043
Financial Gap Ratio	9.002	11.295*
Others		
Net Loans / Total Assets	65.261	65.709
Loans Growth	32.8	-23.924***
Deposits & Short-Term Funds Growth	30.224	-20.716***

Table 2.3: Mean Comparison Test 1996 vs 1997

	1994		1995		1996		1997	
	Non-Failed	Failed	Non-Failed	Failed	Non-Failed	Failed	Non-Failed	Failed
Capital Adequacy								
Total Equity/ Total Assets	11.972	8.079***	11.466	8.431***	13.964	7.963***	12.722	6.076***
Asset Quality								
Loan Loss Provisions / Net Loans	0.553	0.857***	0.589	1.027**	0.607	0.544	1.984	3.023***
Management								
Cost Income Ratio	58.316	56.053	52.314	60.799***	49.323	62.042***	49.412	74.805***
Earnings								
Return on Average Assets	1.268	1.05	1.527	0.788***	1.565	1.042***	0.963	-0.963***
Net Interest Margin	4.113	3.578*	4.402	3.607***	4.424	3.597***	4.763	3.376***
Liquidity								
Liquid Assets / Total Assets	25.484	12.487***	23.961	14.830***	23.772	14.717***	20.977	13.879***
Liquid Assets / Deposits & Short-term Funds	51.732	19.056**	45.077	21.233***	35.824	21.313***	36.674	22.381***
Deposits & Short-term Funds / Total Assets	73.389	72.711	71.747	72.513	71.937	71.425	68.914	69.664
Financial Gap Ratio	2.362	13.165***	5.776	12.228*	7.601	11.223	10.147	15.563*
Others								
Net Loans / Total Assets	60.891	67.313**	62.746	67.333**	64.046	67.610*	63.9293	67.716*
Loans Growth			38.176	23.509**	39.133	21.446*	-17.039	-33.161***
Deposits & Short-Term Funds Growth			32.59	23.408*	35.472	20.906*	-9.774	-32.052**

Table 2.4: Mean Comparison Test (Failed vs Non-Failed)

these ratios to failures.

Table 2.4 shows that failed banks have significantly higher solvency risk, as shown by a lower capital adequacy ratio since 1994. This makes the failed banks less able to absorb the shock that results from loan losses and declining asset value. Failed banks also made significantly higher provision prior to and during a crisis, which suggest that they have riskier loans compared to non-failed banks[53]. Failed banks have higher CIR since 1995, which suggests that they are less efficient. In line with this, failed banks also have significantly lower profit. NIM of failed banks is significantly lower since 1995. This could either be due to their inability in offering more attractive rates or in sourcing cheaper funding.

[53] There is no statistical difference between failed and non-failed banks' ratio of loan loss provision to net loans in 1996.

Failed banks have a significantly lower liquidity ratio since 1994 compared to non-failed banks, as shown by the ratio of Liquid Assets to Total Assets and Liquid Assets to Deposits and Short-term Funds. This suggests that they did not hold an adequate amount of liquid assets. This exposes them to higher liquidity risks during a crisis year when there are large withdrawals of funds. The ratio of Deposits and Short-term Funds to Total Assets of failed and non-failed banks did not differ significantly. However, failed banks have a significantly higher Financial Gap ratio, which suggests that they rely more on sources of funding other than customer deposits (e.g. short-term debts) in financing their loans[54]. This could have exposed them to higher risks when large withdrawals of international lending happened during the crisis year.

In comparison to the non-failed banks, failed banks have a significantly higher ratio of Net Loans to Total Assets. This suggests that failed banks are inherently exposed to more risk if loan holders default. Loan Growth of failed banks has been significantly lower compared to non-failed banks since 1995. However, the drop in failed banks' Loans Growth is considerably more drastic compared to the non-failed ones during crisis year. Failed banks also have relatively less Deposits and Short-term Funds Growth compared to the non-failed banks since 1995. Nevertheless, during the crisis year, the drops in failed banks' Deposits and Short-term Funds Growth are more drastic compared to the non-failed ones. This suggests that failed banks were exposed to more risk of a run by depositors and short-term debt holders than the non-failed ones during the crisis year. This could have increased their likelihood of failure.

2.6.3 Probability of Failure Analysis

Analyses are carried out using probit / logit and IV probit estimations. Probit / logit estimation using 1997 bank level data analyzes the effect of bank level liquidity risk variables on the probability of bank failure without taking into account the endogeneity of the bank level liquidity

[54] Financial gap ratio was significantly higher in 1994, 1995 & 1997. The 1996 gap ratio was higher (but not significantly).

risk variables. IV probit analysis, on the other hand, estimates the probability of bank failure by taking into account of the endogeneity of the bank level liquidity risk variables. Probit / logit estimation using 1996 bank level data analyses the effect of before-crisis bank level liquidity risk variables on the probability of bank failure.

2.6.3.1 Cross Sectional Probit / Logit Estimations Using During Crisis Data

Table 2.5 reports the explanatory variables' marginal effects in the cross-sectional multivariate probit and logit estimations. The findings show that holding all else constant, Deposits and Short-term Funds to Total Assets is associated with significantly lower probability of failure. This suggests that banks that have a higher percentage of assets financed using Deposits and Short-term Funds during a crisis year are less likely to fail. Given the large outflow of funds that happened during the crisis year, this finding implies that higher deposits base during a crisis year is good for banks.

More specifically, the results shows that one percentage point increase in the ratio of Deposits and Short-term Funds to Total Assets reduces the probability of failure by 0.0003 units. The result suggests that this liquidity ratio needs to rise by 100 percent in order to reduce the probability of failure by 0.03 units. As shown in Table A.9, the amount of Deposits and Short-term Funds in the East Asian banking system in 1997 was nearly US$600 billion. This means that the central banks needed to inject an additional US$600 billion into the banking system to reduce the probability of bank failure by 3 percent. This result implies that a large injection of liquidity is needed to reduce the probability of bank failure by a very small percentage. The world's largest liquidity injection happened during the last quarter of 2008 whereby, the Federal Reserve, the European Central Bank, and other central banks injected US$2.5 trillion into the banking system[55]. This finding also confirms that other factors like equity ratio, size, ownership and governance indicator have a bigger impact on bank failure than liquidity.

[55] Source: http://en.wikipedia.org/wiki/2007%E2%80%932012_global_financial_crisis

VARIABLES	(1)	(2)	(3)	(4)
Total Equity / Total Assets	-0.024**	-0.019**	-0.026**	-0.019*
	(0.011)	(0.010)	(0.012)	(0.011)
Loan Loss Provisions / Total Loans	0.003	0.006	0.004	0.007
	(0.024)	(0.021)	(0.024)	(0.020)
Return on Assets	-0.022	-0.03	-0.022	-0.034
	(0.033)	(0.032)	(0.036)	(0.035)
Cost Income Ratio	0.000	0.000	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.000)
Net Interest Margin	-0.019	-0.03	-0.014	-0.027
	(0.022)	(0.027)	(0.023)	(0.029)
Deposits & Short-term Funds / Total Assets	-0.0003***		-0.0002**	
	(0.000)		(0.000)	
Financial Gap Ratio		-0.000		-0.000
		(0.001)		(0.001)
Size	0.038*	0.047*	0.037*	0.044*
	(0.024)	(0.025)	(0.025)	(0.027)
Foreign Ownership	-0.206**	-0.233**	-0.213**	-0.241**
	(0.083)	(0.084)	(0.095)	(0.095)
Governance Indicator	-0.069***	-0.084***	-0.068***	-0.073***
	(0.016)	(0.019)	(0.016)	(0.017)
Type of Estimation	Probit	Probit	Logit	Logit
Observations	218	189	218	189
Wald Chi2	51.72	52.65	41.5	43.3
Prob > Chi2	0.000	0.000	0.000	0.000
Pseudo R2	0.272	0.314	0.273	0.314
Correctly classified	82.11%	80.42%	82.57%	80.42%

1) *** p<0.01, ** p<0.05, * p<0.1
2) Robust standard errors in parentheses.
3) A constant term was included in the estimation.

Table 2.5: Cross-Sectional Probit and Logit Estimation (Marginal Effects) Using 1997 Data

Estimation using the Financial Gap ratio shows that higher holdings of external funding during crisis year is associated with lower likelihood of failure. The finding also confirm that equity ratio is associated with significantly lower probability of failure. However, the measure of asset quality, Loan Loss Provisions to Total Loans, is positive but not significant. The marginal effect of Size is positive and significant. This suggests that banks that are bigger during the crisis year are more likely to fail. This does not provide support to the 'Too big to fail' hypothesis. Regarding the ownership of the banks, the finding shows that foreign-owned banks are associated with significantly lower probability of failures, all else held constant. This suggests that foreign owned banks in East Asia are better governed. Country level Governance Indicator is also associated with significantly lower probability of failure. This shows that apart from bank specific factors, country-specific factors also play a very important role in determining failures. The finding confirms that cross-country variation in political stability and absence of violence, regulatory quality, rule of law and control of corruption plays a significant role in influencing the stability of the banking sector.

Overall, probit / analysis using during the crisis data suggests that only when bank level liquidity risk is measured by Deposits and Short-term Funds to Total Assets is it a significant predictor of bank failures. In addition to this, equity ratio, size, ownership of banks and governance indicator are significant predictors of bank failures. Among these variables, ownership has the biggest impact the probability of bank failure followed by Governance Indicator and Size. This finding suggests that, during a crisis year, CAMEL-type indicators are less effective in predicting bank failures.

2.6.3.2 IV Probit Estimation

Table 2.6 reports the results of the estimations using the IV probit method. The result of the Wald test of exogeneity confirms that the liquidity risk variables are endogenous and that the lagged value of Interest Rate Difference, and the International Capital Control variables are valid

VARIABLES	(1)	(2)
Total Equity / Total Assets	-0.020***	-0.008
	(0.008)	(0.007)
Loan Loss Provisions / Total Loans	-0.08	-0.012
	(0.011)	(0.011)
Return on Assets	-0.007	0.027
	(0.012)	(0.021)
Cost Income Ratio	0.000	0.001
	(0.000)	(0.001)
Net Interest Margin	0.034	0.041**
	(0.022)	(0.020)
Deposits & Short-term Funds / Total Assets	-0.002***	
	(0.001)	
Financial Gap Ratio		0.014***
		(0.001)
Size	-0.037	0.033
	(0.022)	(0.021)
Foreign Ownership	-0.071	-0.158**
	(0.058)	(0.072)
Governance Indicator	-0.001	0.052
	(0.018)	(0.026)
Observations	210	181
Wald Chi-Square	126.65***	321.41***
Wald Test of Exogeneity	3.27	3.82
P(Wald Test of Exogeneity)	0.071	0.051
Amemiya-Lee-Newey minimum Chi-Square	0.033	0.038
P(Overidentification Test)	0.856	0.846

1) *** p<0.01, ** p<0.05, * p<0.1
2) Robust standard errors in parentheses.
3) A constant term was included in the estimation.

Table 2.6: Cross-Sectional IV Probit Estimation (Marginal Effects)

instruments (i.e. the error terms in the structural equation of our bank failure model, and the reduced-form equation for the endogenous liquidity variable are not correlated). The quality of the instruments is tested using Amemiya-Lee-Newey over-identification tests. The results fail to reject the null hypothesis that the instruments are exogenous. The p-value of the chi-square statistic of the Amemiya-Lee-Newey test indicates that the instruments are uncorrelated with the error term of the bank failure regressions[56].

The reduce form regression results in column 1 of Table 2.6 show that lagged International Capital Control reduces the ratio of Deposits and Short-term Funds to Total Assets while lagged Interest Difference increases the Financial Gap ratio. The F-test statistic's value of above 10

[56] The Amemiya-Lee-Newey test results for over-identification of instruments were generated using Baum, Schaffer, Stillman and Wiggins' (2006) overid.ado programme for Stata.

VARIABLES	(1) Deposits & Short-term Funds / Total Assets	(2) Financial Gap Ratio	(3) Deposits & Short-term Funds / Total Assets	(4) Financial Gap Ratio
Total Equity / Total Assets	0.214**	0.230**	-1.051***	0.251
	(1.316)	(0.297)	(0.335)	(0.342)
Loan Loss Provisions / Total Loans	0.430	0.896	-3.348***	0.521
	(1.271)	(0.746)	(1.066)	(1.398)
Return on Assets	-0.368	-2.543**	-3.272**	-3.070*
	(1.153)	(1.158)	(1.374)	(1.774)
Cost Income Ratio	-0.00776	-0.0414	0.000479	-0.0625
	(0.0308)	(0.0690)	(0.0290)	(0.0928)
Net Interest Margin	-0.207**	-3.123**	3.329**	-2.804**
	(2.667)	(1.217)	(1.380)	(1.266)
Size	-2.362	-1.756	-3.005**	-2.050
	(1.666)	(1.312)	(1.204)	(1.293)
Foreign Ownership	-4.205	7.919**	-3.607	7.818**
	(3.369)	(3.795)	(3.254)	(3.843)
Governance Indicator	-0.658	-2.395	-1.909	-0.835
	(3.788)	(2.895)	(2.967)	(3.035)
Lag Interest Rate Difference	19.88	7.068**	25.65**	9.940***
	(13.13)	(8.557)	(9.962)	(8.184)
Lag International Capital Control	-3.000***	-0.560	-2.169***	-1.043
	(0.946)	(1.088)	(0.782)	(1.313)
Type of Financial Institutions	All	All	Commercial Bank	Commercial Bank
Observations	204	181	178	161
R-squared	0.232	0.299	0.358	0.322
F-Test	10.35***	11.62***	16.18***	12.42***

1) *** $p<0.01$, ** $p<0.05$, * $p<0.1$
2) Robust standard errors in parentheses.
3) A constant term was included in the estimation.

Table 2.7: Reduce Form Regressions of the Endogenous Regressors

confirms the relevance of these two instruments[57].

The cross-sectional IV probit regressions in Table 2.6 show that the ratio of Deposits and Short-term Funds to Total Assets reduces the probability of bank failure. More specifically, it is observed that a one percentage point increase in this ratio reduces the probability of bank failure by 0.002 units, all else held constant. Analysis using probit method shows that a one percentage point increase in this ratio reduces the probability of bank failure by 0.0003 units. The ability of the ratio of Deposits and Short-term Funds to Total Assets to reduce the probability of bank failure by a higher amount under the IV probit estimation could be due to the significant effect of lagged International Capital Control on this variable as shown in the reduced form results in Table 2.6.

Financial Gap ratio is positively and significantly related to banking failure in the IV probit estimation. All else held constant, a one percentage point increase in Financial Gap ratio during a crisis year increases banks' vulnerability to failure by 0.014 units. This result implies that, if banks were to raise their external funding by 10 percent, their probability of failure will increase by 0.14 units. In line with the proposition put forward by Diamond and Rajan' (2000), this finding confirms that higher reliance on external funding (i.e. short-term borrowing) increases banks' vulnerability of failure. This could be due to several reasons. Firstly, banks incur higher costs in servicing external funding. As a result, they might be more inclined to engage in higher risk taking activities in order to get a higher return. Secondly, higher reliance on external funds not only exposes banks to maturity mismatch, but also currency mismatch (Eichengreen., 2003). Refusals by international lenders to renew their short-term financing increases banks' demand for liquidity. This, in turn, raises banks' costs of funding.

As far as the control variables are concerned, analyses using the IV Probit estimation show that the effect of these variables on the probability of failure varies depending on the type of liquidity

[57] The relevance of the instruments is tested in the reduce form regression using the F-statistic of a joint significance. As a rule of thumb, it should be bigger than 10 (Straiger and Stock, 1997).

VARIABLES	(1)	(2)	(3)	(4)
Total Equity / Total Assets	-0.018*	-0.023**	-0.018*	-0.023**
	(0.009)	(0.011)	(0.009)	(0.011)
Loan Loss Provisions / Total Loans	-0.046	-0.034	-0.046	-0.031
	(0.054)	(0.060)	(0.054)	(0.060)
Return on Assets	-0.091	-0.019	-0.093	-0.021
	(0.077)	(0.088)	(0.078)	(0.090)
Cost Income Ratio	0.002	0.004	0.002	0.004
	(0.002)	(0.003)	(0.002)	(0.003)
Net Interest Margin	-0.055*	-0.053	-0.053*	-0.050
	(0.028)	(0.033)	(0.029)	(0.033)
Deposits & Short-term Funds / Total Assets	0.000		0.001	
	(0.002)		(0.002)	
Financial Gap Ratio		0.003**		0.003**
		(0.001)		(0.001)
Size	0.039	0.028	0.037	0.027
	(0.024)	(0.026)	(0.024)	(0.027)
Foreign Ownership	-0.298***	-0.332***	-0.301***	-0.333***
	(0.093)	(0.090)	(0.102)	(0.096)
Governance Indicator	-0.098***	-0.081***	-0.097***	-0.081***
	(0.022)	(0.021)	(0.022)	(0.021)
Type of Estimation	Probit	Probit	Logit	Logit
Observations	252	198	252	198
Wald Chi2	64.21	62.73	55.85	53.51
Prob > Chi2	0.000	0.000	0.000	0.000
Pseudo R2	0.224	0.276	0.232	0.274
Correctly classified	72.62%	74.24%	73.02%	74.24%

1) *** p<0.01, ** p<0.05, * p<0.1
2) Robust standard errors in parentheses.
3) A constant term was included in the estimation.

Table 2.8: Cross-Sectional Probit and Logit Estimation (Marginal Effects) Using 1996 Data

variable used. Analysis using the ratio of Deposits and Short-term Funds to Total Assets as a measure of liquidity risk shows that only equity ratio is significantly associated with failure, while analysis using Financial Gap ratio as a measure of liquidity risk shows that NIM and ownership structure significantly influence failure.

Cross Sectional Probit / Logit Estimations Using Before Crisis Data Table 2.5 reports the explanatory variables' marginal effects in the cross-sectional multivariate probit and logit estimations. Analysis using the ratio of Deposits and Short-term Funds to Total Assets shows that holding higher liquidity before a crisis does not influence the probability of failure. A one percentage point increase in the Financial Gap ratio before a crisis increases banks' vulnerability to failure by 0.003 units, all else held constant. IV probit analysis shows that a one percentage

Details of financial institutions in the sample as of 1997	Indonesia	Korea	Malaysia	Philippines	Thailand
Total	69	44	67	44	30
Commercial Banks	56	27	36	27	16
Other Financial Institutions	13	17	31	21	14
Foreign Bank	22	2	11	5	5

1) Other financial institutions includes finance companies, securities companies and investment banks

Table 2.9: Summary of the Type of Financial Instituitions

point increase in the Financial Gap ratio increases the probability of failure by 0.014 units. This suggests that banks' vulnerability to failure as a result of higher reliance on external funding increases during a crisis year. This could be due to higher volatility and costs involved in servicing external funds compared to customer deposits (Saunders and Cornett, 2006). Once the effect of international illiquidity is taken into account (as shown in the Probit regression using 1997 data), the findings show that Financial Gap ratio does not contribute towards failure. This suggests that higher reliance on external funding is no longer a significant contributor towards bank failure once a large outflow of external funds happens during crisis year.

As far as other CAMEL-type indicators are concerned, only equity ratio and net interest margin significantly predict failures. Higher net interest margin before a crisis significantly reduces the probability of failure while higher margin during a crisis year (as shown in the IV probit regression using 1997 data) increases it. This suggests that net interest margin during a crisis year is associated with greater risk taking. Banks had to rely on domestic funds once the international illiquidity happened in the second half of 1997. Tight liquidity conditions force banks to offer higher interest rate to attract more funds. Banks that offer a high rate may have to engage in high risk taking activities in order to get a higher return. Hence, this could have increased their vulnerability to failure. Compared to the CAMEL-type indicators, ownership and governance indicators are able to reduce the probability by higher percentage.

2.6.3.3 Analysis on Commercial Banks

Table 2.9 provides the summary of the type of financial institutions used in the analysis.

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
Total Equity / Total Assets	-0.023*	-0.031**	-0.020*	-0.014	-0.025***	-0.008
	(0.012)	(0.014)	(0.011)	(0.01)	(0.007)	(0.008)
Loan Loss Provisions / Total Loans	-0.026	0.016	-0.025	-0.009	-0.015	-0.012
	(0.061)	(0.068)	(0.028)	(0.027)	(0.015)	(0.023)
Return on Assets	-0.067	0.028	-0.041	-0.035	-0.008	0.031
	(0.087)	(0.096)	(0.033)	(0.035)	(0.017)	(0.035)
Cost Income Ratio	0.002	0.004	0.002*	0.003*	0.001	0.001
	(0.003)	(0.003)	(0.001)	(0.001)	(0.001)	(0.001)
Net Interest Margin	-0.046	-0.039	-0.014	-0.008	0.045**	0.044**
	(0.033)	(0.037)	(0.024)	(0.026)	(0.022)	(0.019)
Deposits & Short-term Funds / Total Assets	-0.000		-0.0003**		-0.002***	
	(0.002)		(0.001)		(0.001)	
Financial Gap Ratio		0.002		0.000		0.014***
		(0.001)		(0.001)		(0.002)
Size	0.047*	0.049	0.054**	0.074***	-0.034	0.045
	(0.027)	(0.030)	(0.026)	(0.028)	(0.027)	(0.028)
Foreign Ownership	-0.258***	-0.289***	-0.193**	-0.203**	-0.075	-0.151**
	(0.090)	(0.090)	(0.081)	(0.081)	(0.054)	(0.068)
Governance Indicator	-0.103***	-0.099***	-0.080***	-0.084***	-0.004	0.046
	(0.024)	(0.023)	(0.018)	(0.019)	(0.018)	(0.033)
Type of Estimation	Probit	Probit	Probit	Probit	IV Probit	IV Probit
Data Year	1996	1996	1997	1997	1997	1997
Observations	201	169	192	169	184	161
Wald Chi-Square	55.65***	52.41***	50.72***	49.87***	177.52***	295.6***
Wald Test of Exogeneity					4.97	3.42
P(Wald Test of Exogeneity)					0.0258	0.0646
Amemiya-Lee-Newey minimum Chi-Square					0.074	1.154
P(Overidentification Test)					0.785	0.2826

1) *** p<0.01, ** p<0.05, * p<0.1
2) Robust standard errors in parentheses.
3) A constant term was included in the estimation.

Table 2.10: Cross-Sectional Probit, Logit and IV Probit Estimation (Marginal Effects) for Commercial Banks

These institutions consist mainly of commercial banks. Other financial institutions like finance companies, securities firms and investment banks which are included in the sample are smaller in size[58]. Hence, they may be more vulnerable to failure due to international illiquidity or higher reliance on external funding compared to commercial banks. In order to find out if commercial banks' vulnerability to failure is different to that of other financial institutions, probit and IV probit estimation is carried out by using only the sample of commercial banks in the data set. ana

The results in Table 2.9 confirm earlier findings that the ratio of Deposits and Short-term Funds to Total Assets reduces the chances of bank failure by a lower percentage once the endogeneity of

[58] The mean of the Total Assets for commercial banks is USD4 million while the mean of the Total Assets for other financial institutions is USD2.4 million.

this variable is taken into account. Before crisis Financial Gap ratio is not a significant predictor of failure for commercial banks but IV probit results suggest that commercial banks' reliance on external funding increases their likelihood of failure. The latter finding might be due to higher costs involved in funding external funding during the crisis year. The earlier finding, on the other hand, may suggest a few things. Firstly, it may suggest that commercial banks' costs of funding external funds are lower compared to other financial institutions like finance companies, and as a result holding of external funds before the crisis did not influence their vulnerability to failure. Secondly, it may suggest that other financial institutions like finance companies relied more on external funds before the crisis compared to commercial banks, and as a result were more vulnerable to failure.

2.6.4 Robustness Checks

The robustness of the findings is checked in different ways. Firstly, IV estimation is carried out using two-stage least squares (2SLS) and generalized method of moments (GMM) estimation techniques (see Appendix3). The estimations confirm that both liquidity risk measures are endogenous. The validity and the quality of the instruments are confirmed using the Hansen overidentification test. Overall, the findings in Table 2.6.4 show that the results for the liquidity risk variables are in line with IV probit estimations. More specifically, the finding shows that one percentage increase in the Financial Gap ratio ex-ante significantly increases the likelihood of bank failure by 0.021unit under IV 2SLS and 0.027 unit under IV GMM estimation. IV probit estimation shows that the coefficient for this variable is 0.014. This shows that the parameter estimates of the IV 2SLS and IV GMM are higher compared to that of the IV Probit estimate. As for the ratio of Deposits and Short-term Funds to Total Assets, similarly to estimation using the IV probit method, the findings show that a higher ex-ante ratio of this variable is associated with lower likelihood of failure but this effect is not significant under IV 2SLS and IV GMM estimation methods. Based on the above results, it can be generally concluded that the findings on the effect

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
					Ex M&A	Ex M&A
Total Equity / Total Assets	-0.052	-0.004	-0.061	-0.006	-0.020***	-0.007
	(0.060)	(0.009)	(0.060)	(0.009)	(0.008)	(0.007)
Loan Loss Provisions / Total Loans	-0.029	-0.016	-0.029	-0.003	-0.012	-0.016
	(0.064)	(0.039)	(0.064)	(0.023)	(0.007)	(0.023)
Return on Assets	-0.032	0.01	-0.032	0.035	-0.009	0.03
	(0.047)	(0.057)	(0.047)	(0.040)	(0.010)	(0.034)
Cost Income Ratio	0.003**	0.003*	0.004**	0.002	0.0004	0.001
	(0.001)	(0.002)	(0.001)	(0.002)	(0.000)	(0.001)
Net Interest Margin	0.113	0.055	0.134	0.058	0.040***	0.051**
	(0.165)	(0.047)	(0.165)	(0.050)	(0.017)	(0.020)
Deposits & Short-term Funds / Total Assets	-0.005		-0.006		-0.002***	
	(0.004)		(0.004)		(0.0007)	
Financial Gap Ratio		0.021*		0.027**		0.015***
		(0.012)		(0.011)		(0.001)
Size	-0.057	0.145***	-0.083	0.127***	-0.044**	0.036
	(0.157)	(0.039)	(0.157)	(0.040)	(0.019)	(0.023)
Foreign Ownership	-0.197	-0.303**	-0.236	-0.359**	-0.066	-0.137**
	(0.232)	(0.140)	(0.230)	(0.143)	(0.057)	(0.064)
Governance Indicator	-0.022	0.018	-0.022	0.063	0.003	0.055**
	(0.044)	(0.064)	(0.044)	(0.061)	(0.863)	(0.025)
Type of Estimation	IV2SLS	IV2SLS	IVGMM	IVGMM	IVProbit	IVProbit
Observations	184	161	184	161	210	181
Wald Chi-Square	3.09***	6.2***	3.83***	6.54***	143.54***	321.44***
Wald Test of Exogeneity	15.526	9.334	15.526	9.334	3.43	3.41
Chi-sq(1) P-val (Wald Test of Exogeneity)	0.0001	0.0022	0.0001	0.0022	0.0638	0.0647
Hansen J statistic	2.323	1.291	2.323	1.291		
Chi-sq(1) P-val (Overidentification Test)	0.1275	0.2559	0.1275	0.2559		
Amemiya-Lee-Newey minimum Chi-Square					0.004	2.78
P(Overidentification Test)					0.9528	0.601

1) *** p<0.01, ** p<0.05, * p<0.1
2) Robust standard errors in parentheses.
3) A constant term was included in the estimation.

Table 2.11: Cross-Sectional IV 2SLS, IV GMM and IV Probit without Mergers & Acquisitions

of the ex-ante liquidity risks on bank failure are robust to the type of estimation method used.

Even though regulatory bodies encouraged mergers and acquisitions as part of the effort in saving troubled banks, merger and acquisitions can also happen due to strategic reasons. As such, the robustness of the above findings is checked by removing mergers and acquisitions (M&A) from the failure definition. The estimations confirm that both liquidity risk measures are endogenous. The results of the Wald test and Amemiya-Lee-Newey overidentification test for the IV Probit estimation in Table 2.6.4 show that the instruments are valid. Analysis using IV probit estimation shows that the ex-ante ratio of the two liquidity risk proxies significantly influences the

likelihood of bank failure[59]. The direction of the effect also remains the same.

2.7 Discussion and Conclusion

The review of the East Asian crisis (see section 2.2) shows that international illiquidity played an important role in triggering the crisis. The severity of this crisis highlights the importance of liquidity for the well functioning of the banking system. Existing studies by Rojas-Suarez (2001), Bongini et al, (2001), Bongini et al, (2002) and Arena (2008) focus on finding out if banks that failed ex-post in East Asia were fundamentally weak ex-ante. In contrast, the main objective of this study is to analyze the role of liquidity in causing bank failures in East Asia.

The main contribution of this study arises from the methodology that is used in the analysis. The IV estimation method is used to take account of the endogeneity of liquidity risk variable. Banks' vulnerability to failure is influenced by bank specific liquidity which, in turn, is affected by the international illiquidity. Probit analysis using 1997 bank-level data estimates the effect of banks' liquidity measures on the probability of bank failure after the onset of the crisis while probit analysis using 1996 bank-level data estimates the effect of banks' liquidity measures on the probability of bank failure before the onset of the crisis. Differences in the findings of IV probit and probit estimation show us how the coefficient on the liquidity risk variable changes direction or magnitude as a result of the international illiquidity that happened during the crisis year.

In studying the role of liquidity in predicting bank failures, the individual financial institutions' data in five crisis afflicted East Asian countries is analyzed. This study fills in the gap in the existing literature by using new proxies to measure banks' liquidity risk, namely the ratio of Deposits and Short-term Funds to Total Assets and the Financial Gap ratio. Overall, probit / logit estimation using during-crisis bank-level data shows that only the ratio of Deposits and Short-term Funds to Total Assets is a significant predictor of bank failures while IV Probit estimation shows

[59] The results using probit estimation are also similar to the results of the probit estimation that includes M&A in the failure definition.

that both liquidity measures are significant predictors of bank failures. The ratio of Deposits and Short-term Funds to Total Assets reduces the probability of bank failures by a higher percentage under the IV probit estimation compared to probit estimation. This change could be due to the effect of international liquidity on the ratio of Deposits and Short-term Funds to Total Assets as shown in the reduced form regression.

The findings of this study also confirm that weaker (or failed) banks in East Asia relied more on external funding. This finding is in line with Diamond and Rajan's (2000) proposition on the vulnerabilities that arise as a result of higher reliance on short-term funding in financing illiquid investments. Since banks incur higher costs in servicing external funding, they might be more inclined to engage in higher risk taking activities in order to get higher return. Their vulnerabilities to failure could increase as a result of this. When large outflow of international funds happen during crisis year, banks that relied more external funding needed to source fresh funds domestically at higher costs.

Analysis using the sample of commercial banks confirms that international illiquidity increased the vulnerabilities of banks in East Asia to failure. However, commercial banks' reliance on external funding before crisis does not effect their probability of failure but IV probit analysis using crisis year data shows that commercial banks' reliance on external funding increases their likelihood of failure. These findings confirm that all banks faces higher costs in funding external funding during the crisis year. In addition to this, the findings also suggest that commercial banks' costs of funding external funds may be lower than those of other financial institutions, and other financial institutions may have relied more on external funds before the crisis compared to commercial banks.

In conclusion, the above findings confirm that the amount and type of liquidity that banks in East Asia held before and during the crisis influenced their fragility. Illiquidity in the banking

sector is very costly. In the case of the East Asian countries, the respective central banks had to inject large amounts of liquidity into the banking system. For example, the Bank of Indonesia injected massive liquidity support to troubled financial institutions. Between November 1997 and March 1998, the increase in net domestic assets of the central bank amounted to more than twice the entire stock of base money in the beginning of that period (IMF, 1999). Similarly, in December 1997, the Bank of Korea also injected massive liquidity support (more than one-third of its reserve money) in preventing the collapse of the banking system. The central banks of Malaysia and Thailand also injected liquidity worth $9.2 billion and $24.1 billion respectively into the banking system in order to restore depositor confidence (Claessens, 1998). Governments of the affected countries also responded by issuing unlimited guarantees on financial systems' liabilities during 1997 and early 1998 (Klingebiel and Laeven, 2001).

Problems relating to the influx of liquidity and the subsequent illiquidity can be tackled by introducing more restrictive rules for liquidity risk management and a higher reserve requirement on foreign-currency deposits (Goldstein and Turner, 2004) or combining solvency requirements and LOLR interventions with liquidity requirements (Rochet and Vives, 2004). The Financial Stability Forum (FSF) recommends that liquidity mismatch in the foreign-currency business of banks should be monitored at the individual bank level and country level. Better rules governing liquidity management practises also need to be put in place to ensure that banks are able to withstand liquidity shock in the future.

*O*Overall, the findings of this study suggest that CAMEL-type indicators are not able to fully predict bank failures in East Asia. Other bank-specific variables, like size and ownership structure of the banks, and country-specific institutional environment also play crucial roles in predicting failures.

Chapter 3 Depositor Discipline in the East Asian Banking System:Dynamic Panel Data Analysis

3.1 Introduction

The East Asian crisis brought forward the discussion about the need for greater monitoring of banks. Traditionally, regulation in the banking industry has been prescribed as the solution to market failure that arises as a result of a banking crisis. Existing literature has dwelt well on the costs and benefits of bank regulation (Goodhart, 1987; Miles, 1995 and Shleifer, 2005)[60]. Although regulation can enhance social welfare and ensure banking stability, market failure will not be mitigated if regulators act in the interest of the government (i.e. Central Banks are not very independent) or in the interest of the industry (i.e. when regulatory capture happens) (Freixas and Rochet, 2008). Regulation also can be costly (supervisory and administrative costs, dead weight taxation cost and indirect costs arising from the distortion it generates). This suggests that deriving optimal regulation in the banking industry is not a very easy task. In light of these considerations, market discipline is highlighted as one of the key areas of the reform policy in the banking sector. Market discipline is the tool through which stakeholders can monitor and discipline banks that have engaged in high risk taking activities by making them pay for the actual cost of their risk taking. The third pillar of the Basel II highlights the role of market discipline in easing the existing pressure on traditional monitoring measures like capital requirement and government supervision that are emphasized in the first and the second pillars of Basel II[61][62]. In line with this, the present study will examine the effectiveness of market discipline in the East Asian banking system by focusing on the role of depositors in disciplining banks.

The structure of banks' demand deposit contracts gives depositors the flexibility of

[60] Regulation in the banking sector is primarily aimed at protecting individual investors and ensuring systemic stability.
[61] Basel II is the second of the Basel Accords. It is an official effort aimed at preventing crises through the formation of international standards on bank regulation and supervision.
[62] See Basel Committee on Banking Supervision (June 2006) for details.

withdrawing their funds when necessary. This allows them to reward or punish banks for their relative performance. Empirical studies have mainly focused on finding if depositors react to the changes in banks' risk profile that are reflected in the information disclosed by banks. More specifically, these studies find out if depositors punish banks that have taken a higher risk by withdrawing their funds or demanding higher returns. Existing studies that have looked at depositor discipline in East Asia are Arena (2004) and Kaoru et al. (2005). These studies have several shortcomings. Firstly, Arena (2004) did not look at the relationship between price and quantity of deposits. Kaoru et al. (2005), on the other hand, uses pooled OLS regression in studying the determinants of deposits growth and interest rate in each individual country. By doing so, it does not take into account the bank-specific effect and address the simultaneity that exists between price and quantity of deposits.

This study aims to analyze the existence of depositor discipline in the East Asian banking sector. This will be done by finding out if depositors' withdrawals respond to ex-ante weaknesses in an individual bank's fundamentals and the price signal of banks. The present study aims to fill in the gap in the existing literature by trying to overcome some of the shortcomings that exist in the studies by Arena (2004) and Kaoru et al. (2005) on depositor discipline in East Asia. Firstly, since depositors' withdrawal actions and banks' response to them are a jointly determined process, the simultaneity that exists in the depositor discipline model needs to be controlled for in order to ascertain if banks are able to attract higher deposits by offering higher interest rates. Maechler and McDill (2006) use dynamic GMM estimation methods to ascertain if the movement of the interest rate variable has an exogenous impact on the quantity of deposits, independent of the endogenous impact of deteriorating fundamentals on interest rate and quantity of deposits. Studies by Maechler and McDill (2006) and Bowe and Wu (2007) confirms that the relationship between price (interest rate) and quantity of deposits is dynamic. In line with these studies, the

present study aims to find out if depositors in East Asia react to the changes in banks' risk profile that are reflected in the information disclosed by banks and also aims to find out if banks in East Asia are able to attract more deposits for a given price once the simultaneous relationship between price and quantity of deposits is controlled for.

Initial analyses examine depositor behavior in the East Asian banking system from the before-crisis to the after-crisis period (i.e. 1995 to 2005). This study aims to test for the wake-up-call hypothesis, which posits that depositors should be more responsive to banks' risk factors after the crisis. In line with this, depositor behavior will be observed during a post-crisis period only, and the results will be compared to that of the whole sample period.

This study also aims to analyse the possible non-linear relationship between the price elasticity and banks' quality. This will be done by separately analyzing depositors' reaction to the price offered by the weak and healthy banks. Since the banking sector in East Asia underwent a substantial amount of restructuring exercise as a result of the crisis, this criteria will be used to subdivide the sample of banks. Restructured banks are classified as weak while Non-restructured banks are classified as strong. Since depositors respond to ex-ante weaknesses in an individual bank's fundamentals, they may react differently to weak banks compared to healthy ones. If depositor discipline is effective, for a given increase in the price, healthier banks should attract relatively more deposits than average banks while a weaker bank should not be able to do so.

The findings of this study confirm that depositors in East Asia do discipline the banks. More specifically, this study finds depositors prefer banks that have higher equity ratio and are bigger in size. Panel data analyses suggest that banks are able to use price signal to attract more deposit. Price signal is found to be more effective during the post-crisis period. The results also show that depositors are more responsive to the risk profile and price signal of the healthy banks compared to the weaker ones.

However, panel data analyses does not take into account of the fact that banks may raise interest rates in response to depositors' withdrawal intention that is in itself related to banks' risk profile. Hence, depositors' response to price signals under the panel data analyses cannot be construed as signals of depositor discipline. Dynamic panel data analyses are performed to overcome the above shortcomings. The findings confirm that the relationship between the price and quantity of deposits is endogenous. Once the endogeneity is controlled for, the results show that deposits growth in the sample banks is driven by bank fundamentals but not price signals. Similar results are obtained during the post-crisis period. Analyses performed by subdividing the sample of banks into weak and healthy categories confirm that the relationship between deposit growth and interest rate is non-linear. The findings imply that depositors are not more responsive to the price signal of healthy banks compared to weak ones. The findings also show that depositors in East Asia also do not discipline weak banks by demanding higher returns.

Overall, this findings of this study imply that price signal is not effective in influencing depositors behavior in East Asia once the endogenous relationship between the price and quantity of deposits is controlled for. Banks' inability to attract more deposits by offering a higher price may be attributable to the large outflow of deposits the happened during the crisis period and regulations on interest rates.

The rest of the chapter is organized as follows: Section 3.2 describes the concept of market discipline. Section 3.3 briefly reviews the theoretical and empirical literature relating to depositor discipline. In Section 3.4, the empirical methodology is described by emphasizing the dynamic relationship between price and quantity of deposits. This section also discusses the data. Section 3.5 discusses the results. Section 3.6 concludes.

3.2 The Concept of Market Discipline

Market discipline allows stakeholders to safeguard their interest. Freixas and Rochet (2008) describe two types of market discipline that exist in banking, namely ex-ante and interim market

discipline. The former is reflected in the rate that banks pay in sourcing their liabilities while the latter is reflected in the shareholders' action of withdrawing their funds. The threat of action by the stakeholders puts the management under heightened scrutiny and enables suppliers of funds to exert market influence (Flannery, 2001). As highlighted by Greenspan (2001), market discipline essentially acts as 'private counter party supervision' in the banking sector.

Market discipline can be signaled by all three groups of banks' shareholders; depositors, debt holders and equity holders. Depositors can punish banks that engage in excessive risk taking activities either by demanding a higher return (price effect) or withdrawing their deposit (quantity effect) (Berger, 1991; Demirguc-Kunt and Huizinga, 2004 and Martinez-Peria and Schmukler, 1999). Accordingly, debt-holders can discipline banks by demanding a higher yield on the bank's debt for the riskier institutions, while equity holders can do so by selling their shares and exerting downwards pressure on share prices. Empirical evidence shows that all three parties are able to impose discipline on banks in the developed countries. However, the underdevelopment of equity and debt markets in the developing countries limits the ability of shareholder and subordinated debt holders in disciplining banks. Hence, depositors play a larger role of disciplining banks in these markets.

Bliss and Flannery (2001) highlight the two components of market discipline. The first component involves monitoring while the second involves influencing. Monitoring refers to the investors' capability of assessing a firm's actual situation and sending market signals to the managers. Influencing, on the other hand, describes the responsiveness of bank managers to investors' feedback that is reflected in their withdrawal actions or stock prices. The latter aspect of the market discipline process cannot take effect without the former (Flannery, 2001)[63].

Llewellyn (2005) identifies four stages of the market discipline process which are the monitoring by stakeholders, reaction by stakeholders, adjustments in price and quantity that

[63] The analysis of this study will only focus on the monitoring aspect of market discipline.

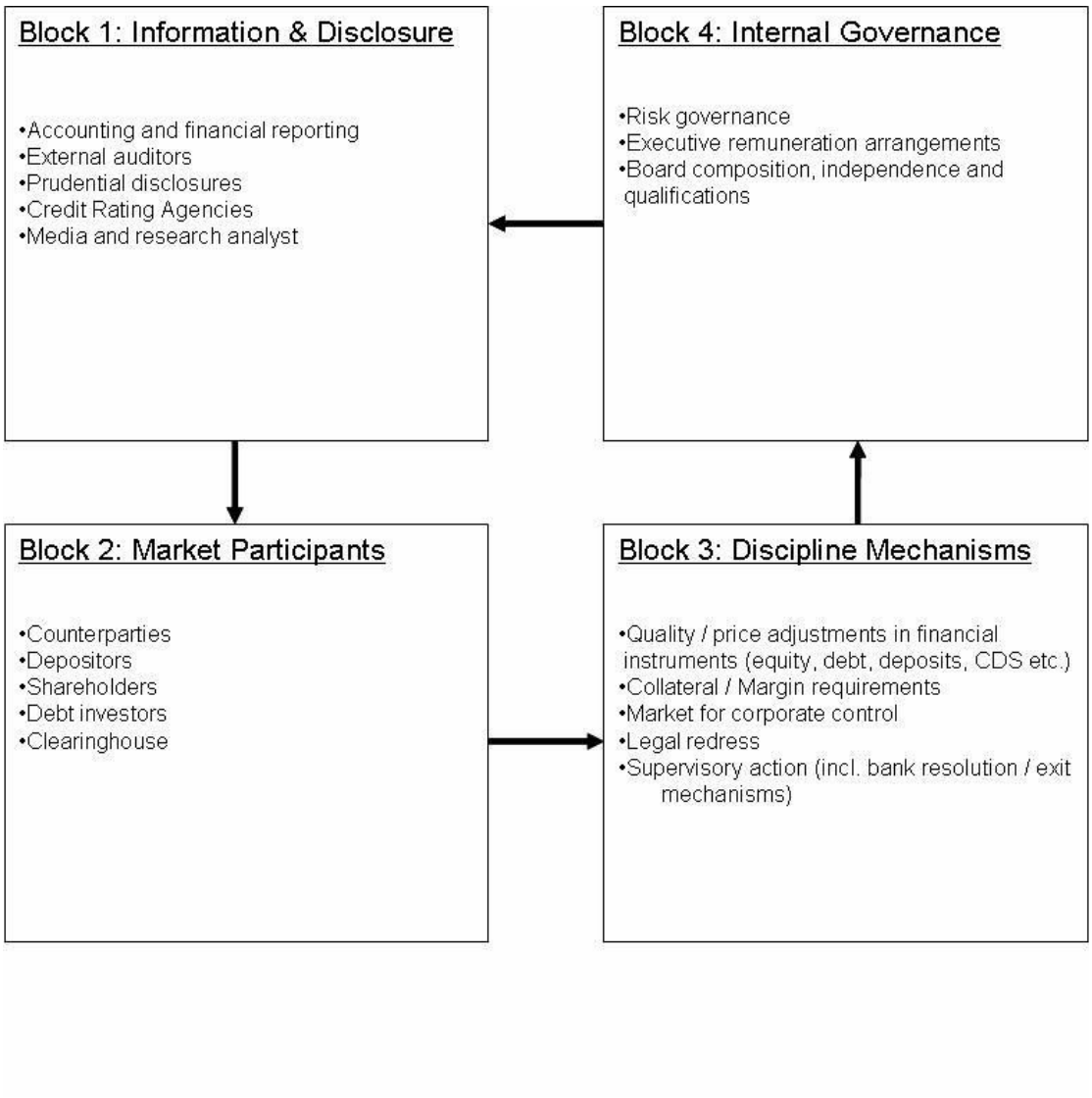

Figure 3.1: Market Discipline Framework

happen as a result of the reactions and corrective behavior by bank managers in response to the signal sent by stakeholders.

In light of this, Stephanou (2010) developed a market discipline framework as shown in Figure 3.1 that comprises four building blocks, which are:

(1) Information and disclosure - the public availability of information about banks' financial standing that is sufficient, consistent, reliable and timely.
(2) Market participants - the existence of independent stakeholders who are able to use the disclosed information correctly and have incentives in monitoring the banks.
(3) Discipline mechanisms - the different type of tools that can be used by stakeholders in disciplining banks such as the quantity or price adjustments of financial instruments, legal assistance or supervisory actions.

(4) Internal governance - the organizational and compensation structures that facilitate managers (senior management and Board of Directors) in understanding and responding to market signals.

Hamalainen et al. (2003) highlights various social benefits of having market discipline. Firstly, by punishing banks that take excessive risks, it reduces banks' moral hazard incentives that might arise as a result of government guarantee and deposit insurance. Secondly, it improves efficiency of banks by putting pressure on inefficient banks to become more efficient or leave the market. Thirdly, efficiency of the supervisory process can be further enhanced because the signal provided by stakeholders on the financial standing of the banks adds up to the insider information obtained by the supervisory body[64]. Lastly, market discipline lowers the social cost of supervision by providing additional information that can supplement traditional supervisory assessment of bank condition.

3.3 Literature Review

3.3.1 Review of the Theory

Existing theoretical literature on banking emphasizes the role of the demand deposit contract in giving incentives to depositors in monitoring bank managers' risk-taking behavior. Diamond and Rajan (2001) asserts that the monitoring feature of the demand deposit contract is desirable even though higher reliance on demand deposits causes the capital structure of banks to be inherently fragile. Calomiris and Kahn (1991) model the interim market discipline using the demand deposit contract. The informed depositors are able to observe an interim signal about banks' return, and as a result they are able to 'vote with their feet' if the observed signal indicates that the return is low. In this case, depositors are able to increase their utility and payoff by prematurely withdrawing their funds from weaker banks. Depositors' risk aversion drives their withdrawal behavior and allows them to penalize banks that have engaged in higher-risk taking activities. Information-based bank run models are also propagated by Bryant (1980), Jacklin and

[64] This avoids the inherent riskiness of depending only on a single monitoring party that might have a conflicting aim.

Bhattacharya (1988), Chari and Jagannathan (1988), Gorton(1988) and Allen and Gale (1998).

Depositors' sensitivity to risks and having their own investment at stake provide incentives for depositors in disciplining banks ex-ante through contractual instruments or by demanding a higher return (Macey, 1988). The cost that depositors need to incur provides them with the incentive to curb bank managers from undertaking risky investment strategies and expropriating creditors' wealth (Berger, 1991 and Flannery, 1994). Disciplining by depositors allows fundamentally sound banks to be rewarded for their prudence and performance and weak banks to be punished for greater risk taking. This enables early detection of weak banks. Signals sent by depositors provide incentives for banks to reduce their excessive risk taking activities. This encourages greater prudence and efficiency among bank managers and enables problems in a particular bank to be contained before they spread to the entire banking sector.

Studies by Dewatripont and Tirole (1994) and Miles (1995) are but a few of the studies in the existing literature that question depositors' ability in disciplining banks. Depositors need to have accurate information about banks' performance in order for them to monitor banks. However, availability and accessibility of such information are not necessarily adequate for the depositors. In line with this, Dewatripont and Tirole (1994) assert that individual depositors have little incentive or poor ability in monitoring banks due to the informational complexity and free-rider problem. This limits depositors' capacity to analyze, evaluate and utilize such information in order to control bank managers' risk-taking behavior. Similarly, Miles (1995) posits that depositors' knowledge about banks' risk can be limited due to their inability to assess bank balance sheets. This hinders depositors' ability in evaluating banks' default probability and as a result limits their ability to discipline banks. The ability of depositors to discipline banks can also be hampered by the cost inefficiency involved in assessing individual banks' financial condition, which may lessen their ability to choose across banks (Cordella and Yeyati, 2002).

3.3.2 Review of Empirical Evidence

Existing empirical literature in banking shows that depositors do discipline banks. Depositors discipline banks using two approaches; price-based approach and quantity-based approach. Under the first approach, banks that engage in higher-risk taking are required to pay a higher return as compensation. Studies by Baer and Brewer (1986), Ellis and Flannery (1992) and Cook and Spellman (1994) find that there is a positive relationship between the rate of large uninsured CDs of US banks, and the riskiness of the banks. The second approach looks at depositors' withdrawal actions or 'flight to quality'[65]. Among the studies that find a positive relationship between banks' risk and deposit withdrawals are Kane (1987), Goldberg and Hudgins (1996), Saunders and Wilson (1996), Calomiris and Mason (1997) and Martinez Peria and Schmukler (1999). Studies that have looked at both approaches are Park and Peristiani (1998), Barajas and Steiner (2000), Calomiris and Powell (2000), Maechler and McDill (2006), Ghosh and Das (2006) and Ungan et al. (2008).

Market discipline can be deterred by the existence of a deposit insurance scheme. Empirical studies by Cook and Spellman (1994), Park and Peristiani(1998), Martínez Pería and Schmukler (1999), Calomiris and Powell (2000), Barajas and Steiner (2000) and Ungan et al. (2008) show that depositor's discipline is present in countries like the United States, Argentine, Chile, Colombia, Mexico and Russia even in the presence of explicit deposit insurance schemes. This essentially shows that depositors may not assume insured deposits to be entirely safe as they may also be worried about banks' solvency and other safety nets in a banking sector (Berger and Turk-Ariss, 2011). The economic solvency and credibility of the insurer also matter (Cook and Spellman, 1994)[66]. This is more so in the case of developing countries where the doubt about the

[65] Bernanke et al. (1996) introduces this term in describing depositors' action of withdrawing funds from the weaker institutions and re-depositing in stronger ones.

[66] Cook and Spellman (1994) find that even though the deposits of U.S. savings and loan associations (S&Ls) are fully insured, their interest rate is still related to the level of risk taken by the individual institutions. This happened mainly due to the weakening financial position of the federal guarantor at that time.

ability of the insurers to cover its guarantees is higher (Demirguc-Kunt and Kane, 2002).

Most of the existing studies analyze depositor discipline in a single country. Earlier studies have focused more on the United States [67]. By studying Ohio's thrift institutions during the March 1985 crisis period, Kane (1987) finds that retail depositors are able to distinguish between weak and strong depository institutions as they made fewer withdrawals from safe institutions. Goldberg and Hudgins (1996)'s analysis of the bank run that happened in the US during the depression era of 1929 to 1933 finds that savings and loan institutions' ratio of uninsured deposits to total deposits ratio fell as early as two to four-year period before their actual failure. Calomiris and Wilson (1998)'s study of banks in New York City during the 1920s and 1930s shows that depositors switched from riskier banks to safer ones. Park and Peristiani (1998) finds that deposits growth is negatively related to the thrift's estimated probability of default. They also find that uninsured depositors exhibit greater market discipline compared to insured ones.

Goldberg and Hudgins' (2002) study of the thrift institutions shows that depositors' discipline is associated with the thrifts' vulnerability to failure. Saunders and Wilson (1996) finds that, in 1929 and 1933, failed banks had significantly lower deposits growth. Their findings also show that depositors withdrew their investments from weaker banks and deposited them into healthier banks as early as three years before their actual failure date. O'Grada and White (2002) uses individual bank accounts of depositors in order to analyze their behavior during the panics of 1857. Their finding shows that this panic episode, which was caused by systemic shock that affected the entire banking system, was fundamentally based[68]. This shows that depositor discipline was in force.

Depositors' discipline has also been studied in Latin American countries that have experienced crises. Schumacher's (2000) study of the Argentinian crisis, that happened as a result of the

[67] Flannery (1998)'s summary of the empirical studies of depositors' discipline in United States provides support for this.

[68] Their study shows that the panic episode of 1854, which was caused by a single bank's bankruptcy, was caused by a random event.

devaluation of Mexican peso in December 1994, shows that depositors transferred funds from fundamentally weak banks to stronger ones. Using both pooled panel and fixed-effect panel models for each country, Martínez Pería and Schmukler (2001) finds that both insured and uninsured depositors withdrew their funds and required higher returns from banks that engaged in higher risk taking activities in Argentina, Chile, and Mexico during the 1980s and 1990s. This shows that deposit protection schemes in these three countries are not credible in all cases. They also find that market discipline is weaker during a crisis and stronger after a crisis. Similarly, Levy Yeyati et al (2004)'s study on depositors' behavior in Argentina and Uruguay during the systemic bank runs in 2000 to 2002 shows that the effectiveness of bank fundamentals in explaining depositors behavior declines during crisis time.

Calomiris and Powell (2000)'s study of Argentina finds that riskier banks attract smaller amounts of uninsured deposits. More specifically, they find that high asset risk and leverage are associated with greater deposit withdrawals. Barajas and Steiner (2000) finds that depositor's discipline exists in Colombian banks using semi-annual data from 1985 to 1999. Their findings show that depositors withdrew their funds from weaker banks even after controlling for the return offered by these banks and the deposit insurance scheme that was in place. Solvency, liquidity, assets quality and profitability of the banks mattered to the depositors. Levy-Yeyati et al.'s (2010) analysis of the bank runs that happened in Argentina and Uruguay in 2000 to 2002 using fixed effect panel data method highlights the importance of macroeconomic factors, in addition to the traditional bank specific factors, in influencing depositors' withdrawal actions.

In addition, depositors' discipline has also been analyzed in other countries. Birchler and Maechler (2001)'s study of 250 banks in Switzerland over the period 1987 - 1998 finds that depositors withdraw uninsured deposits from weaker banks. However, depositors are also sensitive to banks' institutional variation as they did not withdraw funds from a bank that had

state guarantee. Their findings also show that bank-specific fundamental factors accounted for 75 percent of the variation in the uninsured deposits. Graeve and Karas (2008) studies the Russian deposit market during the period from 2002 to 2007 using the vector autoregression (VAR) method. Their findings show that although depositors run on solvent banks with uninsured deposits and insolvent banks with uninsured deposits, the run on the latter was four times higher compared to the run on the former. Ungan et al.'s (2008) study of Russian deposit-taking institutions during the period from 2001 to 2005 using pooled OLS and the fixed effect panel data method finds that solvency and liquidity of banks mattered for the depositors as larger withdrawals are made from undercapitalized and low liquidity banks. Their results are mainly attributed to explicit guarantees for state-owned banks and implicit guarantees for large sound banks that existed in the Russian banking sector. Debasish and Das's (2009) study of Indian commercial banks for the period from 2001 to 2008 finds that banking sector policy variables and bank-specific variables influence depositor's discipline. In addition to this, they also find that macroeconomic variables dominate bank specific variables in influencing foreign banks' depositor's behavior.

Among the studies that have carried out cross-country analysis on depositor discipline are Demirgüç-Kunt and Huizinga (2004) and Arena (2004). The earlier study uses OLS and two-stage least squares analysis (2SLS) in analyzing market discipline in 43 countries over the period from 1990 to 1997. They find that market discipline prevails even with the existence of deposit insurance schemes. Arena (2004) analyses deposits growth in the crisis-led East Asian countries during crisis and non-crisis periods by using a cross-country fixed-effect method. He concludes that the importance of bank-specific factors in explaining depositor withdrawal action declines during a crisis period. This study has several shortcomings. Firstly, it does not take into account the dynamic nature of deposits growth. Secondly, it does not take into account the effect of the

price mechanism (interest rate) that can be used by managers in influencing depositor behavior.

Kaoru et al. (2005) also analyses depositor discipline in the East Asian countries, namely Indonesia, Korea, Malaysia and Thailand. Their analyses, using pooled OLS regression of deposit growth and interest rate for each individual country during the period from 1992 to 2002, find that higher-risk taking by banks reduces deposits growth. They also find that banks with a higher-risk profile offer a higher interest rate. This essentially shows that market discipline was effective in East Asia as depositors are able to demand a higher premium from riskier banks. However, Kaoru et al. (2005)'s study has several shortcomings. Firstly, it does not take into account the bank-specific effect and the panel structure of the data. Secondly, it did not take into account of the dynamic nature of the relationship between price (interest rate) and quantity (deposit quantity).

Maechler and McDill (2006) pioneered the use of Difference-GMM estimation in analyzing the endogenous relationship between price and quantity of deposits in the depositor discipline model. They posit that depositors' withdrawal actions and banks' response to them is a dynamic process that is simultaneously determined. Their findings confirm that the relationship between price and quantity of deposits is endogenous. After taking into account this endogeneity, they find that banks in the United States are able to raise deposits by raising interest rate, and healthier banks are able to raise significantly higher deposits compared to the weaker ones. Similar methodology is used by Karas et al. (2006) and Bowe and Wu (2007) in analyzing the dynamic relationship between price and quantity of deposits in the Russian and Chinese banking sector. However, both studies find a negative relationship between price and quantity of deposits.

The present study aims to fill in the gap in the existing literature by trying to overcome some of the weaknesses that exist in the studies by Arena (2004) and Kaoru et al. (2005) on depositor discipline in East Asia. Firstly, this study aims to find evidence of market discipline in East Asia after controlling for the dynamic relationship between price and quantity of deposits as

illustrated by Maechler and McDill (2006). Secondly, this study aims to take into account the restructuring exercise that happened in the East Asian banking sector as a result of the crisis in analyzing depositor behavior. The sample of banks in the study will be divided into weaker (Restructured) and healthier (Non-restructured) ones, and estimations will be performed in finding out if depositors react differently to the two groups of banks. More importantly, this study aims to find out if stronger banks in East Asia are able to attract more deposits once the simultaneity between price and quantity of deposits is taken into account.

3.4 Methodology

This study aims to find out if depositors discipline banks. The null hypothesis is that depositors' withdrawals do not respond to ex-ante weaknesses in an individual bank's balance sheet. If there is no depositor discipline, deposits growth should be uncorrelated with bank specific variables that reflect their risk characteristics. In addition to this, the aim of this study is also to find out if there is a simultaneous relationship between price and quantity of deposits. Once this is established, the study aims to find if banks are able to attract higher deposits over time by raising interest rates. In answering the above questions, static and dynamic panel data analysis are used. As far as this study is concerned, using dynamic panel methodology enables us to examine whether the changes in the interest rate have an exogenous impact on the quantity of deposits, independent of the endogenous impact of worsening bank balance sheets on the price and quantity of deposits.

3.4.1 Panel Data Analysis

Using pooled OLS regression in analyzing panel data may result in heterogeneity bias as the standard error of the estimators is not independent of the previous periods. In the case of cross country analysis, correlation can also exist across individual banks within a country. In order to overcome this problem, estimation methods that adjust for the correlation in the standard errors of the estimators need to be used.

Random effect (RE), between effect (BE) and fixed effect (FE) estimation methods are

commonly used in panel data analysis. The individual effect in the regression analysis is treated as purely random and, as a result, assumed not to be correlated with the regressors under the RE estimation method. The RE method allows for the estimation of the time-invariant regressors. This method is better than the ordinary least square (OLS) method because it takes into account between and within variation in the estimator[69]. However, this estimation method becomes inconsistent in the event that the individual effect is correlated with the regressor. The between effect model focuses on the variation between units.

The fixed effect model takes into account within variation in the dependent and independent variables. In doing so, its removes the effect of the time-invariant characteristics from the regressor and assesses the regressor's net effect (Green, 2008). Even though the fixed effect model is costly in terms of degrees of freedom lost, it is preferred when there is no justification for treating the individual effects as uncorrelated with the other regressors. This method contributes towards consistent estimates even if the time-invariant component of the error-term is correlated with the regressor. The random effect estimation will be inconsistent and prone to omitted variable biasness (Hausman and Taylor, 1981).

Consider the following regression equation,

$$\begin{aligned} \text{DEPGR}_{i,j,t} &= \alpha_i + \lambda_t + \sigma_j + \mu\text{DEPGR}_{i,j,t-1} + \beta\text{BANK SPECIFIC}_{i,j,t-1} \\ &\quad + \gamma\text{COUNTRY SPECIFIC}_{j,t} + \varepsilon_{i,j,t} \end{aligned} \tag{3.1}$$

such that i=1,...,N ; j=1,...,J ; and t=1,...,T. DEPGR is the growth rate of real deposits for individual bank i at time t in country j. N is the number of banks in each country. J is the number of countries (i.e. 5 countries). T is the number of observations per bank (it varies because the panel is unbalanced). BANK SPECIFIC is a vector of bank level variables that represents banks'

[69] OLS regression does not take into account of the panel structure of the dataset.

risk characteristics. This vector is included with a lag in order to account for the fact that balance sheet information is available to the public with certain delay. COUNTRY SPECIFIC represents macroeconomic variables, banking sector variables and other country-level variables. In analyzing depositor behavior using the panel data method, bank-specific effect, country-specific effect and time effect need to be controlled for. In Equation 3.1, α accounts for the bank-specific effect, σ accounts for the country effect and λ accounts for the time effect. All the variables are expressed in levels.

3.4.2 Dynamic Panel Data Analysis

Estimating depositor's discipline using FE model can be biased in the presence of lagged dependency of the dependent variable. Lagged dependency can arise in the model due to the inertial behavior of the dependent variable. Estimating an equation with lagged dependency using static panel estimates or OLS models, omits dynamics. This causes the problem of dynamic panel bias. Omitted dynamics can result in model misspecification as not all the history of the right-hand-side variables is taken into consideration in the analysis (Greene, 2008). In the case of this study, the rate of deposits growth that banks experience in the past is likely to affect their growth today. For example, smaller banks are likely to attract similar deposits if they remain small in the subsequent period. Similarly, a more reputable bank is likely to enjoy a similar reputation in the subsequent year. Estimating deposits growth using a FE model can be problematic as the lagged dependent variables will be correlated with the compound disturbance terms ($\alpha_i + \varepsilon_{ijt}$) of the model.

The FE model can also be biased in the presence of endogeneity. In the depositor discipline model, an endogenous relationship can arise between the deposits growth and interest rate variables as bank managers who are able to anticipate that bank fundamentals at time t-1 affect deposits at time t may try to adjust banks' interest rate in order to prevent future deposit withdrawals. The instrumental variable method has been introduced to address the endogeneity

problem. This method uses an exogenous variable which is correlated with the independent variable, but cannot be affected by the dependent variable as an instrument. Among the methods that are commonly used are two-stage least squares (2SLS), three-stage least squares (3SLS) or GMM method.

This study uses the Arellano and Bond (1991) dynamic panel data model that relies on instrumental variable estimator or a GMM estimator in addressing the endogeneity issues. This estimator has several econometric advantages. Firstly, it can address endogeneity issues between the dependent variable and the independent variable (deposits and interest rate) by making use of the internal instruments (i.e. lagged dependent variable in levels for first differences). This saves us from having to find and use an external instrument that is disputable. Secondly, it can handle autoregressive properties in the dependent variable (deposits). Thirdly, in the presence of heteroskedasticity, Baum et al. (2002) asserts that the GMM estimator is more efficient than the simple IV estimator[70]. Hence, the GMM estimator is used in this study to control for bank specific non-observable factors.

In determining whether the movement of the interest rate variable has an exogenous impact on the quantity of deposits, independent of the endogenous impact of deteriorating fundamentals on interest rate and quantity of deposits, this study uses Difference-GMM estimation. The main reason for using this estimation method is because it only focuses on across time variation in the dependent and independent variables. This is an important dimension for testing the hypotheses of this study. This estimation method is also suitable in analyzing the sample of banks in this study as the auto regressive parameter of deposits growth variable is not relatively high (below 0.8) and the number of time periods used in this study is not small (i.e. 11 years). Estimation for the Difference-GMM is carried out using the xtabond2 user written command in STATA 11 (Roodman, 2006) (refer to Appendix D for details about Difference-GMM).

[70] Estimation using Breusch Pagan test confirms that heteroskedacticity is present in the data used for this study.

3.4.3 Data Description

The analysis of this study is carried out using the sample of commercial banks in five East Asian countries namely Indonesia, Korea, Malaysia, Philippines and Thailand. Bank level data is obtained from BankScope. The database for each bank is obtained for the period between 1995 and 2005. Country level macroeconomic data is obtained from International Monetary Fund's International Financial Statistics database. Deposits insurance data is obtained from Demirgüç-Kunt et al. (2005). As part of the contribution of the thesis, a comprehensive database on bank restructuring in the five East Asian countries is assembled. The information is gathered from BankScope, banks' and central banks' websites, and academic sources that have detailed the restructuring[71].

All commercial banks' data that is available from BankScope are used for the analysis. This yielded an initial sample of 197 banks. The number of observations available for the regression analysis changes according to the variables used in the regressions. Since two-period lags of the dependent variable are used in the dynamic panel data analysis, banks with less than three-years of financial data in the BankScope database are automatically eliminated in the regressions. Therefore, the actual number of banks used in the dynamic panel data analysis is around 150.

3.4.4 Variables

3.4.4.1 Bank Specific Variables

Deposits Growth Growth rate of real deposits is used as the dependent variable in the analysis. This variable is a measure of Total Deposits Growth from one period to another expressed as a percentage and adjusted for inflation (i.e. expressed in real as opposed to nominal terms)[72].

Interest Rate The ratio of Interest Expense to Interest-Bearing Debt is used as the measure of

[71] Ariff et al. (2001), Ito and Hashimoto (2007a), Ito and Hashimoto (2007b), Kawai and Takayasu (1999), Lindgren et al. (1999), Num and Lum (2006), Pangestu and Habir (2002), Park (2005), Polsiri and Wiwattanakantang (2005), Sato (2005) and Soon and Koh (2005).

[72] Total deposits is used because data on customer deposits is not available for the Indonesian and Korean banks in some of the years.

Interest Rate[73]. This variable capture the funding cost per unit of debt. Studies by Demirgüç-Kunt and Huizinga (1999), Demirgüc-Kunt and Huizinga (2004) and Bowe and Wu (2007) have used this ratio as the interest rate proxy. Demirgüç-Kunt and Huizinga (1999), Demirgüc-Kunt and Huizinga (2004) and Fonseca and González (2010) substracted the government interest rate from the ratio of interest expense to interest-bearing debt of each individual bank to get a cross-sectional measure of bank risk that is adjusted for the nominal risk-free rate. The government rate is the Treasury bill rate where available, otherwise the discount rate[74]. Both rates are used in the analysis.

Capital Adequacy Capital adequacy is measured using the ratio of Total Equity to Total Assets. A higher ratio indicates that banks are able to absorb greater losses. This should send a signal to the market that the default risk is low, and as a result is linked to higher deposits inflow (Barajas and Steiner, 2000 ;Martinez Peria and Schmuckler, 2001; Calomiris and Powell, 2000; Maechler and McDill, 2003; Demirguc-Kunt and Huizinga, 2004; Bowe and Wu, 2007 and Levy-Yeyati et al., 2010).

Profitability Return on Equity (ROE) is used to measure banks' profitability. This variable is measured by the ratio of pre-tax profits to total equity. In general, assuming that risk is adequately controlled for, higher profitability should be linked to greater deposits growth (Barajas and Steiner, 2000; Martinez Peria and Schmuckler, 2001; Demirguc-Kunt and Huizinga, 2004; Bowe and Wu, 2007 and Levy-Yeyati et al., 2010). However, exceptionally risky projects could be associated with huge rates of return. So, it is possible that for some threshold a high degree of profitability could be associated positively with the risk of failure (Gonzalez-Hermosillo, 1999). In this case, higher profitability can be associated with lower deposits.

Liquidity Bank's liquidity is measured using the ratio of Liquid Assets to Total Assets. Liquid

[73] Data on the detail breakdown of interest charged by banks on their deposits is not available in BankScope.
[74] Data for the government debt rate is taken from line 60 zf of the IFS database. Units are in percentage per annum.

Assets take into account of cash reserves and balances with the central bank. Higher liquidity ratio can be linked with greater ability of banks in honoring depositors' withdrawals. Therefore, higher liquidity ratio should be associated with a higher deposits growth rate. However, higher liquidity ratio also can indicate that banks have not engaged in greater financing activities and as a result is linked with lower return. In this case, an increase in this ratio can be associated with lower deposit growth. Studies by Barajas and Steiner (2000), Demirguc-Kunt and Huizinga (2004) and Bowe and Wu (2007) have used this variable.

Asset Quality Asset quality is measured as the ratio of Loan Loss Provisions to Gross Loans. Current loan loss provisions are usually made in order to cover against non-performing loans that banks expect to incur in the following year. Hence, higher provision can signify prudent risk management, and as a result be linked to greater deposits growth. However, higher provision also can be associated with the prospect of lower asset quality. By allocating greater provision, banks are effectively disclosing that their asset quality is low. In this case, higher provision can be linked to lower deposits growth. Studies by Barajas and Steiner (2000) and Bowe and Wu (2007) have used this variable.

Management Quality Management quality is measured using Cost to Income Ratio (CIR). This variable is defined as the ratio of operating costs (it may include expenses such as salary, investment in training, and the marketing fees for banks' financial products) to operating income. A lower ratio may indicate that banks are run efficiently, and as a result may be linked with greater deposits growth. However, a higher CIR ratio may be linked with greater engagement of banks in sales and marketing activities to attract more business. In this case, a higher CIR ratio can be linked with greater deposits growth. Studies by Barajas and Steiner (2000) and Demirguc-Kunt and Huizinga (2004) and Bowe and Wu (2007) have controlled for this by using the ratio of non-interest expenditures to total assets as a proxy.

Size Size is measured as the natural logarithm of Total Assets. It is included to control for bank assets. Depositors' incentives in monitoring and disciplining banks are likely to be weakened by the perception that larger banks are less likely to fail. This can either be due to their diversified customer base, which makes them appear safer, or due to the 'too-big-to-fail' hypothesis, which increases their chances of being bailed-out in the event of financial difficulties. A positive relationship between size and deposits growth will indicate that depositors perceive larger banks to be safer. Studies by Park and Peristiani (1998), Barajas and Steiner (2000), Maechler and McDill (2003) and Bowe and Wu (2007) and Levy-Yeyati et al. (2010) have controlled for size.

Restructured and Non-restructured Banks Studies by Bongini et al. (2001), Bongini et al.(2002), Rojas-Suarez (2001), Arena (2008) and earlier studies mentioned in Chapter 2 confirm that restructured banks in East Asia have weak fundamentals. Based on this premise, banks' restructuring exercises are used to subdivide the sample into two different quality categories. A bank is classified as Restructured if it is recapitalized, suspended, closed or taken-over by another bank, and Non-Restructured otherwise. Restructured banks are considered as weak banks while Non-Restructured banks are considered as healthy banks. Once the restructuring exercise takes place, the banks are removed from the sample size. For those cases in which a bank merged or was acquired, the resulting larger bank is treated as a 'new' bank in the sample[75].

3.4.4.2 Country Specific Variables

GDP Per Capita Deposits growth can be linked to the general economic conditions in a country[76]. Higher growth rate stimulates greater financial intermediation activities. During this time, greater demand for a bank loan will be accompanied by higher interest rates in order to attract more deposits. This is especially the case in emerging markets, where a bank's role as

[75] Eliminating the merged banks from the analysis will create biases given the relatively large number of mergers and acquisitions (around 20) in comparison to the number of banks in the sample (about 150).

[76] GDP per capita, which is measured as the gross domestic product (GDP) divided by the number of people in the country, is especially useful when doing cross-country analysis as it shows the relative performance of the countries.

financial intermediator is more prominent. Similar to Demirguc-Kunt and Huizinga (2004), GDP Per Capita is used to control for the general strength of the economy, which may influence the growth of total deposits in a country[77].

Market Structure Number of banks in the East Asian banking sector has fallen after the crisis due to the consolidation that happened in the banking industry. This increases the concentration levels for assets. The Herfindahl–Hirschman Index (HHI) is one of the most widely used measures of market concentration, and it is used as a proxy for competition in the empirical analysis. It is defined as the sum of the squares of market shares of all the banks in a country, where the market shares are expressed as fractions. It has the following form:

$$HHI_i = \sum_{i=1}^{N} s_i^2$$

where s_i is the market share of bank i and N is the number of banks in the system. Market share of banks is measured using total assets as a proxy for bank size. HHI gives higher weight to larger banks compared to the smaller ones. Higher HHI is associated with greater concentration in the banking industry while lower HHI is associated with greater competition in the industry. Similar to Park and Peristiani (1998) and Ungan et. al. (2008), this study controls for market concentration in the banking sector in analyzing depositor discipline.

Deposit Insurance Depositor discipline can be weakened by the existence of deposits protection schemes. This study controls for the existence of a safety net in the banking sector by using a deposit insurance index. This index is based on Demirgüç-Kunt and Huizinga (2004)'s study. The variation in the deposit insurance schemes is measured based on three aspects, which include explicit deposits insurance, unlimited coverage, and inter-bank deposits coverage. The deposits insurance index ranges from 0 to 3.

3.5 Results

[77] Since total deposits is measured in real values, inflation is not included as a control variable in this study.

3.5.1 Summary Statistics

Table 3.1 provides the summary of the data set. The results show that there is a great variability in the deposits growth variable. This variable varied more across time than across bank as shown by the standard deviation. Interest rate and Interest Rate Ex Gov Debt also displayed variation across time and bank. Solvency ratio, profitability ratio, liquidity ratio, Costs to Income ratio and provisioning ratio of the banks in the sample displayed greater variation overtime than across bank. Size (log value of Total Assets) varied more across bank than across time, highlighting the heterogeneous nature of banks in East Asia.

Table 3.2 provides the summary statistics of the data based on three periods classified as before, during and after the crisis[78]. The information obtained for the three periods is compared with those obtained for the whole sample period. For each period, the table indicates the total number of observations, the average value for each variable, with the standard deviation presented below in parentheses. Table 3.2 shows that banks in East Asia experienced a drastic drop in deposits growth, falling from 32 percent before the crisis to -11 percent during the crisis. Such large drop in growth reflects the severity of the crisis. Deposit growth improved during the post-crisis period. The total interest paid out on interest-bearing debts rose from 8.88% before the crisis to more than 12 percent during the crisis. This increase in interest paid out, to some extent, reflects the higher costs of funding arising from large withdrawals of funds. Post-crisis, the interest rate dropped by half to an average of 5.67 percent. This, in turn, reflects the increase in the stability of the deposits market after crisis. Similarly, government debt rate rose from 9.06 percent before the crisis to an average of 15.47 percent during the crisis. This rate averaged 6.98 percent post-crisis. Government debt rate remains higher than the interest rate paid out by banks in all periods.

Although the equity base of the banks did not change much, the profitability of banks plunged from a high of 11.19 percent before the crisis to a low of -14.33 percent during the crisis period.

[78] Before crisis consists of 1995 to 1996, crisis consists of 1997 to 1998 while post-crisis consists of 1999 to 2005.

		All Period				
Variable Name		Mean	Std. Deviation	Min	Max	Observation
Deposits Growth	overall between within	19.21	58.96 23.77 54.56	-95.96 -21.59 -136.67	515.23 222.55 470.77	1315
Interest Rate	overall between within	7.43	5.87 4.16 4.27	0.7 1.68 -4.57	48.5 22.38 37.33	1018
Interest Rate Ex Gov. Debt Rate	overall between within	-1.61	5.41 4.52 3.37	28.94 -14.19 -20.15	21.06 21.06 22.09	1019
Government Debt Rate	overall between within	9.06	7.96 5.86 5.22	2.00 2.30 -1.88	38.44 23.75 31.94	1018
Total Equity / Total Assets	overall between within	11.03	12.37 8.75 8.92	-129.21 -11.09 -107.08	99.72 55.15 82.2	1640
Return on Equity	overall between within	3.22	77.21 34.95 70.48	-975.36 -242.66 -789.86	967.12 115.08 855.25	1632
Liquid Assets / Total Assets	overall between within	22.96	16.87 13.03 10.4	0.2 1.09 -20.03	96.79 72.01 86.83	1640
Costs to Income Ratio	overall between within	64.33	55.19 31.72 45.19	2.3 12 -94.13	873.58 236.14 742.82	1575
Loan Loss Reserve / Gross Loans	overall between within	6.8	9.46 6.38 7.48	0 0.84 -43.24	90.19 52.43 70.5	1575
Log Size	overall between within	14.11	1.95 1.88 0.41	9.27 9.71 11.39	19.01 18.06 16.4	1638
HHI	overall between within	0.13	0.06 0.03 0.05	0.05 0.09 0.04	0.35 0.171 0.32	2364
Deposit Insurance	overall between within	1.49	0.95 0.42 0.85	0 0.92 -0.76	3 2.25 2.57	2364
GDP Per Capita	overall between within	3004.31	3649.1 3350.33 1464.04	3 768.94 -7065.79	13303.82 10073.83 6234.29	2364

Table 3.1: Summary Statistics

Variable Name	All Period Obs	All Period Mean (Std. Dev.)	Before Crisis Obs	Before Crisis Mean (Std. Dev.)	Crisis Obs	Crisis Mean (Std. Dev.)	Post Crisis Obs	Post Crisis Mean (Std. Dev.)
Deposits Growth	1315	19.206 (58.959)	255	32.880 (54.921)	267	-11.683 (46.817)	793	25.209 (60.380)
Interest Rate	1018	7.429 (5.872)	114	8.885 (3.872)	222	12.096 (8.610)	682	5.667 (3.792)
Interest Rate Ex Gov. Debt Rate	1019	-1.610 (5.410)	114	-0.121 (3.474)	223	-3.269 (8.579)	682	-1.317 (4.048)
Government Debt Rate	1018	9.062 (7.964)	114	9.006 (3.450)	222	15.470 (12.320)	682	6.984 (5.076)
Total Equity / Total Assets	1640	11.035 (12.370)	409	11.134 (9.685)	306	9.165 (17.949)	925	11.610 (11.051)
Return on Equity	1632	3.219 (77.210)	409	11.197 (19.507)	301	-14.326 (132.373)	922	5.407 (67.431)
Liquid Assets / Total Assets	1640	22.957 (16.874)	409	20.843 (13.497)	306	20.971 (16.217)	925	24.549 (18.220)
Costs to Income Ratio	1575	64.328 (55.189)	406	57.664 (28.837)	283	65.961 (59.131)	886	66.860 (62.408)
Loan Loss Reserve / Gross Loans	1575	6.803 (9.460)	390	2.300 (3.218)	298	7.598 (10.429)	887	8.516 (10.291)
Log Total Assets	1638	14.115 (1.9475)	409	14.231 (1.804)	306	13.777 (1.899)	923	14.175 (2.0130)
Total Assets Growth	1405	3.173 (32.056)	256	18.387 (11.545)	277	-23.950 (43.496)	872	7.322 (26.433)
HHI	2364	0.126 (0.061)	591	0.109 (0.0409)	394	0.091 (0.015)	1379	0.144 (0.070)
Deposit Insurance	2364	1.485 (0.946)	591	0.386 (0.789)	394	1.563 (0.995)	1379	1.934 (0.514)
GDP Per Capita	2364	3004.307 (3649.096)	591	2951.375 (3134.772)	394	3104.459 (3340.73)	1379	2998.376 (3929.342)

Table 3.2: Summary Statistics By Time Period

This may reflect the large drop in the economic growth rate in the East Asian countries during the crisis period. Hence, it is perhaps not surprising to see the dramatic increase in loan loss provisioning by the banks. Prior to the crisis, the Loan Loss Provisions to Gross Loans ratio is just 2.30 percent for the average bank. During the crisis year, it more than tripled to 7.59 percent. Such a high rate reflects the possibility that banks build up problem loans. Total assets growth in the banking sector dropped from a high of 18.38 percent before crisis to a low of -23.94 during the crisis. It is perhaps not surprising to see a turnover in Assets Growth of over 7 percent for the average bank post-crisis. Deposits insurance was low before the crisis but increased during the crisis period. It remained high after that.

3.5.2 Partial Correlation

Tables 3.3 and 3.4 exhibit the partial correlations between the dependent and independent variables in levels and first differences. Most importantly, negative correlation is observed between Interest Rate and Deposits Growth in both levels and first differences. This suggests that banks that have high deposit growth are likely to offer relatively lower Interest Rates to their depositors. Meanwhile, a change in Interest Rate is negatively associated with a change in Deposits Growth. This implies that not all banks can raise deposits by raising the price.

The results also show that there is a positive correlation between Interest Rate Ex. Gov. Debt and Deposits Growth in both levels and first differences. This suggests that banks that have high deposits growth are likely offer their depositors interest rates that are closer to the government debt rate. Positive correlation between a change in Interest Rate Ex. Gov. Debt and a change in Deposits Growth suggests that banks that reduce the gap between their interest rate and government debt rate are likely to attract more deposits.

Equity, liquidity and provision shows positive correlation in levels and differences. However, ROE shows a positive correlation with the level of deposits and a negative correlation with the first difference of deposits. This suggests that banks that have a high level of deposits growth are

Table 3.3: Partial Correlations In Levels

	Deposits Growth	Deposits Growth_L1	Interest Rate	Interest Rate Ex Gov. Debt	Disclosure Index_L1	Total Equity / Total Assets_L1	Return on Equity_L1	Liquid Assets / Total Assets_L1	Costs to Income Ratio_L1	Loan Loss Reserve / Gross Loans_L1	Size	HHI	GDP Per Capita
Deposits Growth	1												
Deposits Growth_L1	-0.069	1											
Interest Rate	-0.1053	-0.0737	1										
Interest Rate Ex Gov. Debt	0.1118	-0.2052	-0.0431	1									
Disclosure Index_L1	-0.0216	-0.0888	-0.3723	0.1246	1								
Total Equity / Total Assets_L1	0.1174	0.0504	0.0211	-0.2252	-0.0326	1							
Return on Equity_L1	0.018	0.0939	-0.0368	-0.0985	0.0182	0.1061	1						
Liquid Assets / Total Assets_L1	0.1281	0.1629	0.0094	-0.2433	0.0376	0.2631	0.1433	1					
Costs to Income Ratio_L1	-0.0578	-0.0279	0.049	0.1884	-0.0108	-0.1904	-0.2632	-0.1325	1				
Loan Loss Reserve / Gross Loans_L1	0.2092	0.0755	-0.0432	-0.1607	0.0126	-0.0145	-0.149	0.251	0.0279	1			
Log Size	-0.0797	-0.1322	-0.3791	0.4847	0.253	-0.4491	-0.0191	-0.4499	0.0962	-0.2845	1		
HHI	0.4111	0.0963	0.0677	-0.2875	-0.0423	0.0643	-0.0526	0.3759	-0.089	0.5291	-0.4799	1	
GDP Per Capita	-0.0226	-0.0945	-0.1937	0.5298	-0.0576	-0.3148	-0.0606	-0.3549	0.1065	-0.2345	0.6444	-0.4023	1

Table 3.4: Partial Correlations In First Differences

	D.Deposits Growth	D.Deposits Growth_L1	D.Interest Rate	D.Interest Rate Ex Gov. Debt	D.Disclosure Index_L1	D.Total Equity / Total Assets_L1	D.Return on Equity_L1	D.Liquid Assets / Total Assets_L1	D.Costs to Income Ratio_L1	D.Loan Loss Reserve / Gross Loans_L1	D.Log Size	D.HHI	D.GDP Per Capita
D.Deposits Growth	1												
D.Deposits Growth_L1	-0.4812	1											
D.Interest Rate	-0.2499	-0.1801	1										
D.Interest Rate Ex Gov. Debt	0.5029	-0.1782	-0.1431	1									
D.Disclosure Index_L1	0.0301	-0.0312	0.031	0.0762	1								
D.Total Equity / Total Assets_L1	0.0595	-0.0508	0.1019	-0.0942	-0.0468	1							
D.Return on Equity_L1	-0.0507	0.0358	-0.0021	-0.1148	-0.0293	0.1633	1						
D.Liquid Assets / Total Assets_L1	0.0539	0.1153	-0.2137	0.1064	0.0175	-0.1182	0.0401	1					
D.Costs to Income Ratio_L1	-0.0082	0.0445	-0.0128	0.0149	0.0647	-0.0431	-0.1622	-0.0206	1				
D.Loan Loss Reserve / Gross Loans_L	0.2032	-0.0202	-0.1968	0.2511	-0.0859	-0.0843	-0.1334	0.1757	-0.0169	1			
D.Log Size	0.4211	0.0427	-0.3048	0.1752	0.0189	0.0432	-0.0219	0.0326	-0.0016	-0.0775	1		
D.HHI	0.5684	-0.238	-0.3476	0.6201	-0.0325	-0.2382	-0.099	0.2011	-0.0585	0.4069	0.0171		
D.GDP Per Capita	0.0308	0.0136	-0.0459	-0.0023	-0.0005	0.0195	0.0091	-0.005	-0.0267	0.015	-0.0579	0.0015	1

likely to be more profitable. However, changes in profitability are correlated with lower deposits growth. As far as the size of the banks is concerned, different signs are shown relative to both the level of deposits and its first difference. The positive sign in the first difference correlation implies that banks that increase in asset size are likely to obtain more deposits. The negative sign in the level correlation implies that bigger banks are likely to have lower deposits growth.

3.5.3 Panel Data Analysis

The choice of model specification and variable selection used in this study is based on the existing literature. The effect of a bank specific variable in influencing depositors' behavior after controlling for general country-specific conditions is analyzed. Regression analyses using different assumptions about the error structure of the basic model are carried out. Heteroscedasticity is a norm in cross-sectional data. The standard errors are biased when heteroskedasticity is present (White, 1980). Clustering of standard errors happens when observations in the data are correlated. Serial correlation in a linear panel-data model happens due to the nature of the data that is arranged according to time. This causes the standard errors of the coefficients to be smaller than they actually are. This bias in standard error causes the results to be less efficient[79]. Tests also point to the presence of both heteroscedasticity and autocorrelation in the residuals. Therefore, the assessment of significance is based on robust standard errors that are valid in the presence of non-iid errors. Table 3.5 and 3.6 report the findings using pooled OLS, Random Effect (RE), Between Effect (BE) and Fixed Effect (FE)[80].

The data on East Asian banks seem to support the general hypothesis that deposits growth is associated with movements in banks' fundamentals. Overall, the findings confirm that depositor discipline exists in the East Asian banking sector. The results revealed in Table 3.5 and 3.6 show that higher equity ratio, profitability, liquidity, CIR, loan loss provisions and larger size are linked

[79] Baltagi (2008) highlights the need to account for serial correlation in the presence of random and fixed effects.

[80] Time and country dummies are included in all specification to remove universal time-related and country-related shocks from the error term.

to higher deposits growth. In addition to this, greater concentration in the banking industry and GDP Per Capita are related to higher deposits growth. More importantly, the finding shows that equity ratio and size have a significant impact on deposits growth in all the estimations[81]. This implies that depositors prefer to bank-in their deposits in banks that have high equity ratio and are bigger in size. Apart from this, greater concentration in the banking industry also significantly improves deposits growth.

The estimation result using pooled OLS method is shown in column 1 of Table 3.5. When the panel structure of the data set is not taken into account, estimation using pooled OLS shows that the interest rate variable significantly reduces deposits growth. In addition to this, equity ratio and size appear to be significant determinants of deposits growth. Diagnostic tests on the residuals of this regression using the Breuch Pagan Lagrange Multiplier (LM) test suggest non-normal residuals. This implies that GLS estimation method may be preferred to OLS since it assigns less weight to large residuals when minimizing the sum of squared residuals to derive parameter estimates. RE estimation results shown in column 2 take into account the panel structure of the data set and analyzes within and between variation of the dependent and independent variables. Similar to the pooled OLS results, the interest rate variable exhibits a significant and negative effect on deposits growth while equity ratio and size have significant and positive effect on deposits growth. BE estimation highlights the variation of deposits across banks by regressing the mean of deposits growth of each bank on the mean of the explanatory variables (excludes the time effects). Estimation using BE suggests that there is no significant cross-sectional variation in the interest rate variable. However, significant cross-sectional variations are observed for the equity ratio, provisioning ratio and size of the banks which help banks to attract more funds.

A Hausman specification test is carried out in order to test for the equality of the coefficients

[81] However, BE estimation shows that the cross-sectional variation in banks' Size is not important in explaining the cross-sectional variation in Deposits Growth.

VARIABLES	Dependent Variable : Growth Rate of Real Deposits						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
					Post crisis	Restructured	Non-Restructured
Interest Rate	-1.250***	-1.250***	-0.264	-2.086***	-1.691	-1.845**	-2.116***
	(0.470)	(0.470)	(0.715)	(0.567)	(1.637)	(0.797)	(0.671)
Lag (Total Equity / Total Assets)	2.159***	2.159***	2.072***	3.374***	4.559***	1.926	3.740***
	(0.318)	(0.318)	(0.308)	(0.527)	(0.984)	(1.713)	(0.621)
Lag (Return on Equity)	0.0415*	0.0415*	0.113**	0.0343	0.0472*	-0.00717	0.0558**
	(0.0228)	(0.0228)	(0.0470)	(0.0253)	(0.0283)	(0.0516)	(0.0234)
Lag (Liquid Assets / Total Assets)	0.0372	0.0372	0.0318	0.0815	0.130	0.216	0.0793
	(0.157)	(0.157)	(0.178)	(0.255)	(0.339)	(0.555)	(0.276)
Lag (Costs to Income Ratio)	0.0464	0.0464	0.0678	0.0472	0.0272	-0.000216	0.115*
	(0.0300)	(0.0300)	(0.0614)	(0.0383)	(0.0497)	(0.0456)	(0.0607)
Lag (Loan Loss Reserve / Gross Loans)	0.0822	0.0822	0.617*	0.350	-0.0188	0.328	0.355
	(0.410)	(0.410)	(0.318)	(0.400)	(0.447)	(0.736)	(0.470)
Size	5.842***	5.842***	2.646	52.69***	61.20***	65.64***	51.89***
	(1.655)	(1.655)	(1.808)	(10.21)	(16.11)	(17.62)	(13.00)
HHI	510.1***	510.1***	294.8***	590.0***	867.1***	565.8***	580.9***
	(58.32)	(58.32)	(98.84)	(60.93)	(117.1)	(137.0)	(68.92)
Deposit Insurance	-1.958	-1.958	-5.420	4.424		5.930	4.325
	(4.073)	(4.073)	(8.110)	(4.461)		(5.593)	(5.159)
GDP Per Capita	0.00161	0.00161	-0.00309	0.00291	0.00236	-0.0107	0.00869**
	(0.00515)	(0.00515)	(0.00830)	(0.00554)	(0.00593)	(0.00772)	(0.00373)
Constant	-117.5***	-117.5***	-52.17	-811.3***	-989.2***	-958.2***	-811.5***
	(33.01)	(33.01)	(42.36)	(146.1)	(228.4)	(272.9)	(180.8)
Type of Estimator	Pooled OLS	Random Effect	Between Effcet	Fixed Effcet	Fixed Effcet	Fixed Effcet	Fixed Effcet
Observations	800	800	800	800	504	235	565
Number of Banks		156	156	156	125	61	95
R-squared	0.367		0.646	0.411	0.505	0.576	0.407
F-Stat	15.36***		10.48***	22.19***	11.28***	52.06***	12.87***
Wald chi2		353.10***					

1)*** p<0.01, ** p<0.05, * p<0.1
2)Cluster robust standard errors in parentheses
3)Each regression also contains country and time dummy variables that are not reported

Table 3.5: Panel Data Analysis with Interest Rate Variable

VARIABLES	Dependent Variable : Growth Rate of Real Deposits						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
					Post crisis	Restructured	Non-Restructured
Interest Rate Ex Gov. Debt	1.260***	1.260***	-0.0624	1.953***	2.256*	1.592*	1.956**
	(0.370)	(0.370)	(0.569)	(0.746)	(1.255)	(0.824)	(0.912)
Lag (Total Equity / Total Assets)	2.188***	2.188***	2.008***	3.103***	4.436***	1.653	3.392***
	(0.299)	(0.299)	(0.303)	(0.569)	(0.986)	(1.859)	(0.636)
Lag (Return on Equity)	0.0444*	0.0444**	0.109**	0.0417*	0.0502*	-0.00174	0.0585***
	(0.0225)	(0.0225)	(0.0474)	(0.0245)	(0.0279)	(0.0525)	(0.0221)
Lag (Liquid Assets / Total Assets)	0.0528	0.0528	0.0401	0.190	0.0394	0.199	0.212
	(0.158)	(0.158)	(0.179)	(0.252)	(0.341)	(0.551)	(0.268)
Lag (Costs to Income Ratio)	0.0210	0.0210	0.0519	0.0366	0.0165	-0.000593	0.0902
	(0.0289)	(0.0289)	(0.0637)	(0.0376)	(0.0483)	(0.0445)	(0.0593)
Lag (Loan Loss Reserve / Gross Loans)	0.192	0.192	0.678**	0.319	0.0112	0.149	0.382
	(0.422)	(0.422)	(0.323)	(0.411)	(0.442)	(0.805)	(0.457)
Size	6.169***	6.169***	2.665	52.51***	55.33***	69.12***	50.25***
	(1.703)	(1.703)	(1.805)	(10.53)	(16.95)	(17.45)	(13.37)
HHI	503.1***	503.1***	324.5***	558.7***	819.3***	528.6***	553.1***
	(57.41)	(57.41)	(99.19)	(65.60)	(105.1)	(136.5)	(74.74)
Deposit Insurance	-2.990	-2.990	-8.027	2.755		4.276	3.388
	(4.047)	(4.047)	(8.042)	(4.422)		(6.025)	(5.179)
GDP Per Capita	0.00193	0.00193	-0.00436	0.00337	0.00295	-0.0106	0.00914**
	(0.00514)	(0.00514)	(0.00833)	(0.00556)	(0.00600)	(0.00759)	(0.00378)
Constant	-129.3***	-129.3***	-52.36	-823.5***	-910.9***	-1,019***	-802.9***
	(33.39)	(33.39)	(41.00)	(150.5)	(240.4)	(269.3)	(186.1)
Type of Estimator	Pooled OLS	Random Effect	Between Effcet	Fixed Effcet	Fixed Effcet	Fixed Effcet	Fixed Effcet
Observations	800	800	800	800	504	235	566
Number of Banks		156	156	156	125	61	96
R-squared	0.369		0.642	0.411	0.508	0.576	0.407
F-Stat	14.11***		10.36***	19.41***	10.46***	77.75***	13.24***
Wald chi2		324.5***					

1)*** p<0.01, ** p<0.05, * p<0.1
2)Cluster robust standard errors in parentheses
3)Each regression also contains country and time dummy variables that are not reported

Table 3.6: Panel Data Analysis with Interest Rate Ex Gov. Debt Variable

(Green, 2008). This tests for the statistical significance of the difference between the coefficient estimates obtained by FE and by RE. The null hypothesis is that the RE estimates are efficient and consistent, and FE estimates are inefficient. Rejection of the null hypothesis suggests that the RE estimates will be subject to unobserved heterogeneity bias and will therefore differ systematically from the FE estimates. The Hausman specification test confirms that RE estimates will be subject to unobserved heterogeneity bias.

The FE estimator emphasizes on the variation of dependent and independent variables over time, using deviations from each bank's mean[82]. Once bank-specific effects, country-specific effects and time-effect are controlled for, FE estimation shows that the Interest Rate variable significantly reduces deposits growth. This finding suggests that banks in East Asia are not able to use price mechanism to attract more deposits. Higher equity ratio and larger size influence depositors' behavior. As far as other bank-specific variables are concerned, the results show that profitability, liquidity, costs to income and provisioning is linked to higher deposits growth. Concentration in the banking industry helps banks to attract significantly higher deposits growth. Deposit insurance and GDP per capita are linked higher deposits growth, but the effects are not significant.

In comparison, FE analysis for the post-crisis period shows that the interest rate variable reduces deposits growth but this effect is no longer significant. Depositor behaviors are also driven mainly by the profitability ratio of the banks in addition to their equity ratio and size. The coefficients for the equity ratio and size are higher during the post-crisis period compared to the estimations for the whole sample period. This suggests that the variation in these variables had a stronger influence on depositor behavior after the crisis. This is in line with Martinez-Peria and Schmukler (2001) and Levy Yeyati et al. (2004)'s findings, which show that depositor discipline

[82] It effectively discards the between-person variation and as a result can yield standard errors that are considerably higher than those produced by methods that utilize both within- and between-bank variation.

increased in Chile, Argentina and Mexico after the crisis period. Provisioning by banks during this period is linked to lower deposits growth. This suggests that depositors associate provisioning during this period with lower asset quality and not prudence.

FE estimations for the Restructured and Non-restructured banks show that both types of banks are not able to attract more funds by raising the interest rate. As far as the weaker banks are concerned, only size is associated with significantly higher deposits growth. Equity, liquidity and provisioning ratio are linked to higher deposits growth but profitability and costs to income ratios are associated with lower deposits growth. This finding suggests that higher profitability of the weaker banks is associated with greater risk taking while higher expenditure is related to inefficiency. Analysis for the healthier banks shows that higher equity, profitability and costs to income ratios help banks achieve higher deposits growth. In this case, higher costs to income ratio of the healthier banks may be linked to greater engagement of banks in sales and marketing activities to attract more business. By comparing the findings of weaker banks to those of healthier ones, it can be observed that variations in the fundamentals of healthier banks are more effective in explaining depositors' behavior. This finding suggests that depositors in the East Asian banking system reward good banks for prudence. However, it does not provide good support to the proposition that depositors discipline bad banks for high-risk taking.

In comparison to the Maechler and McDill (2006), Karas et al. (2006) and Bowe and Wu (2007) studies which are based on a single country analysis, this study uses a multi-country analysis. Hence, Interest Rate Ex. Gov. Debt is used as an additional price proxy. This variable adjusts banks' interest rate for the nominal risk-free rate. Compared to the Interest Rate variable which only takes into account of the effect of bank specific interest rate on deposits growth, this variable will also take into account of the effect of any changes in government debt rate on deposits growth. This variable accounts for the gap between these two rates. Summary statistics

in Table 3.2 show that Government Debt rate is always higher than the bank Interest Rate. An increase in the value of this variable implies that the gap is lower, which means that banks are offering an interest rate that is closer to the government debt rate.

When Interest Rate is used as the price proxy, results in Table 3.5 show that its effect on deposits growth is negative. However, when Interest Rate Ex. Gov. Debt is used as the price proxy, estimations using pooled OLS, RE and FE show that this variable is associated with significantly higher deposits growth as shown in Table 3.6. This finding suggests that depositors in East Asia are only driven by the price signal when it competitive to the rate that is offered by the government. In estimation for the post-crisis period, Restructured and Non-restructured banks also show a positive relationship between Interest Rate Ex. Gov. Debt and deposits growth. Comparison of the coefficients of this variable suggests that banks are able raise higher deposits during the post-crisis period compared to the whole sample period by offering a competitive interest rate. Results in columns 6 and 7 of Table 3.6 show that healthier banks are able to attract higher deposits compared to the weaker ones by offering a competitive interest rate.

Even though panel data estimations using Interest Rate Ex. Gov. Debt as the price proxy show that banks are able to attract deposits by offering competitive interest rate, this cannot be taken as signal of market discipline because the estimations are performed without taking into account of the lagged dependency of the dependent variable and endogenous relationship between price and quantity of deposits. This issue will be addressed in the following section.

3.5.4 Dynamic Panel Data Analysis

Panel data estimations can be biased in the presence of lag dependency of the dependent variable and endogeneity. This section will address the shortcomings of the panel data analysis by using dynamic panel data analysis. All variables are entered in difference (not level) terms in the Difference-GMM estimations. The analyses of the data are carried out using one-step robust, two-step and two-step robust Difference-GMM estimators to account for the endogenous

relationship between price and quantity of deposits and also the lagged dependency of the deposits growth variable. Robustness in one-step estimation specifies that the resulting standard errors are consistent with panel-specific autocorrelation and heteroscedasticity. A two-step estimator can produce large efficiency gains as the standard covariance matrix is robust to panel-specific autocorrelation and heteroscedasticity However, the standard errors are downward biased. Hence two-step robust is used to get the finite-sample bias-corrected GMM estimators. This is done by applying Windmeijer (2005)'s correction (refer to Appendix Dfor more detail).

3.5.4.1 Without Price Mechanism

Price mechanism is not included in the first part of the depositor discipline analysis. This enables the comparison of the results from different model specifications. The dynamic nature of the model allows it to capture depositor behaviors, which are simultaneously caused by improvements of bank fundamentals. The results of the Difference-GMM estimations are shown in Table 3.7. Column 1 presents the results for the one-step robust estimation, column 2 presents the results for the two-step estimation and column 3 presents the results for the two-step robust estimation.

The results show that an increase in the equity ratio and size of the banks helps them to attract relatively higher deposits over time, all else held constant. This result is consistent with the FE estimation results. Maechler and McDill (2006) also find a positive and significant relationship between size and deposits. This finding suggests that depositors perceive an increase in asset size as a good sign. Bigger banks have a greater chance of engaging in financial intermediation activities and earn a higher return. As a result, depositors may perceive it as a sign of better financial health. However, a rapid increase in asset size may cause banks to pay less attention to the quality of their loans and as a result be involved in higher-risk taking activities. Banks may attract more funds by offering higher interest rates. This may motivate depositors to place their funds in the banks despite realizing the underlying risk profile of the banks. Therefore, the price

effect (interest rate) needs to be controlled for in the regression model (this issue will be covered in the next part).

Deposits growth also seems to respond to banking sector conditions. It rises significantly when the banking sector is more concentrated. Even though deposits growth rises during a period of high per capita economic growth, this effect is not significant. This implies that a high per capita economic growth rate does not contribute significantly toward increasing the public's willingness to hold bank deposits. Even though Maechler and McDill (2006) find that the growth of uninsured deposits in U.S. rises significantly during periods of high GDP growth, the study by Bowe and Yu (2007) fails to find similar evidence in the case of the Chinese banking sector[83]. This finding implies that investors in East Asia may be able to find other investment options to invest their funds.

The results show that depositor behavior does exhibit a strong persistence. This is shown in columns 1 to 3 of Table 3.7, where the first lag is significantly and negatively related to deposits growth. This result suggests that higher deposits growth today is associated with lower growth tomorrow. This finding contrasts with the Maechler and McDill (2006) and Bowe and Yu (2007) findings, which show that there is a significant and positive relationship between lag value and current value of Deposits Growth. Typically, a bank with good reputation that attracts more deposits today is likely to do the same in the next period. But, one-off shocks to the system would do the reverse. The negative relationship shown in the present case suggests that banks with rapid deposit growth in one period does not experience this in the subsequent period. This reflects the relative instability of the deposits growth in the East Asian banking system, which could be due to the crisis.

The results of Arellano and Bond's (1991) autocorrelation test shown at the end of column 1

[83] Maechler and McDill's (2006) study uses uninsured deposits in the U.S. market while Bowe and Yu's (2007) study uses total customer deposits in the Chinese market.

to 3 reject no first-order and second-order autocorrelation in the residuals at normal significant levels. This implies that the estimates are consistent. Validity of the instruments tested using Hansen over-identification tests reject the null hypothesis under both estimation methods, which suggests that the models are mis-specified.

3.5.4.2 Exogenous Price Mechanism

This section analyses whether the price of deposits influences the quantity of deposits. Interest Rate and Interest Expense to Interest-Bearing Debt rate are included as additional explanatory variables. The model specification aims to find out if an increase in the interest rate variables is linked to higher deposits growth.

The interest rate variables are treated as exogenous in this case. As such, it is directly entered in the dynamic panel data models. Columns 4 to 9 of Table 3.7 show the results. The variable Interest Rate exhibits a negative relationship with deposits growth under all estimations but it is only significant under the one-step robust and two-step estimation. This evidence shows that banks are unable to increase deposits growth by raising the interest rate. All estimations using Interest Rate Ex Gov. Debt Rate as the price proxy show a positive relationship between price and deposits' growth, but this effect is only significant under the two-step method. However, inference cannot be made based on two-step estimator as the standard error is known to be biased downward[84].

There is no second-order serial correlation in the residuals of any of the estimations. However, the Hansen test of over-identification shows that the used instruments are not valid. This could be due to the failure to control for the dynamic relationship between price and quantity of deposits. Since the interest rate variables directly enter this set of regressions, it is implicitly assumed that the deposits growth reacts to exogenous changes of the interest rate and there is no reverse

[84] Arellano and Bond (1991) proposes that inference should be made based on the one-step estimator. In the case of this study, inference can also be made based on two-step robust estimator.

All Period	Without Price Mechanism			Exogenous Price Mechanism					
VARIABLES	Dependent Variable : Growth Rate of Real Deposits								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
L1 Deposits Growth	-0.0423	-0.0597***	-0.117**	-0.0748	-0.0743***	-0.124***	-0.0589	-0.0591***	-0.120**
	(0.0365)	(0.0125)	(0.0458)	(0.0485)	(0.0107)	(0.0475)	(0.0491)	(0.0104)	(0.0583)
L2 Deposits Growth	0.0124	-0.00840	-0.0317	0.0339	0.0241**	0.00376	0.0385	0.0330***	0.00520
	(0.0407)	(0.0105)	(0.0441)	(0.0442)	(0.00953)	(0.0425)	(0.0455)	(0.0104)	(0.0464)
Interest Rate				-1.114*	-1.025***	-0.756			
				(0.598)	(0.280)	(0.788)			
Interest Rate Ex Gov. Debt							1.117	1.309***	0.699
							(0.700)	(0.282)	(1.035)
Lag (Total Equity / Total Assets)	4.129***	3.943***	4.042***	4.638***	4.183***	4.060***	4.400***	4.060***	3.980***
	(0.674)	(0.355)	(0.772)	(0.729)	(0.354)	(0.922)	(0.744)	(0.396)	(1.027)
Lag (Return on Equity)	-0.000198	0.00898	0.0500	-0.0448	-0.0335**	0.00370	-0.0326	-0.0174	0.0190
	(0.0305)	(0.0216)	(0.0415)	(0.0343)	(0.0167)	(0.0488)	(0.0348)	(0.0185)	(0.0485)
Lag (Liquid Assets / Total Assets)	0.203	-0.0307	0.00353	0.227	0.140	0.129	0.290	0.221**	0.163
	(0.221)	(0.104)	(0.228)	(0.248)	(0.0923)	(0.303)	(0.239)	(0.0900)	(0.317)
Lag (Costs to Income Ratio)	0.0264	-0.0194	-0.0343	-0.00231	0.00101	-0.0313	-0.00528	-0.00768	-0.0383
	(0.0281)	(0.0199)	(0.0292)	(0.0414)	(0.0192)	(0.0441)	(0.0390)	(0.0185)	(0.0394)
Lag (Loan Loss Reserve / Gross Loans)	-0.0242	-0.0169	0.0977	-0.381	-0.373***	-0.353	-0.361	-0.374***	-0.331
	(0.385)	(0.120)	(0.434)	(0.438)	(0.106)	(0.376)	(0.443)	(0.120)	(0.374)
Size	129.8***	131.5***	102.5***	125.6***	130.4***	112.7***	127.1***	129.3***	107.6***
	(13.66)	(5.611)	(27.90)	(15.41)	(5.388)	(25.71)	(14.98)	(5.036)	(27.11)
HHI	732.3***	713.2***	645.0***	721.9***	707.0***	665.9***	699.9***	671.8***	650.8***
	(70.23)	(24.59)	(82.58)	(77.10)	(28.16)	(77.34)	(76.87)	(27.59)	(78.22)
Deposit Insurance	-0.368	0.734	-38.51	1.207	1.485	-24.56	0.444	1.055	-31.58
	(4.511)	(2.371)	(24.13)	(5.092)	(2.128)	(26.08)	(5.196)	(2.163)	(29.28)
GDP Per Capita	0.00105	0.000400	-0.000392	0.00303	0.000251	-0.000419	0.00335	0.00206	-7.27e-05
	(0.00472)	(0.00313)	(0.00704)	(0.00573)	(0.00253)	(0.00791)	(0.00582)	(0.00235)	(0.00808)
Type of Difference GMM Estimator	One-step Robust	Two-step	Two-step Robust	One-step Robust	Two-step	Two-step Robust	One-step Robust	Two-step	Two-step Robust
Lags	All lag	All lag	All lag	All lag	All lag	All lag	All lag	All lag	All lag
Observations	624	624	624	454	454	454	454	454	454
Number of Banks	140	140	140	110	110	110	110	110	110
Number of Instruments	61	61	60	62	62	61	62	62	61
AB test of no AR(1) Prob > z =	0.656	0.777	0.829	0.43	0.537	0.614	0.284	0.342	0.561
AB test of no AR(2) Prob > z =	0.752	0.876	0.253	0.513	0.657	0.489	0.690	0.746	0.518
Hansen test of overidentification Prob > chi2 =		0.009	0.01		0.016	0.015		0.013	0.009

1)*** p<0.01, ** p<0.05, * p<0.1
2)Each regression also contains time dummy variables that are not reported

Table 3.7: Dynamic Panel Data without Price Mechanism and with Exogenous Price Mechanism

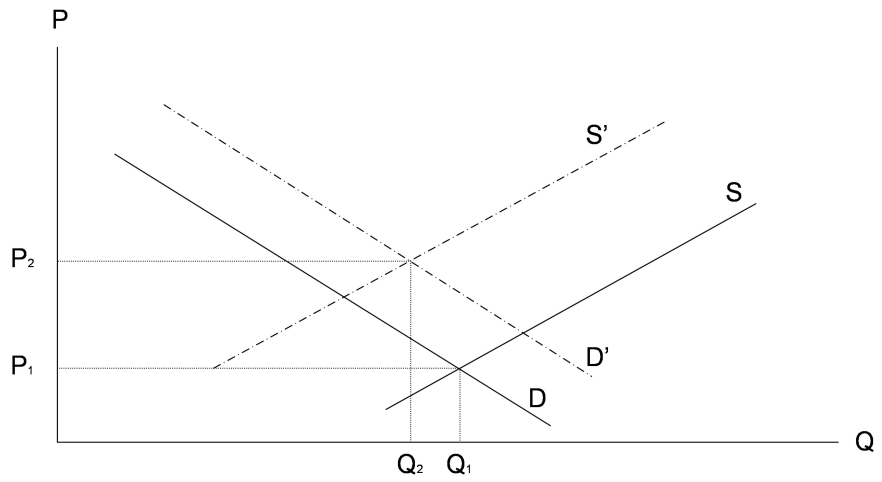

Figure 3.2: The Equilibrium Quantities of Deposits Supply and Demand

causality between these two variables. In other words, the possibility of banks' own attempts to attract more deposits by raising the interest rate is excluded.

However, worsening bank balance sheet may motivate banks to raise the interest rate in an attempt to curb withdrawals. The effect of this action on the quantity of deposits will depend on the overall movement in the supply and demand curve of deposits. Bowe and Wu (2011) illustrate these two processes in Figure 3.2. Depositors' withdrawals due to greater risk taking by banks shifts the supply curve to the left (S') and raises the equilibrium level upward along the demand curve. This lowers the quantity of deposits and raises the price. Banks realize that they will incur shortages in deposits and, as a result, will not have sufficient sources to fund their loan portfolio. Weaker banks may react to this shortfall by offering higher interest rates on a given level of deposits. This action may increase the demands for bank deposits and may shift the demand curve for deposits to the right (D'). The new equilibrium can be either on the left or right-hand side of

the original equilibrium. It's very obvious that the interest rate rises (R2) from its original level (R1) as a result of these shifts. However, concurrent movements in the demand and supply curve of deposits can obscure changes in the quantity of deposits. The total amount of deposits may (i) increase (Q2> Q1), (ii) remain the same (Q2= Q1), or (iii) decrease (Q2< Q1)[85].

Treating the interest rate variables as exogenous, it is implicitly assumed that changes in the interest rate affect deposit growth and there is no reverse causality between these two variables. This does not allow us to take into account possible attempts by banks to get more funds by increasing the interest rate. In actual fact, banks' action in raising their interest rates may be in response to a depositors' withdrawal intention that is in itself linked to the banks' risk profile. So, in analyzing the effect of changes in the interest rate variables on banks' deposits growth, the effect of changes in banks' risk profile on those two variables needs to be controlled for. This will allow us to ascertain whether the positive or negative link between the interest rate variables and deposits' growth are signals of depositor discipline.

3.5.4.3 Endogenous Price Mechanism

This section considers the fact that changes in price and quantity of deposits can be jointly determined by the financial strength of a bank. Withdrawals by depositors due to greater risk taking by banks may trigger movements in the supply and demand curve of deposits, which may obscure the direct relationship between the movement of price and the quantity of deposits. These two processes (i.e. movements in the supply and demand curve of deposits) need to be disentangled by controlling for the possible price effect of worsening fundamentals (shift in supply curve) and analyzing whether an increase in the interest rate can influence the quantity of deposits (shift in demand curve).

The Interest rate variable is treated as endogenous in this case. All the examined statistical tests satisfy the key assumptions of the Difference-GMM, and confirm that this model is an appropriate

[85] The outcomes of changes in quantity will also depend on the relative elasticity of supply of and demand for deposits.

statistical generating mechanism in this case. The estimation results are shown in columns 1 to 6 of Table 3.8. Treating the deposits' growth and interest rate as endogenous variables allows for correlation between the interest rate variable and the contemporaneous error term. Estimations using dynamic panel models show that there is no second-order serial correlation in the residuals. The Hansen test of over-identification shows that the instruments used are valid at normal significance levels. Overall, the results provide evidence that the interest rate and deposits growth are better modeled as endogenous variables as this estimation procedures take into account simultaneity or reverse causality between the two variables.

The variable Interest Rate exhibits a negative sign under all estimation methods, but it is only significant under the two-step estimation. Results in columns 4 to 6 of Table 3.8 show that there is a positive relationship between Interest Rate Ex Gov. Debt Rate and Deposits Growth and, this association is also only significant under the two-step estimation. Price signal is no longer effective in influencing depositor behavior once the downward bias of the two-step estimator is corrected.

Overall, even though panel data analyses show that banks can use price signal to attract more deposits, this signal is no longer effective once endogenous relationship between the price and quantity of deposits is taken into account. This results imply that depositors in East Asia do not discipline banks by demanding higher price for their deposits. Depositors behavior are mainly driven by banks' equity ratio, size and the concentration in the banking industry.

3.5.4.4 Post-Crisis

In this section, estimations are carried out using post crisis data (i.e. from 1999 to 2005)[86] in order to find out if depositors' response to banks' risk profile and price changes after a crisis. Greater response by depositors during the post-crisis period will be in line with the wake-up-call hypothesis. All estimations pass the diagnostic tests. The findings presented in Table 3.9 suggest

[86] All period consist of time period from 1995 to 2005.

All Period	Endogenous Price Mechanism					
VARIABLES	Dependent Variable : Growth Rate of Real Deposits					
	(1)	(2)	(3)	(4)	(5)	(6)
L1 Deposits Growth	-0.127**	-0.129***	-0.165***	-0.115**	-0.115***	-0.118**
	(0.0544)	(0.00269)	(0.0489)	(0.0553)	(0.00184)	(0.0586)
L2 Deposits Growth	0.00428	0.00474**	-0.00615	0.0115	0.00949***	0.00827
	(0.0451)	(0.00214)	(0.0449)	(0.0442)	(0.00209)	(0.0458)
Interest Rate	-0.342	-0.419***	-0.843			
	(0.770)	(0.114)	(0.819)			
Interest Rate Ex Gov. Debt				0.765	0.703***	0.665
				(0.859)	(0.108)	(0.895)
Lag (Total Equity / Total Assets)	4.473***	4.404***	4.391***	4.468***	4.319***	4.295***
	(0.762)	(0.0709)	(0.703)	(0.733)	(0.115)	(0.774)
Lag (Return on Equity)	-0.0277	-0.0359***	-0.0123	-0.0310	-0.0292***	-0.0278
	(0.0335)	(0.00614)	(0.0408)	(0.0337)	(0.00535)	(0.0390)
Lag (Liquid Assets / Total Assets)	0.328	0.297***	0.312	0.448	0.419***	0.425
	(0.266)	(0.0224)	(0.232)	(0.294)	(0.0232)	(0.300)
Lag (Costs to Income Ratio)	-0.00364	0.000971	-0.0349	-0.000248	-3.54e-05	0.00179
	(0.0415)	(0.00226)	(0.0402)	(0.0393)	(0.00708)	(0.0430)
Lag (Loan Loss Reserve / Gross Loans)	-0.316	-0.331***	-0.370	-0.246	-0.239***	-0.233
	(0.408)	(0.0293)	(0.402)	(0.429)	(0.0181)	(0.416)
Size	116.0***	117.5***	99.08***	121.8***	121.9***	120.6***
	(15.58)	(1.490)	(19.04)	(15.78)	(1.157)	(19.30)
HHI	684.0***	672.7***	660.8***	664.6***	665.0***	663.5***
	(75.28)	(8.767)	(66.10)	(67.96)	(6.681)	(70.84)
Deposit Insurance	-1.846	-0.281	-26.96**	1.271	1.637	-1.374
	(5.378)	(1.200)	(13.22)	(6.049)	(1.307)	(11.91)
GDP Per Capita	0.00227	0.00167*	0.00131	0.00240	0.00268***	0.00240
	(0.00564)	(0.000863)	(0.00676)	(0.00586)	(0.000845)	(0.00629)
Type of Difference GMM Estimator	One-step Robust	Two-step	Two-step Robust	One-step Robust	Two-step	Two-step Robust
Lags	All lag	All lag	All lag	All lag	All lag	All lag
Observations	454	454	454	454	454	454
Number of Banks	110	110	110	110	110	110
Number of Instruments	105	105	104	105	105	104
AB test of no AR(1)						
Prob > z =	0.23	0.309	0.466	0.245	0.296	0.347
AB test of no AR(2)						
Prob > z =	0.567	0.529	0.318	0.713	0.705	0.713
Hansen test of overidentification						
Prob > chi2 =		0.374	0.438		0.187	0.174

1)*** p<0.01, ** p<0.05, * p<0.1

2)Each regression also contains time dummy variables that are not reported

Table 3.8: Dynamic Panel Data with Endogenous Price Mechanism

that price signal are not effective in influencing depositor behavior during the post-crisis period.

3.5.4.5 Restructured versus Non-Restructured Banks

Asset pricing models imply that banks that take higher risks need to offer depositors higher returns in order to induce them to deposit their funds in the bank. This suggests that the relationship between deposit growth and interest rate is linear. Analyses in the previous sections are performed based on this assumption. However, reformulation of the credit rationing model suggests that the relationship between deposit growth and interest rate is not linear at all times as banks that offer too high interest can be perceived as risky[87]. This section analyses the possibility of a non-linear relationship between the interest elasticity and banks' quality by examining if depositors in weak banks are more sensitive and require a higher price premium than depositors in healthy banks.

Existing studies by Bongini et al. (2001), Bongini et al.(2002), Rojas-Suarez (2001), Arena (2008) and the study in Chapter 2 of this thesis show that a bank restructuring exercise is a good proxy for the overall quality of a bank in East Asia. Hence, it is used to subdivide the sample of banks in the data set into weak and healthy banks. Overall, there are 74 banks in the sample that are categorized as healthy while 36 that are categorized as weak. A mean comparison test shows there is a statistical difference in the average interest rate offered by the weak (Restructured) and healthy (Non-restructured) banks. On average, weak banks offer a 8.33 percent interest rate while healthy banks offer 7.10 percent. Weak banks also have lower deposits growth compared to the healthy ones. The latter have an average deposits growth of 21.07 percent while the former have an average deposits growth of 13.72 percent.

Dynamic panel data estimations for the Restructured banks are presented in Table 3.10 while estimations for the Non-restructured banks are presented in Table 3.11[88]. By differentiating

[87] Insolvent or near-insolvent banks may wish to follow a risky growth strategy in overcoming their financial troubles. As a result, they may offer a very high interest rate.

[88] The number lags used as instruments in the Restructured and Non-restructured banks analyses are capped due to

Post Crisis	Endogenous Price Mechanism					
VARIABLES	Dependent Variable : Growth Rate of Real Deposits					
	(1)	(2)	(3)	(4)	(5)	(6)
L1 Deposits Growth	-0.146***	-0.147***	-0.147***	-0.160***	-0.165***	-0.165***
	(0.0485)	(0.00341)	(0.0494)	(0.0542)	(0.00360)	(0.0548)
L2 Deposits Growth	-0.0314	-0.0261***	-0.0261	-0.0336	-0.0380***	-0.0380
	(0.0517)	(0.00298)	(0.0532)	(0.0520)	(0.00305)	(0.0489)
Interest Rate	0.473	0.284**	0.284			
	(1.060)	(0.123)	(1.147)			
Interest Rate Ex Gov. Debt				-0.666	-0.943***	-0.943
				(1.033)	(0.135)	(1.001)
Lag (Total Equity / Total Assets)	5.008***	5.154***	5.154***	5.155***	5.142***	5.142***
	(0.872)	(0.0944)	(0.936)	(0.798)	(0.0732)	(0.698)
Lag (Return on Equity)	0.00544	-0.00228	-0.00228	-0.00921	-0.0122**	-0.0122
	(0.0379)	(0.00518)	(0.0422)	(0.0388)	(0.00620)	(0.0407)
Lag (Liquid Assets / Total Assets)	0.304	0.312***	0.312*	0.390	0.364***	0.364
	(0.229)	(0.0238)	(0.178)	(0.254)	(0.0204)	(0.243)
Lag (Costs to Income Ratio)	0.00934	0.0115***	0.0115	0.00786	0.00748	0.00748
	(0.0392)	(0.00397)	(0.0426)	(0.0381)	(0.00609)	(0.0444)
Lag (Loan Loss Reserve / Gross Loans)	-0.499	-0.477***	-0.477	-0.466	-0.426***	-0.426
	(0.425)	(0.0454)	(0.429)	(0.456)	(0.0290)	(0.404)
Size	109.2***	110.9***	110.9***	112.5***	115.2***	115.2***
	(16.66)	(1.568)	(14.18)	(17.24)	(1.782)	(17.21)
HHI	738.7***	730.7***	730.7***	753.8***	744.6***	744.6***
	(83.76)	(10.69)	(75.20)	(78.11)	(9.911)	(77.26)
Deposit Insurance	32.25*	29.57***	29.57	31.95*	33.80***	33.80*
	(19.57)	(4.668)	(20.54)	(18.96)	(3.567)	(19.55)
GDP Per Capita	0.00278	0.00388***	0.00388	0.00256	0.00170*	0.00170
	(0.00574)	(0.000788)	(0.00481)	(0.00592)	(0.000878)	(0.00744)
Type of Difference GMM Estimator	One-step Robust	Two-step	Two-step Robust	One-step Robust	Two-step	Two-step Robust
Lags	All lag	All lag	All lag	All lag	All lag	All lag
Observations	391	391	391	391	391	391
Number of Banks	102	102	102	102	102	102
Number of Instruments	100	100		100	100	
AB test of no AR(1)						
Prob > z =	0.23	0.339	0.376	0.319	0.404	0.432
AB test of no AR(2)						
Prob > z =	0.899	0.814	0.845	0.836	0.856	0.875
Hansen test of overidentification						
Prob > chi2 =		0.351	0.351		0.408	0.408

1)*** p<0.01, ** p<0.05, * p<0.1

2)Each regression also contains time dummy variables that are not reported

Table 3.9: Dynamic Panel Data with Endogenous Price Mechanism for Post-Crisis Period

Restructured Banks	Endogenous Price Mechanism					
VARIABLES	Dependent Variable : Growth Rate of Real Deposits					
	(1)	(2)	(3)	(4)	(5)	(6)
L1 Deposits Growth	-0.381***	-0.301***	-0.371***	-0.385***	-0.397***	-0.441**
	(0.124)	(0.0522)	(0.131)	(0.120)	(0.0410)	(0.176)
L2 Deposits Growth	-0.247**	-0.169***	-0.231*	-0.223***	-0.205***	-0.233*
	(0.108)	(0.0590)	(0.120)	(0.0709)	(0.0491)	(0.140)
Interest Rate	-4.283	-0.521	1.547			
	(3.361)	(2.731)	(4.555)			
Interest Rate Ex Gov. Debt				-0.218	-0.292	0.466
				(3.211)	(0.879)	(3.831)
Lag (Total Equity / Total Assets)	3.607*	4.003***	3.538*	2.623	3.138**	2.188
	(1.918)	(1.190)	(2.108)	(1.948)	(1.349)	(3.389)
Lag (Return on Equity)	-0.0377	-0.0859***	-0.0142	-0.0449	-0.0571**	-0.0240
	(0.0397)	(0.0243)	(0.0549)	(0.0307)	(0.0234)	(0.0747)
Lag (Liquid Assets / Total Assets)	-0.383	-0.295	-0.608	-0.197	-0.166	-0.372
	(0.460)	(0.301)	(0.800)	(0.401)	(0.236)	(0.605)
Lag (Costs to Income Ratio)	-0.0600***	-0.0534***	-0.0789*	-0.0563***	-0.0453***	-0.0534
	(0.0190)	(0.0167)	(0.0472)	(0.0213)	(0.0162)	(0.0335)
Lag (Loan Loss Reserve / Gross Loans)	-0.353	-0.671	-0.842	-0.128	0.456	0.485
	(0.802)	(0.502)	(1.051)	(0.726)	(0.417)	(1.292)
Size	87.90***	111.1***	46.66	120.3***	131.1***	114.4***
	(21.66)	(16.26)	(40.21)	(15.70)	(9.036)	(35.01)
HHI	632.7***	649.6***	587.2***	649.7***	553.5***	459.7*
	(146.5)	(95.78)	(174.9)	(193.2)	(63.12)	(235.4)
Deposit Insurance	5.902	3.078	-70.34**	2.882	-0.898	-15.10
	(8.384)	(6.164)	(31.93)	(8.666)	(4.439)	(21.18)
GDP Per Capita	-0.0103	-0.0112***	-0.0162	-0.0111	-0.0101***	-0.0106
	(0.00771)	(0.00293)	(0.0135)	(0.00822)	(0.00237)	(0.00809)
Type of Difference GMM Estimator	One-step Robust	Two-step	Two-step Robust	One-step Robust	Two-step	Two-step Robust
Lags	lag (3 3)	lag (3 3)	lag (3 3)	lag (3 3)	lag (3 3)	lag (3 3)
Observations	108	108	108	108	108	108
Number of Banks	36	36	36	36	36	36
Number of Instruments	31	31	30	31	31	30
AB test of no AR(1)						
Prob > z =	0.777	0.825	0.679	0.132	0.107	0.411
AB test of no AR(2)						
Prob > z =	0.751	0.978	0.992	0.434	0.692	0.822
Hansen test of overidentification						
Prob > chi2 =		0.332	0.692		0.151	0.131

1)*** p<0.01, ** p<0.05, * p<0.1

2)Each regression also contains time dummy variables that are not reported

Table 3.10: Dynamic Panel Data with Endogenous Price Mechanism for Restructured Banks

Non-restructured Banks	Endogenous Price Mechanism					
VARIABLES	Dependent Variable : Growth Rate of Real Deposits					
	(1)	(2)	(3)	(4)	(5)	(6)
L1 Deposits Growth	-0.187*	-0.211***	-0.159	-0.245	-0.197**	-0.324
	(0.108)	(0.0448)	(0.103)	(0.183)	(0.0986)	(0.202)
L2 Deposits Growth	-0.154***	-0.103***	-0.0774**	-0.141	-0.101	-0.160
	(0.0547)	(0.0254)	(0.0391)	(0.170)	(0.0925)	(0.109)
Interest Rate	-0.430	-0.532	-0.293			
	(1.609)	(0.657)	(1.214)			
Interest Rate Ex Gov. Debt				-2.659	-0.553	-2.513
				(2.349)	(1.887)	(3.631)
Lag (Total Equity / Total Assets)	3.709***	3.184***	2.800***	3.783***	3.185***	2.685*
	(0.875)	(0.632)	(0.950)	(1.132)	(0.838)	(1.592)
Lag (Return on Equity)	0.0847	0.00119	-0.0667	0.0542	0.0233	-0.0171
	(0.0567)	(0.0343)	(0.0849)	(0.0511)	(0.0306)	(0.0606)
Lag (Liquid Assets / Total Assets)	0.0807	-0.0300	-0.142	0.0952	-0.000755	-0.192
	(0.226)	(0.117)	(0.193)	(0.196)	(0.135)	(0.272)
Lag (Costs to Income Ratio)	0.0474	0.0654**	0.167*	0.0646	0.0720**	0.135
	(0.0375)	(0.0294)	(0.0953)	(0.0517)	(0.0332)	(0.0860)
Lag (Loan Loss Reserve / Gross Loans)	-0.136	-0.133	-0.190	-0.185	-0.111	-0.170
	(0.285)	(0.186)	(0.321)	(0.431)	(0.228)	(0.390)
Size	129.1***	128.0***	143.8***	136.9***	128.2***	157.0***
	(18.05)	(11.98)	(23.18)	(16.49)	(13.43)	(31.74)
HHI	672.6***	691.9***	753.0***	768.7***	725.3***	733.7***
	(86.70)	(52.75)	(107.0)	(75.07)	(58.08)	(99.55)
Deposit Insurance	-6.115	0.252	97.87	-8.797	0.323	66.05
	(5.346)	(3.834)	(81.47)	(8.068)	(5.145)	(54.63)
GDP Per Capita	0.00723*	0.00434	0.00344	0.00587	0.00621**	0.00551
	(0.00409)	(0.00342)	(0.00466)	(0.00438)	(0.00312)	(0.00411)
Type of Difference GMM Estimator	One-step Robust	Two-step	Two-step Robust	One-step Robust	Two-step	Two-step Robust
Lags	lag (3 3)	lag (3 3)	lag (3 3)	lag (3 3)	lag (3 3)	lag (3 3)
Observations	346	346	346	346	346	346
Number of Banks	74	74	74	74	74	74
Number of Instruments	31	31	30	31	31	30
AB test of no AR(1)						
Prob > z =	0.398	0.813	0.261	0.689	0.763	0.288
AB test of no AR(2)						
Prob > z =	0.134	0.32	0.214	0.443	0.376	0.197
Hansen test of overidentification						
Prob > chi2 =		0.238	0.356		0.106	0.182

1)*** p<0.01, ** p<0.05, * p<0.1

2)Each regression also contains time dummy variables that are not reported

Table 3.11: Dynamic Panel Data with Endogenous Price Mechanism for Non-restructured Banks

between different qualities of banks, this study finds that for each percentage increase in interest rate, healthier banks are not able to attract higher deposits. Similarly, the findings also show that weak banks cannot attract more deposits by raising their deposit interest rates. This suggests that the relationship between risk and deposit interest rate is not non-linear. The results imply that weaker banks do not incur more costs in getting deposits. This shows that depositors in East Asia did not discipline weaker banks by demanding higher returns.

3.6 Discussion and Conclusion

This paper analyses depositor discipline in the East Asia banking system. Overall, the empirical findings indicate that depositors behave in a manner that is consistent with depositor discipline. The results suggest higher-quality banks are capable of attracting higher deposits growth. Panel data analyses show that banks are only able to attract more deposits by offering an interest rate that is closer to the government debt rate. Depositors also prefer to invest their money in banks that have a high equity ratio and are big in size. In line with the wake-up-call hypothesis, analysis for the post-crisis period confirms that bank-specific factors are able to explain greater variation in depositors' behavior. Healthy banks are able to attract more deposits by offering an interest rate that is closer to the government debt rate compared to the weaker banks.

However, depositor responsiveness to price signal under the panel data analyses cannot be construed as a sign of depositor discipline because it does not account for the lag dependency of deposits growth and the endogenous relationship between price (interest rate) and quantity of deposits. Dynamic panel data analysis is carried out to overcome these shortcomings. Initial estimation without the price variable shows that equity ratio and size of the banks are highly significant in explaining deposits growth. In the subsequent analysis, any price effect is controlled for by including the interest rate variables as additional exogenous variables in the model. The findings confirm that banks' fundamentals help in explaining the amount of deposits that banks

lower number of sample size in each group.

can attract for a given price. In the subsequent analyses, the interest rate variables are treated as endogenous. Comparing the diagnostic tests result between the exogenous price mechanism and the endogenous price mechanism, the study finds that the model specification tests favor the latter.

When the endogeneity between the price and quantity of deposits is taken into account, the results show that deposits growth in the sample banks is driven by bank fundamentals and risk aversion activities but not by price movements. This suggests that depositors in East Asia do not discipline banks by demanding higher price for deposits. Analysis focusing only on the post-crisis period also shows similar results. Analysis by dividing the banks in sample into weak and healthy ones suggests that the relationship between the interest elasticity and banks' quality is linear. The results show that healthier banks are not able to attract more deposits by offering a higher price. The findings also confirm that depositors do not discipline weaker banks by demanding a higher return.

Ineffectiveness of the price signal in attracting more deposits is in line with the findings by Bowe and Yu (2007) and Karas et al. (2006) in the Chinese and Russian banking sectors. Lack of responsiveness by depositors to price signal can be attributable to a number of factors. Firstly, it may be due to the large outflow of funds from the banking system that happened as a result of the 1997 crisis. In analyzing the equilibrium price and quantity in the deposits' market, it can be shown that concurrent movements in supply and demand curves of deposits can result in a lower equilibrium quantity of deposits compared to the initial level. This can happen when the movement in the supply curve of deposits outweighs the movement in the demand curve. When this happens, depositors' withdrawal action overwhelms any actions by banks to raise price to attract more deposits.

Secondly, the inability of the price signal to influence depositor behavior may also be due to interest rate controls imposed by the regulatory authorities. All the five East Asian countries had

an interest rate regime whereby either deposit rates or lending rates were freed, but the other rates were subject to a band or only a part of interest rates was determined at market rates (Abiad et al., 2008). Malaysia and Korea shifted to a partially repressed interest rate regime in 1998 and 2001 respectively whereby either deposit rates or lending rates are freed, but the other interest rates are set by government or subject to a ceiling/floor. This may have limited banks' ability to raise interest rate to influence depositor behavior.

Chapter 4 Information Disclosure and Depositor Discipline

4.1 Introduction

The severity of the East Asian crisis highlights the need for greater transparency and sufficient information disclosure in the East Asian banking system. The World Bank (1998) report identifies "unreliable financial reporting, lack of adequate disclosure, lax enforcement to ensure compliance, and poor audits" (p.67) to be among the factors that aggravated problems in the banking sector in East Asia. As a result of this, international banking institutions like the Basel Committee, World Bank and International Monetary Fund (IMF) have urged these countries to enhance their banking sector transparency by improving disclosure[89]. Information disclosure is a prerequisite for market discipline to take effect. The third pillar of Basel II aims to

"....encourage market discipline by developing a set of disclosure requirements, which will allow market participants to assess key pieces of information on the scope of application, capital, risk exposures, risk assessment processes, and hence the capital adequacy of the institution"

In line with this, regulatory bodies in the East Asian banking system have taken measures to enhance disclosure. The present study aims to investigate the effect of greater information disclosure on banks.

Financial statements act as the most reliable and readily accessible mechanism in disseminating banking information. The amount of information that banks disclose matters as the absence of information prevents market discipline from taking place while limited information weakens it. Existing theory is divided on whether banks should disclose more information. One strand of literature argues that disclosure is good for banks as it can help them attract more funds and encourage them to be more prudent. However, another strand of literature argues that disclosure

[89] Bank of International setttlement (2006) provides the guideline for banks in disclosing information.

is bad for banks as it can cause coordination failure among depositors. Banks have a general tendency to under disclose since full disclosure is not the optimal choice for them as it can be costly, may cause banks to lose their competitiveness and also may create negative externalities. Theoretical ambiguity surrounding the role of information disclosure in banking emphasizes the need for empirical analysis in ascertaining the effect. Nevertheless, to date, there is a lack of studies that have dwelt on this topic. This study fills in the gap in the existing literature by answering a pertinent question: Should banks disclose more risk-related information? This question will be addressed by analyzing whether greater information disclosure can be used by banks as a signal to attract more deposits.

Deposits represent a very important and stable source of funding for banks. Ability to attract higher deposits is good for banks as it allows them to perform a greater financial intermediation role, and as a result earn higher income. In analyzing depositor discipline, existing empirical studies have focused on the content of information disclosure. This study will contribute to the existing literature by looking at the content as well as the quantity of risk-related information disclosure. This study will directly test the hypothesis of whether banks are able to attract more deposits by disclosing additional risk-related information by investigating depositors' reaction to the amount of risk-related information that banks disclose. Greater disclosure requirement has been shown to enhance market discipline (Jordon et al., 1999), reduce the cost of banking crises (Rosengren, 1999), reduce the probability of runs on healthier banks (Hoggarth et al., 2003), improve banks performance (Barth et al., 2004), reduce stock price volatility (Baumann and Nier, 2004) and also reduce the probability of a banking crisis (Tadesse, 2006). To my knowledge, at present there are no other studies that have empirically analyzed the effect of greater information disclosure on deposits growth.

This study contributes to the existing literature by adopting a dynamic panel data analysis

method in analyzing the relationship between the amount of risk-related information disclosure and deposits growth. In line with the proposition of signaling theory, empirical studies by Nier and Baumann (2006) and Wu and Bowe (2010) confirm that greater ex-post risk-related disclosure is associated with lower ex-ante risk taking by bank managers[90]. Since depositors' withdrawal actions and banks' response to them is a jointly determined process, the simultaneity that exists in the depositor discipline model needs to be controlled for in order to ascertain if greater information disclosure helps banks to attract more deposits. Dynamic panel data analysis is used to confirm whether changes in the amount of information disclosure have an exogenous impact on the quantity of deposits, independent of the endogenous impact of deteriorating fundamentals on disclosure and quantity of deposits.

Analysis on depositors' reaction to the amount of information disclosed by banks is performed for the period from before crisis to after crisis (i.e. 1995 to 2005) and after crisis only. Greater responsiveness of depositors to information disclosure after the crisis period will be in line with the wake-up-call hypothesis. This study also contributes to the existing literature by looking at depositors reaction to the information disclosed by weak (Restructured) and healthy (Non-restructured) banks. Since depositors respond to ex-ante weaknesses in individual banks' fundamentals, they may react differently to the amount of information disclosed by weaker banks compared to the stronger ones. Weaker banks may, in turn, try to stop deposits' drain by disclosing less information. If depositor discipline is effective, for a given increase in the amount of information disclosure, healthier banks should attract relatively more deposits than average banks while a weaker bank may not be able to do so. Analysis of depositors' reaction to the amount of information disclosed by banks is performed for the period from before crisis to after crisis (i.e. 1995 to 2005) and after crisis only. Greater responsiveness of depositors to information

[90] Signalling theory posits that by choosing to disclose more information banks chose to lower their default risk in equilibrium (Cordella and Yeyati, 1998 and Boot and Schmeits, 2000).

disclosure after the crisis period is in line with the wake-up call hypothesis.

Overall, this results of this study confirm that greater disclosure helps banks to attract more deposits. Panel data analysis shows that the East Asian banks were able to attract relatively more funds by disclosing more risk-related information during the post-crisis period. Dynamic panel data analysis is performed to account for the lagged dependency of the dependent variable and also endogenous relationship between disclosure and deposits growth. The results confirm that changes in the amount of disclosure can exogenously influence depositor behavior. More specifically, the results show that banks in East Asia were able to attract more deposits over time by disclosing greater risk-related information. In line with the wake-up-call hypothesis, depositors' responsiveness to greater disclosure was higher during the post-crisis period as opposed to the whole sample period.

The results also show that healthier (Non-Restructured) banks were able to raise higher deposits over time by revealing more information. However, weaker (Restructured) banks were not able to do so. This confirms that the amount of risk-related information that banks disclose is related to their quality. Greater disclosure is a good signal to attract deposits only for the healthy banks but not the weak ones. Those results suggest that depositors in East Asia reward healthy banks for greater disclosure but they do not discipline weaker banks by demanding greater disclosure.

The chapter is organized as follows. Section 4.2 describes the disclosure practice in East Asia. Section 4.3 provides the literature review on the theory and empirical evidence that relates information disclosure to depositor behavior. Section 4.4 describes the methodology used in the analyses. Section 4.5 explains the results while Section 4.6 concludes the chapter.

4.2 Disclosure in East Asia

Information disclosure and transparency varied across the countries in the East Asian region[91].

[91] Transparency refers to the process by which information about existing conditions, decisions, and actions is made accessible, visible, and understandable (IMF report, 1998).

Within the crisis led countries, information disclosure prior to the crisis was less in Indonesia, Philippines and Thailand (where the regulatory system was mostly merit-based) compared to Korea and Malaysia (where the regulatory system was disclosure-based) (Ghosh, 2006 and Huang, 2006)[92]. Under the merit-based system, the regulators takes the role of protecting the investors by reviewing the merits of the issuers' investments, whereas under the disclosure based system, the issuers and the intermediaries that offers the securities need to provide investors with adequate, precise and timely disclosure of relevant information relating to the firms performance and prospects in order for investors to make decision.

As far as the transparency of financial systems is concerned, Goldman Sachs gave a "satisfactory" rating to Indonesia, Malaysia and Philippines, a "fair" rating to Korea and a "poor" rating to Thailand (Gochoco-Bautista et al., 2000). This variation can be partly attributed to the differences in the accounting and auditing standards and practices[93]. Apart from this, financial statements of banks in East Asia also lacked compliance with the international accounting standards such as International Accounting Standard (IAS) 30 (Rahman, 1999)[94].

Prior to the crisis, among the weaknesses that were present in the accounting and disclosure practices in East Asia were:

- Insufficient disclosure of related-party transactions and off-balance sheet financing that concealed high corporate leverage.
- Insufficient reporting of contingent liabilities of the parent of a conglomerate or of financial institutions for loan guarantee (mainly foreign-currency loans).
- Insufficient reporting of the large foreign-currency exposure by banks and corporations that happened as a result of high foreign-currency short-term debt.
- Insufficient information disclosure on sectorial loan segmentation, although all countries set a large exposure limit on them.
- Consolidated statements were usually not provided.
- Weak information disclosure on derivative financial instruments.
- Weak disclosure on loan classification, provisioning for non-performing loans and interest

92 Thailand was progressing towards a disclosure-based system.

93 This can be attributed to the differences in their legal framework origins. The legal framework of Malaysia and Thailand originated from the United Kigdom while the legal framework of Indonesia and Philippines originated from the French. Korea, on the other hand, has German legal origin.

94 IAS 30 prescribes appropriate presentation and disclosure standards for banks and similar financial institutions that supplement other requirements standards.

accrual. Even though the accounting policy governing loan loss provisions was reported by the banks, information on the aggregate amount of problem loans and advances was not disclosed. Time periods for overdue criteria of interest suspension and loan classification ranged between six to twelve months.

- In Korea, there was a difficulty in evaluating the solvency of the largest borrowers due to the existence of cross-guarantees.

Source: IMF (1998), Lindgren et al. (1999) and OECD (2003)[95].

Limited information availability hid details about banks over lending, insufficient credit control and prudential internal regulation of the East Asian banks (MacDonald, 1998). In order to overcome these shortcomings, measures were taken by the East Asian countries to improve transparency and financial disclosure. Among the steps taken by them were adopting IAS, introducing consolidated reporting requirements for corporate groups and requiring disclosure on non-financial information (OECD, 2003)[96]. Disclosure quality was enhanced by new rules on loan classification, provisioning and interest accruals and by greater participation of on-site examiners and international auditors (Lindgren et al., 1999). In addition to this, the Central Bank of Malaysia mandated more frequent reporting of non-performing loans, provisions, and capital positions for all financial institutions and decreased the time lag in releasing data on key indicators of financial soundness to public from six to four months. Similarly, Indonesia, Korea and Thailand also mandated greater and more frequent disclosure.

The World Bank Database on Bank Regulation and Supervision shows that measures have been taken by regulators in these countries to enhance the disclosure on standards of capital adequacy, loan classification and provisioning rules. However, regulations on disclosure still vary across these countries. The bank Disclosure Index shown in Figure 4.1 is based on the measurement framework originally proposed by Erlend Nier from the Bank of England[97]. This index shows that

[95] The White Paper on Corporate Governance in Asia has been prepared by the Asian Roundtable on Corporate Governance within the framework of the Asia Programme of the OECD Centre for Co-operation with Non-Members. The White Paper is a collective effort by Asian policy makers, regulators,business leaders and regional and international experts in identifying the weaknesses that existed before and during the crisis, and formulating common reform policy in order to improve corporate governance in Asia.

[96] A high number of conglomerates, which are mainly family controlled, exists in Asia. They are able to conceal poor financial performance of the holding company by moving the incurred losses to their subsidiaries.

[97] The index is created for individual banks based on fifteen dimensions of risk-related accounting information disclosed

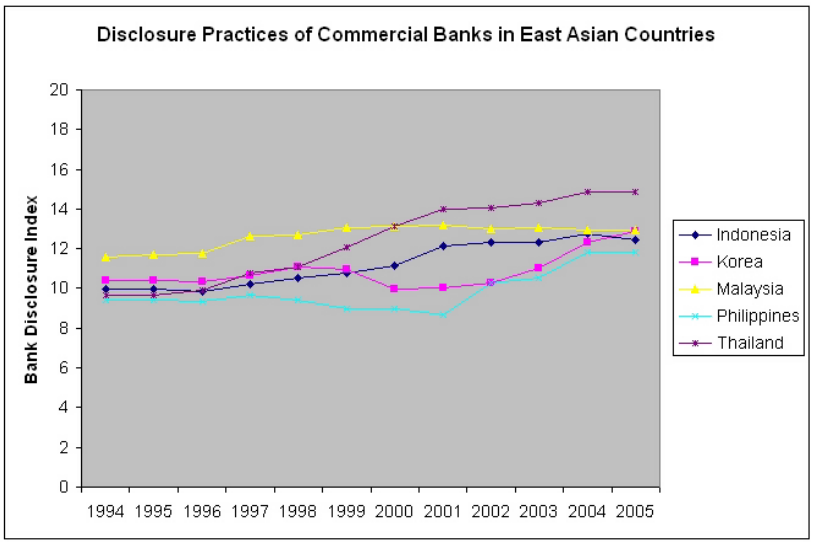

Figure 4.1: Disclosure Practices of Commercial Banks in the East Asian Countries

banks in Korea and Malaysia had better disclosure practice before the crisis. Since then, banks in Indonesia and Thailand have gradually increased their disclosure. Bank disclosure in Malaysia increased gradually during the crisis before stagnating since 1999, while disclosure by banks in Korea and Philippines diminished post-crisis before increasing gradually since 2001.

4.3 Literature Review

4.3.1 Review of the Theory

Information asymmetry can lead to an adverse selection problem, which changes the optimal price and quantity in the market, and as a result, reduces liquidity (Verrecchia, 2001). In addition to this, information asymmetry also gives rise to the moral hazard problem as it conceals individuals' actions, and thereby makes it impossible to be monitored (Hölmstrom, 1979). This insulates managers, who have more information about firms' financial standing, from risks and gives them a greater incentive to act in their best interest at the expense of their shareholders. This can encourage managers to engage in greater risk taking activities. Hölmstrom (1979) asserts that moral hazard problems can be reduced by requiring additional disclosure of information as it

by banks in their financial statements. The country level index is created by averaging the index values of each bank in a country (only banks that are covered in this study).

permits more precise evaluation about firms' performance to be made. Disclosure is related to signaling theory in the economic literature. This theory asserts that informational asymmetry can be reduced through the signal sent via the disclosure of risk related information by the informed party (i.e., management) to the uninformed (i.e., investors) (Morris, 1987). Information disclosure also helps financial statement users in making better investment decisions and mitigates resource misallocation in the economy (Watts and Zimmerman, 1986).

The role of information disclosure in banking is dealt with in the existing literature. Chari and Jagannathan's (1988) model shows that availability of information can alter depositors' behavior as it facilitates their investment decision making. The role of interim private information about banks' assets payoffs in influencing depositors' behavior has also been looked into in studies by Bryant (1980), Jacklin and Bhattacharya (1988), Alonso (1996), Kaplan (2006) and Chen and Hasan (2006). Existing theory suggests that disclosure is beneficial as it allows depositors to punish bad banks for higher risk-taking and reward good banks for greater prudence (Berger, 1991 and Flannery, 1994). Cordella and Yeyati (1998) asserts that when there are no bankruptcy costs and corporate governance problems between bank shareholders and manager, uninsured depositors are able to discipline banks when banks' risk choices are observable. This happens because depositors are able punish banks that have engaged in high risk taking by demanding higher compensation. Cordella and Yeyati (1998) and Boot and Schmeits (2000) assert that disclosure can reduce moral hazard because by choosing to disclose more information banks chose to lower their default risk in equilibrium.

However, information disclosure about weak fundamentals can cause coordination failure among depositors, and trigger panic based runs (Goldstein and Pauzner, 2005). Information disclosure by banks can cause investors to misinterpret particular information revealed by a single bank to reflect the weaknesses of the entire banking system. Misinterpretation can be costly as it

can trigger depositors' panic as shown by Calomiris and Mason (1997) in the case of commercial bank failure in Chicago during the early 1930s. A contagious bank run is inefficient as it can even cause strong banks to fail, which reduces depositors' welfare and creates negative externalities.

A review of literature by Healy and Palepu (2001) and Verrecchia (2001) shows that full disclosure is not the optimal disclosure strategy as far as banks are concerned. Markets may not generate a socially desirable level of disclosure due to various reasons. Firstly, it could be due to the cost involved in producing and disseminating information (Verrecchia, 1983 and Gorton, 1985). Secondly, information disclosure can be hampered by the negative externalities that it creates. This may happen when stakeholders have a tendency to free ride (due to the public good nature of accounting information) and when firms' values are correlated[98]. This causes banks to lose their competitiveness. Thirdly, disclosure also can be hampered by entrepreneurs' desire to extract private benefits (Östberg, 2006)[99]. Lastly, forcing banks to disclose information can be bad when the return is low as it may cause depositors to make early withdrawals (Kaplan, 2006). All the above reasons provide incentives for banks not to disclose a socially desirable amount of information to the public.

4.3.2 Review of Empirical Evidence

Jordan et al. (1999) studies the effect of the U.S. Congress enforcement that requires banks to drastically increase the amount of information disclosure to the supervisory body in 1989, amidst the savings and loan crisis. The impacts of this announcement on bank deposits are analyzed using the quarterly data of 35 problem banks. Using mean comparison tests, their findings show that the drop in the uninsured deposits is higher compared to the insured ones. However, the total deposits' drop is not substantial and many of the troubled banks survived the crisis.

The benefit of greater information disclosure in East Asia has been highlighted by Mitton

[98] The latter is illustrated by Admati and Pfleiderer (2000). They show that overflow of information from one firm to another prevents the disclosure of socially optimum level of information.

[99] If disclosing greater amount of information reduces firms' opportunity in reaping private benefit, firms may not be keen to undertake certain projects.

(2002). His findings confirm that higher disclosure quality and greater transparency are linked with greater performance during crisis time (1997 to 1998). Caprio (1998) studies the role of information disclosure in twelve Asian and Latin American financial systems in 1997. This is done by developing a transparency score using information about the countries' requirement in having the banks rated, the number of top ten banks with international ratings and a corruption index[100]. His findings show that countries that were badly affected by the crisis had lower transparency while countries like Singapore and Hong Kong, which were less affected by the crisis, had higher transparency[101].

Cross-country analysis by Barth et al. (2001, 2004, 2006) on banking sector regulation and supervisory framework shows that greater information disclosure improves banks' performance and banking sector stability. Similarly, Tadesse's (2006) study of 49 countries in the 1990s documents the importance of more detailed and accurate regulated information disclosure in ensuring the soundness of the banking system. His findings show that the probability of banking crisis is lower in countries that have higher disclosure standards. More specifically, the findings show that a one standard deviation increase in regulated bank disclosure reduces the probability of a banking crisis by about 3.5 percent per annum.

Nier and Baumann (2006) study the relationship between the amount of banks' ex-post disclosure of risk-related information and managers' ex-ante risk-taking in 729 banks from 32 different countries during the period from 1993 to 2000. They use random effect (GLS) panel data analysis and incorporate two-stage least squares (2SLS) estimation in order to account for potential endogeneity between the capital ratio and the amount of information disclosure. After controlling for the banks' profitability, NPL, size and the safety net in the banking sector, their findings confirm that high disclosure regime decreases banks' tendency to take excessive risks.

[100] Corruption index is included because higher corruption is likely to be linked to lower accuracy of information disclosure.

[101] However, this evidence does not show that insufficient transparency caused the crisis to happen.

Similarly, Wu and Bowe (2010) uses random effect panel data analysis in analyzing the risk-taking behavior of 120 Chinese banks over the period from 1998 to 2008[102]. Their finding shows that banks that disclose more risk-related information to the public maintain larger capital ratios.

A study by Baumann and Nier (2004) analyses the effect of the amount of risk-related information that banks disclose on investors' investment decisions using cross-sectional regression analysis. By ignoring the time-series dimension of the data, they study the relationship between average disclosure and average stock price volatility of 600 banks across 31 countries over the period from 1993 to 2000. Even though their findings confirm that greater disclosure of risk-related information is beneficial for banks as it reduces stock price volatility, this finding is questionable as it does not account for the fact that management decisions to disclose information change over time[103]. Looking at the time series dimension will require dynamic analysis of stock volatility.

Cordella and Yeyati (1998) assert that information disclosure influences bank managers' behavior and also depositors' behavior. Hölmstrom (1979) shows that greater disclosure enables depositors to make more precise evaluation of a bank's performance. Based on this theoretical framework, the present study aims to address some of the limitations that are present in the above empirical studies. Firstly, these studies have linked disclosure to banking system performance and stability, managers' risk-taking behavior and stock market investors' investment decisions However, none of the studies has linked information disclosure to depositors' behavior. Secondly, existing empirical evidence, which links banks' information disclosure to depositors' behavior relies almost exclusively upon the content of the information disclosure (refer to Section 3.3.2). None of these studies have looked at the content and also the quantity of risk-related information

[102] Endogeneity of disclosure variable is addressed using Two Stage Least Squares (2SLS) instrumental variables estimation procedure.

[103] They assert that lower volatility of equity return is beneficial for banks as it is associated with lower cost of capital and greater effectiveness of stock based compensation.

that banks disclose. The present study aims to overcome these limitations by analyzing the effect of the amount of risk-related information that banks disclose in their financial statements on deposits growth. Thirdly, since disclosure influence depositors' and managers' behavior, the present study aims to control for the simultaneity that exists in the depositor discipline model by using dynamic panel data analysis.

In finding out if banks are able to attract higher deposits over time by disclosing more risk-related information, Disclosure Index will be used as an additional variable in the depositor discipline model. In comparison to the CAMEL-type indicators which measure the level of risk of the banks, Disclosure Index measures the amount of risk related information that banks disclose relating to their interest-rate risk, credit risk, liquidity risk, market risk, and capital. This index is constructed using the information available in banks' annual reports on fifteen core disclosure items. More specifically, this index takes account of information on breakdown of loans by maturity and type, problem loans by total amount and type, breakdown of investments by type and maturity, securities by type, breakdown of deposits by maturity and type, long-term borrowing by type, disclosures of reserves, capital ratio, off-balance-sheet items, breakdown of non-interest income and disclosure of loan loss provisions.

4.4 Methodology

This study aims to analyze the existence of depositor discipline in the East Asian banking system. The focus of this study is to find if banks are able to attract higher deposits over time by disclosing more risk-related information in their financial statements. Accordingly, the null hypothesis of this study is that depositors' withdrawals do not respond to the amount of risk-related information that banks disclose in their financial statements. If the amount of risk-related disclosure does not matter to depositors, deposits growth should be uncorrelated with this variable.

4.4.1 Panel Data and Dynamic Panel Data Analysis

When Disclosure Index is included as a variable of interest, Equation 3.1 is written as the following :

$$\begin{aligned} \text{DEPGR}_{i,j,t} &= \alpha_i + \lambda_t + \sigma_j + \mu\text{DEPGR}_{i,j,t-1} + \delta\text{Disclosure Index}_{i,j,t-1} + \\ &\quad \beta\text{BANK SPECIFIC}_{i,j,t-1} + \gamma\text{COUNTRY SPECIFIC}_{j,t} + \varepsilon_{i,j,t} \end{aligned} \tag{4.1}$$

To overcome the possibility of simultaneity and reverse causality in the model, dynamic GMM estimation methods developed by Arellano and Bond (1991) is used. This method enables us to determine whether the movement of the disclosure index variable has an exogenous impact on the quantity of deposits, independent of the endogenous impact of deteriorating fundamentals on the amount of risk-related disclosure and quantity of deposits. Estimations using dynamic panel data method remove the potential parameter inconsistency due to simultaneity or reverse causality between these variables and deposits growth. Analysis of this study will be carried out using Difference-GMM. Estimation using this method focuses on the variation over time in the dependent and independent variables. This facilitates answering the question as to whether banks are able to attract higher deposits overtime by disclosing additional risk-related information (refer to Appendix D for detail explanations on Difference-GMM and one-step and two-step GMM).

4.4.2 Data Description

The analysis of this study is carried out using the sample of commercial banks in five East Asian countries namely Indonesia, Korea, Malaysia, Philippines and Thailand. Detail description of the data is given in Section 3.4.3.

4.4.3 Variables

4.4.3.1 Bank Specific Variables

Disclosure Index Disclosure Index is one of the commonly used disclosure proxies in the

existing literature[104]. Disclosure Index consists of the list of selected accounting information that can be disclosed in the company report (Marston and Shrives, 1991). More specifically, Hassan and Marston (2010) define the disclosure index as "a research instrument to measure the extent of information reported in a particular disclosure vehicle(s) by a particular entity(s) according to a list of selected items of information".

For the present study, Disclosure Index will be measured based on the measurement framework proposed by Erlend Nier from the Bank of England. The index for each bank is derived using the amount of information available in the bank's annual reports on fifteen core disclosure items as reported in the Fitch IBCA BankScope database. This index is constructed using the check box approach similar to the CIFAR (Center for International Financial Analysis Research) index, but it is constructed at bank level[105]. The index combines information from five categories of disclosures, including: (1) LOANS: breakdown of loans by maturity and type, and problem loans by total amount and type; (2) OTHER EARNING ASSETS: breakdown of investments by type and maturity, and securities by type; (3) DEPOSITS: breakdown of deposits by maturity and type, and long-term borrowing by type; (4) MEMO LINES: disclosures of reserves, capital ratio and off-balance-sheet items; (5) INCOMES: breakdown of non-interest income and disclosure of loan loss provisions. Each category consists of a sub-index. These sub-indices contain a total of fifteen disclosure items relating to interest-rate risk, credit risk, liquidity risk, market risk, and capital[106] (see Appendix E). These items are very compatible with the frameworks proposed by IMF's Financial Soundness Indicators (FSI) and Basel Committee (Huang, 2006). Studies by Baumann and Nier (2004), Nier and Baumann (2006), Huang (2006) and Wu and Bowe (2010) have used

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104 Marston and Shrives (1991) provides a survey of the use of disclosure indices. Hassan and Marston (2010) provide the comprehensive survey of the use of various disclosure proxies.

105 CIFAR index consists of ninety items that are included in the companies' annual reports. Seventy percent of the companies are involved in the non-financial sector.

106 Even though the definition of the items included in the index may vary from one country to another, it is less of a concern as far as this study is concerned because this study is mainly interested in the availability of information instead of the content of information.

this index.

4.4.3.2 Country Specific Variables

4.4.3.3 External Instrument

Disclosure Intensity The World Bank provides the database on the regulation of disclosure in the banking sector for many countries based on the response of the supervisory bodies as described in Barth et al. (2001). This data has been extensively used in studies by Barth et al. (2004), Cull et al.(2005), Cleassens and Laeven (2004), Demirguc-Kunt and Huizinga (2004) and Tadasse (2006). Based on Bushman et al. (2004)'s framework in measuring corporate reporting quality, Tadasse (2006) describes Disclosure Intensity as a measure of the degree and magnitude of financial information disclosure that is required by the banking regulators. The variable is constructed by adding the survey response on information relating to whether banks are required to disclose information about risk management practices, accurately exhibit non-performing loans, provide detailed information on bank activity by reporting consolidated financial statements, and exhibit detailed information by reporting off-balance sheet transactions. In comparison to the items in Disclosure Intensity, items in Disclosure Index relate detailed information that banks provide in their published accounts. This information relates to the risk categories emphasized by Basel Committee as well as FSI indicators proposed by the IMF. Since the amount of information that banks disclose is conditional on the regulated disclosure in the banking sectors in each country, Disclosure Intensity is used as an additional instrument in this study.

Detail descriptions of other bank specific and country specific data are given in Section 3.4.4.

4.5 Results

4.5.1 Summary Statistics

Disclosure Index ranges from a minimum of 4 to a high of 23 in the sample of banks in this study as shown in Table 4.1. On average, banks disclose risk-related information in 11 risk categories. Disclosure Intensity ranges from 2 to 4 with an average score of 3.24. Disclosure

Index exhibits a negative correlation with the level of deposits and a positive correlation with the first difference of deposits (see Table 3.3 and 3.4). This may imply that a higher deposits growth arises as a consequence of banks' decision to disclose more risk-related information. However, in terms of the absolute value of deposits, a large amount of deposits may remain in those banks where disclosure is lower than others.

As far as the comparisons between periods are concerned, Table 4.2 shows that an average bank disclosed less risk related information before the crisis than during and after the crisis. On average, disclosure is higher during the post-crisis period compared with the whole sample period. Compared to the whole sample period, Disclosure Intensity is lower before crisis and higher post-crisis. This shows that regulators in East Asia required banks to disclose more information after the crisis.

4.5.2 Panel Data Analysis

This section analyses depositors' reaction to the amount of risk-related information that banks disclose and directly test the hypothesis of whether banks should disclose more risk-related information. All variables are entered in levels. Results of the regression analyses using pooled OLS, Random Effect (RE), Between Effect (BE) and Fixed Effect (FE) are reported in Table 4.3. By ignoring the panel structure of the data set and counter factually assuming that all observations are on the same bank, pooled OLS estimate results in Column 1 suggest that the amount of information that banks disclose is associated with lower deposits growth but this effect is not significant. RE estimation takes into account the panel structure of the data set and analyses the within and between variation of the variables. RE estimation (Column 2) shows that Disclosure Index does not influence depositor behavior[107]. BE estimation excludes the time effects and only highlights the variation of deposits across banks. BE estimation results in Column 3 show that

[107] Since the random effects estimator is essentially a weighted average of the fixed and between estimators, the coefficient on beta is very small compared to the rest.

	All Period					
Variable Name		Mean	Std. Deviation	Min	Max	Observation
Deposits Growth	overall between within	19.21	58.96 23.77 54.56	-95.96 -21.59 -136.67	515.23 222.55 470.77	1315
Interest Rate	overall between within	7.43	5.87 4.16 4.27	0.70 1.68 -4.57	48.50 22.38 37.33	1018
Disclosure Index	overall between within	11.58	2.23 1.99 1.34	4.00 4.00 5.58	23.00 18.50 17.41	1327
Total Equity / Total Assets	overall between within	11.03	12.37 8.75 8.92	-129.21 -11.09 -107.08	99.72 55.15 82.20	1640
Return on Equity	overall between within	3.22	77.21 34.95 70.48	-975.36 -242.66 -789.86	967.12 115.08 855.25	1632
Liquid Assets / Total Assets	overall between within	22.96	16.87 13.03 10.40	0.20 1.09 -20.03	96.79 72.01 86.83	1640
Costs to Income Ratio	overall between within	64.33	55.19 31.72 45.19	2.30 12.00 -94.13	873.58 236.14 742.82	1575
Loan Loss Reserve / Gross Loans	overall between within	6.80	9.46 6.38 7.48	0.00 0.84 -43.24	90.19 52.43 70.50	1575
Log Size	overall between within	14.11	1.95 1.88 0.41	9.27 9.71 11.39	19.01 18.06 16.40	1638
HHI	overall between within	0.13	0.06 0.03 0.05	0.05 0.09 0.04	0.35 0.17 0.32	2364
Deposit Insurance	overall between within	1.49	0.95 0.42 0.85	0.00 0.92 -0.76	3.00 2.25 2.57	2364
GDP Per Capita	overall between within	3004.31	3649.10 3350.33 1464.04	3.00 768.94 -7065.79	13303.82 10073.83 6234.29	2364
Disclosure Intensity	overall between within	3.24	0.60 0.47 0.37	2.00 2.33 2.91	4.00 4.00 4.91	2364

Table 4.1: Summary Statistics

	All Period		Before Crisis		Crisis		Post Crisis	
Variable Name	Obs	Mean (Std. Dev.)	Obs	Mean (Std. Dev.)	Obs	Mean (Std. Dev.)	Obs	Mean (Std. Dev.)
Deposits Growth	1315	19.206 (58.959)	255	32.880 (54.921)	267	-11.683 (46.817)	793	25.209 (60.380)
Interest Rate	1018	7.429 (5.872)	114	8.885 (3.872)	222	12.096 (8.610)	682	5.667 (3.792)
Disclosure Index	1327	11.57875 (2.228555)	332	10.43976 (1.743174)	243	11.08642 (1.835357)	752	12.24069 (2.292068)
Total Equity / Total Assets	1640	11.035 (12.370)	409	11.134 (9.685)	306	9.165 (17.949)	925	11.610 (11.051)
Return on Equity	1632	3.219 (77.210)	409	11.197 (19.507)	301	-14.326 (132.373)	922	5.407 (67.431)
Liquid Assets / Total Assets	1640	22.957 (16.874)	409	20.843 (13.497)	306	20.971 (16.217)	925	24.549 (18.220)
Costs to Income Ratio	1575	64.328 (55.189)	406	57.664 (28.837)	283	65.961 (59.131)	886	66.860 (62.408)
Loan Loss Reserve / Gross Loans	1575	6.803 (9.460)	390	2.300 (3.218)	298	7.598 (10.429)	887	8.516 (10.291)
Log Total Assets	1638	14.115 (1.9475)	409	14.231 (1.804)	306	13.777 (1.899)	923	14.175 (2.0130)
Total Assets Growth	1405	3.173 (32.056)	256	18.387 (11.545)	277	-23.950 (43.496)	872	7.322 (26.433)
HHI	2364	0.126 (0.061)	591	0.109 (0.0409)	394	0.091 (0.015)	1379	0.144 (0.070)
Deposit Insurance	2364	1.485 (0.946)	591	0.386 (0.789)	394	1.563 (0.995)	1379	1.934 (0.514)
GDP Per Capita	2364	3004.307 (3649.096)	591	2951.375 (3134.772)	394	3104.459 (3340.73)	1379	2998.376 (3929.342)
Disclosure Intensity	2364	3.245 (0.595)	591	3.091 (0.535)	394	3.091 (0.535)		3.355 (0.611)
GDP Per Capita	2364	3004.307 (3649.096)	591	2951.375 (3134.772)	394	3104.459 (3340.73)	1379	2998.376 (3929.342)

Table 4.2: Summary Statistics By Time Period

Disclosure Index has a positive sign. However, cross-sectional variation in Disclosure Index is not important in explaining cross-sectional variation in deposits growth.

The FE estimator emphasizes the variation over time variation in the dependent and independent variables, using deviations from each bank's mean. FE estimation results in Column 4 show that variation in the amount of information that banks disclose is not a significant predictor of deposits growth. However, FE estimation using post crisis data only shows that the variation in the amount of information that banks disclose is a significant predictor of deposits growth. This finding is in line with the wake-up-call hypothesis. FE estimation for weak banks shows that greater disclosure is associated with lower deposits growth while FE estimation for strong banks shows that greater disclosure is associated with higher deposits growth. As far as the other bank specific variables are concerned, all estimations show that depositors are influenced by the equity ratio and also the size of the banks. Greater concentration in the banking industry also influences deposits growth.

4.5.3 Dynamic Panel Data Analysis

Panel data estimations can be biased in the presence of lag dependency of the dependent variable and endogeneity. This section will address the shortcomings of the panel data analysis by using dynamic panel data analysis. All variables are entered in difference (not level) in the Difference-GMM estimations. The dynamic relationship between disclosure and deposits growth is estimated using one-step robust, two-step and also two-step robust Difference-GMM estimator. This study aims to find out if an increase in Disclosure Index is linked to higher deposits growth. Initially, a model specification that treats Disclosure Index as an exogenous variable and directly enters it in the dynamic panel models is examined. Then, a model specification which treats Disclosure Index as an endogenous variable is looked into. This will be done with and without controlling for the interest rate effect. Further to this, the endogenous relationship between Disclosure Index and deposits growth will be analyzed for the post-crisis period only. Similar analysis is carried out by segregating banks in the sample into healthy (i.e. Non-restructured) and

Table 4.3: Panel Data Analysis with Disclosure Index

VARIABLES	Dependent Variable : Growth Rate of Real Deposits						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
					Post crisis	Restructured	Non-Restructured
Interest Rate	-1.253***	-1.253***	-0.280	-2.052***	-1.653	-1.942**	-2.046***
	(0.465)	(0.465)	(0.711)	(0.560)	(1.685)	(0.804)	(0.666)
Lag (Disclosure Index)	-0.137	-0.137	2.276	0.841	3.507**	-1.630	1.527
	(0.834)	(0.834)	(1.426)	(1.510)	(1.624)	(3.949)	(1.690)
Lag (Total Equity / Total Assets)	2.158***	2.158***	2.057***	3.389***	4.590***	1.947	3.766***
	(0.319)	(0.319)	(0.307)	(0.527)	(0.973)	(1.711)	(0.620)
Lag (Return on Equity)	0.0414*	0.0414*	0.112**	0.0349	0.0482*	-0.00825	0.0563**
	(0.0228)	(0.0228)	(0.0467)	(0.0252)	(0.0282)	(0.0527)	(0.0234)
Lag (Liquid Assets / Total Assets)	0.0379	0.0379	0.0150	0.0809	0.125	0.245	0.0815
	(0.159)	(0.159)	(0.177)	(0.255)	(0.334)	(0.585)	(0.274)
Lag (Costs to Income Ratio)	0.0465	0.0465	0.0607	0.0480	0.0335	-0.00192	0.116*
	(0.0300)	(0.0300)	(0.0612)	(0.0384)	(0.0496)	(0.0449)	(0.0614)
Lag (Loan Loss Reserve / Gross Loans)	0.0813	0.0813	0.614*	0.375	0.0837	0.314	0.409
	(0.410)	(0.410)	(0.316)	(0.399)	(0.451)	(0.730)	(0.468)
Size	5.870***	5.870***	1.925	53.01***	63.34***	63.07***	51.92***
	(1.672)	(1.672)	(1.854)	(10.26)	(16.30)	(16.01)	(13.03)
HHI	509.9***	509.9***	299.3***	590.4***	887.3***	560.8***	579.8***
	(58.12)	(58.12)	(98.30)	(61.01)	(118.5)	(138.0)	(69.41)
Deposit Insurance	-1.929	-1.929	-5.575	4.173		6.027	3.823
	(4.086)	(4.086)	(8.064)	(4.451)		(5.607)	(5.182)
GDP Per Capita	0.00159	0.00159	-0.00418	0.00307	0.00275	-0.0110	0.00891**
	(0.00517)	(0.00517)	(0.00828)	(0.00560)	(0.00592)	(0.00776)	(0.00379)
Constant	-116.4***	-116.4***	-63.56	-826.0***	-1,067***	-899.9***	-830.0***
	(33.27)	(33.27)	(42.72)	(149.2)	(234.6)	(244.5)	(181.4)
Type of Estimator	Pooled OLS	Random Effect	Between Effcet	Fixed Effcet	Fixed Effcet	Fixed Effcet	Fixed Effcet
Observations	800	800	800	800	504	235	565
Number of Banks		156	156	156	125	61	95
R-squared	0.367		0.653	0.411	0.509	0.577	0.407
F-Stat	14.74***		10.26***	21.52***	11.47***	55.83***	12.64***
Wald chi2		353.73***					

1)*** p<0.01, ** p<0.05, * p<0.1

2)Cluster robust standard errors in parentheses

3)Each regression also contains country and time dummy variables that are not reported

weak (i.e. Restructured) ones.

Since there are two endogenous variables in this model, the number of instruments used in the analysis needs to be limited to ensure that the problem of weak instruments does not arise. Estimations have been carried out by increasing or decreasing the number of instruments. A three period lag in level and difference (i.e. lag (3 3)) is chosen as any other limits worsen the diagnostics.

4.5.3.1 Exogenous Disclosure Mechanism

In this section, Disclosure Index continuos to be treated as an exogenous variable and directly entered in the dynamic panel models. This specification focuses on whether an increase in disclosure is associated with a rise in deposits growth. Columns 1 to 3 of Table 4.4 show the estimation results without controlling for the price effect. The findings show that an increase in disclosure, when treated as an exogenous change, affects deposits growth positively. But this effect is not statistically different from zero. Estimations by controlling for the price effect are shown in columns 4 to 6 of Table 4.4. The results show that the coefficient of Disclosure Index is positive but not statistically significant. The positive relationship between changes in the disclosure and deposits growth is in line with the positive partial correlation shown in Table 3.4.

The diagnostic tests for the estimation without an interest rate variable show that there is no second-order serial correlation but the Hansen test of over-identification has a p-value of 0.10. This provides some support for the proposition that the dynamic process between the deposits growth and disclosure is still not properly controlled for. The diagnostic test for the estimation with an interest rate variable shows that there is second-order serial correlation under the one-step robust estimation while the diagnostic test for the two-step robust estimation shows that the Hansen test has a p-value of 0.081. This suggests that the instruments used are not valid.

By treating Disclosure Index as an exogenous variable, it is assumed that changes in the amount of risk-related information disclosure and quantity of deposits are not jointly determined by the

All Period	Exogenous Disclosure Mechanism					
VARIABLES	Dependent Variable : Growth Rate of Real Deposits					
	(1)	(2)	(3)	(4)	(5)	(6)
L1 Deposits Growth	0.170	0.145	0.145	-0.182	-0.164***	-0.182**
	(0.244)	(0.173)	(0.249)	(0.122)	(0.0422)	(0.0720)
L2 Deposits Growth	-0.134	-0.152*	-0.152	-0.140*	-0.0644**	-0.0865**
	(0.101)	(0.0831)	(0.121)	(0.0715)	(0.0264)	(0.0393)
Interest Rate				0.994	-0.766	0.479
				(1.828)	(0.953)	(1.199)
Lag (Disclosure Index)	1.398	2.270	2.270	1.273	0.275	1.175
	(1.787)	(1.707)	(2.193)	(1.706)	(1.302)	(1.640)
Lag (Total Equity / Total Assets)	4.697***	4.928***	4.928***	3.234***	3.431***	3.438***
	(1.221)	(1.069)	(1.592)	(0.812)	(0.674)	(0.970)
Lag (Return on Equity)	-0.000884	-0.0278	-0.0278	-0.00112	-0.0847**	-0.0348
	(0.0525)	(0.0452)	(0.0587)	(0.0665)	(0.0375)	(0.0355)
Lag (Liquid Assets / Total Assets)	-0.264	-0.420*	-0.420*	-0.0274	-0.196	-0.127
	(0.266)	(0.236)	(0.235)	(0.205)	(0.120)	(0.164)
Lag (Costs to Income Ratio)	0.00309	-0.0183	-0.0183	0.00796	0.0587*	0.000946
	(0.0378)	(0.0362)	(0.0466)	(0.0556)	(0.0354)	(0.0346)
Lag (Loan Loss Reserve / Gross Loans)	-0.0709	-0.260	-0.260	-0.0555	-0.290*	-0.186
	(0.277)	(0.249)	(0.355)	(0.252)	(0.170)	(0.263)
Size	133.4***	124.9***	124.9***	137.6***	156.0***	133.2***
	(15.68)	(14.84)	(20.17)	(38.94)	(14.49)	(16.08)
HHI	894.2***	911.8***	911.8***	739.2***	749.9***	754.6***
	(113.5)	(94.16)	(123.4)	(97.06)	(57.42)	(95.62)
Deposit Insurance	5.273	4.189	4.189	1.736	67.14**	2.898
	(6.878)	(4.913)	(5.146)	(61.46)	(29.89)	(3.961)
GDP Per Capita	0.00274	0.00283	0.00283	0.00194	0.00118	-0.000775
	(0.00583)	(0.00576)	(0.00702)	(0.00574)	(0.00552)	(0.00733)
Type of Difference GMM Estimator	One-step Robust	Two-step	Two-step Robust	One-step Robust	Two-step	Two-step Robust
Lags	lag (3 3)	lag (3 3)	lag (3 3)	lag (3 3)	lag (3 3)	lag (3 3)
Observations	466	466	466	454	454	454
Number of Banks	113	113	113	110	110	110
Number of Instruments	25	25		31	31	32
External Instrument						
AB test of no AR(1)						
Prob > z =	0.154	0.067	0.254	0.609	0.086	0.91
AB test of no AR(2)						
Prob > z =	0.287	0.202	0.358	0.063	0.338	0.35
Hansen test of overidentification						
Prob > chi2 =		0.100	0.100		0.189	0.081

1)*** p<0.01, ** p<0.05, * p<0.1

2)Each regression also contains time dummy variables that are not reported

Table 4.4: Dynamic Panel Data with Exogenous Disclosure Mechanism

financial strength of a bank. However, forward looking bank managers may expect depositors to react to changes in bank fundamentals. In line with this, their decision to disclose information may change over time depending on the banks' financial strength. In expectation of depositors' reaction ex-post, managers of the stronger banks may disclose more information while those in weaker banks may disclose less information. To address this issue, the impact of a change in banks' financial strength on deposits growth and disclosure needs to be controlled for. Doing so enables the examination of the effect of a bank's decision to disclose information on depositor behavior.

Endogenous Disclosure Mechanism In this section, Disclosure Index is treated as an endogenous variable to control for the simultaneity or reverse causality between Disclosure Index and deposits growth. By doing so, this study aims to find if changes in the amount of disclosure can exogenously influence depositor behavior. Difference-GMM controls for the dynamic interactions between disclosure and deposits growth by using internal instruments. These instruments are highly correlated with the endogenous variables and not correlated with the error term. This technique uses the lagged levels of the endogenous variables as valid instruments and combines it with first differences of the strictly exogenous variables to control for potential biases induced by simultaneity or reverse causality between endogenous variables.

The estimations without the interest rate variable are presented in columns 1 to 3 of Table 4.5. The results are consistent with the requirement of no second-order serial correlation. The Hansen test of over-identification has a p-value of 0.058. This suggests that the models presented in these columns are mis-specified. Columns 4 to 6 present the results of the estimations when the interest rate is added as an additional endogenous regressor. The model specification passes the Hansen test, suggesting that the model is correctly specified. The results are also consistent with the requirement of no second-order serial correlation.

Table 4.5: Dynamic Panel Data with Endogenous Disclosure Mechanism

VARIABLES	Endogenous Disclosure Mechanism								
	Dependent Variable : Growth Rate of Real Deposits								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
L1 Deposits Growth	-0.0486	-0.0889	-0.0857	-0.206**	-0.209***	-0.209**	-0.205**	-0.208***	-0.208**
	(0.178)	(0.110)	(0.179)	(0.0854)	(0.0504)	(0.0855)	(0.0835)	(0.0504)	(0.0856)
L2 Deposits Growth	-0.0606	-0.124*	-0.121	-0.100**	-0.0722**	-0.0722	-0.100**	-0.0711**	-0.0711
	(0.0793)	(0.0673)	(0.102)	(0.0503)	(0.0301)	(0.0493)	(0.0495)	(0.0300)	(0.0499)
Interest Rate				-0.407	-0.770	-0.770	-0.397	-0.751	-0.751
				(1.336)	(0.660)	(1.005)	(1.299)	(0.658)	(1.005)
Lag (Disclosure Index)	12.51***	11.00***	11.15**	9.682**	9.476***	9.476**	9.708**	9.558***	9.558**
	(4.808)	(3.445)	(5.010)	(4.326)	(2.882)	(4.035)	(4.303)	(2.874)	(4.055)
Lag (Total Equity / Total Assets)	4.377***	3.607***	3.693***	3.666***	3.182***	3.182***	3.668***	3.240***	3.240***
	(1.081)	(0.890)	(1.276)	(0.821)	(0.649)	(1.080)	(0.828)	(0.618)	(1.068)
Lag (Return on Equity)	0.0209	0.0328	0.0346	0.00437	-0.0278	-0.0278	0.00421	-0.0268	-0.0268
	(0.0361)	(0.0325)	(0.0544)	(0.0284)	(0.0210)	(0.0467)	(0.0283)	(0.0205)	(0.0448)
Lag (Liquid Assets / Total Assets)	-0.0976	-0.230	-0.237	-0.0931	-0.124	-0.124	-0.0932	-0.131	-0.131
	(0.177)	(0.150)	(0.231)	(0.206)	(0.112)	(0.171)	(0.206)	(0.109)	(0.165)
Lag (Costs to Income Ratio)	-0.00522	-0.0108	-0.0102	-0.00982	-0.0102	-0.0102	-0.00985	-0.00970	-0.00970
	(0.0328)	(0.0280)	(0.0521)	(0.0311)	(0.0243)	(0.0502)	(0.0310)	(0.0243)	(0.0489)
Lag (Loan Loss Reserve / Gross Loans)	0.163	-0.108	-0.110	0.0647	-0.0237	-0.0237	0.0650	-0.0271	-0.0271
	(0.269)	(0.201)	(0.313)	(0.264)	(0.176)	(0.293)	(0.264)	(0.176)	(0.296)
Size	131.1***	133.3***	133.1***	130.3***	137.7***	137.7***	130.4***	137.9***	137.9***
	(14.07)	(11.76)	(16.97)	(14.86)	(9.700)	(15.97)	(14.68)	(9.676)	(16.09)
HHI	771.3***	733.5***	735.4***	696.6***	667.2***	667.2***	697.2***	670.5***	670.5***
	(102.9)	(72.88)	(122.1)	(76.78)	(53.74)	(84.36)	(75.99)	(52.61)	(82.96)
Deposit Insurance	-1.490	1.885	1.634	-2.842	2.763	2.763	-2.833	2.673	2.673
	(5.484)	(4.065)	(5.209)	(4.274)	(3.302)	(4.180)	(4.266)	(3.287)	(4.159)
GDP Per Capita	0.00228	-0.00113	-0.00160	0.00238	0.000376	0.000376	0.00239	-0.000206	-0.000206
	(0.00566)	(0.00534)	(0.00842)	(0.00569)	(0.00527)	(0.00869)	(0.00566)	(0.00484)	(0.00796)
Type of Difference GMM Estimator	One-step Robust	Two-step	Two-step Robust	One-step Robust	Two-step	Two-step Robust	One-step Robust	Two-step	Two-step Robust
Lags	lag (3 3)	lag (3 3)	lag (3 3)	lag (3 3)	lag (3 3)	lag (3 3)	lag (3 3)	lag (3 3)	lag (3 3)
Observations	466	466	466	454	454	454	454	454	454
Number of Banks	113	113	113	110	110	110	110	110	110
Number of Instruments	32	32	33	39	39	39	40	40	40
External Instrument							Disc. Intensity	Disc. Intensity	Disc. Intensity
AB test of no AR(1)									
Prob > z =	0.313	0.166	0.37	0.543	0.969	0.973	0.551	0.965	0.969
AB test of no AR(2)									
Prob > z =	0.877	0.323	0.472	0.868	0.822	0.836	0.867	0.833	0.845
Hansen test of overidentification									
Prob > chi2 =		0.04	0.058		0.162	0.162		0.202	0.202

1)*** p<0.01, ** p<0.05, * p<0.1

2)Each regression also contains time dummy variables that are not reported

Estimations with the interest rate variable in columns 4 to 6 show that the coefficient of Disclosure Index is positive and statistically significant. This implies that once the dynamic relationship between the amount of information disclosure and the deposits growth is controlled for; for a given price, banks are able to attract higher deposits by disclosing more risk-related information. This findings also implies that depositors in East Asia are more responsive to the amount of risk-related information that banks disclose than the price that they offer. This suggest that greater disclosure is a better signal in attracting more deposits. The coefficient of Disclosure Index is 9.68. This implies that a one-unit increase in Disclosure Index raises deposits growth by 9.68 percent. This finding shows that banks are able to attract more deposits by revealing more detailed information about their risk profiles in the financial statements. This provides a good support for the need of greater transparency in the banking sector.

In order to check for the robustness of the findings, lag value of Disclosure Intensity is added as an external instrument[108]. Estimations are shown in column 7 to 9 of Table 4.5. The diagnostic tests show that there is no second order serial correlation, and the Hansen test shows this instrument is valid. The results show that greater disclosure significantly increases deposits growth. In addition to this, the findings also show that depositors prefer banks that are more solvent and bigger. Results in column 7 shows that once the endogenous effect of disclosure and price is taken into account, profitability and provisioning are linked to higher deposits growth while liquidity and costs to income ratio are linked to lower deposits growth.

4.5.3.2 Post-Crisis

Estimations are performed using post crisis data (i.e. from 1999 to 2005) in order to find out if depositors response to banks' risk profile and the amount of information disclosure changed after the crisis[109]. Greater sensitivity by depositors to bank-specific information during the post-crisis

[108] GMM technique allows the use of external instruments (Roodman, 2006).
[109] 'All period' consists of the time period from 1995 to 2005.

period will be in line with the wake-up-call hypothesis. All estimations pass the diagnostic tests. Estimation of depositor discipline during the post crisis period is reported in columns 1 to 3 of Table 4.6. The results show that Disclosure Index is associated with higher deposits growth. More specifically, two-step robust estimation shows that a one-unit increase in Disclosure Index raises deposits growth by 11.60 percent. Estimation for the whole sample period shows that a one-unit increase in Disclosure Index raises deposits growth by 9.56 percent. The findings suggest that depositors were more responsive to the amount of risk-related information that banks disclose after the crisis. This findings provide support to the wake-up-call hypothesis.

4.5.3.3 Restructured vs Non-restructured Banks

In this section, the study aims to find out whether depositors react differently to the risk-related information disclosed by healthier banks compared to weaker ones. Existing studies by Bongini et al. (2001), Bongini et al.(2002), Rojas-Suarez (2001), Arena (2008) and the study in Chapter 2 of this thesis show that a bank restructuring exercise is a good proxy for the overall quality of banks in East Asia. In line with this, bank restructuring is used as the criterion to subdivide the sample of banks in the data set into weak and healthy banks. Restructured banks are categorized as the weak banks while Non-restructured banks are categorized as the healthy banks. Overall, 74 banks in the sample are categorized as healthy while 36 are categorized as weak. Mean comparison tests confirm that healthy banks have deposits growth and Disclosure Index values that are higher than those of the weak banks. Healthier banks have an average deposits growth of 21.07 percent and Disclosure Index value of 11.75 while the weaker ones have an average deposits growth of 13.72 percent and Disclosure Index value of 11.10.

The analysis performed in this section aims to find out whether depositors in weak banks are more sensitive and as a result require more information disclosure compared to depositors in healthy banks. If depositor discipline is present, healthier banks in East Asia should be able to raise more deposits by disclosing additional risk-related information compared to an average

VARIABLES	Endogenous Disclosure Meachanism								
	Dependent Variable : Growth Rate of Real Deposits								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Post-Crisis			Restructured			Non-Restructured		
L1 Deposits Growth	-0.164*	-0.164***	-0.164*	-0.456***	-0.248*	-0.248	-0.166*	-0.186***	-0.186**
	(0.0858)	(0.0620)	(0.0904)	(0.141)	(0.134)	(0.211)	(0.0993)	(0.0538)	(0.0908)
L2 Deposits Growth	-0.0849	-0.0588	-0.0588	-0.223*	-0.164**	-0.164	-0.111**	-0.0755**	-0.0755
	(0.0523)	(0.0378)	(0.0510)	(0.123)	(0.0721)	(0.141)	(0.0554)	(0.0301)	(0.0480)
Interest Rate	0.238	-0.231	-0.231	-4.234	-4.449*	-4.449	-0.802	-1.135**	-1.135
	(1.401)	(0.935)	(1.207)	(3.108)	(2.347)	(3.407)	(1.175)	(0.519)	(0.767)
Lag (Disclosure Index)	15.00***	11.60***	11.60**	5.889	-2.799	-2.799	9.166*	9.788***	9.788**
	(4.942)	(3.278)	(4.609)	(4.436)	(5.228)	(7.923)	(5.331)	(2.932)	(4.467)
Lag (Total Equity / Total Assets)	4.667***	4.235***	4.235***	3.661*	4.099***	4.099	4.083***	3.281***	3.281***
	(1.025)	(0.709)	(1.024)	(1.963)	(1.115)	(2.747)	(0.868)	(0.560)	(0.938)
Lag (Return on Equity)	0.0263	0.000777	0.000777	-0.0190	-0.0881***	-0.0881*	0.0768	0.0133	0.0133
	(0.0364)	(0.0251)	(0.0455)	(0.0446)	(0.0317)	(0.0513)	(0.0507)	(0.0241)	(0.0298)
Lag (Liquid Assets / Total Assets)	-0.0385	-0.0458	-0.0458	-0.392	-0.796***	-0.796	0.0555	-0.0399	-0.0399
	(0.189)	(0.114)	(0.144)	(0.475)	(0.287)	(0.557)	(0.220)	(0.105)	(0.153)
Lag (Costs to Income Ratio)	-0.00986	0.00534	0.00534	-0.0709***	-0.0631***	-0.0631**	0.0513	0.0886***	0.0886**
	(0.0353)	(0.0278)	(0.0475)	(0.0257)	(0.0207)	(0.0316)	(0.0409)	(0.0280)	(0.0388)
Lag (Loan Loss Reserve / Gross Loans)	0.163	0.0302	0.0302	-0.323	-0.820	-0.820	0.0680	0.0787	0.0787
	(0.268)	(0.184)	(0.276)	(0.849)	(0.722)	(1.341)	(0.304)	(0.177)	(0.240)
Size	138.9***	141.7***	141.7***	87.46***	92.42***	92.42***	127.7***	131.2***	131.2***
	(15.28)	(10.77)	(15.24)	(21.54)	(18.49)	(29.08)	(17.70)	(10.19)	(16.02)
HHI	741.1***	740.1***	740.1***	602.2***	657.3***	657.3**	659.1***	673.7***	673.7***
	(93.56)	(72.93)	(105.4)	(146.4)	(117.7)	(257.6)	(71.46)	(40.27)	(61.00)
Deposit Insurance	7.908	14.60	14.60	3.256	10.07	10.07	-7.884	-0.430	-0.430
	(19.06)	(17.33)	(19.10)	(8.077)	(7.397)	(14.01)	(5.218)	(3.822)	(4.727)
GDP Per Capita	0.00287	0.000289	0.000289	-0.00977	-0.0118***	-0.0118	0.00743*	0.00588**	0.00588*
	(0.00572)	(0.00490)	(0.00819)	(0.00750)	(0.00290)	(0.00859)	(0.00402)	(0.00241)	(0.00355)
Type of Difference GMM Estimator	One-step Robust	Two-step	Two-step Robust	One-step Robust	Two-step	Two-step Robust	One-step Robust	Two-step	Two-step Robust
Lags	lag (3 3)	lag (3 3)	lag (3 3)	lag (3 3)	lag (3 3)	lag (3 3)	lag (3 3)	lag (3 3)	lag (3 3)
Observations	391	391	391	108	108	108	346	346	346
Number of Banks	102	102	102	36	36	36	74	74	74
Number of Instruments	38	38	38	39	39	39	40	40	40
External Instrument	Disc. Intensity	Disc. Intensity	Disc. Intensity	Disc. Intensity	Disc. Intensity	Disc. Intensity	Disc. Intensity	Disc. Intensity	Disc. Intensity
AB test of no AR(1)									
Prob > z =	0.26	0.619	0.658	0.643	0.59	0.762	0.313	0.765	0.784
AB test of no AR(2)									
Prob > z =	0.942	0.853	0.865	0.305	0.76	0.833	0.536	0.785	0.796
Hansen test of overidentification									
Prob > chi2 =		0.44	0.44		0.936	0.936		0.655	0.655

1)*** p<0.01, ** p<0.05, * p<0.1
2)Each regression also contains time dummy variables that are not reported

Table 4.6: Dynamic Panel Data with Endogenous Disclosure Mechanism for Post-Crisis Period, Restructured and Non-restructured Banks

bank. The results for the diagnostic tests show that there is no second order serial correlation in either case. However, estimation for the weak banks can be biased as the number of instruments exceeds the number of panels, and the p-value of the Hansen J-statistic is close to 1. This suggests that the depositor discipline model for the weak banks is mis-specified.

The results in columns 7 to 9 of Table 4.6 suggest that healthier banks are able to attract relatively higher deposits by disclosing more information. More specifically, the finding shows that healthier banks are able to increase deposits growth by 9.79 percent in the next period by disclosing an additional unit of information. This rate is marginally more than what an average bank in the whole sample can achieve (9.56 percent). Weaker banks are not able to attract more deposits by disclosing more information. This result implies that the effectiveness of disclosure depends on the risk profile of the banks. This finding shows that depositors in East Asia reward good banks for disclosing more information. This implies that healthy banks can use disclosure signals to attract more deposits. However, the finding of this study does not show depositors in East Asia discipline weak banks by demanding greater disclosure. This finding also does not suggest that greater disclosure is a good signal for weak banks.

4.6 Discussion and Conclusion

This study extends the existing literature on disclosure in banking (Nier and Baumann, 2006; Wu and Bowe, 2010; Baumann and Nier, 2004; Tadesse, 2006 and Rosengren, 1999) by finding out if greater risk-related disclosure enables banks to attract more deposits. Overall, the findings of this study confirm that depositors in East Asia are sensitive to the content and also the quantity of risk-related information that banks disclose. This finding is in line depositor discipline hypothesis.

Panel data analysis shows that greater risk-related information disclosure helps banks to attract more deposits only during the post-crisis period. Subsequently, the relationship between disclosure and depositor behavior is modelled as a jointly determined process. When banks' financial standing deteriorates, a depositor may be inclined to withdraw their funds. Banks in

turn may adjust the amount of risk-related information that they disclose in anticipation of this. Simultaneous movements in disclosure and deposits growth needs to be taken into consideration in analyzing the effect of disclosure on depositor behavior. Hence, dynamic panel data analysis is performed to account for the lagged dependency of deposits growth and endogeneity of the interest rate and disclosure variables.

The findings of this study confirm the endogenous relationship between disclosure and deposits growth. Once the endogeneity is controlled for, this study finds that depositors in East Asia react to the changes in banks' risk profile and also changes in the amount of risk-related information disclosure. The results also show that price signals are not effective in attracting more deposits. This implies that depositors' behavior is driven by the amount of risk-related information that they know about the banks rather than the price that is offered by the banks. Overall, these findings provide support to the proposition of the third pillar of the Basel II which aims to encourage market discipline by requiring banks to disclose more risk-related information.

In line with the wake-up-call hypothesis, depositors' responsiveness to the amount of disclosure increases after the crisis period. When differentiation is made between restructured and non-restructured banks, the study finds that healthy banks are able to attract higher funds over time by disclosing greater information, but weaker ones are not able to do so. This suggests that the amount of risk-related information that banks disclose is related to their quality. These findings show that depositors in East Asia reward good banks for disclosing more information but they do not discipline weak banks by demanding greater disclosure. This findings imply that greater disclosure is an effective signal for healthy banks but not for weak ones.

In conclusion, this chapter confirms the presence of depositor discipline in the East Asian banking system. It also confirms that disclosure is good for banks as it allows them to attract more funds. Since greater disclosure is not an effective signal for the weak banks, they might not

be inclined to disclose more risk-related information. This brings forward the need to regulate information disclosure in the banking system. Admati and Pfleiderer (2000) asserts that stringent disclosure requirements can also contribute towards greater investor confidence which, in turn, increases liquidity and market efficiency and decreases firms' cost of capital. However, greater regulated disclosure may generate fragility in the banking sector when bank managers are not able control banks' risk exposure (Cordella and Yeyati, 1998), when it hampers the bank manager's ability to use their insights in disclosing information (Östberg, 2006)[110], when firms operate under different constraints (Admati and Pfleiderer, 2000) and when the return is low (Kaplan, 2006). This presents a dilemma for regulators since they have to decide to either provide incentives for bank managers to voluntarily disclose more information or regulate information disclosure in the banking sector.

[110] Firms will be better off by choosing their optimal disclosure policy endogenously in order to maximize firm value (Ostberg, 2006).

Chapter 5 Conclusion

The East Asian financial crisis warrants special attention due to the devastating effect it had on the economy. Rapid growth in the banking sector prior to the crisis imposed great pressure on the underdeveloped financial market in countries like Indonesia, Korea, Malaysia, Philippines and Thailand. The central banks and the regulatory bodies in the affected countries did not have adequate expertise to deal with this. As a result, prudent regulation and effective supervision were not put in place. This caused excessive risk-taking and increased moral hazard in the banks. The findings of this thesis contribute towards understanding of the crisis. Firstly, it highlights the importance of liquidity management for the well functioning of the banking system. Secondly, empirical analyses on depositor discipline in East Asia confirm that higher equity ratio and bigger size enable banks to attract more deposits. However, depositors in East Asia do not discipline banks by demanding a higher price. This study finds that banks are able to attract higher deposits by disclosing more risk-related information in their financial statements. This finding supports the goals of the third pillar of the New Basel Capital Accord that aims to encourage market discipline through greater disclosure.

5.0.1 Policy Recommendations

The recent episode of Global Financial crisis that began in mid-2007 highlights the importance of liquidity in the banking system. This crisis shows that liquidity reserves were necessary as a guarantee for banks and other financial institutions to survive the possible effects (Korean Institute of Finance, 2010). This study shows that liquidity risk played a very important role in the East Asian crisis. Greater reliance on external funding before the crisis made banks in East Asia more vulnerable to failures. Since the crisis, changes have been made to the liquidity requirement and management of the individual financial institutions in East Asia. Among the measures

that have been introduced in managing liquidity risk are setting liquidity policies for managing liquidity risk, performing stress tests and scenario analysis, developing contingency funding plans in dealing with stress scenarios, setting limits to the amount of liquidity risks that banks can take, requiring all banks to report their liquidity positions to regulators and also requiring banks to disclose information about their liquidity risk management to public[111]. Even though these countries have set their liquidity risk measurement and management based on the Sound Practices for Managing Liquidity in Banking Organizations of Basel Committee of Banking Supervision (2000), different minimum requirements are set by national supervisors in managing liquidity risk during normal and crisis times[112][113].

In terms of policy recommendation, chapter 2 of this thesis brings forward the case for stronger management and regulation of banks' liquidity risk in East Asia[114]. Regulators need to ensure that rules and regulations that govern liquidity risk management are reviewed regularly to keep up with the dynamic nature of banking operations. The recent global financial crisis highlights the changing nature of risks that banks are exposed to. Credit derivatives, that facilitate the transfer of the credit risk of the underlying loan out of the banking system, were used rampantly at the onset of the crisis. Sale of bank's assets (loan) reduces bank's vulnerability to liquidity shocks. Even though the stability implication of credit derivatives is highlighted in BIS (2004) report, Wagner (2007) postulates that it can expose banks to new risks. Using data on both loan purchases and sales of all domestic commercial banks in the United States from June 1987 to 1993, Cebenoyan

111 The Fiscal Policy Research Institute 2010 Report provides information about the liquidity risk management frameworks and regulations in the five East Asian countries post-crisis (Korean Institute of Finance, 2010).

112 In 2008, the Basel Committee has conducted a fundamental review of its 2000 Sound Practices for Managing Liquidity in Banking Organisations. Since then, these countries have adopted the Principles for Sound Liquidity Risk Management and Supervision of the Bank for International Settlements (BIS).

113 Every national supervisor has set a minimum reserve requirement as a cushion to absorb shocks, adopted a qualitative or qualitative approach or a combination of both in managing liquidity risk, set the requirements on liquidity asset obligations and maturity mismatch analysis, set the asset liability management requirement for banks in the form of both balance sheet and daily cash management and also set different asset liability management requirements during irregular times (Korean Institute of Finance, 2010).

114 Large liquidity gap can be managed through asset management and liability management (Diamond, 1997; Duttweiler, 2009).

and Strahan (2004) find that banks that have access to loan sale markets hold a larger share of their portfolio in risky assets than banks inactive in loan sales. This shows that financial innovation and growth of complex financial instruments expose banks to different forms of risk. Regulators need to ensure that banks are able to manage the potential contingent liquidity risks.

Chapter 3 of this thesis suggests that market discipline can be a reliable tool to discipline banks. In terms of policy recommendation, these results suggest that measures should be taken by banking regulators to build up a more effective market discipline as a component of the regulatory framework. Financial institutions should be required to release accurate and timely information to the public in order for them to assess the bank's ability to absorb aggregate shocks and remain solvent.

Chapter 4 of this thesis validates the benefits of disclosure, which is in line with the goals of the third pillar of the New Basel Capital Accord that aims to encourage market discipline. By allowing market participants to assess banks' risk exposure, disclosure requirements help in achieving the broader regulatory objective of promoting banking system stability. In terms of policy recommendation, regulators can either encourage bank managers to voluntarily disclose more information or regulate information disclosure in the banking sector. The latter can be done by requiring banks to adhere to particular accounting practices or rules and also mandates the disclosure of certain information. The former, on the other hand, requires bank managers to disclose more information by providing them with an incentive to do so[115].

5.0.2 Limitations of the Study

There are some limitations of the GMM methodology used in the analyses. Firstly, the problem of weak instruments (i.e. instruments that are only weakly correlated with the included endogenous variables) arises in GMM method (Stock et al, 2002). Secondly, the GMM method allows for contemporaneous correlations between endogenous variables and the error term.

[115] This leads to the corporate governance issue (Kalfaoglou and Sarris, 2006).

However, the use of lagged values as instruments can sometimes be invalid if the errors are serially correlated. In overcoming this problem, in Chapter 4 of this thesis, Disclosure Intensity is used as an external instrument in addition to the lagged values.

Chapters 3 and 4 look into the effectiveness market discipline in the banking system. Even though the overall benefits of disclosure can be viewed from a broader perspective as it is aimed at increasing the overall stability in the banking sector and also to protect individual investors, the present study is mainly aimed at analyzing the benefits of disclosure to banks.

A breakdown of customer deposits is not available for banks in Indonesia and Korea in some of the years. Due to this limitation in data availability, Total Deposits is used to derive the Deposits Growth variable in chapter 3 an 4. Due to the lack of adequate data on interest rates paid by each bank on deposits, an implicit interest rate calculated as the ratio of Interest Expense to Interest-Bearing Debt is used as the measure of interest rate in chapters 3 an 4. However, using a market interest rate may be a better option as it reflects the actual costs of funding.

Chapters 3 and 4 of this thesis confirms that depositors in East Asia do punish banks for weak fundamentals. However, these studies do not analyze the effectiveness of depositor discipline by examining the degree to which depositor discipline reduces bank managers' risk-taking behavior. This limitation, however, is a common feature of research in this area. It is also important to emphasize that the focus in this thesis is on the content and amount of information banks disclose and not on the truthfulness of the disclosed information. In fact, it will assumed, as is often done in the literature on disclosure, that all disclosed information is truthful.

5.0.3 Future Research

Going forward, future research can address some of the limitations of this study. This study is mainly focused on the role of liquidity risk in the crisis led countries in East Asia before and during the crisis. Future studies should focus on the management of liquidity risk after the crisis. More specifically, these studies need to focus on the ability of the East Asian banks in

withstanding the liquidity shocks during the recent Global Financial crisis. Comparison also can be made between the different regions in order to analyze the regional asymmetry regarding the resilience of the banking sector to liquidity shocks. This can illustrate the heterogeneity among the banking sectors of different regions.

In analyzing the depositor's responses to the amount of information that banks disclose, future studies should segregate the information disclosed by banks into regulated and non-regulated or voluntary disclosure. Analyzing the effect of greater regulated disclosure on banks' deposits' growth will help us in answering the question as to whether greater regulation is good for banks while analyzing the effect of voluntary disclosure on banks' deposits' growth will help us in answering the question as to whether banks are better off by disclosing more information than is required.

	1994	1995	1996	1997	1998	1999	2000
Indonesia	n.a	n.a	n.a	n.a	n.a	n.a	n.a
Korea	2.84	4.07	6.06	2.54	0.62	1.35	2.48
Malaysia	n.a	n.a	n.a	n.a	n.a	-0.88	-1.87
Philippines	2.56	6.47	7.45	0.87	0.4	6.8	1.41
Thailand	2.43	3.44	2.94	3.7	0.29	-0.09	-0.33

Table A.1: Net Portfolio Liabilities to GDP (%)

	1994	1995	1996	1997	1998	1999	2000
Indonesia	2.61	6.44	6.32	-0.34	-6.17	-3.78	-4.78
Korea	2.72	4.01	5.21	-1.9	-1.87	2.58	2.39
Malaysia	1.91	10.3	11.61	2.51	-3.14	-7.68	-6.69
Philippines	8.56	8.48	17.02	9.32	0.7	5.88	4.26
Thailand	11.08	18.28	15.33	-9.62	-12.58	-9.45	-8.5

Table A.2: Financial Account to GDP (%)

Appendix A The East Asian Crisis

	1994	1995	1996	1997	1998	1999	2000
Indonesia	n.a	n.a	n.a	n.a	n.a	n.a	n.a
Korea	1.82	3.04	4.63	1.95	-0.23	-1.16	-0.07
Malaysia	n.a	n.a	n.a	n.a	n.a	n.a	n.a
Philippines	2.56	6.47	4.31	1.5	-0.25	6.04	1.62
Thailand	2.79	1.56	2.06	0.61	0.03	-0.9	-1.06

Table A.3: Net Debt Liabilities to GDP (%)

	1994	1995	1996	1997	1998	1999	2000
Indonesia	n.a	n.a	n.a	n.a	n.a	n.a	n.a
Korea	1.01	1.04	1.43	0.59	0.85	2.51	2.54
Malaysia	n.a	n.a	n.a	n.a	n.a	n.a	n.a
Philippines	n.a	n.a	3.14	-0.63	0.65	0.76	-0.21
Thailand	n.a	n.a	n.a	n.a	n.a	n.a	n.a

Table A.4: Net Equity Liabilities to GDP (%)

	1994	1995	1996	1997	1998	1999	2000
Indonesia	n.a	n.a	n.a	n.a	-4.76	-1.36	-0.69
Korea	5.32	8.23	8.26	1.09	-4.58	0.84	0.19
Malaysia	-3.57	2.52	-4.41	7.44	6.83	0	n.a
Philippines	n.a	n.a	12.25	5.7	-3.37	2.13	-4.32
Thailand	10.25	18.24	7.29	-12.28	-13.21	-11.16	-7.05

Table A.5: BOP Net Other Investment Liabilities to GDP (%)

	1994	1995	1996	1997	1998	1999	2000
Indonesia	n.a	n.a	n.a	n.a	n.a	n.a	n.a
Korea	3.15	4.78	3.93	-0.3	-2.94	0.33	-0.62
Malaysia	-3.71	n.a	n.a	n.a	n.a	n.a	n.a
Philippines	n.a	n.a	10.24	1.78	-2.78	1.05	-3.42
Thailand	13.89	13.3	0.13	-0.35	-7.42	-8.41	-2.13

Table A.6: BOP Net Bank Liabilities to GDP (%)

	1994	1995	1996	1997	1998	1999	2000
Indonesia	1.43	2.73	3.61	2.6	-0.15	-1.19	-2.76
Korea	0.21	0.41	0.5	0.59	1.21	1.9	1.74
Malaysia	6.42	5.63	6.22	5.86	2.67	4.52	4.04
Philippines	2.66	2.36	2.29	1.75	3.3	1.74	2.95
Thailand	1.24	1.72	1.84	3.11	6.52	5.21	2.74

Table A.7: Direct investment to GDP (%)

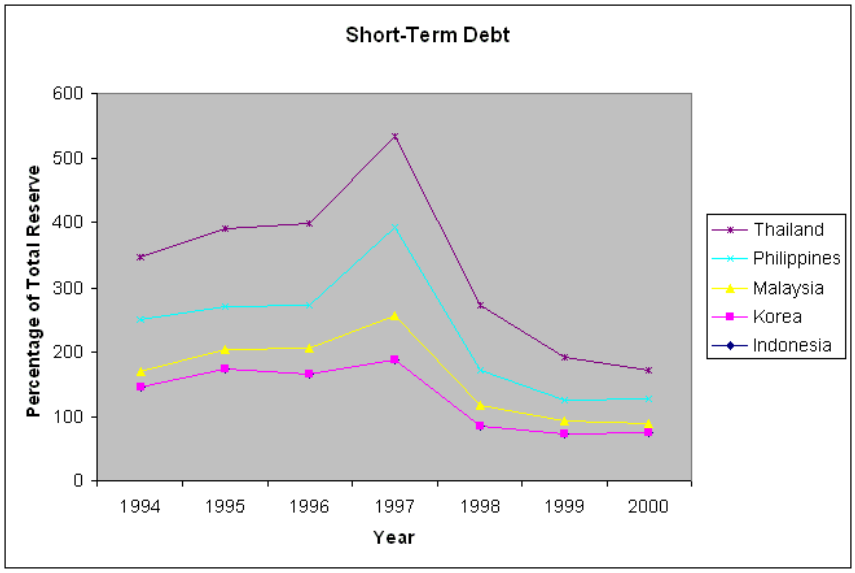

Figure A.1: Short-Term Debt as a Percentage of Total Reserve

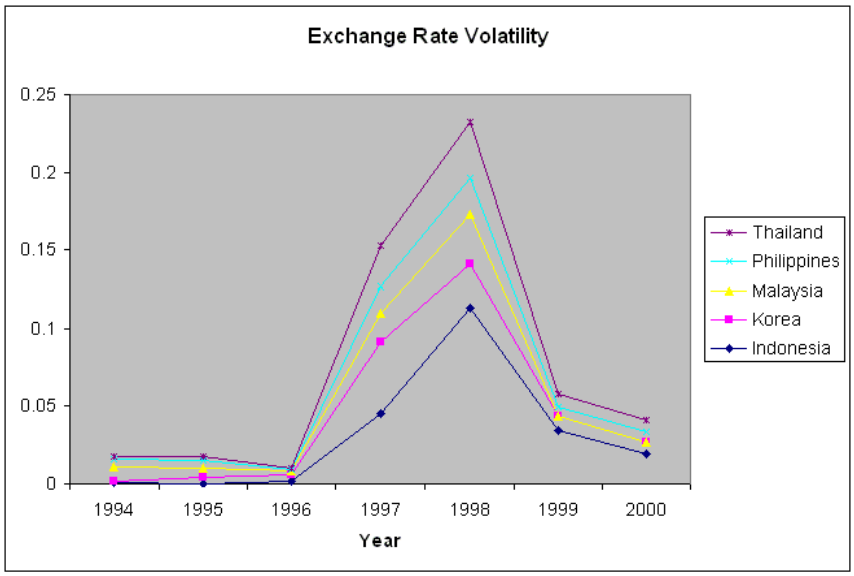

Figure A.2: Exchange Rate Volatality

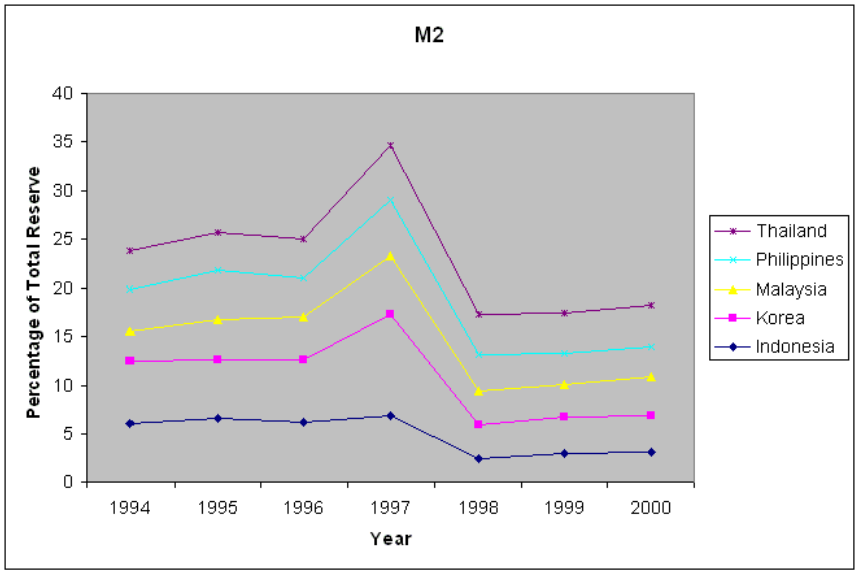

Figure A.3: M2 as a Percentage of Total Reserve

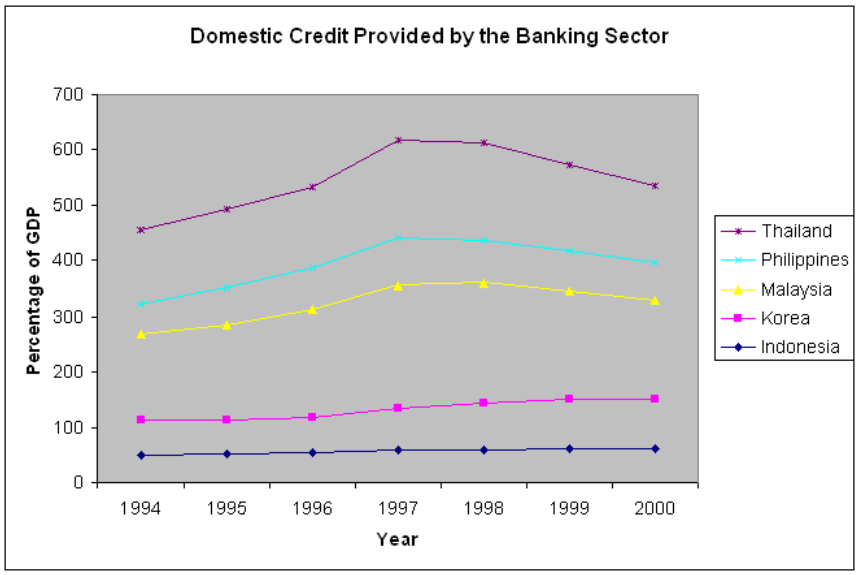

Figure A.4: Domestic Credit Provided by the Banking Sector

	Banks	Non-bank Private	Public Sector	Short-Term	Reserves	Short Term / Reserves
Dec-95						
Indonesia	8900	28800	6700	27600	14700	1.9
Korea	50000	21400	6200	54300	32700	1.7
Malaysia	4400	10100	2100	7900	23900	0.3
Philippines	2200	3400	2700	4100	7800	0.5
Thailand	25800	34700	2300	43600	37000	1.2
Total	91300	98400	20000	137500		
Dec-96						
Indonesia	11700	36800	6900	34200	19300	1.8
Korea	65900	28300	5700	67500	34100	2
Malaysia	6500	13700	2000	11200	27100	0.4
Philippines	5200	5300	2700	7700	11700	0.7
Thailand	25900	41900	2300	45700	38700	1.2
Total	1152000	126000	19600	166300		
Jun-97						
Indonesia	12400	39700	6500	34700	20300	1.7
Korea	67300	31700	4400	70200	34100	2.1
Malaysia	10500	16500	1900	16300	26600	0.6
Philippines	5500	6800	1900	8300	9800	0.8
Thailand	26100	41300	2000	45600	31400	1.5
Total	121800	136000	16700	175100		

Table A.8: International Claims Held by Foreign Banks - Distribution by sector and maturity (In millions of USD)Source : Bank for International Settlements

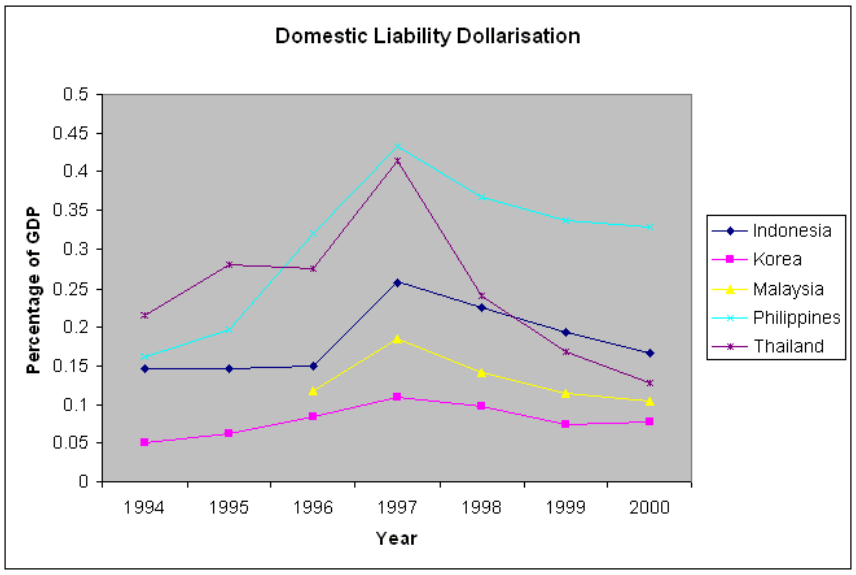

Figure A.5: Domestic Liability Dollarisation as a Percentage of GDP

	1994	1995	1996	1997
Liquid Assets	$109,301,081.64	$141,454,108.47	$148,514,048.87	$115,462,820.45
Net Loans	$458,331,772.60	$594,239,499.14	$690,059,230.00	$470,255,759.95
Total Deposits	$429,817,822.56	$534,520,912.44	$616,877,645.28	$480,266,250.07
Deposits & Short-term Funds	$560,919,223.50	$726,346,639.52	$830,686,052.77	$596,512,653.14

Table A.9: Data Summary for the Financial Institutions Covered in the Study (in thousand USD)

Indonesia	13
Korea	8
Malaysia	10
Philippines	14
Thailand	13

Table A.10: Non-Performing Loans as of 1996 (% of Total Lending) Source: BIS Annual Report

	Trough Index	Date	Peak Index	Date
Indonesia	65	1997 Q2	100	1992 Q3
Korea	77	1997 Q4	100	1990 Q1
Malaysia	86	1997 Q4	100	1995 Q2
Philippines	104	1997 Q4	113	1996 Q1
Thailand	93	1997 Q4	180	1991 Q4

Table A.11: Commercial Property Prices, Peak and Trough during 1990 to 1997,Source: BIS 68th Annual Report 1998

	Trough Index	Date	Peak Index	Date
Indonesia	100	1994 Q1	170	1997 Q3
Korea	93	1997 Q4	100	1994 Q1
Malaysia	91	1997 Q4	100	1995 Q3
Philippines	117	1997 Q4	124	1996 Q3
Thailand	53	1997 Q4	100	1992 Q1

Table A.12: Residential Property Prices, Peak and Trough during 1990 to 1997,Source: BIS 68th Annual Report 1998

	01-Jan-96	28-Jun-96	01-Jan-97	30-Jun-97	01-Jan-98	30-Mar-98	01-Jun-98
Indonesia	100	114	120	133	30	28	17
Korea	100	89	68	74	19	31	21
Malaysia	100	116	125	109	38	51	35
Philippines	100	127	122	108	46	62	52
Thailand	100	97	64	42	15	24	15

Table A.13: Stock Market Prices Indices (USD)Note : 1 January 1996 = 100 Source: Datastream

Appendix B IV Probit Estimation

In estimating limited-dependent variable models with endogenous regressors, Newey (1987) derived the following reduced form equation:

$$\begin{aligned} y_{1i}^{*} &= (x_i\Pi + v_i)\beta + x_{1i}\gamma + u_i \\ &= x_i\alpha + v_i\beta + u_i \\ &= x_i\alpha + V_i \end{aligned}$$

where $V_i = v_i\beta + u_i$. In this case

$$\alpha = \begin{bmatrix}\Pi_1 \\ \Pi_2\end{bmatrix}\beta + \begin{bmatrix}I \\ 0\end{bmatrix}\gamma = D(\Pi)\delta$$

The estimator of δ is defined by

$$\max_{\delta}(\widetilde{\alpha} - \widehat{D}\,\delta)'\widehat{\Omega}^{-1}(\widetilde{\alpha} - \widehat{D}\,\delta)$$

Thus the efficient estimator δ is

$$\widehat{\delta} = (\widehat{D}'\widehat{\Omega}^{-1}\widehat{D})^{-1}\widehat{D}'\widehat{\Omega}^{-1}\widetilde{\alpha}$$

$$Var(\widehat{\delta}) = (\widehat{D}'\widehat{\Omega}^{-1}\widehat{D})^{-1}$$

From Proposition 5 of Newey (1987), $\sqrt{N}(\widetilde{\alpha} - \widehat{D}\,\delta) \xrightarrow{d} N(0, \Omega)$,where

$\Omega = J_{\alpha\alpha}^{-1} + (\lambda - \beta)' \sum_{22}(\lambda - \beta)Q^{-1}$

Based on the properties of the normal distribution,

$E(u_i \mid v_i) = v_i \sum_{22}^{-1} \sum_{21}$and $Var(u_i \mid v_i) = 1 - \sum_{21}' \sum_{22}^{-1} \sum_{21}$

u_i is written as

$u_i = v_i \sum_{21}^{'} \sum_{22}^{-1} \sum_{21} + e_i$, where $e_i \sim N(0, 1 - p^2), p^2 = \sum_{21}^{'} \sum_{22}^{-1} \sum_{21}$,and e_i is independent of v_i.

Probit estimation is used in the second stage to estimate the parameters of

$y_{1i} = z_i\delta + v_i\lambda + e_i$.

Since v_i is unobservable, sample residuals from the first stage regressions is used.

$\Pr(y_{1i} = 1 \mid z_i, v_i) = \Pr(z_i\delta + v_i\lambda + e_i > 0 \mid z_i, v_i) = \Phi\{(1 - p^2)^{-\frac{1}{2}}(z_i\delta + v_i\lambda)\}$

Hence, $\delta_p = \frac{1}{(1-p^2)^{\frac{1}{2}}}\delta$ and $\lambda_p = \frac{1}{(1-p^2)^{\frac{1}{2}}}\lambda$ is estimated instead of δ and λ.

Appendix C IV2SLS vs IVGMM2S

It is possible to estimate linear probability models by 2SLS and GMM2S.

In the case of overidentification ($\ell > k$), the set of k instruments are defined as :

$$\widehat{X} = Z'(Z'Z)^{-1}Z'X = P_z X$$

gives rise to two stage least squares (2SLS) estimator

$$\widehat{\beta}_{2SLS} = (\widehat{X}'X)^{-1}\widehat{X}'y = (X'P_Z X)^{-1}X'P_Z y$$

In the 2SLS method with overidentification, the ℓ available instruments are reduced to the k needed by defining the P_Z matrix. The IV-GMM method, that reduction is not necessary as all instruments are used in the estimator. A weighting matrix is used in choosing $\widehat{\beta}_{GMM}$ so that the elements of $\overline{g}(\widehat{\beta}_{GMM})$ are as close to zero as possible. The IV-GMM estimator of an over identified equation is given by:

$$\widehat{\beta}_{GMM} = (X'ZWZ'X)^{-1}X'ZWZ'y \tag{C.1}$$

The variance-covariance matrix for $\widehat{\beta}_{GMM}$ is given by

$$V(\frac{1}{\sqrt{n}}\widehat{\beta}_{GMM}) = \frac{1}{n}(Q'_{xz}WQ_{xz})^{-1}(Q'_{xz}WSWQ_{xz})(Q'_{xz}WQ_{xz})^{-1} \tag{C.2}$$

where S is a covariance matrix of the moment conditions g:

$$S = AVar\{\overline{g}(\beta)\} = \lim_{N\longrightarrow\infty} N^{-1}[Z'\Omega Z]$$

and $Q_{xz} \equiv E(X'_i Z_i)$.

Even though the GMM estimator is consistent for any positive-definite weighting matrix W,

its efficiency is not guaranteed for an arbitrary W. This estimator is referred to as the possibly inefficient estimator (Baum et al., 2007).

Hansen (1982) suggest using the estimator with an optimal weighting matrix $W = S^{-1}$. By substituting this consistent estimator into C.1and C.2, we obtain the efficient GMM (EGMM) estimator

$$\widehat{\beta}_{EGMM} = (X'Z\widehat{S}^{-1}Z'X)^{-1}X'Z\widehat{S}^{-1}Z'y \tag{C.3}$$

The variance-covariance matrix for $\widehat{\beta}_{EGMM}$ is given by

$$V(\frac{1}{\sqrt{n}}\widehat{\beta}_{EGMM}) = \frac{1}{n}(Q'_{xz}S^{-1}Q_{xz})^{-1} \tag{C.4}$$

where the estimate of Q_{xz} is given by

$$\frac{1}{n}\sum_{i=1}^{n} X'_i Z_i = \frac{1}{n}X'Z$$

In two-step EGMM, the estimation of S is obtained in the first step while the estimator and its asymptotic variance is calculated using C.3and C.4in the second step.

IV2SLS robust is an IGMM estimator while IVGMM2s robust is the two-step FEGMM.

Appendix D Difference GMM

The normal method of dealing with the heterogeneity (unobserved time-invariant bank-specific effects) that can arise in either the fixed or random effects' case is to take first differences. Equation 3.1becomes:

$$\begin{aligned} \text{DEPGR}_{i,j,t} - \text{DEPGR}_{i,j,t-1} &= \mu'(\text{DEPGR}_{i,j,t-1} - \text{DEPGR}_{i,j,t-2}) + \\ &\beta'(\text{BANK SPECIFIC}_{i,j,t-1} - \text{BANK SPECIFIC}_{i,j,t-2}) + \\ &\gamma'(\text{COUNTRY SPECIFIC}_{j,t} - \text{COUNTRY SPECIFIC}_{j,t-1}) \\ &+(\varepsilon_{i,j,t} - \varepsilon_{i,j,t-1}) \end{aligned} \tag{D.1}$$

Even though Equation D.1 eliminates the individual effects, it is still problematic due to the correlation between the lagged dependent variable $(\text{DEPGR}_{i,j,t-1} - \text{DEPGR}_{i,j,t-2})$ and the new error term $(\varepsilon_{i,j,t} - \varepsilon_{i,j,t-1})$ that arises from its first-order moving average process. Anderson and Hsiao (1981) propose that this problem can be resolved by using appropriate instruments, namely the lagged levels or lagged first differences of the dependent variable. In other words, they propose using $(\text{DEPGR}_{i,j,t-2})$ or $(\text{DEPGR}_{i,j,t-2} - \text{DEPGR}_{i,j,t-3})$ which are uncorrelated with the error term $(\varepsilon_{i,j,t} - \varepsilon_{i,j,t-1})$ but correlated with $(\text{DEPGR}_{i,j,t-1} - \text{DEPGR}_{i,j,t-2})$ as instruments for $(\text{DEPGR}_{i,j,t-1} - \text{DEPGR}_{i,j,t-2})$. Arellano (1989) compares the variance of the estimators produced by both instruments and finds that lagged difference produces a very large variance. Similarly, Arellano and Bond (1991) also favours the use of lagged levels as instruments based on the simulation results.

The Arellano and Bond (1991) model relaxes the condition that explanatory variables should be strictly exogenous. This means that $E[x_{it}\,\varepsilon_{is}] = 0$ for all t and s, implying that x is uncorrelated with the error term in past, present, and future. The variable is predetermined if $E[x_{it}\,\varepsilon_{is}] \neq 0$ for

$s < t$ but $E[x_{it}\,\varepsilon_{is}] = 0$ for all $s \geq t$. In this case, the error term at time t has some feedback on the later realizations of x_{it}. An endogenous variable, on the other hand, has $E[x_{it}\,\varepsilon_{is}] \neq 0$ for $s \leq t$ but $E[x_{it}\,\varepsilon_{is}] = 0$ for all $s > t$. This means that endogenous variables allow for the correlation between x_{it} and ε_{it} at time t while predetermined variables do not. This study controls for the potential endogeneity of the interest rate variable. This removes the potential parameter inconsistency that may happen due to simultaneity or reverse causality that is present between deposits growth and the interest rate variable.

Suitable instruments need to be used when applying the dynamic model to the data set. These instruments must satisfy the condition that instrumental variables are highly correlated with the endogenous variables and not correlated with the error term. Arellano and Bond (1991) propose the use of the traditional first-differenced GMM (denoted as Difference-GMM) estimator in resolving the endogeneity problem, whereby lagged levels of the endogenous variables are used as instruments. In this case, lagged values of interest rate variables, which are highly correlated with the endogenous variables (DEPGR and interest rate variable) but not directly correlated with the error term $(\varepsilon_{i,j,t} - \varepsilon_{i,j,t-1})$ can be used as instruments. Under the assumption that a) the error term ε_{it} is not serially correlated, and b) the endogenous variables are assumed to be correlated with the past and present realization of the error term but uncorrelated with the future realization of the error term, the GMM estimator uses the following moment conditions:

$$E\left[\text{DEPGR}_{i,j,t-s}(\varepsilon_{i,j,t} - \varepsilon_{i,j,t-1})\right] = 0 \text{ for } s \geq 2; t = 3, ..., T \tag{D.2}$$

$$E\left[\text{Interest Rate}_{i,j,t-s}(\varepsilon_{i,j,t} - \varepsilon_{i,j,t-1})\right] = 0 \text{ for } s \geq 2; t = 3, ..., T \tag{D.3}$$

In Chapter 4, differencing Equation 4.1gives:

$$\begin{aligned}\text{DEPGR}_{i,j,t} - \text{DEPGR}_{i,j,t-1} &= \mu'(\text{DEPGR}_{i,j,t-1} - \text{DEPGR}_{i,j,t-2}) + \\ &\quad \delta'(\text{Disclosure Index}_{i,j,t-1} - \text{Disclosure Index}_{i,j,t-2}) + \\ &\quad \beta'(\text{BANK SPECIFIC}_{i,j,t-1} - \text{BANK SPECIFIC}_{i,j,t-2}) + \\ &\quad \gamma'(\text{COUNTRY SPECIFIC}_{j,t} - \text{COUNTRY SPECIFIC}_{j,t-1}) \\ &\quad +(\varepsilon_{i,j,t} - \varepsilon_{i,j,t-1})\end{aligned} \tag{D.4}$$

An additional moment condition will be used as instruments as the following :

$$E\left[\text{Lagged Disclosure Index}_{i,j,t-s}(\varepsilon_{i,j,t} - \varepsilon_{i,j,t-1})\right] = 0 \text{ for } s \geq 2; t = 3, ..., T \tag{D.5}$$

Using dynamic GMM, the validity of the instruments needs to be checked by analyzing the first-order and second-order residual autocorrelation. The consistency of the Arellano and Bond (1991) model requires first-order, and no second-order autocorrelation in the residuals. Hence, the presence of first-order autocorrelation in the difference residuals does not imply the estimates are inconsistent, but the presence of second-order autocorrelation would imply that the estimates are inconsistent. In order for the instruments to be valid, the null hypothesis that there is no first-order serial correlation should be rejected but the null hypothesis that there is no second-order autocorrelation should not be rejected. All the dynamic panel data regressions outputs in this study include tests to support the validity of the model specification.

The consistency of the GMM estimator also depends on validity of the instruments, which can be tested using standard the Sargan test or Hansen's test of over-identifying restrictions. These tests assess whether the instrumental variables are associated with bank deposits beyond their ability to explain bank specific fundamentals. Under the null hypothesis that the instruments are not correlated with the error term, the test is distributed as with degrees of freedom equal to the number instruments minus the number of regressors. If the data do not reject the null hypothesis,

then the data do not reject the validity of the instrumental variables.

The Sargan test statistic has an asymptotic chi-squared distribution only when the error terms are homoscedastic. Hence it is not robust to heteroskedasticity or autocorrelation[116]. Hence, the Sargan test is not reported when hetroscedacticity is present. The Hansen J statistic, which is robust to heteroskedasticity, is reported.

Roodman (2007) emphasizes that the number of instruments used in the dynamic panel needs to be reported, since those models can generate an enormous number of potentially "weak" instruments that can cause biased estimates. However, there is no clear guideline on how many instruments is "too many". Roodman (2006 and 2007) highlights two ways of ascertaining this. Firstly, the number of instruments should not exceed the number of panels, which is satisfied in almost all the estimations in this study. Secondly, a p-value of the Hansen J-statistic should not be too high. Roodman (2007) suggests that the p-value should be higher than the conventional 0.05 or 0.10 levels but should not be near 1. The number lags in levels and differences and also the number of instruments used in the analysis are reported in the results tables.

D.0.3.1 One-Step and Two-Step GMM

One-step GMM estimation assumes that errors are homoscedastic. However, heteroscedasticity of data is a common problem with dynamic panel data models. In line with this, Arellano and Bond (1991) using the moment conditions D.2 and D.3, propose a two-step GMM estimator. In the first step, the error terms are assumed to be independent and homoscedastic. across banks and over time. In the second step, the residuals obtained in the first step are used to construct a consistent estimate of the variance-covariance matrix, thus relaxing the assumptions of independence and homoscedasticity. Hence, the two-step estimator is thus asymptotically more efficient than the first step estimator in the presence of heteroscedasticity and serial correlation (Wooldridge, 2001).

However, Monte Carlo stimulations show that the efficiency gain is typically small, and that

[116] Arellano and Bond (1991) shows that the one-step Sargan test over-rejects in the presence of heteroskedasticity.

the two-step GMM estimator has the disadvantage of converging to its asymptotic distribution relatively slowly. In finite samples, the asymptotic standard errors associated with the two-step GMM estimators can be seriously biased downwards. Thus it is not a reliable guide for inference (Bond, Hoeffler, and Temple 2001). Arellano and Bond (1991) propose that inference should be made based on the one-step estimator. Windmeijer (2005) creates an extra finite sample variation which can be used to correct the standard error of the two-step estimation. This correction causes the two-step estimates and their standard errors to be very similar to the one-step estimates. Roodman (2006) suggests that the two-step robust GMM estimates are more efficient than one-step robust ones.

Appendix E Disclosure Index

Bank level disclosure index is constructed using the BankScope database as the information source. The indices are intended to measure the level of detail that banks provide in their published accounts on fifteen disclosure items. These indices reveal whether banks disclose information relating to various sources of risk that they face such as interest rate risk, credit risk, liquidity risk, market risk and solvency risk.

The composite index is defined as

$$DISC = \sum_{i=1}^{15} S_i$$

where each sub-index,s_i can be related to one or more sources of risk. Rather than ordering the sub-indices based on the sources of risk, the definition and the ordering of the fifteen sub-indices are created based on the presentation in the BankScope database. The table below lists the sub-indices used in the study in more detail.

For all sub-indices,we assign a value of 0 if there is no entry in any of the corresponding categories and a value of 1 otherwise, except for the capital sub-index. For the latter, we assign a value of 0 when there is no entry in any of the four categories, 1 if there is only one entry, 2 if there are two entries and 3 if there are three or four entries. Note that whenever a bank discloses information on three of these items,one can infer the fourth. Providing three item is therefore considered as informatively same as providing four items. The maximum attainable score on the sum of the sub-indices is 17.

	Sub-index	Breakdown by Category	Basel Risk Category
ASSETS			
Loans	S1: Loans by maturity	Short-term loan (< 1 year), Medium-term loan (< 3 years)	Interest rate risk, Liquidity risk
		& Long-term loan(> 3 years)	
	S2: Loan by type	Mortgage Loan, Retail Loan, Commercial Loans,	Credit risk
		Loans to Banks and Other Loans	
	S3: Problem loans	Total Impaired Loans	Credit risk
	S4: Problem loans by type	Normal Loan, Special Mention Loan, Substandard Loan, Doubtful Loans	Credit risk
		Loss Loan, Overdue Loans and Restructured Loan	
Other Earning Assets	S5: Investments by type	Loans and Advances to Banks	Liquidity risk
		Reverse Repos and Cash Collateral Securities, Investments in Property and	
		Other Earning Assets	
	S6: Securities by type	Trading Securities, Derivatives, Government Securities,	Liquidity risk
		Equity Investments, Other	
	S7: Investments by maturity	Debt Securities, Senior Debt, Subordinated Debts,	Liquidity risk
		(< 3 months , 3 to 12 months, 1 to 5 years & > 5 years)	
LIABILITIES			
Deposits	S8: Deposits by maturity	Retail and Other deposit	Interest rate risk,
		(< 3 months , 3 to 12 months, 1 to 5 years & > 5 years)	Liquidity risk
	S9: Deposits by type	Customer Deposit, Bank Deposit,	Liquidity risk
		Government / Municipalities Deposit	
	S10: Long-term funding	Senior Debt, Subordinated Borrowing, Other Funding	Liquidity risk, Market risk
Memo Lines	S11: Reserves	Loan Loss Reserve	Credit risk
	S12: Capital	Total Capital Ratio, Tier 1 Ratio, Total Capital, Tier 1 Capital	Cushion for risk
	S13: Off-balance sheet items	Letter of Credit Issued,	Credit risk
		Bank Guarantee Letter, Total Contingent Liabilities	
INCOME STATEMENTS			
	S14: Non-interest income	Net Fees & Commission Income, Net Gain	Market risk
	S15: Loan Loss Provisions	Loan Loss Provisions	Credit risk

Table E.14: Sub-indices to Construct the Synthetic Disclosure Index

Appendix F Disclosure Informativeness

Tadasse (2006) construct this variable to measures the extent and comprehensiveness of the regulation on banks financial reporting. The data to construct this variable is obtained from the responses in the World Bank survey of bank regulation and supervision described in Barth et al. (2001).

The variable is constructed by adding the survey response on the following indicator variables:

(i) a variable that takes the value 1 if banks are required to disclose risk management procedures to the public

(ii) a variable that takes 1 if the disclosure regulation requires that accrued income on non-performing loans (NPL) should not be reported in the bank's income statement

(iii) a variable that assumes 1 if consolidated financial statements of bank and non-bank financial subsidiaries are required

(iv) a variable that takes 1 if off balance sheet items need to be disclosed to the public

The above indicator variables are coded as a 0 or 1, whereby a value 1 represents good disclosure practice with respect to the disclosure item the variable denotes while 0 otherwise. Reporting risk management procedures to investors is considered as a good disclosure practise as it enable investors to assess banks risk profile. Similarly, not reporting the income on NPL is good as it provides a more accurate representation of banks' financial condition. Disclosure of consolidated financial statements is considered good as it provides comprehensive information about banks activities. Reporting off-balance sheet items is good as it provides a more complete picture of banks' financial standing.

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