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Capital Regulation, Risk-Taking, Bank Lending and Depositor Discipline

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Capital Regulation, Risk-Taking, Bank Lending and Depositor Discipline

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Dedication

This dissertation is dedicated to my father Dr. Md. Sultan Hossain, retired Professor of Dhaka University, my mother Hasina Ara Begum, and my wife, Rumana Hassan. My two sons, Marzook and Mahrooz Hussain. They all made great sacrifices for me.

Aknowledgement

I would like to convey my thanks and respect to all my teachers and students at the department of Economics and Finance. Speical thanks goes to the two co-chairs: Professor Oscar Varela and Kabir Hassan.

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Abstract

In this dissertation we investigate different aspects of capital regulations and their impact on the behavior of commercial banks. In chapter two, we foucs on the impact of capital regulations on risk-taking of commercial banks in developed and developoing countries separately and togahter. We find that such regulations indeed reduce the risk taking of commercial banks. At the same time, we examine the relationship between capital ratios and risk taking. In line with previous literature, we find that this ratio is negative also. Further examinations including the degree of liberalization and the level of finanicl development did not yield conclusive results.

In chapter three, we examine the relationship between the capital regulations and total lending and total depositis. We do not find conclusive evidence in support of the 'credcit crunch' or the ' risk retrenchment' hypothesis. However, several important variables do show a tendency to change with capital ratios. As a result, changes in capital ratios in response to regulations do have important impact on bank lending and decision making.

In chapter four, we study five South East Asian countries within the context of the crisis of 1996. First we test for the existence of depositor discipline in these countries and find that the sate of such discipline is very weak even after such a huge crisis. We also test the degree of risk taking in the banking industry in these countries. Evidence shows that perfect competition prevails in the bankins secotr. We also try to establist the link between "the index of depositor discipline" and "index of competition". But we don ot find evidence in support of this.

Keywords: Bank Regulations, Depositor Discipline, Risk Taking, Basel Capital Regulations, Credit Crunch.

Chapter 1. Overall Introduction

The purpose of this dissertation is to examine several issues in banking that most bank capital regulation papers omit—namely, the impact of Basel I-like national capital regulations on capital adequacy ratios, and changes in the risk-taking behavior of banks in developing countries. To analyze these issues, we examine as much as 30 developed and developing countries in Chapter 2.

Another area omitted by the literature is the degree of depositor discipline experienced by banks in five South-east Asian countries (i.e., Indonesia, South Korea, Malaysia, Philippines and Thailand) during the Asian Crisis of 1997; changes in the risk-taking behavior of banks before and after that crisis, as well as the link between risk-taking and depositor discipline, is examined. The last area studied here is the impact of capital regulations on bank lending, which is popularly known as a "credit crunch."

The central theme in examining the first two topics is the risk-taking behavior of banks, and it is one of the core areas of Basel I (signed in 1988) that focuses on the "measurement and management of risk-taking in commercial banks." This agreement has emerged as one of the most successful international banking accords of the 1990s. Based on the success of Basel I and to remedy some of the limitations of Basel I, the Basel Committee initiated Basel II in 2004; it will soon be implemented by the G10 and several other countries.

Basel II specifically outlines the three pillars of modern banking: capital regulations, depositor discipline, and regulatory supervision.[1] The chapters of this dissertation are directly related to two of the most important areas of contemporary banking regulations under Basel II, and the findings herein may contribute to better policy-making, especially in the context of developing countries.

Chapter 2 of the dissertation comprises a study of the impact of Basel I-like capital regulations on both developed and developing countries. The basic framework of the analysis will be to examine the changes in capital ratios of undercapitalized banks in response to capital requirements, and then to examine the relationship between changes

[1] Pillar 1 describes the regulatory capital for credit, operational and market risk; pillar 2 gives supervisors the discretion to increase regulatory capital above pre-defined limits, if necessary; pillar 3 allows market discipline to operate by providing information to the public.

in capital ratios and risk. In the second step, we attempt to expand the evidence derived from the initial step, into four areas: depositor discipline, liberalization, regulatory restrictiveness, and financial development. We also attempt to examine how banks react to capital regulations given changes in those four areas.

Chapter 3 examines the popular "credit crunch" literature. Evidence supports the existence of a "credit crunch"; Chiuri et al. (2001), for example, provide evidence of a "credit crunch" in 12 developing countries. Central to the related literature are examinations of whether the adoption and implementation of capital requirements curtails the credit supplies of banks or not. Whereas the present study examines both developed and developing countries, most studies to date have examined this relationship on a country-by-country basis, with a special focus on the 10 OECD countries. Our study will encompass evidence from a larger sample that includes both developed and developing countries, and we will concurrently look to Peek and Rosengren (1998, 1997) and Berger and Udell (1994) to examine the impact of capital regulations on loan supply from banks.

Finally, chapter 4 reviews the state of depositor discipline in five South-east Asian countries between 1996 and 2004; bank risk-taking behavior between 1992 and 2004, with a focus on changes in such behavior in the aftermath of the 1997 crisis; and the link between depositor discipline and risk-taking behavior. Four alternative asset quality measures are used to examine the impact of a decline in these measures on growth of inflation-adjusted deposits. In order to examine risk-taking behavior and competitiveness, we use the two most widely accepted models to measure changes in bank risk-taking (competitiveness) before and after 1997, namely the Shaffer (1993) model and the Panzer and Rosse (1982, 1987) methodology. This combination is rarely used in the existing literature. As a final step in this study, we examine the link between depositor discipline and bank risk-taking (competitiveness), in light of Gruben et al. (2003).

Chapter 2. Impact of Basel I-Like Bank Capital Requirements on Bank Credit Risk

In 1988, all the OECD countries, as well as Switzerland and Luxemburg, signed the Basel I Accord (capital adequacy regulations). It was implemented during a three-year period, from 1990 to 1993. During the 1990s and 2000s, the Accord emerged as the landmark document for bank capital regulations and supervision in about 100 countries, both developed and developing. Evaluation studies have shown that the regulation did increase the capital ratios of all banks in developed countries, including undercapitalized banks. These studies also found a weak negative relationship between capital ratios and the risk-taking of banks, indicating that the improvement of capital ratios of undercapitalized banks was not accompanied by a concomitant increase in risk.

At present, there is a dearth of literature on the impact of such regulations in developing countries. Most of the previous studies are of a single-country nature and are not cross-sectional. Critics caution that developing countries have very different banking histories, structures and environments; those countries also differ from developed countries in their levels of government intervention in banking, degrees of governmental bank ownership, degrees of bank liberalization, levels of privatization *vis-à-vis* state-owned banks, degrees of regulatory forbearance, and in their institutional set-ups and other socio-economic factors that affect banking operations. Therefore, in the present study, we examine the reaction of banks in developing countries to Basel I-like capital regulations.

Recent increases in the number of bank crises around the world[2] have renewed the interest of professional policy makers and academia in identifying the determinants of such crises. Several studies[3] on the determinants of bank crises have already identified regulatory changes as a major factor. It is instructive to assess the impact of capital regulations on bank risk-taking behavior and on the relationship between capital ratios and bank risk-taking. This is the primary focus of the present study.

[2] The IMF and World Bank published comprehensive studies in 1996 that show that a full three-quarters of their membership had experienced significant banking problems between 1980 and 1996.
[3] Kaminsky (1999) and Kaminsky and Reinhart (1999).

Literature Review

The literature begins, in earnest, with Shrieves and Dahl (1992), who use several periods of cross-sectional data on commercial banks in the United States, under the two equation (capital equation and risk equation) simultaneous equations framework. They found that the effectiveness of risk-based capital regulations depends on how well the regulations reflect the true risk exposure of banks.

The results of studies by Aggarwal and Jacques (1997, 2001) on U.S. banks are not easy to interpret. Samples selected for these studies are from 1991-1993 and 1991-1996 respectively. Both of these samples coincide with the passage and implementation of the *Federal Deposit Insurance Corporation Improvement Act* (FDICIA) in December 1991. Prompt Corrective Action (PCA), contained in Section 131 of FDICIA, went one step further than the Basel I Accord by defining three regulatory ratios (the Basel capital standards plus an advantage requirement) and five categories in which banks are classified according to their compliance with the three ratios. The impacts of Basel I and PCA under FDICIA therefore overlapped for U.S. banks, and it is thus difficult to ascribe the findings of the two papers by Aggarwal and Jacques (1997, 2001) to the Basel I Accord alone. However, if one were interested in implementing such regulations with a concomitant hardening of the central bank's behavior, then the results remain valid. Thus the authors find that undercapitalized banks increased their capital target ratios more quickly than banks that had higher initial capital.

The study by Jacques and Nigro (1997) deals exclusively with the consequences of the Basel I Accord, as it concentrates on the years 1990-91, which is the period before the FDICIA was passed. Their finding was in line with those of Aggarwal and Jacques (1997, 2001); however, the problem inherent in this study is the very low number of undercapitalized institutions in Jacques and Nigro's sample – less than 2 percent of the total number of banks, which may reduce the reliability of some of their estimates.

Following studies present non-U.S. evidence regarding the relationship between capital ratios and credit risk. Ediz, Michael, and Perraudin (1998), employ confidential U.K. data, including detailed information about the balance sheets and profit and loss accounts of all British banks, from 1989 to 1995. It uses a limited-information technique that differs from that of the Shrieves and Dahl (1992) framework mentioned earlier, and

they found evidence that capital regulations were effective in increasing the capital to meet the minimum standard. Unfortunately, Ediz et al.'s model leads to a puzzling conclusion: banks are adjusting their capital levels each year by more than the difference between the current level and the target they have in mind, which means that banks are overshooting their targets (and by more and more each year).

The study by Rime (2001) is interesting, because it provides the first application of the Shrieves and Dahl (1992) model to non-U.S. banks during 1989-1996. His results indicate that Swiss banks reacted to capital regulations by increasing their capital, but that this did not change banks' risk-taking behavior. One of the possible problems with this study is that Rime adopted the PCA regulatory classification to measure regulatory pressure on Swiss banks; this may be inappropriate, given that the additional requirements set out by PCA have not been formally adopted by any country other than the United States.

Patrick Van Roy (2003) studies banks in seven G10 countries (Canada, France, Italy, Japan, Sweden, United Kingdom, and the United States) in a panel data set for the 1988-95 period, and achieved similar results. Godlewski (2004) studies the response of banks in 30 emerging market countries in Central and Eastern Europe, Asia, and South America to such regulations; his results corroborate the existing findings for banks in developed countries, and also show that regulatory, environmental, and legal milieu play important roles in bank capitalization and credit risk-taking behavior in emerging market economies.

To assess the impact of deposit insurance and regulatory restrictiveness on the effectiveness of capital regulations, studies by Demirguc-Kunt et al. (1999, 2001) and Barth et al. (2000) are examined. Demirguc-Kunt et al. provide evidence that explicit deposit insurance tends to be detrimental to bank stability, especially when bank interest rates are deregulated and the institutional environment is weak. Evidence provided by Barth et al. (2000) indicates that a positive relationship exists between the degree of regulatory restrictiveness and banking sector fragility.

We summarize the finding of the articles discussed in the review section, as follows: these articles generally support the idea that undercapitalized banks increased their capital adequacy ratios in the first half of the 1990s; a similar trend was observed for

well-capitalized banks, but to a lesser extent. However, there is little consensus among the reviewed literature that banks, whether adequately capitalized or not, engaged in riskier activities because of changes to capital regulations.

Based on the background presented above, in the present study, we analyze the following: (i) the change in actual capital ratios in response to regulatory minimum capital ratios of banks; (ii) the relationship between change in risk and change in capital ratios to examine if the increase in capital ratios came at the cost of higher risk-taking or not; (iii) impact of different important elements on the relationship between change in risk and change in capital, which include: liberalization (foreign direct investment as a percentage of Gross Domestic Product(GDP); bank activities restrictiveness index ; different characteristics of deposit insurance schemes; and domestic credit as percentage of GDP.

The present study differs from other/previous studies in several ways: (i) the data is a panel data of developed and developing countries; and (ii) we extend the existing literature, more specifically the study of the relationship between capital ratios and risk across different dimensions, liberalization, bank activities restrictiveness index, different deposit insurance schemes, and domestic credit as percentage of GDP.

Empirical Models

In the model utilized, observed changes in bank capital ratio and portfolio risk levels are broken down into two components: (i) discretionary adjustment and (ii) changes caused by an exogenously determined random shock. Therefore, observed changes are

$$\Delta CAPRAT_{j,t} = \Delta^{d} CAPRAT_{j,t} + E_{j,t} \tag{2.1}$$

$$\Delta RISK_{j,t} = \Delta^{d} RISK_{j,t} + U_{j,t} \tag{2.2}$$

where $\Delta CAPRAT_{j,t}$ and $\Delta RISK_{j,t}$ are the observed changes in capital ratios and risk levels for bank j in period t, respectively. $\Delta^{d} CAPRAT_{j,t}$ and $\Delta^{d} RISK_{j,t}$ represent discretionary adjustments in capital ratios $CAPRAT_{j,t}$ and risk levels, respectively. $E_{j,t}$ and $U_{j,t}$ are exogenous shocks. Banks may not be able to adjust to their desired capital ratios and risk

levels instantaneously; thus, following Shrieves and Dahl (1992), the discretionary changes ($\Delta^d CAPRAT_{j,t}$ and $\Delta^d RISK_{j,t}$) in capital and risk are modeled using a partial adjustment framework, which allows for changes in discretionary capital and risk in this period, t, to be proportional to the difference between the target levels in period, t, and the levels existing in period t-1.

$$\Delta^d CAPRAT_{j,t} = \alpha (CAPRAT^{*}_{j,t} - CAPRAT_{j,t-1}) \quad (2.3)$$

$$\Delta^d RISK_{j,t} = \beta (RISK^{*}_{j,t} - RISK_{j,t-1}) \quad (2.4)$$

where $CAPRAT^{*}_{j,t}$ and $RISK^{*}_{j,t}$ are bank j's target capital and risk levels at time t, respectively. $CAPRAT_{j,t-1}$ and $RISK_{j,t-1}$ are bank j's actual capital and risk levels at time t-1, respectively. We assume $0<\alpha,\beta<1$.

Substituting equations (2.3) and (2.4) into equations (2.1) and (2.2), respectively, the observed changes in capital and risk can be written as:

$$\Delta CAPRAT_{j,t} = \alpha (CAPRAT^{*}_{j,t} - CAPRAT_{j,t-1}) + E_{j,t} \quad (2.5)$$

$$\Delta RISK_{j,t} = \beta (RISK^{*}_{j,t} - RISK_{j,t-1}) + U_{j,t}) \quad (2.6)$$

In equations (2.5) and (2.6), the observed changes in capital and risk in period t are functions of the target capital and risk levels, the lagged capital and risk levels, and any exogenous factors. Target capital and risk levels are not directly observable, but they .are assumed to depend upon some set of observable variables.

In line with Aggarwal and Jacques (1998) and Jacques and Nigro (1997), this study argues that target capital ratio – *CAPRAT** in equation (2.5) – depends on a number of explanatory variables, including the size of the bank (*SIZE*), bank's income (*ROA*), investment in government bonds (*BONDS*), and liquidity of assets (*LIQUIDITY*). Similarly, target level of risk – *RISK** in equation (2.6) – depends on *SIZE*, loan-loss reserves (*LLOSS*), *BONDS*, and *LIQUIDITY*. Moreover, *SIZE* and *ROA* variables were taken from Shrieves and Dahl (1992). On the right hand side of the equations we put the change in capital ratios ($\Delta CAPRAT$) and change in risk ($\Delta RISK$) for capital and risk equations respectively.

To develop the model fully, we add additional variables and categorize the variables thus: (i) Regulatory Dummy Variable, (ii) Bank-Specific Variables, (iii) Country-Specific/Macro-economic Variables, (iv) Year Dummy, (v) Deposit Insurance, and (vi) Regulatory Restrictiveness. All the variables mentioned in the previous paragraph fall under the Bank-Specific Variables category. We describe each of these variables in detail below.

A list of these variables, with expected signs, is presented in the Appendix to this Chapter (Appendix A – Chapter 1). The complete model is also presented at the end of this section as equations (2.7) and (2.8). Following Aggarwal and Jacques (1998) and Jacques and Negro (1997), we estimate the two simultaneous equations with three stage least square technique.

Regulatory Dummy Variable (REG_DUM). Different studies have formulated this regulatory pressure dummy in different ways. The main idea is to create a dummy variable that takes a value of one for undercapitalized banks (those whose actual capital ratios are lower than the regulatory minimum) and a value of zero for adequate or overcapitalized banks (those whose capital ratios are equal to or higher than the regulatory minimum). In the present study, we will follow Van Roy (2003) in constructing this variable; the advantage of such a construction is that it accounts for the following: the level below which banks should be regarded as undercapitalized and hence influenced by capital ratios; and the size of the gap between the bank's capital ratio and the threshold level, which will reflect the magnitude of regulatory pressure experienced by such banks.

We set up the dummy (REG) to be equal to the difference between the regulatory minimum capital ratio (THR) and the actual capital ratio when the bank is undercapitalized. For overcapitalized or adequately capitalized banks, the dummy takes a value of zero.

$$REG = \begin{cases} THR - CAR & if CAR < THR \\ 0 & otherwise \end{cases}$$

Banks having capital ratios lower than the regulatory minimum are classified as undercapitalized, and those with capital higher than the regulatory minimum are classified as over or adequately capitalized.

We expect to find a positive and significant coefficient for this variable in the *CAPRAT* equation (2.5), indicating that regulatory pressure compelled the undercapitalized banks to increase their capital ratios. In the *RISK* equation (2.6), we expect to find an insignificant coefficient for this equation, indicating that such capital regulations did not result in an increase in risk-taking activity on the part of banks.

Bank-Specific Variables. Following Shrieves and Dahl (1992) and Aggarwal and Jacques (2001), we select the following variables. We exclude *ROA* from the *RISK* equation (2.6) and *LLOSS* from the *CAPRAT* equation (2.5) to make the system exactly identical. The reasons behind the expected signs are explained below.

Natural logarithm of bank's total assets (SIZE). Following Jacques and Nigro (1997), Aggarwal and Jacques (1998), and Van Roy (2003), natural logarithm of total assets, SIZE is included because larger banks have better access to capital markets. So, they have lower risk. Therefore, we assume that SIZE has a negative relation with both the target level of capital and risk. This is also related to the "too big to fail" hypothesis.

Bank's profitability (ROA). ROA is included in the equation, because profitable banks may prefer to increase capital through retained earnings rather than through equity issues. Studies by Jacques and Nigro (1997), Aggarwal and Jacques (1998), and Van Roy (2003) all include some variant of such a variable. The variable is expected to have a positive relationship with capital ratio.

Current loan loss provisions to potential bad loans (LLOSS). Following Van Roy (2003), we include *LLOSS*. This variable is deducted from outstanding loans and will therefore lead to a decrease in risk-weighted assets. Thus, a negative relationship will exist between target risk and loan loss provisions for bad loans.

Ratio of government securities to total assets (BONDS). Banks with a higher percentage of government securities can be expected to have higher capital ratios through the sale of securities. As Aggarwal and Jacques (2001) point out, if banks with large holdings of government securities retained – rather than sold – these securities during a falling rate environment, then they may need lower levels of capital to comply with existing regulations. At the same time, banks with high ratios of government securities in their asset portfolios will be exhibiting lower levels of risk. Thus, we proceed with the

assumption that both capital and risk are inversely related to a bank's holding of government securities and bonds.

Ratio of liquid reserves to total assets (LIQUIDITY). Banks with relatively higher liquidity ratios are faced with less risk and, hence, need to hold less capital; such banks may be willing to increase their levels of risk. Therefore, we assume that a negative relationship should exist between the ratio of liquid reserves to total assets and the level of a bank's capital, and that a positive relationship between this ratio and the level of a bank's portfolio risk should exist.

Country-specific/macro-economic variables (GDP_GROWTH, INFLATION, and EXCHANGE_RATE)

We include three variables – inflation, exchange rate and per-capita GDP growth rate – to control for country-specific heterogeneity. We expect these variables to be significant, indicating that the difference between the banking environments across countries is important to the success of capital regulations. We followed Chiuri et al. (2000) and include these variables to control for country-specific heterogeneity.

Year Dummy (YEAR)[4]The interaction term between the REG and the year dummy variables was used to examine the impact of capital regulation on actual capital ratio and risk across time. We expect these variables to have significant and positive signs on the capital ratio equation (equation (2.7)). On the other hand, in the risk equation, they should have negative signs or be insignificant, indicating that the implementation of capital ratios did increase the risk-taking of commercial banks (equation (2.8)).

Deposit Insurance (DEP_INS). These variables reflect the characteristics of the deposit insurance scheme of a country. Demirguc-Kunt et al. (2001) finds that some of these characteristics are positively related to the probability of a financial crisis. In an earlier study into the determinants of a banking crisis, Demirguc-Kunt et al. (1998) found that explicit deposit insurance positively correlated with the probability of a banking crisis. Kane (1989) attributed the U.S. Savings and Loan crisis of the 1980s to three

[4] Van Roy, 2003.

factors: generous deposit insurance, financial liberalization, and regulatory failure. All three of these factors encouraged excessive risk-taking and subsequent default.[5]

Our variables were taken from the World Bank Survey of Bank Supervision (2003). Following an approach similar to that of Demirguc-Kunt et al. (2001), three variables are included for deposit insurance. We will create a dummy variable based on the following criteria: (i) the existence of deposit insurance, (ii) a method of funding deposit insurance (i.e., government, banks or both), and (iii) a change in insurance fees, in response to changes in the banks' risk positions. Demirguc-Kunt et al. (2001) already used the first two variables to find that when deposit insurance exists and when the government funds it, probability of banking crisis increases.

We expect these variables to be negatively related to capital ratios and positively related to banks' risk-taking. We argue that the stronger the insurance scheme, the less interested the banks will be in undertaking the painful and costly measures of implementing capital ratios. We expect to find negative and significant coefficients for these variables in the *CAPRAT* equation, but the banks will have a higher incentive to take on more risks. When banks receive assurance from the government that parts of any financial losses will be covered by an insurance fund, they become reluctant to halt increases in risk-taking. We expect to find positive and significant coefficients for the corresponding variables in the *RISK* equation.

We will run the two-equation system (i.e., equations (2.5) and (2.6)) three times, alternatively using each of these dummy variables as specifications and checking to see if the coefficient of the dummy variable is of the desired sign or not.

Regulatory Restrictiveness (REG_RES). We use this variable *vis-à-vis* degree of restrictiveness of banks' activities, as created and used by Barth, Caprio, and Levine (1999, 2001, and 2002). Based on a cross-section of 45 countries, Barth et al. find that the higher the level of restriction on a bank's activities, the higher the probability of a bank

[5] As Demirguc-Kunt et al. (1998) points out, there are two views regarding the impact of deposit insurance. According to the first view, deposit insurance should enhance the financial stability of the banking system by putting an end to depositor runs. According to the second view, however, it can create moral hazards. As a bank's ability to attract deposits no longer reflects the risk of its asset portfolio, the bank is encouraged to finance high-risk, high-return projects. If banks take on risks that are correlated, then systematic banking crises may become more frequent. Based on empirical evidence, one can claim that the second view is more dominant role, especially where institutional frameworks are underdeveloped and regulatory supervision is weak.

crisis. However, Demirguc-Kunt and Detragiache (1998) find the opposite: that a banking crisis is more likely to occur when countries have liberalized their commercial banking sector, even after controlling for other country characteristics. They also find that the probability of such crisis declines by the presence of a strong institutional environment represented by rule of law, low levels of corruption, and good contract enforcement.

In order to explore the relationship between restrictiveness of the banking sector and implementation of bank regulations, we follow the method of Barth et al. (2002). We will code restrictiveness in each of the four lines of non-traditional business (i.e., insurance, real estate, securities, and ownership of non-financial firms) first. The codes are 1 = unrestricted, 2 = permitted, 3 = restricted, and 4 = prohibited. Then we form a composite index of overall restrictiveness across all activities by taking the average of the scores associated with individual activities. We insert the variable in the two-equation system (equations (2.5) and (2.6)) and check to see if the coefficients are of the desired sign.

We expect to find that if banks are less restricted, they will find it easier to meet capital adequacy ratios without taking higher risk; they have the opportunity to diversify into different businesses and thus avoid risk. We therefore expect to find a positive relationship between this variable and *CAPRAT* in equation (2.5). In the *RISK* equation (2.6), we expect to find that this relationship will be negative, indicating that higher diversification leads to lower risk.

It can nonetheless be argued that financial liberalization may also result in an increase in risk-taking, especially when there is lack of prudent regulation and supporting institutions to ensure effective supervision. Mehrez and Kaufmann (1999), Glick and Hutchison (2001), Arteta and Eichengreen (2002), and Noy (2004) find evidence to support this.

*Foreign Investment as Proxy for Liberalization (FINV)***.** It should be pointed out that all of the countries included in the sample underwent considerable privatization (i.e., reducing government ownership) and liberalization (i.e., allowing foreign entry) throughout the 1990s, as part of the structure of their adjustment programs.[6] However,

[6] Structural Adjustment Programs (SAPs) were sponsored by donor agencies like the World Bank and IMF throughout the 1990s, and implemented in many developing countries. The SAP policy package had

liberalization in the financial services obviously took different forms in different countries. Notwithstanding these diverse liberalization measures, allowing the entry of foreign banks and ownership by foreign banks were key components of liberalization programs. Such measures led to changes in the structure and operation of, and competition in, the domestic financial services industry. Such changes may have affected the relationship between risk-taking and capital adequacy requirements; hence, to control for this change, we include as one of the variables in the model annual foreign investment, as a percentage of gross domestic product. The coefficient of this variable will show us the impact of changes in foreign investment on capital ratios and commercial banks' risk-taking.

Level of Financial Development (FDEV). In accordance with the existing literature, we use domestic credit from the banking sector as a percentage of GDP as a measure of a given country's level of financial development. Because we use an unbalanced-panel dataset, we are able to infer how the relationship between risk-taking and capital adequacy changes with fluctuations in the financial sector's level of development. This is important in the context of developing countries, where we cannot take the existence of a well developed and sustainable financial sector for granted.

The variables discussed thus far are presented via the following two equations. Equation (2.7) has change in capital ratios as the dependent variable, and equation (2.8) has change in risk as the dependent variable. Full descriptions of the expected signs are presented in Appendix A – Chapter 2, at the end of this chapter.

$$\begin{aligned} DCAPRAT_{ijt} &= \alpha_0 + \alpha_1 DRISK_{ijt} + \alpha_2 ROA_{ijt} + \delta_1 REG\_DUM_{ijt} + \alpha_3 BONDS_{ijt} + \alpha_4 LIQUIDITY_{ijt} \\ &+ \alpha_5 SIZE_{ijt} + \alpha_6 GDP\_GROWTH_{jt} + \alpha_7 INFLATION_{jt} + \alpha_8 EXCHANGE\_RATE_{jt} + \\ &\alpha_9 YEAR_{jt} * REG\_DUM_{jt} + \alpha_{10} DEP\_INS_{jt} + \alpha_{11} REG\_RES_{jt} + \alpha_{12} FINV_{jt} + \alpha_{13} FDEV_{jt} + u_{jt} \end{aligned} \quad (2.7)$$

$$\begin{aligned} DRISK_t &= \beta_0 + \beta_1 DCAPRAT_t + \beta_2 LLOSS_t + \delta_1 REG\_DUM_{ijt} + \beta_3 BONDS_t + \beta_4 LIQUIDITY_t \\ &+ \beta_5 SIZE_t + \beta_6 GDP\_GROWTH_{jt} + \beta_7 INFLATION_{jt} + \beta_8 EXCHANGE\_RATE_{jt} + \\ &\beta_9 YEAR_{jt} * REG\_DUM_{jt} + \beta_{10} DEP\_INS_{jt} + \beta_{11} REG\_RES_{jt} + \beta_{12} FINV_{jt} + \beta_{13} FDEV_{jt} + v_{jt} \end{aligned} \quad (2.8)$$

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elements covering policy reforms in many areas, such as financial institutions, financial markets, trade reforms, currency reforms, and revenue policy reforms.

The system is defined in such a way as to take account of interdependence between capital and bank risk-taking (i.e., change in *RISK* in the *CAPRAT* equation and change in *CAPRAT* in the *RISK* equation). As a result, we estimate the model in two steps: first we estimate each of the equations separately with 2SLS, and then we estimate them simultaneously with 3SLS estimation technique. Summary of expected signs of the important variables are presented in Appendix A at the end of this chapter.

A sample of countries, together with dates of adoption and implementation of capital regulations, is given at the end of this chapter. Data comes from several sources (IMF-IFS database, WDI online, 2005; Bank scope, 2005), and Table I of Appendix B, shows the capital ratios for 10 OECD countries. Table II outlines the adoption of the Basel I Accord between 1988 and 2002 and Table III provides a summary of the previous studies in the field. Our sample will be based on Table IV (-a, -b, -c). In Table IV-a, we merge the earlier samples of Chiuri et al. (2000) and IMF Working Paper WP/05/38 to create our own sample in the fourth column. Table IV-b shows a breakdown of developed and developing countries, and Table IV-c gives a year-by-year breakdown. In column (3) of this latter table, a three-year window is shown, and in column (4) a five-year window since the date of adopting the Accord.

Empirical Findings

Data for macro-economic variables come from WDI online 2005, whereas data for bank-specific variables come from the Bank Scope 2005 database. Table I in the empirical appendix at the end of this chapter, presents summary statistics of the sample, with the first three left-hand columns presenting data for all banks. This data shows 1,622 bank-year observations from all countries. Of this total, 330 are from developing countries and 1,336 from developed countries (they do not add up as they come from two separate files). The last three columns of Table I show data for undercapitalized countries. In total, there are 258 undercapitalized bank-year observations, out of which 51 are from developing countries and 223 from developed countries.

The most important variables for this study are total capital, total capital ratio, tier-1 capital and tier-1 capital ratio. The averages for total capital and tier-1 capital for all countries are 2,447,330.37 and 1,496,010.02 thousand United States dollars (USD),

respectively. The corresponding figures for developing countries are 828,195.91 and 756,397.18 thousand USD, respectively, while for developed countries, the figures are 2,819,642.79 and 1,709,857.54 thousand USD, respectively. For total capital and tier-1 capital ratios, the figures for all countries are 13.56 and 11.04 percent, respectively; for developing countries, 14.42 and 11.58 percent, respectively; and for developed countries, 13.42 and 11.40 percent, respectively. This finding is surprising, because developing countries have higher average capital ratios than their counterparts in developed countries.

The total capital ratio and tier-1 capital ratio of undercapitalized banks in all countries are 5.35 and 1.42 percent, respectively. For developing countries, the corresponding ratios are 2.24 and -1.04 percent respectively, whereas for developed countries, they are 5.82 and 2.68 percent. Clearly, there is an urgent need to study these banks and their behaviors as they operate amidst divergent economies and policy regimes over time.

Tables 2.2-a, 2.2-b and 2.2-c, present 3SLS estimates on the models of two simultaneous equations system (equations (2.7) – capital equations and (2.8) – risk equations). Each model has two equations, namely the capital and risk equations. Each model is presented in a pair of columns in Tables 2.2-a, 2.2-b, and 2.2-c (for example, columns 2 and 3 of Table 2.2-a present one model). Two models for total capital are presented in the first left-hand column: one using Van Roy's dummies and another for simple dummies representing undercapitalized banks. Two models in the last four columns are for tier-1 capital. Again, two sets of dummies are used. To elaborate, the first header row shows whether total capital or tier-1 capital was used. The second header row shows the equation name (i.e., capital or risk equation), while the third header row shows the dummy variable being used to identify the undercapitalized banks (Van Roy or simple dummies).

Table 2.2-a-measures the estimates for all countries, Table 2.2-b for developed countries only, and Table 2.2-c for developing countries only.

Relationship between Capital Ratio and Risk. The change in risk variables in capital equations and the change in capital variables in the risk equations has a negative and significant coefficient in each of the equations of all the models, which is expected.

Table 2.2-b and 2.2-c present similar results for developed and developing countries. All coefficients are negative and significant.

The sign and significance of these coefficients are similar to the findings of Jacques (1998), Van Roy (2005), and other studies within the context of developed OECD countries. The key highlight of the present study is its provision of evidence showing that the relationship also holds across developing countries, not just developed countries. As a result, this study expands the evidence into a cross-country context where national banking sectors are heterogeneous.

Impact of the Basel I Accord on Capital Ratios. The focus is on the capital equations in each pair of Tables 2.2-a to 2.2-c. Table 2.2-a shows that the coefficients of the regulation dummy is significant and positive in all models; this too is expected – it shows that overall, across all developing and developed countries, Basel and similar national capital regulations did have a positive impact on the capital ratios of undercapitalized banks. These banks were forced to increase their capital ratios in the face of pressure from regulatory agencies. In addition to this, Table 2.2-a shows that this is true for both total and tier-1 capital.

For developed countries, Table 2.2-b shows that the coefficient of the regulatory pressure dummy was positive and significant only for models with total capital. Such was not the case for tier-1 capital, and this warrants further explanation. OECD countries officially started to adopt the 8 percent total capital requirement and 4 percent tier-1 capital requirement at year-end 1992, but even before that, they imposed these ratios on their respective banks. Van Roy (2005) points out those banks in OECD countries reacted to and reached the required ratios of the Basel I Accord in 1989. It is thus possible that much of the response of undercapitalized banks occurred before the five-year sample period of this study (1992 to 1996). Furthermore, in the initial stages, the national monetary authorities of OECD countries put more emphasis on core capital build-up, which explains the insignificant coefficients in the risk and capital equations.

Evidence with respect to developing countries is, of course, equally important. Table 2.2-c shows that all the coefficients of regulatory pressure dummies in capital equations were significant and positive, which again implies that undercapitalized banks were forced to increase both total and tier-1 capital, due to capital regulations.

These results, taken together, explain the popularity and widespread application of regulations across many different countries.

Impact of the Basel I Accord on Portfolio Risk. In the risk equations in Table 2.2-a, we have only one significant and negative coefficient for the simple dummy variable and tier-1 capital. In the case of developed countries (Table 2.2-b), we find the coefficients to be negative and significant in three out of four alternate models, which is desirable. This implies that increases in the capital ratios of undercapitalized banks were not accompanied by a concomitant increase in risk.

Such is not the case for developing countries (Table 2.2-c). There, the coefficients are significant, but positive in the total capital and tier-1 capital models only with Van Roy's dummies. This indicates to an increase in risk-taking activities in the wake of implementing capital regulations. However, in the models with simple dummies, the coefficients are insignificant, but these results do not hold across all models.)

Impact of Liberalization. Table 2.2-a does not show significant coefficients for this variable in any capital or risk equations, save for the last column. There, the coefficient in the risk equation is negative, which implies that liberalization results in reduced risk-taking on the part of banks.

Table 2.2-b shows that the variable has negative and significant coefficients in all four capital equations, but in risk equations, only one coefficient is significant (i.e., total capital).

In Table 2.2-c, the coefficients are positive and significant in terms of both the risk equations for total capital, but this does not hold for tier-1 capital.

From this evidence, we can conclude that in developed countries, higher liberalization is associated with lower bank capital ratios. This may be explained as a result of liberalization, where banks enjoy different options to raise capital when needed, hence the reduced urgency to raise capital ratios.[7] In developing countries it higher liberalization is associated with more risk also in one of the models. The evidence is nonetheless weak. Other results do not hold across different specifications;

[7] It can be also be argued that liberalization should make it relatively cheaper for banks to raise capital, compared to a relatively more restrictive regime; hence, the variable should be positively related to capital ratios. This study's evidence does not favor this argument.

Impact of Financial Development. Table 2.2-a shows that the coefficients of the risk equations for total capital models are both negative and significant, implying that as a percentage of domestic credit to GDP increases, risk-taking by banks decreases. For tier-1 capital models, we get similar results, but only for the model with a simple dummy variable.

Table 2.2-b derives ambiguous results for the impact of proxy for financial development variable in developed countries. The risk equations for the two tier-1 capital models have negative and significant coefficients, but for the total capital model, the risk equations with simple dummy variables show a positive and significant coefficient for this variable. Coefficients in the other equations are not significant.

For developing countries (Table 2.2-c) there is no significant coefficient in any equation.

Regulatory Dummy and Year Interaction. Table 2.3 presents evidence regarding the interaction of the dummy variable and successive years within a five-year window. Here, there are no consistent results. Coefficients are significant and positive for total capital and simple dummy equations in years one, three, and four. For tier-1 capital and simple dummy equations, the coefficients are again significant and positive, in years one and three. This provides weak evidence that undercapitalized banks continue to adjust their capital ratios throughout the five-year window following the adoption of capital regulations. Signs for risk equations are also inconsistent.

Impact of Restrictiveness of Banking Activities. In Table 2.4, we present evidence regarding the relationship of capital ratios and the risk and effectiveness of capital ratio regulations, within the context of restrictions imposed by central banking authorities (see the last row of the Table 2.4). We change the basic model (Tables 2.2-a to 2.2-c and Table 2.2) by dropping the undercapitalization dummy variable and alternatively inserting the index of restrictiveness. This is one of the alternative modifications of the equations 2.7 and 2.8.

Column (3) of Table 2.4 shows that there is a negative and significant coefficient for index of restrictiveness in the risk equation. This means that the higher the value of the index (i.e., the more restrictiveness the regime is), the lower the level of risk-taking on the part of banks. This findings supports the evidence of Mehrez and Kaufmann

(1999), Glick and Hutchison (2001), Arteta and Eichengreen (2002), and Noy (2004), but all the coefficients of the capital equations were nonetheless insignificant. For the capital equation in column (4), the variable is likewise not significant.

Impact of Deposit Insurance Schemes. Columns (4) and (5) of Table 2.4 present results for the depositor insurance dummy variable. It takes a value of one if the country has a deposit insurance scheme and zero if it does not. The coefficient of the depositor insurance dummy is positive and significant in the risk equation, which means that countries that have depositor insurance experience higher risk-taking on the part of its banks. This supports the "moral hazard" hypothesis regarding bank behavior, as explained by Demirguc-Kunt et al. (1998, 2001).

In columns (6) to (9) of Table 2.4, we present the results for the second depositor insurance dummy variable. These results focus on the question, "Is depositor insurance funded by the government, the banks, or both?" We create three dummy variables, with each taking a value of one when the condition is met, and zero otherwise.

Although the results are not presented here, we do not find significant coefficients when the insurance program is funded by the government. When it is funded by the banks, however, we find that the banks' risk-taking declines and the coefficient of the dummy is negative and significant in column (7). However, it is positive and significant in column (6), which suggests that the capital ratios of banks increase when depositor discipline is funded solely by the banks.

In columns (8) and (9) of Table 2.4, the coefficient is significant and positive, indicating that when the depositor insurance scheme is funded by both the banks and the government, the banks have a tendency to take on more risk. This is in line with the findings of Demirguc-Kunt et al. (1998, 2001), who found that full government funding is associated with a higher level of bank crisis. In contrast, our evidence is from bank-level data, indicating a reduction in risk-taking by banks if they bear part of the burden of financing the insurance.

The last two columns (columns (10) and (11)) of Table 2.4 represent the dummy variable, which asks the question, "Do deposit insurance fees charged to banks vary, based on some assessment of risk?" If the answer is "yes," then the dummy takes a value of one; if "no," then it is zero. We do not have a significant coefficient for the variable in

the capital equations, but in the risk equation, we have a negative and significant coefficient. This has important implications, as it indicates that if insurance fees are indeed tied to some measure of risk, then banks tend to take on lower risk.

Conclusion

Evidence presented in the paper supports the view that capital and risk are indeed inversely related to one another. At the same time, evidence shows that Basel and similar capital regulations are successful in both developed and developing countries, in the sense that the undercapitalized banks in these countries are forced to increase their capital ratios. Evidence also suggests that such a positive improvement is not at the cost of higher risk. Evidence regarding the change or risk and capital ratios of undercapitalized banks is ambiguous.

Likewise, evidence regarding liberalization and financial development in developing countries is ambiguous, but in developed countries, we find that a higher degree of liberalization is associated with lower capital ratios. Again, for same countries, we find that a higher degree of financial development results in a lower amount of risk-taking by banks. This aggregate evidence, however, is not robust across different specification of the models.

At the same time, evidence supports the view that in relatively more restrictive environments, banks abstain from taking higher risks. As for depositor discipline, there is evidence supporting the following conclusions: (i) when depositor insurance exists, it creates incentives for banks to take on higher risks than they would otherwise take, (ii) when such insurance schemes are funded by banks themselves, banks take on less risk and also tend to hold more capital, (iii) if such insurance schemes are funded by both the government and the banks, banks tend to take higher risk than would otherwise be the case, and (iv) when the premiums of such insurance schemes are tied to some measurement of risk, banks again show a tendency to take less risk. These findings illustrate some of the desirable characteristics of bank deposit insurance schemes being implemented in different parts of the world.

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Chapter 3. The Impact of the Basel I Accord on Credit Expansion in Developing Countries

The G10 countries adopted and implemented the Basel I Accord in 1988 and 1990-1993, and central bank authorities in different countries around the world started to implement national versions of the Accord throughout the 1990s and early 2000s. The primary objective behind such a worldwide acceptance was to promote the soundness of the national financial system, to "catch up" with the international banking standards in the wake of financial liberalization and integration, and to foster economic growth with the help of a better-functioning financial system.

During the 1990s and early 2000s, several concerns were raised by academia and financial practitioners around the world about several adverse impacts of the Basel I Accord, like capital regulations on the banking system of host countries in particular, and consequences in terms of the economy as a whole. Over the years, this debate took the form of two key questions (IMF, Survey): What is the reaction of banks' behavior to such an Accord, which entails a capital charge of the risks they take? What is the impact of such changes in their behavior with respect to lending? The second question is central to what is now popularly called the "credit crunch" literature.

The previous chapter of this dissertation primarily examined the impact of regulatory capital ratios on actual capital ratios and risk taking of banks. But in the present study, we examine a different and related field, namely, the impact of capital regulations (minimum capital requirements) from different point of views: (i) the lending behaviour of banks; (ii) several variables representing equity; loan; and profitability; and (iii) risk sensitivity of loans.

Literature Review

If banks face a constraint of capital for the loans they want to make, they must raise new capital. Nonetheless, asymmetric information and "lemons" problems may prevent them from issuing new capital. Myers and Majluf (1984) point out that banks may prefer to shrink rather than issue new equities, due to asymmetric information and "lemons" problems. Holmtrom and Tirole (1997) provide evidence revealing the

importance of capital as determinants of investment, monitoring, and interest rates, and the importance of capital in terms of macro-economic implications, especially with regard to banks. As a result of such difficulties associated with raising new capital and the concomitant importance of the role of capital in the decision-making of banks, banks may decrease lending in response to capital regulation. This is the central argument of the "credit crunch" literature.

Notwithstanding the above argument and evidence on "credit crunch," banks may respond positively to capital requirements and increase – rather than decrease – capital and bank lending. To date, a substantial body of literature has dealt with this issue. Recent work by Chami and Cosimano (2001) reveals that banks are more likely to expand its lending to meet pent-up demands for credit, and risk punishments from other banks.

Using the data from the states and form New Jersey during 1991-1992, Bernanke and Lown (1991) demonstrated that loan growth at individual banks during the 1991-1992 was positively linked to initial capital ratios. They also find evidence that declines in bank capital have contributed to the slowdown in lending, which is consistent with 'capital crunch' hypothesis. However, they cautioned that the magnitude of the effect is not insignificant but also not extremely large either. Peek and Rosengern (1995) find the similar evidence of "credit crunch" for similar period of time by focusing on bank deposits. In addition, the results of several studies on Japanese banks (Ito & Sasaki, 1998; Kim & Moreno, 1994; Who, 1999; Honda, 2002) show that the result of Basel I on Japan was similar to that on the United States.

Berger and Udell (1994) investigate the impact of risk-based capital adequacy on credit crunch in the United States as well as some alternative explanations of credit decline of early 1990s. They compared how bank portfolios changed in the early 1990s from the 1980s and how these changes were related to key variables related with risk based capital and other variables (large banks, banks with weaker capital ratios, and banks supervised by the OCC). Their findings indicate that the risk based capital related credit crunch hypothesis fares the worst of all the alternative explanations of the bank credit reallocation of the 1990s. On the other hand, macro-regional effects dominate the other factors behind the credit decline.

With respect to emerging market countries, Chiuri et al. (2002) argue that the introduction of higher minimum bank capital requirements may well induce a contraction of bank credit, and aggregate slowdown. Their sample includes 16 emerging countries, 10 of which experienced both regulatory change and financial crises; another five were non-crisis countries. This study confirms the existence of "credit crunch." Nonetheless, Barajas et al. (2005) did not find strong evidence of a Basel-induced credit crunch in Latin America.

Watanabe (2004) analyzes the impact of prudential regulation in slowing down credit expansion, countering the effectiveness of monetary policy in stimulating economic conditions in Japan. Stagnation in Japan persisted during the last decade despite monetary easing, as evident by "zero interest rate policy" since February 1999, which proved to be ineffective.

Over the years, several scholars have studied the impact of capital regulations intensively. Aggarwal and Jacques (1997, 2001) and Jacques and Nigro (1997) deal exclusively with the impact of such regulations on the risk-taking behavior of commercial banks and changes in capital ratios. One of the major objectives of Basel was to increase the capital ratios of undercapitalized banks; these studies on developed countries find that the basic relationship between risk-taking and capital ratios were negative and that such regulations did, in fact, increase the capital ratios of undercapitalized banks. Van Roy (2003) later found evidence that risk-taking by commercial banks and capital ratios were negatively related in developing countries, confirming earlier findings of the literature. Hussain and Hassan (2004) find similar results, and also find that the impact of Basel I fell short of expectations (i.e., did not increase the capital ratios of banks).

As already pointed out, many developing and emerging market countries have adopted and implemented (or are at different phase of implementing) a national capital regulation regime. During the 1990s and early 2000s, the principles of Basel I have emerged as the core principles of capital regulation regimes around the world, but data on implementation years and stages throughout the world was relatively scarce and remains scattered.

The objective of the present study is to examine the impact of the implementation of Basel I-like capital requirements on bank lending in emerging market countries. We

expand upon previous empirical analysis in several ways. First, our sample consists of a larger sample of emerging market countries and not just an individual country, as is the case with existing literature. Second, we focus on identifying supply-driven credit restrictions by utilizing data on individual banks that are active in each sampled country, rather than on country-level data. (The use of such bank-wise disaggregated data is not common in the literature.) Third, we use a model that examines both external and regulatory shocks to bank capital. Fourth, we use the frameworks of Peek and Rosengren (1995) and Berger and Udell (1994). The former's framework is used to test the short-run impact of Basel I; the latter's framework, being of a long-run nature, is used to examine the time dimension of risk-based capital, and it thus allows us to test the structural change regarding banks' overall loan supplies. Finally, because banking sectors from emerging market countries differ from one another in many respects, we take into account international (as well as inter-temporal) dimensions with the help of panel analyses, and by including control variables for year and macro-economic effects.

Model Description

To fulfill the objectives of this paper, we need first to identify the countries in the emerging market region who adopted the Basel I Accord, and make note of when it was adopted. We rely on IMF (2003) and World Bank surveys of bank regulations for this. We construct a database of individual banks from 1987 to 2004, to test for structural changes *vis-à-vis* banks' overall loan supplies.

The "capital crunch" hypothesis envisages that poorly capitalized banks will decrease deposits more rapidly than better capitalized banks, holding the loan demand effects constant (Peek & Rosengren, 1995). We adopt the following equation from Peek and Rosengren (1995) and Chiuri et al. (2000) to test the hypothesis. (For details, please see Appendix C – Chapter 3.) Instead of utilizing bank-specific dummy variables in these studies, we propose the use of countrywide dummy variables (given by vector X) to account for countrywide heterogeneity.

$$dD_{\tau}/A_{\tau-1} = a_0 + a_1 TC_{\tau-1}/A_{\tau-1} + (a_2 + a_3 TC_{\tau-1}/A_{\tau-1}) dTC_{\tau}/A_{\tau-1} + a_4 \log(A_{\tau}) + a_5 \log(ROA_{\tau}) + a'_j X + a'_i Dy_{\tau} + \varepsilon_D \quad (3.1)$$

with $\tau = (t-1, t, t+1)$,

$$dL_{\tau}/A_{\tau-1} = b_0 + b_1 TC_{\tau-1}/A_{\tau-1} + (b_2 + b_3 TC_{\tau-1}/A_{\tau-1}) dTC_{\tau}/A_{\tau-1} + b_4 \log(A_{\tau}) + b_5 \log(ROA_{\tau}) + b'_j X + b'_i Dy_{\tau} + \varepsilon_L \quad (3.2)$$

with $\tau = (t-1, t, t+1)$,

Superscript "d" represents change over the previous period. The variables TC represent total capital, D represents total deposit and L indicates total loan. These are normalized by the beginning of period assets, to reduce the potential heteroscedasticity problems with the error term. This is widely used in the literature. ε_D and ε_L are normal i.i.d. random errors in the deposit and loan equations, respectively.

The vector Dy_{τ} consists of year dummies, which use the year preceding the enforcement as a reference category. This controls for year-wise heterogeneity of the panel data set. As bank-specific variables, we include both log (A) (as the natural logarithm of the total assets of banks) and *ROA* (or the return on assets).

The coefficient a_2 captures the effect of a change in initial total capital over total assets on current deposit, over initial total assets where log of total assets and country/time varying act as controls. The impact of a change in total capital on current deposit over initial capital is shown by a_3 for undercapitalized banks.

In the second equation, b_2 represents the impact of a change in the ratio of initial total capital over total assets on current loan over initial total assets. As with the first equation, the coefficient b_3 measures the same impact but for an undercapitalized bank.

In the next step, the time dimension of risk-based capital is examined by using the framework of Berger and Udell (1994). We implement the two modifications of the original Berger and Udell (1994) approach, as proposed and adopted by Barajas et al. (2005). The first modification involves longer sample period compared to the original Berger and Udell (1994) approach, which places emphasis on the longer-term impacts of Basel I. In the second modification, Barajas et al. (2005) examine both the composition of bank assets and the real growth rate of loans.

In order to assess whether there is a significant change in means between the pre- and post-Basel periods in bank capital and lending, we initially regress each variable on an intercept variable:

$$V_{ijt} = BASELYR_{jt} \tag{3.3}$$

Vijt represents the ratio of equity to total assets (*EQTA*), total capital ratio. (*TOTCAPRAT*), the ratio of net loans to total assets (*NLOANTA*), the real annual growth rate of loans (*RLOANGROWTH*), return on assets (*ROA*), and net interest margin (*NIM*). Sub-indices *i*, *j*, and *t* stand for bank, country, and year, respectively, and *BASELYR* is a dummy variable for the adoption year of each country.

In line with the approach taken by Barajas et al. (2005), we run the following tests: (i) an OLS regression across countries and time, (ii) a fixed-effect regression with bank-specific intercepts, (iii) a regression that includes only country dummies, and (iv) a regression that includes a relative measure of financial development, *FINDEV*, as well as its interaction with *BASELYR*.

In the next step, we utilize a specification similar to Berget and Udell (1994) and Barajas et al. (2005), in order to test if loan supply declined in the wake of the implementation of Basel regulations. Bank loans are assumed to respond to lagged risk factors; if risk increases, banks decrease their lending activity. As a result, it can be argued that banks with higher levels of risk would tend to adjust by having a smaller loan portfolio on average, compared to safer banks. This is the "risk retrenchment" hypothesis discussed by Berger and Udell (1994).

We examine the following model to work with the hypothesis:

$$V_{ijt} = \alpha_0 + \alpha_1 BASELYR_{jt} + \alpha_2 RISK_{ijt-1} + \alpha_3 BASELYR_{jt}.Risk_{ijt-1} + \alpha_4 X_j \tag{3.4}$$

We alternatively use two dependent variables: the loan-asset ratio (*NLOANTA*) and growth rate of loans (*RLOANGROWTH*). Also included are three risk measures: capital ratio (*EQTA*), the ratio of nonperforming loans to total loans (*NPFRAT*), and a proxy for credit risk measure (*RWATA*) (i.e., risk-weighted assets divided by total assets)[8]. Our macro-economic controls are the real growth rate of GDP (to capture

[8] This measure of credit risk was adopted from Roy (2003) and Hassan (2005).

changes in loan demand), and the annual change in the inverse money velocity (to capture shifts in the public's demand for bank deposits). This is calculated as the absolute annual change in the ratio of money and quasi-money to GDP.

The coefficient of *BASELYR*RISK (*α3) measures the impact of the Basel I Accord on the marginal impact of risk. A positive value for this coefficient will imply that banks decreased loans even more in response to a drop in capital, which will confirm risk retrenchment. For the other variable measuring risk (the ratio of non-performing loans to total loans), a negative value of α3 will imply that banks contract loans in response to a rise in credit risk. If the value of coefficient α1 is negative, then we can conclude – regardless of their risk characteristics – that banks in the emerging market countries experienced a loan contraction following Basel.

Empirical Findings

Table 3.1 presents summary statistics for the important variables used in Chapter 3. Table 3.2 presents the estimates of equations (3.1) (column (2)) and (3.2) (column (3)), based on a fixed effect with bank-specific intercepts. Column (2) of the table shows that the sign of the coefficient of the change in total capital, divided by the total assets variable ($dTC_{\tau-1}/A_{\tau-1}$), is significant and positive. This implies that a change in deposit scaled by total assets is positively associated with a change in the bank capital endowment.

For the interaction term between total capital and change in total capital – each scaled by total assets ($TC_{\tau-1}/A_{\tau-1} * dTC_{\tau}/A_{\tau-1}$) – we find a negative and significant coefficient; given the set-up of the Peek and Rosengren (1995) model, this coefficient implies that as the interaction term increases for undercapitalized banks, the total deposit divided by total assets of the last period decreases.

Column (3) of Table 3.2 presents the estimates of equation (3.2). In this case, we find both the coefficients of total capital divided by total assets and the interaction variables are significant and positive. As a result, we do not find in this case evidence to support a "credit crunch."

In summary, evidence by way of these models and in support of the "credit crunch" remains ambiguous. This contradicts the findings of Chiuri et al. (2000), who found evidence in support of the "credit crunch."

In Table 3.3, several alternative dependent variables are presented across the columns: *EQTA*, *TOTCAPRAT*, *NLOANTA*, *RLOANGROWTH*, *ROA*, and *NIM*. Each panel presents different models: panel a: Year Dummies Only; panel b: Country Dummies Only; panel c: Countries and Year Dummies (Country Dummies Not Presented); panel d: Fixed Effects with Bank-Specific Intercept; Panel e: Financial Development Model; and Panel f: Financial Development Model Without Interaction.

The focus here is on the significant and signs of the dummy variable *BASELYR*, which takes a value of zero before and one after the dummy variable is implemented. In panel a, we present the model for the time dummy variables. We find significant and negative coefficients in the *EQTA*, *NIM*, and *RLOANGROWTH* columns, which means that these variables declined in value in the aftermath of implementing such regulations. On the other hand, *ROA* has a positive sign, which means that *ROA* increased after the implementation of capital regulations.

In panel b, we present models with country dummy variables. Here, we find significant and positive coefficients for the *EQTA* and *TOTCAPRAT* columns. On the other hand, for *NLOANTA*, *RLOANGROWTH*, *ROA* and *NIM* columns, the coefficients are negative.

In panel c, we present models for country and year dummies; here, there are negative and significant coefficients for the *RLOANGROWTH* and *NIM* columns.

Panel d presents models with fixed effects and bank-specific intercept. We have negative and significant coefficients for the *EQTA*, *NLOANTA*, *RLOANGROWTH*, *ROA*, and *NIM* columns.

Panel e presents models with financial development variable. We have positive coefficients in the *EQTA*, *TOTCAPRAT*, and *ROA* columns.

Panel f presents a model with a financial development variable model, with interaction term. We have negative and significant coefficients for *NLOANTA*, but in the *TOTCAPRAT* and *ROA* columns, we have positive and significant coefficients.

Let us now present the above findings in terms of variables. *EQTA* is positively associated with *BASELYR* in panels b, d, and e, but it is negatively associated with *BASELYR* in panel a. As a result, it is concluded that capital regulations have a positive impact on equity of banks – that is, the mean of post-Basel equity was higher than that of the pre-Basel era. The same conclusion can be obtained for *TOTCAPRAT* in panels a, b, d, e, and f. It does appear that Basel and Basel I-like capital regulations did have the desired impact on the banks.

Let us examine the "credit crunch" literature in terms of *NLOANTA* and *RLOANGROWTH*. *RLOANGROWTH* is negatively associated with *BASELYR* dummy variables in panels a, b, c, and d. On the other hand, *NLOANTA* is negatively associated with *BASELYR* dummies in panels b, d, and f; thus, we do find evidence of a decrease in these loan-related variables in the aftermath of Basel, indicating a supply-driven "credit crunch." These findings are in line with those of Barajas et al. (2005).

Based on aforementioned evidence, we can claim that overall, Basel and similar capital regulations resulted in changes of all the included bank specific variables. Given that these variables play a significant role in banks' important decision-making, it can be expected that such regulations profoundly impacted the behavior of banks. This assertion, too, is in line with the findings of Barajas et al. (2005).

In Table 3.4, we present results for tests of the "risk retrenchment" hypothesis. The impact of the Basel I Accord on risk sensitivity will be measured by the interaction between *BASELYR* and the respective risk variable. If banks experienced risk retrenchment after Basel, then the coefficient of the interaction term should be positive in the *EQTA* model and negative in the *NPFRAT* and *RWATA* models. As mentioned, we use two alternate dependent variables (*NLOANTA*, or total loan to total asset ratio, and *RLOANGROWTH*, or growth rate of loans). Two variations of the models are presented: one with macro-economic variables, and another without.

For the total loans to total assets ratio (column (2)), we find a negative and significant coefficient for capital ratios. This is unexpected evidence against the "risk retrenchment" hypothesis. If banks' lending become more sensitive to risk after adopting capital regulations, the coefficient should be positive. This, however, is not the case; we find that bank lending becomes less sensitive to capital ratios. However, when we use the

net-problem loans to total assets ratio and risk-weighted assets as a proxy for credit risk, we get expected results: the signs here should be negative, and indeed they are. So, in this case, the banks' contract loans change even more in response to a rise in credit risk in the aftermath of capital regulations. This supports the "risk retrenchment" hypothesis.

In columns (3) and (5), we use *RLOANGROWTH* as a dependent variable. For risk measured with capital ratios, we find positive and significant coefficients; this is expected. On the other hand, for the non-performing loans to total assets ratio, we do not find a significant coefficient. For risk-weighted assets, we find positive and significant coefficients; this is unexpected and runs counter to the "risk retrenchment" hypothesis.

Therefore, for this part of the analysis, we find only limited support for the "risk retrenchment" hypothesis. There is limited evidence in support of both the "credit crunch" and "risk retrenchment" hypotheses, which is, in line with the findings of Barajas et al. (2005). Tallman et al (2000) also found similar evidence for Australian Banks for the period 1986 to 1993. But Berger et al (1994) did not find evidence of "credit crunch". They found limited evidence in support of "risk retrenchment."

Conclusion

Based on the findings presented in this section, we find limited evidence of "credit crunch" in the aftermath of adopting Basel I. Given that our sample consists of both developed and developing countries, this finding is important, as "credit crunch" had been previously observed only in the United States and in Scandinavian countries in the early 1990s.

Next, we used a cross-section dataset to conduct a mean-test to determine if the Basel I Accord had a significant effect on bank activities. The mean-test indicates that the Accord had a significant impact on bank activities (i.e., bank capital increased in the wake of adoption of the Accord, loans scaled by total assets and the growth rate of loans decreased for the same period). As a result, we find that the Accord was successful in raising the capital ratios and equity of banks, paving the way for the financial soundness of commercial banks. At the same time, we find further evidence of "credit crunch."

In the final step of the study, we find limited evidence supporting the "risk retrenchment" hypothesis. We find that the loans-total assets ratio is negatively related to credit risk – that is, ratios of problem loans to total assets and risk-weighted assets to total assets. With respect to loan growth rate, we find it is positively related to capital ratio.

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Chapter 4. Depositor Discipline and Bank Risk-Taking Behavior: Evidence From the South-East Asian Financial Crises

In the wake of successful regulatory changes in the developed countries[9], many developing countries started to liberalize their financial sectors in the 1990s. In spite of their initial success, the liberalization policies now face a backlash in several developing countries. Critics present the cases of international financial crises (the Mexican Crisis in 1995 and the Asian Crisis of 1997) and domestic crises (Japan in the late 1990s and Turkey during the early 2000s). The argument centers on the timing, pace and the ways in which such policies were implemented. These have renewed the profession's interest in the issues of competition and stability in the banking sector.

One consequence of liberalization and privatization in the banking sector of developing countries was that it increased competition in the banking sector of the host countries, as documented by IMF (1998) and several other studies.[10] Liberalization opened up the banking sector to open competition by the private, foreign and even government banks. This paved the way for increased risk taking.

Malaysia, Korea, Thailand, Indonesia, and Philippines faced such situations since the starting of the 1990s. The focus of the present study is to follow that episode with focus on 1997 Asian crisis. More specifically we indent to examine the changes in risk taking behavior of banks before and after 1997. In addition to risk taking behavior of banks we will examine evidence of depositor discipline in the after math of 1997 crisis. If depositors punish banks when quality of assets of commercial banks decline, then we claim that there is evidence of depositor discipline. But if this is not the case when we claim otherwise.

[9] In the European Union the major regulations that opened up ways for changes in the banking sector is the Second Banking Coordination Directive of European Union allowing the Single Banking License in 1991. For 10 OECD countries, the Basel I Accord of 1988 initiated a change towards stricter capital requirements for banks. In the USA, several regulations were implemented during the 1990s starting with the Basel I Accord, followed by the FDIC Improvement Act (FDICIA) of 1991 (emphasis on adequate capitalization of banks and allowing special privileges, or eligible operations, for banks deemed to be well-capitalized), the Riegle-Neal Act of 1994 (allowed interstate banking), and the Financial Sector Modernization Act of 1999 (allowed banks to enter insurance, real estate and security related activities).

[10] Klaus et al , 1997.

Literature Review

Until recently, most of the literature in this field has concentrated on the determinants of financial/bank crisis (i.e., Calomiris, 1990; de la Caudra & Valdes, 1992; Kaminksy & Rienhart, 1996; McKinnon & Pill, 1996; Hagen & Ho, 2003; Demirguc-Kunt & Detragiache, 1998, 2005), where incentives that lead banks to take on more risk have taken a back stage. However, our approach to studying the risk taking problems of banks is the change in risk incentives directly and it is relatively new. Following Gruben et al. (1997, 1998, 2003), we examine the shifts in bank risk and the factors that directly make such activities more attractive.

Gruben et al. (1999) point out that the two major factors that cause banking panic are lack of market (depositor) discipline and financial liberalization. Demirguc-Kunt and Detragiache (1998a, 1998b, 2005) and Kaminsky and Reinhart (1996) find evidence indicating that the risk-taking activities of banks increase in the wake of liberalization, especially in countries where financial institutions are underdeveloped, law enforcement is weak and regulatory supervision is inadequate, which is more likely in developing countries. In developing countries, such liberalization often results in increased opportunities for excessive risk-taking and fraud.

Demirguc-Kunt and Detragiache (1998a, 1998b, and 2000a) find evidence that risk-taking activities on the part of banks also increase due to the moral hazards created by deposit insurance. This shows that explicit deposit insurance reduces depositor discipline, which increases moral hazard. Thus two factors directly related to the stability of banks are market discipline and financial liberalization.

Apart from the recent increase in the number of bank crises and the resultant academic interest, in June 2004,[11] the Basel Committee and the 10 OECD countries finalized Basel II. It is expected that before long, this will become the internationally accepted standard for bank supervision and regulation, like its predecessor Basel I, which is at different phases of implementation in over 100 countries[12]. The primary focus of

[11] Website of the Basel Committee on Bank Supervision.
[12] Panel Discussion on Basel II by Jaime Caruana: Basel II at the Bankers Conference 2004, New Delhi, 11 November, 2004.

Basel II is risk measurement and risk management,[13] making the changes in banks' risk-taking in response to policy changes more important than before. At the same time, the Committee has also decided that "market discipline" be made one of the three pillars[14] on which future financial regulation should be based, because such discipline imposes strong incentives on banks to conduct their business in a safe, sound, and efficient manner, and also to hold adequate capital with respect to the regulatory minimum. These steps are expected to reduce the risk of bank portfolios (Ghosh & Das, 2004), but as it has been pointed out, there is little empirical evidence supporting this hypothesis. This paper looks to fill that gap.

Despite strong interest of and rapid progress in research into the issues (not to mention the urgency of such studies), research with respect to developing and emerging market countries remain incomplete, with the exception of some jurisdictions (i.e., Argentina (1995), Canada (1984-86), Mexico (1995), Singapore (1997-99), Norway (1987-89), and Texas Savings and Loan Associations (1984-90)). Kaminsky and Reinhart (1999) refer to the South American financial problem of 1995 and to the Asian Crisis of 1997 as the "twin crisis"; the countries involved in these crises face concurrent exchange rate and banking problems. The present study expands upon the existing literature for South Asian countries, to include South Korea, Philippines, Thailand, Malaysia, and Indonesia.

One of the relevant studies for the present study is Gruben and McComb (2003), who apply the Breshnahan methodology to the Mexican banking sector of the mid-1990s and find that the Mexican banking system was super-competitive – that is, marginal prices were set below marginal costs. This was called "super-competition," where banks take risks now to capture a larger share of the market, and in the future hopefully reap the benefits of such a hostile expansion of market share.

The two most relevant studies for the current paper are Gruben et al. (1998) and Gruben et al. (2003). The study of Argentina, Mexico and Canada by Gruben et al. (1998) finds that lending risk (measured as a level of "super-competition") increases

[13] Inaugural address by Nicholas C. Pan, Superintendent, Office of the Superintendent of Financial Institutions, Canada, Chairman of the Basel Accord Implementation Group, February 2005.
[14] According to the June 2004 declarations of the Basel II Accord, the three pillars include (i) risk-weighted capital ratios, (ii) supervisory oversight, and (iii) market discipline.

significantly in the aftermath of liberalization, in countries where market discipline is weak. However, where depositors discipline banks by withdrawing deposits when asset quality falls , banks do not behave in a risky fashion. Again, another study by Gruben et al. (2003) on six jurisdictions (Argentina, Canada, Mexico, Norway, Singapore, and Texas) provides evidence that bank risk increases significantly in the aftermath of liberalization, but only where depositors fail to discipline banks and where market discipline and bank risk were persistently and inversely related.

As a result, current paper attempts to find answers to the following three important questions: (i) does depositor discipline exist in the selected South East Asian countries; (ii) does risky lending occur prior to bank crises, and (iii) what is the relationship between depositor discipline and bank risk-taking behavior? We follow a joint Breshnan (1982)/Shaffer (1989)/Gruben (1999) framework. We intend to extend the study for five South Asian Countries, including Malaysia, Indonesia, Korea, Philippines and Thailand, during the Asian Crisis of 1997. We focus directly on the changes to risk-taking attitude of banks immediately before and after that financial crisis.

Analysis

Following Gruben et al (2003) and Gruben et al (2003) we test the existence of depositor discipline: do the depositors punish banks by withdrawing deposits when asset quality declines. If so, then the growth rate of deposits (RTDEPGROW) should be negatively related with asset quality (ASSETQUALITY). We set up the following model:

$$RTDEPGROW_{it} = \theta_0 + \theta_1 ASSETQUALITY_{it} + \theta_2 EQTA_{it} + \theta_3 LTA_{it} + \theta_4 TDTL_{it} + \varepsilon_{it} \quad (4.1)$$

The proxies for ASSETQUALITY included here are (i) Ratio of Loan Loss Reserve to Gross Loan (LLRG); (ii) Ratio of Loan Loss Provision to Net Internal Reserve (LLLP); (iii) Loan Loss Reserve to Impaired Loan (LLRL); and (iv) Impaired Loan to Gross Loan

(ILGL)[15]. These variables are used one after another in equation (1.1) and so the regression is run four times. If depositor discipline exists, then all of these variables should be negatively related to the dependent variable. For more on the expected signs for this and all subsequent models (i.e., equations (4.9), (4.10) and (4.11)), please see Appendix D – Chapter 4.

Equation (4.1) includes three control variables: *EQTA*, or Ratio of equity capital to total assets; *LTA*, or Log of Total Assets; and *TDTL*, or deposit configuration variable. The signs of the coefficients of *EQTA* and *TDTL* are empirical. If depositors prefer an adequately capitalized bank to an undercapitalized bank – to the extent that they will transfer their funds from the undercapitalized to the adequately capitalized bank, then *EQTA* will have a positive relationship with deposit growth. This needs to be tested empirically. Similar implications hold for *TDTL*, but for *LTA*, the "too big to fail" hypothesis implies that larger banks should be able to attract more deposits, as they command higher levels of confidence among depositors.

In the next step, we construct the index of competition using the simultaneous equation model that Shaffer (1989, 1993, 1995) introduced. The model tests the market power of a commercial banking system by estimating an index of market power (λ) and then identifying breaks in competitiveness by applying a dummy variable. To test if the degree of competition increases following liberalization, the dummy variable is set to change value from zero to one after liberalization.

The index of market power (λ) captures the difference between a firm's perceived marginal revenue schedule and its demand schedule. Under competitive conditions, marginal cost can be set to be equal to perceived marginal revenue. If the firm's perceived marginal revenue schedule and its demand schedule are identical, then setting marginal cost equal to perceived marginal revenue is the same as setting marginal cost equal to demand price, which is the condition of perfect competition. If firms act in collusion, however – such as in a duopoly or extreme monopoly – then they set marginal cost equal to a perceived marginal revenue that corresponds to the industry's marginal revenue curve.

[15] Depositor discipline can be tested in several ways. One is to examine if banks with lower asset quality have to pay higher interest rates on their deposit to attract more fund. We have tested such a model but did not find significant and meaningful coefficients to support this. So, we do not elaborate that model.

A demand function for commercial bank services is written as follows:

$$Q = D(P, Y, \alpha) + \varepsilon \tag{4.2}$$

Where Q is quantity, P is price, Y is a vector of exogenous variables, α is a vector of demand equation parameters to be estimated, and ε is a random error term.

Actual (as distinguish from perceived) marginal revenue[16] is:

$$\begin{aligned} MR &= P + h(Q, Y, \alpha), \\ &= P + Q/(\partial Q / \partial P) \end{aligned} \tag{4.3}$$

The function $h(Q,Y,\alpha)$ is the inverse of semi-elasticity of demand,[17] and $h(*) \leq 0$. A firm's perceived marginal revenue is:

$$MR^P = P + \lambda h(Q, Y, \alpha) \tag{4.4}$$

where λ is a new parameter to be estimated, $0 \leq \lambda \leq 1$. Here, λ measures the degree to which firms recognize the distinction between demand and marginal revenue functions. Let c(Q, W, β) be the average firm's marginal cost function, where W is a vector of exogenous supply side variables and β is a vector of supply-side parameters to be estimated. Maximizing firms will set perceived marginal revenue equal to marginal cost, or where η is a random error term.

$$P = c(Q, W, \beta) - \lambda h(Q, Y, \alpha) + \eta \tag{4.5}$$

If firms act as price-takers so that they do not perceive a difference between their marginal revenue functions and demand function, then λ = 0. If firms act as a joint monopoly (λ = 1), clearly perceiving a difference between their demand and marginal revenue functions, they set an output where marginal cost equals marginal revenue.

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[16] $TR = P.Q \Rightarrow \partial TR / \partial Q = MR = P. \partial Q / \partial Q + Q. \partial P / \partial Q = P. + Q. \partial P / \partial Q$

[17] $MR = P + Q/(\partial Q/\partial P) = P + \dfrac{1}{\left(\partial Q / \partial P\right) / Q} = P + \dfrac{1}{\dfrac{\partial Q}{Q} . \dfrac{1}{\partial P}} = P + \dfrac{1}{\dfrac{\partial Q}{Q} \Big/ \dfrac{\partial P}{1}}$

Intermediate values of λ correspond to other oligopoly solution concepts. A Cournot equilibrium is suggested when λ = 1/n.

To estimate λ, it is necessary to estimate simultaneously specifications of both (4.2) and (4.5), treating P and Q as endogenous variables. The demand function is specified as:

$$Q = \alpha_0 + \alpha_1 P + \alpha_2 Y + \alpha_3 PZ + \alpha_4 Z + \alpha_5 PY + \alpha_6 YZ + \varepsilon \tag{4.6}$$

where Q is output quantity, P is output price, Y is a measure of macro-economic activity (assumed to be an exogenous variable), and Z is the price of a substitute for bank output (also assumed to be exogenous). The interaction terms – the products PZ, PY and YZ – are necessary to permit the rotation of the demand curve, as required to identify λ.

Following the model of Shaffer (1993), a translog cost function is used to estimate the average commercial bank's cost function as follows:

$$\begin{aligned} \ln C = {} & \gamma_0 + \gamma_1 \ln Q + \gamma_2 (\ln Q)^2 + \gamma_3 \ln W_1 + \gamma_4 \ln W_2 + \gamma_5 \ln(W_1)^2 / 2 + \gamma_6 \ln(W_2)^2 / 2 \\ & + \gamma_7 \ln W_1 \ln W_2 + \gamma_8 \ln Q \ln W_1 + \gamma_9 \ln Q \ln W_2 , \end{aligned} \tag{4.7}$$

where C is total cost, and W_1 and W_2 are exogenous input prices, as explained below. Equation (4.7) gives rise to the following marginal cost function, c(Q,W,β).

$$MC = (C/Q)(\beta_1 + \beta_2 \ln Q + \beta_3 \ln W_1 + \beta_4 \ln W_2) + \eta \tag{4.8}$$

Therefore, equation (4.5) is specified as follows:

$$P = -\lambda Q/(\alpha_1 + \alpha_3 Z + \alpha_5 Y) + (C/Q)(\beta_1 + \beta_2 \ln Q + \beta_3 \ln W_1 + \beta_4 \ln W_2) + \xi \tag{4.9}$$

Based on this equation, in the first step, the value of –λ represents a typical bank's percentage deviation of output from competitive levels. This –λ is smaller than zero, which implies that output is below competitive levels. If λ is zero, it implies that output is at a competitive level; a –λ larger than zero implies that output exceeds that of competitive levels. The last of is these is called super-competition. This means that banks are operating at a point where marginal cost is larger than perceived marginal benefit.

However, equation (4.9) is not configured to facilitate the analysis of breaks in bank behavior. To allow for breaks, we rely on the following specification of (4.6):

$$P=-\lambda Q/(\alpha_1+\alpha_3 Z+\alpha_5 Y)+(C/Q)(\beta_1+\beta_2 \ln Q+\beta_3 \ln W_1+\beta_4 \ln W_2)-\beta_5 DQ(\alpha_1+\alpha_3 Z+\alpha_5 Y)+\xi \quad (4.10),$$

where D is a dummy variable (which is more fully explained below), and ξ is a random error term. The system of equation represented by (4.6) and (4.10) is then estimated simultaneously with 3SLS.

At this stage, we deal with the difference of competition between the two periods, and we use the value of dummy variable β_5 . Before, the liberalization date index of market power will be λ; afterwards, it will be λ+ β_5 . Thus, β_5 shows the difference between the levels of competition between the two periods. If we find that the value of β_5 is negative and large, that will imply that banks significantly increased its risk-taking behavior after liberalization or privatization. For more on the expected signs of these equations (i.e., equations (4.9) and (4.10)), please see Appendix D – Chapter 4.

Gruben et al. (2003) examine the relationship between depositor discipline and the structural break in the direction of super-competitiveness with the help of graphical representation. In the first representation, t-statistics associated with the past-due-loans-to-total-assets[18] (indicator of depositor discipline) ratio were plotted on the horizontal axis against the index of competition (coefficient β_5 in equation (4.10)) on the vertical axis. In the next graph, t-statistics associated with the past-due-loans-to-total-assets ratio[19] are plotted on the horizontal axis against the t-statistics of the same index of competition (coefficient β_5 in equation (4.10)).

The Panzer and Rosse (1982, 1987) or PR approach is used to assess the competitive nature of banking industries, starting from 1998. The PR H-statistics, which will be our index of competition, is calculated from reduced-form bank revenue equations. This index measures the sum of the elasticities of the total revenue of the banks with respect to the bank's input prices. The PR H-statistic is adopted from Claessens et al. (2003) and its values and interpretations are presented in Table A below[20].

[18] This t-statistic was multiplied by -1.
[19] This t-statistic was multiplied by -1.
[20] These values and interpretation assume that the tests are undertaken on observations that are in long-run equilibrium.

Table A: PR H-statistics

Value of PR H-statistics	Decision
H<0	Monopoly
H=1	Perfect Competition
0<H<1	Monopolistic Competition

Again in line with Claessens et al. (2003), the following reduced-form revenue equation is estimated on pooled samples for each country to derive the H-statistics

$$\ln(P_{it}) = \alpha + \beta_1 \ln(W_{1,it}) + \beta_2 \ln(W_{2,it}) + \beta_3 \ln(W_{3,it}) + \gamma_1 \ln(Y_{1,it}) + \gamma_2 \ln(Y_{2,it}) + \gamma_3 \ln(Y_{3,it}) + \varepsilon_{it} \quad (4.11)$$

Here, P_{it} is the ratio of gross interest revenue to total assets (proxy for output price of loans), $W_{1,it}$ is the ratio of interest expense to total deposits and money market funding (proxy for input price of deposits), $W_{2,it}$ is the ratio of personnel expense to total assets (proxy for input price of labor), and $W_{3,it}$ is the ratio of other operating and administrative expense to total assets (proxy for input price of equipment/fixed capital). The subscript "i" and "t" denote banks and years, respectively.

Three control variables are also included in the model $Y_{1,it}$, which is the ratio of equity to total assets. $Y_{2,it}$ is the ratio of net loans to total assets, and $Y_{3,it}$ is the logarithm of total assets (to control for potential size effect). The natural logarithm of all variables is taken.

The model is estimated using different techniques: (i) bank specific intercept with fixed effect; (ii) random effect; (iii) between effect; and (iv) OLS on pooled data. Also we run the regressions across countries and across years.

All data for bank specific variables come from Bank Scope CD, 2005. All macro-economic variables come from World Development Indicators Online, 2005.

Empirical Results

We present the summary statistics in Table 4.1 of the Data Appendix. Panel a presents summary statistics for the variables used in the Shaffer (1993) model. The sample period is 1992-2004. We test for breaks in competitive behavior after the 1996-2004 periods.

On the other hand, panel b of Table 4.1 presents summary statistics for depositor discipline regressions for the period 1996-2004. Table 4.2 presents similar panels for correlation between variables.

Table 4.3 presents the OLS regression results for equation (4.1). The equation tests for the existence of depositor discipline in the selected five South Asian countries (Malaysia, Indonesia, South Korea, the Philippines, and Thailand), to see if the depositors withdraw their deposits when the asset quality of banks declines. With each dependent variable, we alternatively tested with three different dependent variables: (i) deposit growth rate, (ii) total deposit, and (iii) total deposit divided by total assets. Only the results for the last one were reported, because it had the best outcome. On the other hand, we also tested with four alternative definitions of asset quality, namely: (i) ratio of loan loss reserve to gross loan (*LLRG*), presented in panel a; (ii) ratio of loan loss provision to net internal reserve (*LLLP*), in panel b; (iii) ratio of impaired loan to gross loan (*ILGL*), in panel c; and (iv) ratio of loan loss reserve to impaired loan (*LLRL*), in panel d. In total, four sets of regressions were run through equation (4.1) for each of the five countries.

Overall, we find that the state of depositor discipline was very weak. Most of the asset quality proxies have insignificant coefficients, and even when they were significant, the coefficients were very low or close to zero, indicating the impact was very small. As a result, we conclude that total deposits scaled by total assets are probably not related to changes in asset quality. Given the role of government guarantees, this is hardly surprising. This can be supported by the recent findings of Mondschean et al (1998) in the case of Poland. These authors find that use of explicit deposit guarantees starting in late 1994 has removed the use of market discipline as a check on these banks behavior. Before the deposit guarantee program, depositors extracted a price of risk, but after the program was initiated that stopped. Imai (2005) found that when the Japanese government lifted a blanket guarantee on April 1, 2002, the sensitivity of interest rates on

deposits increased, implying enhanced depositor discipline. Ioannidou et al (2006) pointed found similar evidence in case of Bolivia between 1998 to 2003. Martinez et al (1999) studied depositor discipline in Argentina, Mexico and Chile during the 1980s and 1990s. They examined if the depositors punish risky banks by withdrawing their deposits and found support for this. So, their evidence supports the argument that depositor discipline exists.

In Tables 4.4, results for the Shaffer (1993) model (equations (4.6) and (4.10)) are presented based on 3SLS estimation method, with a cross-equation restriction for the parameters of the demand equation (4.6). The 3SLS method estimates the equations simultaneously.

None of the λ coefficients in the five countries are significant. This implies that the coefficient is statistically equal to zero, indicating perfect competition. Similarly, the beta five coefficients are all insignificant, indicating there was no change in the competitive behavior of banks before and after 1996.

In Table 4.5, we combine the index of competition (panel a – beta five coefficient 3SLS) from Table 4.4 with the index of depositor discipline (panel b – coefficient of proxy for asset quality) in Table 4.3, in order to test the link between the two. We do not find evidence aligned with that of Gruben et al. (2003), that these are inversely related.

Table 4.6 shows the results for the PR-methodology (H-statistics) across countries and across years. The value of the H-statistics (between zero and one) shows evidence of collusion among banks in the different countries.

Table 4.7 shows the value of H-statistics for each country between 1996 and 2004, using different estimation techniques. The parameters estimated with OLS are the smallest, whereas those estimated with fixed effects are the highest. Random-effect results are found in the middle, but all those values are less than one – again suggesting collusive behavior in the banking sectors of these five countries.

Conclusions

The present study provides evidence on the behavior of banks with respect to risk taking and strength of depositor discipline within the context of South East Asian Crises of 1997. The results are in line with that of Gurben (1998, 2003) and other studies. Even in the after-math of Asian Crises, the strength of depositor discipline (tested as a negative

relationship between depositor discipline and assets quality) was absent. Depositors as a group did not withdraw deposits from banks in reaction to a decline in their asset quality. This also highlights the importance of the need to improve measures that strengthen depositor discipline, such as, the measures put forward in Basel II. Timely and accurate dissemination of information can go a long way to solve these problems. Overall, any measure that enhances transparency and accountability of the decision making of banks is welcome. These are some of the objectives of Basel II.

For the test of a break in the competitive behavior of banks before and after 1996, we find no change in banks' risk-taking behavior before and after the crisis. Also the index has a value of zero, implying competitive behavior of banks in these countries. This to is in line with Gruben et al. (1998, 2003). However, use of PR-methodology to measure bank competitive behavior indicates the monopolistic competition and not perfect competition exists in these markets.

However, we did not find a consistent link between depositor discipline and bank risk taking, which can be explained by the weak state of depositor discipline. At least until today depositor discipline has not grown strong enough to affect banks risk-taking behavior. More needs to be done to make depositor discipline effective. Caprio et al (2004) also arrived at the same conclusion. They pointed out that "it seems that greater emphasis on the third pillar in the Basel II Accord that on the refinements of the risk-weighting system of the first pillar may be warranted for most developing countries.

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Chapter 5. Overall Conclusion

We present the overall conclusion of the three essays in the present dissertation in the following couple of paragraphs. Chapter 2 and 3, provide combined evidence that the capital regulations similar to Basel accord had several important impacts on the risk taking and lending activities of commercial banks in the developed and developing countries around the world. In contrast to previous studies that deal with one developed countries with a few exceptions, evidence of these chapters come from multi-country panel data.

It is often pointed out that the two most important impacts of Basel accord are: one; undercapitalized banks did increase their actual capital ratios in response to regulatory minimum capital ratio; and two; there is limited evidence that such regulations were associated with a decline in bank lending activities due to pressure on banks to hold more capital.

Chapter 2 provides evidence that the increase in actual capital ratio of under-capitalized banks did not come at the cost of higher risk. Indeed, evidence reveals that the relationship between these two variables is negative.

In the second step, we examine the relationship between capital ratios and risk under different conditions. Evidence for the proxy of financial development remains ambiguous. There is evidence that banks operating in more restrictive environment, abstain from taking higher risk.

Chapter 3 also provides long-run evidence that the average capital ratios and equity of banks increased in the aftermath of implementation of capital regulations. It also provides evidence that such regulations have strong impact on the important decision making variable of banks, for example, measures of banks capital and bank loans.

Chapter 4 provides evidence that the state of depositor discipline is weak in five selected countries of South East Asia, which include Malaysia, South Korea, Philippines, Thailand and Indonesia. Depositors did not punish commercial banks in response to a decline in the quality of assets. Banking industry in these countries remained perfectly competitive during this time period and there was no shift of bank competition. But we could not establish the link between depositor discipline and bank capital.

Chatper 2 . Empirical Appendix

Table 2.1-a: Summary Statistics

	All Banks			Undercapitalized Banks		
	Developing Countries	Developed Countries	All Countries	Developing Countries	Developed Countries	All Countries
Total Capital	828195.912 1085865.477 [330]	2819642.794 7970942.997 [1336]	2447330.370 7286497.394 [1622]	188813.902 491796.388 [51]	625301.818 1012443.761 [223]	579342.349 970156.729 [258]
Tier-1 Capital	576397.176 716118.665 [330]	1709857.540 4421719.465 [1336]	1496010.019 4045554.335 [1622]	109408.590 296539.631 [50]	507127.741 909434.602 [223]	461079.175 861720.270 [258]
Tier-1 Capital Ratio	11.583 10.027 [330]	11.379 13.265 [1336]	11.407 12.833 [1622]	-1.038 10.488 [20]	2.675 28.819 [209]	1.421 27.856 [228]
Total Capital Ratio	14.426 9.962 [330]	13.422 13.053 [1336]	13.564 12.642 [1622]	2.241 7.998 [56]	5.821 2.396 [229]	5.355 4.019 [268]
Total Assets	1.12446D+07 1.53137D+07 [330]	4.06122D+07 1.10136D+08 [1336]	3.49981D+07 1.00716D+08 [1622]	143531.926 354911.681 [54]	498603.294 788298.073 [204]	454002.438 747306.372 [242]
Loan Loss Reserve Divided Gross Loan	5.82022 4.61194 [330]	2.530 4.448 [1336]	3.161 4.690 [1622]	6988798.643 1.02450D+07 [56]	1.81576D+07 3.24475D+07 [203]	1.67233D+07 3.02344D+07 [242]
Return on Assets	-.029 2.930 [330]	1.029 9.586 [1336]	.815 8.809 [1622]	5.439 7.186 [56]	3.601 2.293 [193]	4.104 3.886 [232]
Liquid Assets	2212584.173 2640161.047 [330]	7145146.945 2.01144D+07 [1336]	6053621.568 1.82572D+07 [1622]	-1.858 4.052 [56]	1372.701 19466.861 [201]	1149.27 117815.123 [240]
Government Security and Bond Holding	506208.827 1041874.784 [330]	1244145.526 4414793.708 [1336]	1073584.311 4021236.328 [1622]	1590150.3931 970397.446 [56]	4473199.547 1.46353D+07 [203]	4063338.810 1.34596D+07 [242]
Domestic Credit to Private Sector (% of GDP)	121.389 39.007 [330]	157.815 34.417 [1311]	151.963 35.977 [1622]	327409.875 519752.035 [56]	705727.961 2313089.753 [229]	635704.153 2148083.047 [268]

Table 2.1-a: (Continued)

	All Banks			Undercapitalized Banks		
	Developing Countries	Developed Countries	All Countries	Developing Countries	Developed Countries	All Countries
Foreign Direct Investment, Net Inflows (% of GDP)	1.74565D+11 1.61818D+11 [330]	6.56499D+12 2.31918D+12 [1311]	5.34068D+12 3.26717D+12 [1622]	61.7504 4.876 [56]	165.554 57.588 [229]	152.423 64.584 [268]
GDP (Constant 2000 USD)	3.752 6.785 [330]	2.337 1.041 [1311]	2.451 1.280 [1622]	44.896 49.379 [56]	124.031 39.075 [229]	114.704 46.919 [268]
Inflation, Consumer Prices (Annual %)	984.317 9464.450 [330]	84.025 281.887 [1311]	123.092 341.355 [1622]	2.13002D+11 2.24761D+11 [56]	3.95940D+12 1.62911D+12 [229]	3.42375D+12 1.99125D+12 [268]
Official Exchange Rate (LCU per USD; Period Average)	3.186 1.922 [330]	.741 .470 [1311]	1.214 1.333 [1622]	24.056 23.296 [56]	.9661 .196 [229]	3.052 8.183 [268]

Note: Numbers in parenthesis reflect the total number of observation.

Table 2.1-b: Summary Statistics

Observation	Country	Banks	Percentage of Total
1	BELGIUM	77	2
2	BRAZIL	302	9
3	CANADA	62	2
4	CHILE	58	2
5	FRANCE	419	13
6	GERMANY	311	11
7	INDIA	28	1
8	ITALY	193	6
9	JAPAN	361	11
10	KOREA REP. OF	71	2
11	MALAYSIA	76	2
12	NETHERLANDS	73	2
13	NORWAY	29	1
14	SWEDEN	20	1
15	SWITZERLAND	284	9
16	THAILAND	32	1
17	UNITED KINGDOM	250	8
18	USA	571	17
19	VENEZUELA	59	2
		2731	100

Table 2.2-a: All Countries: Simple Model (Capital Equation (2.7) and Risk Equations (2.8))

	Total Capital				Tier-1 Capital			
	Capital Equation	Risk Equation	Capital Equation	Risk Equation	Capital Equation	Risk Equation	Capital Equation	Risk Equation
	Van Roy's Dummy Variable		Simple Dummy Variable		Van Roy's Dummy Variable		Simple Dummy Variable	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Constant	-12.67 -5.39 (.00***)	-.09 -3.25 (.00***)	-12.54 -5.25 (.00***)	-.10 -3.28 (.00***)	-12.48 -4.72 (.00***)	-.04 -.53 (.59)	-11.26 -4.11 (.00***)	-.07 -1.05 (.29)
Change in Risk/ Change in Capital	-25.40 -14.63 (.00***)	.00 -16.34 (.00***)	-26.35 -15.02 (.00***)	00 -16.59 (.00***).	-5.46 -7.15 (.00***)	-.01 -7.57 (.00***)	-11.10 -8.05 (.00***)	-.01 -12.94 (.00***)
Regulatory Dummy Variable	.96 7.38 (.00***)	.00 1.13 (.26)	2.75 3.86 (.00***)	.01 1.38 (.17)	.88 6.54 (.00***)	.00 .48 (.63)	2.76 2.38 (.02**)	-.04 -1.43 (.15)
Lag of Capital Ratio/Risk	.28 18.17 (.00***)	.22 14.84 (.00***)	.28 17.85 (.00***)	.22 14.86 (.00***)	.31 20.06 (.00***)	.15 12.63 (.00***)	.29 18.33 (.00***)	.30 22.13 (.00***)
Log of Total Assets	.46 4.15 (.00***)	.00 -1.06 (.29)	.44 3.92 (.00***)	.00 -1.12 (.26)	.60 4.88 (.00***)	.00 -.54 (.59)	.55 4.33 (.00***)	.00 -1.30 (.19)
Log of Ratio of Liquid Assets to Total Assets	-.84 -3.56 (.00***)	.01 3.25 (.00***)	-.84 -3.53 (.00***)	.01 3.28 (.00***)	-.90 -3.69 (.00***)	.01 1.44 (.15)	-.84 -3.30 (.00***)	.01 1.76 (.08*)
ROA	-.04 -1.83 (.07*)	.00 1.11 (.27)	-.04 -1.98 (.05**)	.00 1.07 (.29)	-.04 -1.86 (.06*)	.00 1.27 (.21)	-.04 -1.83 (.07*)	.00 2.28 (.02**)

Table 2.2-a: Continued

	Total Capital				Tier-1 Capital			
	Capital Equation	Risk Equation	Capital Equation	Risk Equation	Capital Equation	Risk Equation	Capital Equation	Risk Equation
	Van Roy's Dummy Variable		Simple Dummy Variable		Van Roy's Dummy Variable		Simple Dummy Variable	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Log of Ratio of Government Assets to Total Assets	8.04 1.87 (.06*)	.29 5.30 (.00***)	7.50 1.72 (.09*)	.29 5.26 (.00***)	2.75 .57 (.57)	.20 1.37 (.17)	4.01 .80 (.42)	.10 .74 (.46)
Domestic Credit to Private Sector (% of GDP)	.00 -.31 (.75)	.00 -2.85 (.00***)	.00 -.19 (.85)	.00 -2.77 (.01***)	-.01 -1.46 (.14)	.00 -.44 (.66)	-.02 -1.81 (.07*)	.00 -.60 (.55)
Foreign Direct Investment, Net Inflows (% of GDP)	.00 -.19 (.85)	.00 -.71 (.48)	.00 -.26 (.79)	.00 -.83 (.41)	.02 .08 (.93)	-.01 -.72 (.47)	.20 .82 (.41)	-.01 -1.71 (.09*)
GDP (Constant 2000 USD)	.00 .77 (.44)	.00 5.98 (.00***)	.00 .63 (.53)	.00 5.96 (.00***)	.00 -.31 (.75)	.00 1.27 (.21)	.00 .51 (.61)	.00 .58 (.56)
Inflation, Consumer Prices (Annual %)	-.01 -.04 (.97)	.00 -.60 (.55)	.01 .08 (.94)	.00 -.50 (.62)	.13 .62 (.54)	.00 -.50 (.62)	.03 .14 (.89)	.00 -.78 (.43)
Official Exchange Rate (LCU per USD; Period Average)	.00 .38 (.71)	.00 2.49 (.01**)	.00 .79 (.43)	.00 2.55 (.01**)	.00 -1.09 (.28)	.00 -.78 (.44)	.00 -.58 (.56)	.00 -.00 (.48)

Table 2.2-b: Developed Countries: Simple Model (Capital Equation (2.7) and Risk Equations (2.8))

	Total Capital				Tier-1 Capital			
	Capital Equation	Risk Equation	Capital Equation	Risk Equation	Capital Equation	Risk Equation	Capital Equation	Risk Equation
	Van Roy's Dummy Variable		Simple Dummy Variable		Van Roy's Dummy Variable		Simple Dummy Variable	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Constant	-10.75 -3.36 (.00***)	-.04 -1.54 (.12)	-11.71 -3.62 (.00***)	.00 -1.68 (.09*)	-11.78 -3.54 (.00***)	-.03 -.65 (.51)	-11.70 -3.51 (.00***)	-.03 -.55 (.59)
Change in Risk	-46.38 -17.12 (.00***)	.00 -19.52 (.00***)	-46.80 -17.27 (.00***)	-.06 -2.05 (.04**)	-14.76 -8.46 (.00***)	.00 -9.58 (.00***)	-14.79 -8.46 (.00***)	.00 -9.61 (.00***)
Regulatory Dummy Variable	.88 2.48 (.01**)	.00 .84 (.40)	2.87 3.16 (.00***)	.00 -19.53 (.00***)	.45 1.08 (.28)	-.01 -2.07 (.04**)	1.03 .67 (.50)	-.07 -2.94 (.00***)
Lag of Capital Ratio/Risk	.25 14.14 (.00***)	.15 10.77 (.00***)	.25 14.18 (.00***)	.02 3.03 (.00***)	.30 16.74 (.00***)	.14 5.77 (.00***)	.30 16.72 (.00***)	.14 5.76 (.00***)
Log of Total Assets	.44 3.01 (.00***)	.00 -1.98 (.05**)	.49 3.29 (.00***)	.15 10.81 (.00***)	.61 3.99 (.00***)	.00 -.06 (.95)	.61 3.98 (.00***)	.00 -.12 (.90)
Log of Ratio of Liquid Assets to Total Assets	-.72 -2.65 (.01***)	.01 2.76 (.01***)	-.72 -2.65 (.01***)	.00 -1.49 (.14)	-.94 -3.35 (.00***)	.01 1.71 (.09*)	-.94 -3.36 (.00***)	.01 1.69 (.09*)

Table 2.2-b: Continued

	Total Capital				Tier-1 Capital			
	Capital Equation	Risk Equation	Capital Equation	Risk Equation	Capital Equation	Risk Equation	Capital Equation	Risk Equation
	Van Roy's Dummy Variable		Simple Dummy Variable		Van Roy's Dummy Variable		Simple Dummy Variable	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ROA	-.03 -1.24 (.22)	.00 2.51 (.01**)	-.03 -1.24 (.22)	.01 2.83 (.00***)	-.04 -1.63 (.10)	.00 1.53 (.13)	-.04 -1.64 (.10)	.00 1.59 (.11)
Log of Ratio of Government Assets to Total Assets	15.95 1.62 (.10)	.24 2.71 (.01***)	13.57 1.37 (.17)	.00 2.43 (.02**)	10.14 .97 (.33)	.00 -.01 (.99)	10.23 .98 (.33)	-.01 -.04 (.97)
Domestic Credit to Private Sector (% of GDP)	-.01 -.60 (.55)	.00 1.46 (.14)	-.01 -.89 (.37)	.22 2.40 (.02**)	-.02 -1.53 (.13)	.00 -1.87 (.06*)	-.02 -1.55 (.12)	.00 -1.85 (.06*)
Foreign Direct Investment, Net Inflows (% of GDP)	-1.80 -2.20 (.03**)	-.02 -2.91 (.00***)	-1.54 -1.86 (.06*)	.00 1.09 (.28)	-1.51 -1.71 (.09*)	-.02 -1.38 (.17)	-1.52 -1.73 (.08*)	-.02 -1.46 (.15)
GDP (Constant 2000 USD)	.00 -.18 (.86)	.00 -1.77 (.08*)	.00 .18 (.85)	-.02 -2.37 (.02**)	.00 -.02 (.98)	.00 1.31 (.19)	.00 -.03 (.98)	.00 1.27 (.20)
Inflation, Consumer Prices (annual %)	.99 2.10 (.04**)	.01 2.35 (.02**)	.99 2.09 (.04**)	.00 -1.23 (.22)	.67 1.32 (.19)	.00 .51 (.61)	.68 1.32 (.19)	.00 .42 (.68)
Official Exchange Rate (LCU per USD; Period Average)	.00 -1.72 (.09*)	.00 -1.40 (.16)	.00 -1.68 (.09*)	.01 2.40 (.02**)	.00 -1.87 (.06*)	.00 -3.04 (.00***)	.00 -1.87 (.06*)	.00 -3.03 (.00***)

Table 2.2-c: Developing Countries: Simple Model (Capital Equation (2.7) and Risk Equations (2.8))

	Total Capital				Tier-1 Capital			
	Capital Equation	Risk Equation	Capital Equation	Risk Equation	Capital Equation	Risk Equation	Capital Equation	Risk Equation
	Van Roy's Dummy Variable		Simple Dummy Variable		Van Roy's Dummy Variable		Simple Dummy Variable	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Constant	-14.38 -4.65 (.00***)	-1.03 -4.30 (.00***)	-14.99 -4.33 (.00***)	-1.07 -4.42 (.00***)	-3.67 -1.26 (.21)	.36 .87 (.39)	-2.45 -.68 (.49)	.30 .74 (.46)
Change in Risk	-2.87 -5.14 (.00***)	-.01 -3.99 (.00***)	-2.26 -3.63 (.00***)	-.01 -2.36 (.02**)	-2.87 -7.84 (.00***)	-.04 -6.52 (.00***)	-3.07 -6.81 (.00***)	-.03 -5.96 (.00***)
Regulatory Dummy Variable	1.11 12.52 (.00***)	.03 3.51 (.00***)	8.33 6.89 (.00***)	.00 .01 (.99)	.90 14.33 (.00***)	.03 3.17 (.00***)	5.08 4.84 (.00***)	.05 .42 (.67)
Lag of Capital Ratio / Risk	.35 14.35 (.00***)	.93 10.84 (.00***)	.36 13.26 (.00***)	.94 10.88 (.00***)	.25 13.38 (.00***)	.14 5.94 (.00***)	.27 11.70 (.00***)	.14 6.01 (.00***)
Log of Total Assets	.66 3.43 (.00***)	.03 1.79 (.07*)	.64 2.95 (.00***)	.03 1.87 (.06*)	.01 .06 (.95)	-.02 -.72 (.47)	-.06 -.28 (.78)	-.01 -.56 (.58)
Log of Ratio of Liquid Assets to Total Assets	-.38 -.70 (.49)	.11 2.69 (.01***)	-.70 -1.13 (.26)	.11 2.60 (.01***)	-.12 -.23 (.82)	.22 3.39 (.00***)	.15 .24 (.81)	.22 3.34 (.00***)

Table 2.2-c: Continued

	Total Capital				Tier-1 Capital			
	Capital Equation	Risk Equation	Capital Equation	Risk Equation	Capital Equation	Risk Equation	Capital Equation	Risk Equation
	Van Roy's Dummy Variable		Simple Dummy Variable		Van Roy's Dummy Variable		Simple Dummy Variable	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ROA	-.47 -5.99 (.00***)	.00 -.69 (.49)	-.48 -5.32 (.00***)	.00 -.77 (.44)	-.07 -1.09 (.28)	.00 .30 (.76)	-.18 -2.06 (.04**)	.00 .28 (.78)
Log of Ratio of Government Assets to Total Assets	1.98 .60 (.55)	.65 2.59 (.01***)	2.57 .70 (.48)	.64 2.52 (.01**)	-1.56 -.58 (.56)	-.18 -.50 (.62)	-1.97 -.59 (.55)	-.20 -.54 (.59)
Domestic Credit to Private Sector (% of GDP)	.00 -.62 (.54)	.00 .21 (.83)	.00 -.31 (.75)	.00 .14 (.89)	.00 -.03 (.97)	.00 .85 (.39)	.00 -.57 (.57)	.00 .66 (.51)
Foreign Direct Investment, Net Inflows (% of GDP)	.00 .06 (.96)	.00 4.15 (.00***)	.00 -.94 (.35)	.00 4.37 (.00***)	.13 1.15 (.25)	.00 -.02 (.98)	.19 1.39 (.17)	.00 .03 (.97)
GDP (Constant 2000 USD)	.00 -2.42 (.02**)	.00 2.73 (.01***)	.00 -1.90 (.06*)	.00 3.06 (.00***)	.00 .84 (.40)	.00 1.55 (.12)	.00 1.64 (.10)	.00 1.71 (.09*)
Inflation, Consumer Prices (Annual %)	-.02 -.52 (.61)	.00 -.16 (.87)	-.03 -.68 (.50)	.00 -.06 (.95)	.03 .52 (.60)	.00 .59 (.55)	-.01 -.07 (.94)	.00 .53 (.60)
Official Exchange Rate (LCU per USD, Period Average)	.00 .85 (.40)	.00 -1.14 (.25)	.00 .49 (.62)	.00 -1.18 (.24)	.00 -.63 (.53)	.00 -.67 (.50)	.00 -.08 (.93)	.00 -.60 (.55)

Table 2.3: All Countries: Year-Regulatory Dummy Interaction

	Total Capital				Tier-1 Capital			
	Capital Equation	Risk Equation	Capital Equation	Risk Equation	Capital Equation	Risk Equation	Capital Equation	Risk Equation
	Van Roy's Dummy Variable		Simple Dummy Variable		Van Roy's Dummy Variable		Simple Dummy Variable	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Constant	-12.324 -5.210 (.000***)	-.087 -3.046 (.002***)	-10.882 -4.048 (.000***)	-.036 -1.358 (.175)	-11.072 -4.175 (.000***)	-.023 -.284 (.776)	-6.135 -1.946 (.052*)	.039 .481 (.631)
Change in Risk	-27.644 -15.564 (.000***)	-.005 -17.537 (.000***)	-37.313 -17.185 (.000***)	-.004 -18.862 (.000***)	-6.131 -7.916 (.000***)	-.006 -8.020 (.000***)	-37.299 -15.312 (.000***)	-.015 -25.307 (.000***)
Regulatory Dummy	-.140 -.144 (.885)	-.017 -1.426 (.154)	-5.200 -1.841 (.066*)	-.107 -3.751 (.000***)	.186 .178 (.859)	-.002 -.072 (.942)	-4.392 -1.043 (.297)	-.120 -1.079 (.281)
Lag of Capital Ratio	.269 17.725 (.000***)	.204 14.406 (.000***)	.262 16.759 (.000***)	.183 13.955 (.000***)	.307 19.831 (.000***)	.141 3.346 (.001***)	.195 12.163 (.000***)	.006 .183 (.855)
Log of Total Assets	.458 4.115 (.000***)	-.001 -.860 (.390)	.544 4.386 (.000***)	-.003 -2.561 (.010*)	.472 3.870 (.000***)	-.002 -.507 (.612)	.355 2.437 (.015*)	-.001 -.261 (.794)
Log of Ratio of Liquid Assets to Total Assets	-.832 -3.538 (.000***)	.009 2.888 (.004***)	-.691 -2.823 (.005***)	.010 3.958 (.000***)	-.885 -3.605 (.000***)	.008 1.002 (.316)	-.533 -1.818 (.069*)	-.002 -.221 (.825)

Table 2.3: Continued

	Total Capital				Tier-1 Capital			
	Capital Equation	Risk Equation	Capital Equation	Risk Equation	Capital Equation	Risk Equation	Capital Equation	Risk Equation
	Van Roy's Dummy Variable		Simple Dummy Variable		Van Roy's Dummy Variable		Simple Dummy Variable	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ROA	-.039 -1.779 (.075*)	.001 1.503 (.133)	-.040 -1.767 (.077*)	.001 2.714 (.007***)	-.041 -1.791 (.073*)	.002 1.145 (.252)	-.026 -1.184 (.236)	.002 1.438 (.150)
Log of Ratio of Government Assets to Total Assets	8.651 2.007 (.045*)	.290 5.449 (.000***)	5.873 1.227 (.220)	.192 3.935 (.000***)	3.615 .749 (.454)	.333 2.176 (.030*)	10.947 1.890 (.059*)	.313 2.035 (.042*)
Domestic Credit to Private Sector (% of GDP)	-.003 -.351 (.726)	.000 -3.022 (.003***)	-.021 -2.038 (.042*)	.000 -1.995 (.046*)	-.015 -1.488 (.137)	-.001 -2.121 (.034*)	-.033 -2.705 (.007***)	-.001 -2.124 (.034*)
Foreign Direct Investment, Net Inflows (% of GDP)	.000 .227 (.821)	.000 .374 (.708)	.236 1.057 (.291)	-.002 -.808 (.419)	-.020 -.088 (.930)	.017 2.314 (.021*)	.736 2.642 (.008***)	.019 2.590 (.010***)
GDP (Constant 2000 USD)	.000 .778 (.437)	.000 5.915 (.000***)	.000 1.762 (.078*)	.000 4.976 (.000***)	.000 -.077 (.939)	.000 3.472 (.001***)	.000 2.705 (.007***)	.000 3.069 (.002***)
Inflation, Consumer Prices (Annual %)	-.029 -.235 (.814)	-.002 -1.072 (.284)	-.013 -.061 (.951)	-.009 -4.031 (.000***)	.103 .495 (.621)	-.010 -1.451 (.147)	-.264 -1.032 (.302)	-.008 -1.240 (.215)
Official Exchange Rate (LCU per USD, Period Average)	.000 .363 (.717)	.000 2.330 (.020*)	.000 .063 (.950)	.000 3.451 (.001***)	-.001 -1.081 (.280)	.000 .388 (.698)	.000 -.411 (.681)	.000 -.061 (.952)

Table 2.3: Continued

	Total Capital				Tier-1 Capital			
	Capital Equation	Risk Equation	Capital Equation	Risk Equation	Capital Equation	Risk Equation	Capital Equation	Risk Equation
	Van Roy's Dummy Variable		Simple Dummy Variable		Van Roy's Dummy Variable		Simple Dummy Variable	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Regulatory Dummy	1.095	.011	8.934	.089	.576	-.002	9.267	.173
and	1.042	.836	2.291	2.251	.518	-.057	1.788	1.256
Year 1 Interaction	(.297)	(.403)	(.022*)	(.024*)	(.604)	(.955)	(.074*)	(.209)
Regulatory Dummy	-1.288	-.046	3.304	.034	-.461	-.080	-6.864	-.222
and	-1.113	-3.228	.951	.969	-.352	-1.937	-1.196	-1.462
Year 2 Interaction	(.266)	(.001***)	(.342)	(.333)	(.725)	(.053*)	(.232)	(.144)
Regulatory Dummy	1.272	.026	13.809	.257	.816	.009	11.202	.196
and	1.298	2.114	4.343	8.105	.774	.283	2.195	1.447
Year 3 Interaction	(.194)	(.035*)	(.000***)	(.000***)	(.439)	(.777)	(.028*)	(.148)
Regulatory Dummy	.798	.004	6.400	.082	.483	-.008	4.776	.094
and	.766	.328	2.133	2.702	.418	-.225	1.025	.761
Year 4 Interaction	(.444)	(.743)	(.033*)	(.007***)	(.676)	(.822)	(.305)	(.447)

Table 2.4: Restrictiveness Index and Deposit Insurance Characteristics

	Total Capital Restrictiveness Index		Total Capital Depositor Discipline		Tier-1 Capital Depositor Discipline		Tier-1 Capital Depositor Discipline	
	Capital Equation	Risk Equation	Capital Equation	Risk Equation	Capital Equation	Risk Equation	Capital Equation	Risk Equation
	Regulatory Restrictiveness Dummy Variable		Does explicit deposit insurance exist?		Is the Insurance program funded by the banks?		Is the Insurance Program funded by both the government and the banks?	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Constant	-13.41 -4.62 (.00***)	-.05 -1.29 (.20)	-11.10 -4.45 (.00***)	-.11 -3.62 (.00***)	-10.64 -3.86 (.00***)	-.08 -1.15 (.25)	-10.57 -3.83 (.00***)	-.06 -.78 (.44)
Change in Risk	-26.93 -15.30 (.00***)	.00 -16.72 (.00***)	-26.85 -15.25 (.00***)	.00 -16.61 (.00***)	-12.17 -8.51 (.00***)	-.01 -13.47 (.00***)	-11.37 -8.29 (.00***)	-.01 -13.03 (.00***)
Lag of Capital Ratio	.27 17.42 (.00***)	.22 15.10 (.00***)	.27 17.34 (.00***)	.22 15.00 (.00***)	.28 17.94 (.00***)	.31 21.03 (.00***)	.29 18.08 (.00***)	.30 22.28 (.00***)
Log of Total Assets	.45 3.98 (.00***)	.00 -1.37 (.17)	.47 3.98 (.00***)	.00 -1.59 (.11)	.53 4.11 (.00***)	.00 -1.29 (.20)	.52 4.03 (.00***)	-.01 -1.83 (.07*)
Log of Ratio of Liquid Assets to Total Assets	-.84 -3.48 (.00***)	.01 3.07 (.00***)	-.89 -3.67 (.00***)	.01 3.50 (.00***)	-.82 -3.21 (.00***)	.01 1.85 (.06***)	-.80 -3.09 (.00***)	.02 2.31 (.02*)
ROA	-.04 -1.96 (.05*)	.00 1.27 (.20)	-.05 -2.02 (.04***)	.00 1.04 (.30)	-.04 -1.91 (.06***)	.00 1.92 (.05***)	-.04 -1.86 (.06*)	.00 1.88 (.06*)
Log of Ratio of Government Assets to Total Assets	6.57 1.41 (.16)	.34 5.84 (.00***)	8.35 1.90 (.06***)	.28 5.21 (.00***)	3.18 .63 (.53)	.13 1.00 (.32)	3.10 .60 (.55)	.02 .14 (.89)

Table 2.4: Continued

	Total Capital Restrictiveness Index		Total Capital Depositor Discipline		Tier-1 Capital Depositor Discipline		Tier-1 Capital Depositor Discipline	
	Capital Equation	Risk Equation	Capital Equation	Risk Equation	Capital Equation	Risk Equation	Capital Equation	Risk Equation
	Regulatory Restrictiveness Dummy Variable		Does explicit deposit insurance exist?		Is the Insurance program funded by the banks?		Is the Insurance Program funded by both the government and the banks?	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Domestic Credit to Private Sector (% of GDP)	-.01 -.90 (.37)	.00 -1.52 (.13)	-.01 -.92 (.36)	.00 -1.26 (.21)	-.01 -1.25 (.21)	.00 -1.26 (.21)	-.02 -1.89 (.06*)	.00 -.66 (.51)
Foreign Direct Investment, Net Inflows (% of GDP)	.00 .10 (.92)	.00 -.03 (.98)	.00 .34 (.74)	.00 -.63 (.53)	-.09 -.33 (.74)	.00 -.40 (.69)	.15 .64 (.52)	-.01 -1.59 (.11)
GDP (Constant 2000 USD)	.00 .59 (.55)	.00 6.13 (.00***)	.00 1.08 (.28)	.00 2.55 (.01***)	.00 -.36 (.72)	.00 1.47 (.14)	.00 -.23 (.82)	.00 -.82 (.41)
Inflation, Consumer Prices (Annual %)	-.03 -.25 (.81)	.00 -.99 (.32)	-.05 -.41 (.68)	.00 -.59 (.56)	.09 .42 (.68)	-.01 -1.12 (.26)	.08 .39 (.70)	.00 -.38 (.70)
Official Exchange Rate (LCU per USD, Period Average)	.00 .24 (.81)	.00 3.47 (.00***)	.00 .96 (.34)	.00 2.29 (.02***)	.00 -.88 (.38)	.00 -.35 (.73)	.00 -.80 (.42)	.00 -1.25 (.21)
Index of Restrictiveness/ Depositor Discipline	.82 1.01 (.31)	-.03 -2.48 (.01**)	-.95 -.88 (.38)	.03 1.86 (.06***)	6.05 2.06 (.04***)	-.23 -2.70 (.01***)	.76 .90 (.37)	.06 2.48 (.01*)

Note: Last rows of columns (2) and (3) represent estimates for the last two columns. Column (4) and (5) represent the depositor insurance dummy which takes a value of 1 if the country has depositor discipline and 0 otherwise. Column (6) and (9) represents two dummies based on the questions: Who funds the depositor dummy: the government, the banks or both?

Table 2.4: Restrictiveness Index and Deposit Insurance Characteristics (Continued)

	Total Capital Depositor Discipline	
	Capital Equation	Risk Equation
	Is the premium of the dummy variable related with risk.	
(1)	(10)	(11)
Constant	-10.71 -4.20 (.00***)	-.07 -2.36 (.02*)
Change in Risk	-26.98 -15.33 (.00***)	.00 -16.80 (.00***)
Lag of Capital Ratio	.27 17.38 (.00***)	.22 14.90 (.00***)
Log of Total Assets	.40 3.33 (.00***)	.00 -1.59 (.11)
Log of Ratio of Liquid Assets to Total Assets	-.83 -3.45 (.00***)	.01 3.39 (.00***)
ROA	-.04 -1.99 (.05*)	.00 .99 (.32)

Table 2.4: Continued

	Total Capital Depositor Discipline 31	
	Capital Equation	Risk Equation
	Is the premium of the dummy variable related with risk.	
(1)	(10)	(11)
Log of Ratio of Government Assets to Total Assets	6.87 1.52 (.13)	.26 4.70 (.00***)
Domestic Credit to Private Sector (% of GDP)	-.01 -.74 (.46)	.00 -3.21 (.00***)
Foreign Direct Investment, Net Inflows (% of GDP)	.00 .08 (.94)	.00 -.97 (.33)
GDP (Constant 2000 USD)	.00 1.20 (.23)	.00 5.81 (.00***)
Inflation, Consumer Prices (Annual %)	-.02 -.13 (.90)	.00 -.29 (.77)
Official Exchange Rate (LCU per USD, Period Average)	.00 .87 (.39)	.00 2.61 (.01***)
Index of Restrictiveness/ Depositor Discipline	-.75 -1.14 (.25)	-.01 -1.77 (.08*)

Note: The last rows of column (10) and (11) show the results of the dummy variable based on the question: Is the premium in the deposit insurance program tied to risk or not? If answer to the question is 'yes', then the dummy takes a value of 1 and if the answer is 'no' then it takes a value of zero.

Appendix A – Chapter 2: Summary of Hypothesis

Coefficient	Variable Description	Expected Sign
Dependent Variable: Equation (2.7): *DCAPRAT*	Change in Capital Ratio	
DRISK	Change in Risk	Negative
ROA	Return on Assets	Positive
REG_DUM	Regulatory Dummy Variable: Takes value of one for undercapitalized banks, and zero otherwise	Positive
SIZE	Log of Total Assets	
BONDS		Negative
LIQUIDITY		Negative
GDP_GROWTH		
INFLATION		
EXCHANGE_RATE		
YEAR		
Alternative Specifications		
YEAR REG_DUM*		Positive
DEP_INS		Negative
REG_RES		Positive
FINV		Positive
FDEV		Negative

Appendix A – Chapter 2: Summary of Hypothesis (Continued)

Coefficient	Variable Description	Expected Sign
Equation (2.8): *DRISK*	Change in Risk	
DCAPRAT	Change in Capital Ratio	Negative
LLOSS	Return on Assets	Negative
REG_DUM	Regulatory Dummy Variable: Takes value of one for undercapitalized banks, and zero otherwise	Insignificant
SIZE	Log of Total Assets	
BONDS		Negative
LIQUIDITY		Positive
GDP_GROWTH		
INFLATION		
EXCHANGE_RATE		
YEAR		
Alternative Specifications		
*YEAR*REG_DUM*		
DEP_INS		Positive
REG_RES		Negative
FINV		Negative
FDEV		Negative

Appendix B. Basel Implementation Dates

Table I: The 1988 Basel I Accord: Transitional and Implementation Agreements

	End of 1990	End of 1992
Total Capital Ratio	7.25%	8%
Tier-1 Ratio	3.25%	4%
Limit on General Provision (or General Loan Loss Reserves) in Tier-2 Capital	Maximum 1.5 % or, exceptionally, up to 2% of Tier-2 capital	Maximum 1.5% or, exceptionally and temporarily, up to 2% or Tier-2 capital
Limit on Term Subordinated Debt in Tier-2 Capital	No limit (at discretion)	Maximum 50% of Tier-1 capital
Deduction for Goodwill	Deduction from Tier-1 capital (at discretion)	Deducted from Tier-1 capital

Source: Basle Committee on Banking Supervision, 1988.

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Table II: Adoption of the Basel I Accord

Adoption Year	Latin American & Caribbean	Rest of the World	Total
1988	0	16	16
1989	0	0	0
1990	0	1	1
1991	1	2	3
1992	0	3	3
1993	4	8	12
1994	3	5	8
1995	3	6	9
1996	1	4	5
1997	4	7	11
1998	2	3	5
1999	1	6	7
2000	1	6	7
2001	0	4	4

Appendix B.

Table II: Adoption of the Basel I Accord

Adoption Year	Latin American & Caribbean	Rest of the World	Total
2002	0	0	0
Total Dated	20	71	91
Total Undated	2	32	34
Total Adopting Countries	22	103	125
Total Non-adopting Countries	2	9	11

Source: Created by Barajas et al. (2005), based on a survey of IMF field economists; Chiuri et al. (2000); IMF Monetary and Financial Systems Development Regulatory Database; and World Bank online database on bank regulation and supervision.

Appendix B

Table III: Summary of Previous Studies in the Field

Author(s) (Year of Publication)	Sample and Period	Impact of Regulatory Pressure on Changes in *CAPRAT*	Impact of Regulatory Pressure on Changes in *RISK*	Relationship Between Changes in *CAPRAT* and Changes in *RISK*
Jacques and Nigro (1997)	2,570 U.S. commercial banks with assets over $ 100 million over 2 years (1990-91) – First step in the implementation process	+ for A 0 / - for U	- for A 0 for U	mostly 0
Aggarwal and Jacques (1997)	2,849 U.S. commercial banks with assets over $ 100 million over 3 years (1991-93) – Second step in the implementation process	+ for A in 93 + for U	+ in 91/- in 92-93 for A and U	- in 91-92 / + in 93
Ediz et al. (1998)	94 U.K. banks over 25 quarters (4th quarter 1989 – 4th quarter 1995)	+ for U	0 for U	Not studied
Rime (2001)	154 Swiss banks over 7 years (1989-95)	0 for A + for U	0 for A and U	0/+
Aggarwal and Jacques (2001)	1,685 U.S. commercial banks with assets over 100 million (1991-96)	+ for A and U in 91	+ in 91 / 0 in 92 / - in 93-96 for A and U	+ and – in 91-92 / + in 93-96

Note: +: significantly positive; -: significantly negative; 0; insignificant; A: adequately capitalized banks; U: undercapitalized banks.
Source: Van Roy (2003).

Appendix B

Table IV-a: Enforcement Dates of Capital Accord

In this table, we compare the adoption and implementation dates from two sources, namely Chiuri et al. (2000) with that of IMF working paper (2005) in columns (2) and (3), respectively. We then establish the enforcement dates, for the purposes of our study, in column (4).

Country	Year of Enforcement: Chiuri et al. (2000)	Year of Enforcement: IMF Working Paper, WP/05/38	Year of Enforcement (as Implemented in This Study)
(1)	(2)	(3)	(4)
Argentina	1994	NA	1994
Brazil	1997	NA	1997
Chad	NA	2003	2003
Chile	1997	NA	1997
Costa Rica	1998	NA	1998
Croatia	NA	1998, 2002	2002
Hungary	1992 and 1994	1992 and 1994	1994
India	1996	1996	1996
Indonesia	NA	2003	2003
Italy	NA	1992	1992
Japan	NA	1993	1993
Korea	1997	1997	1997
Malaysia	1997	NA	1997
Mauritius	NA	1994	1994

Country	Year of Enforcement: Chiuri et al. (2000)	Year of Enforcement: IMF Working Paper, WP/05/38	Year of Enforcement (as Implemented in This Study)
(1)	(2)	(3)	(4)
Mexico	1993	NA	1993
Morocco	1994	NA	1994
Norway	NA	1992	1992
Paraguay	1994	NA	1994
Poland	1993	1993	1993
Slovenia	1994	1994	1994
Sweden	NA	1994	1994
Thailand	1997	NA	1997
Turkey	1994	1994	1994
Togo	NA	2002	2002
Uruguay	NA	1995	1995
United States	NA	1990, 1992	1992
Venezuela	1996	1996	1996
European G10 Countries	NA	1992	1992

Appendix B

Table IV-b. Enforcement Dates of Capital Accord
We split the total sample given in Table IV-b into two parts, based on differences between developed and developing countries.

Country	Year of Enforcement: Chiuri et al. (2000)	Year of Enforcement: IMF Working Paper, WP/05/38	Year of Enforcement (as Implemented in This Study)
Panel a: Developed Countries			
Korea	1997	1997	1997
Japan	NA	1993	1993
Italy	NA	1992	1992
Norway	NA	1992	1992
Sweden	NA	1994	1994
United States	NA	1990, 1992	1992
European G10[21] Countries	NA	1992	1992
Panel b: Developing Countries			
Argentina	1994	NA	1994
Brazil	1997	NA	1997
Chad	NA	2003	2003
Chile	1997	NA	1997
Costa Rica	1998	NA	1998
Croatia	NA	1998, 2002	2002
Hungary	1992 and 1994	1992 and 1994	1994
India	1996	1996	1996
Indonesia	NA	2003	2003
Malaysia	1997	NA	1997
Mauritius	NA	1994	1994
Mexico	1993	NA	1993
Morocco	1994	NA	1994

[21] The G10 comprises 11 industrialized countries: Belgium, Canada, France, Germany, Italy, Japan, The Netherlands, Sweden, Switzerland, the United Kingdom and the United States.

Table IV-b. Continued

Country	Year of Enforcement: Chiuri et al. (2000)	Year of Enforcement: IMF Working Paper, WP/05/38	Year of Enforcement (as Implemented in This Study)
Paraguay	1994	NA	1994
Poland	1993	1993	1993
Slovenia	1994	1994	1994
Thailand	1997	NA	1997
Turkey	1994	Same	1994
Togo	NA	2002	2002
Uruguay	NA	1995	1995
Venezuela	1996	Same	1996

Appendix B

Table IV-c. Enforcement Dates of Capital Accord;
Groupings Based on Implementation Date or Reference Year[22]

Columns (3) and (4) present three- and four-year windows following the enforcement dates, respectively.

	Countries	Three-Year Window	Five-Year Window
(1)	(2)	(3)	(4)
1992	Belgium, Canada, France, Germany, Italy, The Netherlands, Norway Switzerland, the United Kingdom, the United States	1993-1995	1993-1997
1993	Japan	1994-1996	1994-1998
1994	Argentina, Hungary, Mauritius, Morocco, Paraguay, Slovenia, Sweden, Turkey	1995-1997	1995-1999
1995	Uruguay	1996-1998	1996-2000
1996	India, Venezuela	1997-1999	1997-2001
1997	Brazil, Chile, Korea, Malaysia, Thailand	1998-2000	1998-2002
1998	Costa Rica	1999-2001	1999-2004
2002	Croatia, Togo	2003-2005	2003-present
2003	Chad, Indonesia	2004-present	2004-present

[22] In the present study, Reference Year is also the Implementation Year.

Appendix C – Chapter 3: Summary of Hypothesis

Coefficient	Variable Description	Expectation
Dependent Variable: Equation (3.1): $dD_{\tau}/A_{\tau-1}$	Change in deposit divided by initial total assets	
$dTC_{\tau-1}/A_{\tau-1}$	Ratio of change in total capital to total assets	If coefficient is significant, then we find impact of changes in capital ratios on deposit.
$TC_{\tau-1}/A_{\tau-1}*dTC_{\tau}/A_{\tau-1}$	Ratio of total capital to total assets (first part) multiplied by change in total capital to total assets	If significant, then we find significant impact of changes in capital ratios on deposit for undercapitalized banks. If coefficient is significant and negative we find evidence of "credit crunch."
Dependent Variable: Equation (3.2): $dL_{\tau}/A_{\tau-1}$	Change in loan divided by initial total assets	
$dTC_{\tau-1}/A_{\tau-1}$	Ratio of change in total capital to total assets	If coefficient is significant, then we find impact of changes in capital ratios on loan.
$TC_{\tau-1}/A_{\tau-1}*dTC_{\tau}/A_{\tau-1}$	Ratio of total capital to total assets (first part), multiplied by change in total capital to total assets	If significant, then we find significant impact of changes in capital ratios on loans made by undercapitalized banks.
Dependent Variable: Equation (3.3): Alternatively use *EQTA*, *TOTCAPRAT*, *NLOANTA*, *RLOANGROWTH*, *ROA* and *NIM*		
BASELYR	Dummy variable, which takes a value of zero before adoption year and one thereafter.	If the coefficient is significant, then it implies that Basel capital regulations had a major impact on these variables.

Appendix C – Chapter 3: Summary of Hypothesis (Continued)

Coefficient	Variable Description	Expectation
Dependent Variable: Equation (3.4): Alternatively use *NLOANTA* and *RLOANGROWTH*	NLOANTA: ratio of total loan to total assets RLOANGROWTH: growth rate of loan	
BASELYR	Dummy variable, which takes a value of zero before adoption year and one thereafter	
RISK: Alternatively use *EQTA*, *NPFRAT*, *RWATA*	*EQTA*: capital ratio; *NPFRAT*: ratio of non-performing loans to total loans; *RWATA*: risk-weighted assets divided by total assets	
BASELYR RISK*	Interaction term between the BASELYR dummy variable and three alternative variables to measure risk	If significant, this will means that the Basel I Accord had a significant impact on the risk-taking of banks.

Chapter 3. Empirical Appendix

Table 3.1-a: Summary Statistics

Variable	Mean	Standard Deviation	Observations
EQTA	0.121767	0.15666	25632
TOTCAPRAT	17.47954	28.75076	11534
NLOANTA	50.96548	24.56715	25373
RLOANGROWTH	186.3817	16659.14	21149
ROA	0.735846	6.528802	25426
NIM	4.425397	10.23031	24774
NPFRAT	0.037159	0.07823	11145
RWA	106536.3	485319.5	7871
RWATA	0.037665	2.315992	7869

Table 3.1-b: Summary Statistics

Observation	Country	No Of Banks	Percentage of Total
1	ARGENTINA	12	3
2	BELGIUM	9	3
3	BRAZIL	24	7
4	CANADA	7	2
5	CHAD	1	0
6	CHILE	4	1
7	COSTA RICA	4	1
8	CROATIA	5	1
9	FRANCE	39	11
10	GERMANY	30	8
11	HUNGARY	4	1
12	INDIA	6	2
13	INDONESIA	11	3
14	ITALY	21	6
15	JAPAN	24	7
16	KOREA REP. OF	6	2
17	MALAYSIA	6	2
18	MAURITIUS	1	0
19	MOROCCO	1	0
20	NETHERLANDS	8	2
21	NORWAY	3	1
22	PARAGUAY	4	1
23	SLOVENIA	3	1
24	SWEDEN	2	1
25	SWITZERLAND	27	7
26	THAILAND	2	1
27	TOGO	1	0
28	TURKEY	11	3
29	UNITED KINGDOM	24	7
30	URUGUAY	6	2
31	USA	46	13
32	VENEZUELA	5	1
	Grand Total	359	100

Table 3.2: Peek and Rosengren (1995) Model

The following tables present the estimates of equations (3.1) and (3.2). Fixed effects with bank-specific intercepts were used to obtain the estimates.

	Change in Deposit Divided by Total Assets of Previous Period $dD_\tau / A_{\tau-1}$	Change in Lending Divided by Total Assets of Previous Period $dL_\tau / A_{\tau-1}$
(1)	(2)	(3)
$TC_{\tau-1} / A_{\tau-1}$	7.060 .343 (.000***)	1.489 .120 (.000***)
$dTC_\tau / A_{\tau-1}$	7.033 .031 (.000***)	4.997 .010 (.000***)
$TC_{\tau-1} / A_{\tau-1} * dTC_\tau / A_{\tau-1}$	-5.977 .094 (.000***)	.494 .032 (.000***)
$\log(A_\tau)$	.047 .009 (.000***)	.017 .003 (.000***)
$\log(ROA_\tau)$	-.021 .022 (.328)	-.003 .007 (.681)
CONSTANT	-.785 .109 (.000***)	-.388 .037 (.000***)

Table 3.3: Test of Change in Mean Before and After Adoption of the Basel I Accord

Estimates for equation (3.3) are presented here. Alternate dependent variables are presented along different columns with name of the dependent variables in the top cell.

Panel a: Year Dummies Only

Dependent Variables	*EQTA*	*TOTCAPRAT*	*NLOANTA*	*RLOANGROWTH*	*ROA*	*NIM*
BASELYR	-.014 .004 (.001)***	-1.437 1.277 (.261)	.300 .628 (.480)	-1668.426 505.269 (.001)***	.577 .167 (.001)***	-2.649 .263 (.000)***
t1	.040 .016 (.012)***	1.923 7.796 (.805)	2.329 2.492 (.930)	1580.586 2292.476 (.491)	.123 .663 (.852)	3.261 1.062 (.002)***
t2	.037 .015 (.013)***	3.783 7.119 (.595)	1.680 2.344 (.720)	1241.707 2032.403 (.541)	.111 .625 (.859)	3.968 1.002 (.000)***
t3	.050 .015 (.001)***	5.060 7.047 (.473)	1.987 2.301 (.860)	1497.805 1952.629 (.443)	.047 .613 (.939)	4.519 .985 (.000)***
t4	.052 .014 (.000)***	7.577 7.001 (.279)	2.122 2.271 (.930)	1362.057 1920.378 (.478)	.393 .605 (.516)	5.117 .972 (.000)***
t5	.042 .014 (.003)***	7.140 6.918 (.302)	2.988 2.218 (1.350)	3776.775 1900.712 (.047)**	.037 .591 (.950)	3.859 .951 (.000)***
t6	.040 .014 (.004)***	6.809 6.928 (.326)	2.836 2.232 (1.270)	1651.965 1889.837 (.382)	-.029 .595 (.960)	4.260 .956 (.000)***
t7	.042 .014 (.003)***	6.640 6.923 (.338)	2.502 2.233 (1.120)	1637.852 1889.979 (.386)	-.290 .595 (.626)	4.464 .957 (.000)***
t8	.048 .014 (.001)***	8.095 6.917 (.242)	2.115 2.232 (.950)	1614.058 1888.524 (.393)	.259 .595 (.664)	4.693 .956 (.000)***
t9	.057 .014 (.000)***	9.040 6.917 (.191)	3.076 2.233 (1.380)	1631.418 1889.073 (.388)	.245 .595 (.680)	4.553 .957 (.000)***
t10	.061 .014 (.000)***	10.802 6.916 (.118)	2.160 2.233 (.970)	1606.608 1888.967 (.395)	-.118 .595 (.843)	4.949 .956 (.000)***
t11	.063 .014 (.000)***	11.755 6.917 (.089)	1.680 2.237 (.750)	1697.744 1891.693 (.369)	-.631 .596 (.289)	4.693 .958 (.000)
t12	.055 .014 (.000)***	10.173 6.929 (.142)	2.193 2.246 (.980)	1728.096 1896.157 (.362)	-.060 .598 (.920)	4.323 .962 (.000)***

Panel a: Contined

t13	.065 .016 (.000)***	10.002 7.319 (.172)	.467 2.586 (.180)	1697.477 2087.276 (.416)	.727 .688 (.291)	6.518 1.102 (.000)***
t14	-.022 .028 (.443)		-4.538 4.504 (-1.010)		.317 1.185 (.789)	-.426 1.946 (.827)
t15	-.012 .021 (.583)	-.700 11.715 (.952)	-.061 3.368 (-.020)***	495.159 3243.523 (.879)	.609 .896 (.496)	-.417 1.443 (.773)
CONSTANT	.084 .013 (.000)***	10.178 6.764 (.132)	48.359 2.099 (23.040)	6.190 1795.552 (.997)	.231 .559 (.679)	2.395 .902 (.008)***

Note: Year 16 is the base year, and its dummy has been dropped from these equations.

Panel b: Country Dummies Only

	EQTA	*TOTCAPRAT*	*NLOANTA*	*RLOANGROWTH*	*ROA*	*NIM*
BASELYR	.009 .005 (.041**)	4.690 1.832 (.010**)	-1.389 .689 (.044**)	-2738.185 658.777 (.000***)	-5.643 .419 (.000***)	-.750 .300 (.012**)
d1	-.044 .010 (.000***)	-35.778 8.314 (.000***)	4.943 1.469 (.001***)	59.722 1209.045 (.961)	-2.993 .450 (.000***)	-9.558 .628 (.000***)
d2	-.154 .010 (.000***)	-35.707 3.429 (.000***)	-7.612 1.575 (.000***)	13.573 1298.814 (.992)	-1.689 .390 (.000***)	-15.509 .675 (.000***)
d3	-.030 .009 (.001***)	-23.393 2.162 (.000***)	-5.606 1.368 (.000***)	-196.884 1126.933 (.861)	-3.024 .468 (.000***)	-5.619 .585 (.000***)
d4	-.106 .011 (.000***)	-16.809 2.604 (.000***)	24.069 1.639 (.000***)	42.311 1340.215 (.975)	-2.268 .383 (.000***)	-14.899 .702 (.000***)
d5	-.031 .009 (.001***)	-33.042 3.538 (.000***)	10.109 1.341 (.000***)	73.290 1101.591 (.947)	-2.676 .495 (.000***)	-15.552 .574 (.000***)
d6	-.060 .011 (.000***)	-22.439 2.831 (.000***)	18.960 1.732 (.000***)	-198.994 1414.502 (.888)	-1.901 .518 (.000***)	-12.046 .741 (.000***)
d7	-.070 .012 (.000***)	-29.067 12.736 (.022**)	19.773 1.809 (.000***)	-333.134 1490.006 (.823)	-3.061 .381 (.000***)	-10.819 .777 (.000***)
d8	-.114 .009 (.000***)	-36.966 2.795 (.000***)	7.724 1.330 (.000***)	87.249 1093.027 (.936)	-3.115 .374 (.000***)	-14.697 .570 (.000***)
d9	-.120 .009 (.000***)	-31.710 2.168 (.000***)	6.906 1.310 (.000***)	65.012 1076.895 (.952)	-2.213 .389 (.000***)	-14.720 .561 (.000***)
d10	-.084 .009 (.000***)	-26.668 2.552 (.000***)	2.304 1.353 (.089*)	197.312 1112.206 (.859)	-2.150 .513 (.000***)	-13.593 .602 (.000***)
d11	-.028 .012 (.019**)	-23.451 4.518 (.000***)	8.893 1.793 (.000***)	-1941.793 1493.742 (.194)	-2.531 .513 (.000***)	-11.443 .771 (.000***)
d12	-.119 .012 (.000***)	-34.252 3.239 (.000***)	7.762 1.794 (.000***)	74.571 1467.621 (.959)	-4.612 .462 (.000***)	-12.355 .769 (.000***)
d13	-.124 .011 (.000***)	-23.953 2.833 (.000***)	13.114 1.613 (.000***)	-2281.554 1354.858 (.092*)	-2.680 .448 (.000***)	-13.676 .694 (.000***)
d14	-.163 .010 (.000***)	-36.157 2.257 (.000***)	4.478 1.567 (.004***)	1255.729 1278.885 (.326)	-3.182 .392 (.000***)	-15.062 .672 (.000***)
d15	-.107 .009 (.000***)	-30.544 2.045 (.000***)	9.864 1.372 (.000***)	144.024 1130.889 (.899)	-3.916 .381 (.000***)	-14.200 .588 (.000***)

Panel b: Contined

	EQTA	TOTCAPRAT	NLOANTA	RLOANGROWTH	ROA	NIM
d16	-.180 .009 (.000***)	-37.104 1.987 (.000***)	27.551 1.332 (.000***)	87.539 1094.522 (.936)	-4.037 .480 (.000***)	-15.623 .571 (.000***)
d17	-.170 .011 (.000***)	-37.516 2.700 (.000***)	15.764 1.677 (.000***)	6189.559 1366.647 (.000***)	-2.750 .696 (.000***)	-15.277 .720 (.000***)
d18	-.124 .016 (.000***)	-34.741 6.547 (.000***)	10.822 2.410 (.000***)	-176.003 1931.634 (.927)	-4.977 .751 (.000***)	-13.799 1.130 (.000***)
d19	-.067 .017 (.000***)	-31.742 5.228 (.000***)	16.409 2.691 (.000***)	107.814 2211.024 (.961)	-2.686 .472 (.000***)	-14.269 1.150 (.000***)
d20	-.131 .011 (.000***)	-30.485 2.456 (.000***)	18.199 1.657 (.000***)	-263.942 1345.805 (.845)	-2.522 .456 (.000***)	-14.492 .712 (.000***)
d21	-.116 .010 (.000***)	-27.745 2.586 (.000***)	4.771 1.597 (.003***)	50.593 1311.589 (.969)	-2.767 .577 (.000***)	-15.565 .721 (.000***)
d22	-.154 .013 (.000***)	-35.940 2.821 (.000***)	39.033 2.015 (.000***)	23.630 1628.366 (.988)	-1.723 .573 (.003***)	-14.832 .868 (.000***)
d23	-.067 .013 (.000***)		10.611 2.002 (.000***)	66.329 1688.778 (.969)	-2.973 .649 (.000***)	-6.678 .859 (.000***)
d24	-.158 .015 (.000***)	-25.152 3.078 (.000***)	16.598 2.266 (.000***)	105.500 1874.794 (.955)	-2.716 .577 (.000***)	-14.623 .972 (.000***)
d25	-.104 .013 (.000***)	-31.950 3.101 (.000***)	11.885 1.991 (.000***)	78.563 1631.396 (.962)	-2.340 1.663 (.159)	-13.524 .864 (.000***)
d26	-.061 .039 (.113)		17.173 5.805 (.003***)	-2639.486 4951.393 (.594)	-2.671 1.461 (.068*)	-10.493 2.979 (.000***)
d27	-.165 .034 (.000***)		14.838 5.101 (.004***)	-2102.192 4444.323 (.636)	-5.323 .587 (.000***)	-11.495 2.190 (.000***)
d28	-.168 .014 (.000***)	-35.537 3.070 (.000***)	28.965 2.051 (.000***)	-83.175 1643.237 (.960)	-1.846 .451 (.000***)	-15.761 .880 (.000***)

Panel b: Contined

	EQTA	TOTCAPRAT	NLOANTA	RLOANGROWTH	ROA	NIM
d29	-.099 .010 (.000***)	-19.395 3.008 (.000***)	-6.010 1.575 (.000***)	42.724 1312.117 (.974)	-2.148 .369 (.000***)	-3.476 .677 (.000***)
d30	-.126 .008 (.000***)	-32.552 1.915 (.000***)	20.805 1.291 (.000***)	102.927 1061.695 (.923)	-5.700 .513 (.000***)	-12.813 .553 (.000***)
d31	-.065 .012 (.000***)		23.458 1.793 (.000***)	257.159 1530.403 (.867)	3.527 .399 (.000***)	-10.757 .770 (.000***)
CONSTANT	.218 .009 (.000***)	43.921 2.593 (.000***)	40.998 1.395 (.000***)	2660.043 1198.703 (.026**)	-5.643 .419 (.000***)	18.145 .601 (.000***)

Panel c: Countries and Year Dummies (Country Dummies Not Presented)

Dependent Variables	*EQTA*	*TOTCAPRAT*	*NLOANTA*	*RLOANGROWTH*	*ROA*	*NIM*
BASELYR	-.009 .006 (.119)	3.190 2.095 (.128)	-.675 .861 (.433)	-3068.008 787.189 (.000***)	.143 .247 (.564)	-.734 .373 (.049**)
t1	.039 .016 (.013**)	-1.349 7.709 (.861)	1.660 2.346 (.479)	2822.670 2352.075 (.230)	.573 .673 (.395)	.881 1.032 (.393)
t2	.039 .015 (.008***)	-1.143 7.190 (.874)	-1.084 2.231 (.627)	2304.217 2101.273 (.273)	.485 .641 (.449)	1.056 .985 (.284)
t3	.049 .015 (.001***)	-.076 7.117 (.992)	-.154 2.203 (.944)	2674.010 2041.777 (.190)	.454 .633 (.474)	1.288 .974 (.186)
t4	.050 .014 (.001***)	2.288 7.061 (.746)	.130 2.175 (.952)	2513.162 2004.127 (.210)	.728 .624 (.243)	1.716 .961 (.074*)
t5	.045 .014 (.002***)	1.477 7.004 (.833)	-.463 2.135 (.828)	4929.041 1984.582 (.013**)	.393 .613 (.521)	.793 .944 (.401)
t6	.040 .014 (.006***)	.393 7.044 (.956)	-.338 2.169 (.876)	3005.992 1997.154 (.132)	.371 .623 (.551)	.777 .959 (.418)
t7	.043 .014 (.003***)	.823 7.041 (.907)	-1.168 2.171 (.590)	3010.160 1999.698 (.132)	.147 .623 (.814)	.885 .960 (.356)
t8	.049 .014 (.001***)	1.679 7.039 (.812)	-1.463 2.171 (.500)	3006.281 1999.298 (.133)	.673 .623 (.280)	.931 .960 (.332)
t9	.056 .014 (.000***)	2.466 7.040 (.726)	-.659 2.172 (.762)	3025.389 1999.768 (.130)	.671 .624 (.282)	.733 .960 (.445)
t10	.059 .014 (.000***)	4.090 7.040 (.561)	-1.471 2.173 (.498)	3006.187 2000.320 (.133)	.328 .624 (.599)	.998 .960 (.299)
t11	.061 .014 (.000***)	4.655 7.045 (.509)	-1.849 2.179 (.396)	3114.323 2006.186 (.121)	-.168 .626 (.789)	.833 .963 (.387)
t12	.054 .015 (.000***)	3.144 7.068 (.656)	-1.561 2.191 (.476)	3162.618 2013.512 (.116)	.423 .629 (.501)	.553 .968 (.568)
t13	.034 .017 (.042**)	-1.023 7.471 (.891)	.575 2.514 (.819)	3048.234 2213.095 (.168)	1.060 .721 (.141)	-.476 1.106 (.667)
t14	-.017 .027 (.525)		-6.827 4.134 (.099*)		.356 1.172 (.761)	-.429 1.846 (.816)
t15	-.010 .020 (.634)	-.603 11.456 (.958)	-.126 3.090 (.967)	495.709 3242.577 (.878)	.619 .886 (.484)	-.368 1.369 (.788)
CONSTANT	.184 .015 (.000***)	42.520 6.923 (.000***)	41.340 2.304 (.000***)	-114.121 2075.867 (.956)	3.015 .661 (.000***)	17.385 1.013 (.000***)

Panel d: Fixed Effects with Bank-Specific Intercept

Dependent Variables	*EQTA*	*TOTCAPRAT*	*NLOANTA*	*RLOAN-GROWTH*	*ROA*	*NIM*
BASELYR	-.001 .003 (.008***)	2.832 1.364 (.159)	-1.066 .361 (-1.774***)	-5379.466 23180.310 (0815.220***)	-.115 .211 (-.530***)	-.563 .268 (1.088**)
CONSTANT	.123 .003 (.117)	14.794 1.303 (12.240)	51.945 .337 (51.283)	-6391.393 21916.940 (-350.830***)	.842 .197 (.455)	4.942 .250 (4.452)

Panel e: Financial Development Model

Dependent Variables	*EQTA*	*TOTCAPRAT*	*NLOANTA*	*RLOAN GROWTH*	*ROA*	*NIM*
BASELYR	.011 .004 (.002***)	3.427 1.253 (.006***)	-3.965 .579 (.000***)	-4103.727 13345.070 (.758)	.391 .158 (.013**)	-.113 .246 (.648)
FINDEV	.000 .000 (.000***)	-.054 .005 (.000***)	.085 .003 (.000***)	-134.054 63.788 (.036**)	.001 .001 (.240)	-.032 .001 (.000***)
CONSTANT	.140 .004 (.000***)	21.161 1.238 (.000***)	44.635 .569 (.000***)	8320.962 12977.340 (.521)	.262 .155 (.091*)	8.304 .242 (.000***)

Panel f: Financial Development Model Without Interaction

Dependent Variables	*EQTA*	*TOTCAPRAT*	*NLOANTA*	*RLOAN-GROWTH*	*ROA*	*NIM*
BASELYR	-.001 .002 (.464)	1.584 .664 (.017**)	-.481 .203 (.018**)	-2077.076 1495.554 (.165)	.188 .062 (.002***)	.081 .128 (.526)
FINDEV	-.001 .000 (.000***)	-.155 .003 (.000***)	-.374 .002 (.000***)	10.530 7.149 (.141)	-.008 .000 (.000***)	-.047 .001 (.000***)
FINDEV_BASELYR	.008 .000 (.000***)	.008 .000 (.000***)	.007 .000 (.000***)	.006 .000 (.000***)	.009 .000 (.000***)	.009 .000 (.000***)
CONSTANT	.130 .002 (.000***)	19.229 .656 (.000***)	50.793 .200 (.000***)	-767.793 1454.359 (.598)	.685 .061 (.000***)	6.002 .126 (.000***)

Table 3.4: Risk Sensitivity and Basel
The results of equation (3.4) are presented below.

Dependent Variables	*NLOANTA*	*RLOAN-GROWTH*	*NLOANTA*	*RLOAN-GROWTH*
BASELYR	4.248 .689 (.000***)	-2279.430 578.164 (.000***)	4.345 .693 (.000***)	-2288.281 607.606 (.000***)
EQTA	-15.881 3.278 (.000***)	-4772.352 2890.269 (.099*)	-13.950 3.247 (.000***)	-5266.119 2984.837 (.078*)
BASELYR _EQTA	-31.173 3.460 (.000***)	4662.735 3030.223 (.124)	-34.849 3.444 (.000***)	5237.732 3145.541 (.096*)
CONSTANT	52.318 .659 (.000***)	2364.886 556.321 (.000***)	.007 .002 (.000***)	-.087 2.518 (.973)
INTEREST RATE			.208 .051 (.000***)	72.108 41.036 (.079*)
GDP GROWTH RATE			-.025 .004 (.000***)	-.752 5.435 (.890)
INFLATION			52.330 .687 (.000***)	2204.426 601.618 (.000***)
BASELYR	13.616 1.169 (.000***)	3.359 37.053 (.928)	11.285 1.102 (.000***)	12.473 37.793 (.741)
NPFRAT	34.852 5.139 (.000***)	-92.619 156.882 (.555)	40.786 4.852 (.000***)	-55.619 161.194 (.730)
BASELYR _ NPFRAT	-14.113 5.906 (.017**)	-93.644 180.082 (.603)	-10.458 5.538 (.059*)	-128.320 185.547 (.489)
CONSTANT	42.536 1.148 (.000***)	31.748 36.418 (.383)	-.583 .018 (.000***)	1.584 1.446 (.273)
INTEREST RATE			-.094 .069 (.175)	4.092 2.405 (.089*)
GDP GROWTH RATE			.154 .012 (.000***)	-1.361 1.646 (.408)
INFLATION			47.764 1.121 (.000***)	10.004 38.347 (.794)

Table 3.4: Continued

Dependent Variables	*NLOANTA*	*RLOAN-GROWTH*	*NLOANTA*	*RLOAN-GROWTH*
BASELYR	38.212 7.233 (.000***)	-90282.260 12834.050 (.000***)	33.320 7.126 (.000***)	-90486.400 12904.640 (.000***)
RWATA	4847.659 1002.155 (.000***)	-8355030.000 1768576.000 (.000***)	4664.580 987.421 (.000***)	-8382089.000 1779629.000 (.000***)
BASELYR _RWATA	-4849.160 1002.156 (.000***)	8355026.000 1768578.000 (.000***)	-4665.971 987.422 (.000***)	8382100.000 1779631.000 (.000***)
CONSTANT	21.905 7.231 (.002***)	90318.020 12829.570 (.000***)	-.248 .076 (.001***)	-17.520 136.327 (.898)
INTEREST RATE			-.251 .095 (.008***)	22.244 159.541 (.889)
GDP GROWTH RATE			-.301 .087 (.001***)	-.291 155.032 (.999)
INFLATION			28.679 7.131 (.000***)	90497.760 12908.270 (.000***)

Chapter 4. Empirical Appendix

Table 4.1: Summary Statistics for chapter 4

Panel a: Shaffer (1993) Model (1992-2004)

	Total Equity	Total Assets	Total Deposits
Mean	646058.43	7379065.01	5266561.11
Standard Error	25500.37	296119.35	210790.18
Count	3189	3293	3184
	Interest Income	Personnel Expenditure	Interest Expense
Mean	504155.48	53167.15	368803.13
Standard Error	19751.19	2386.73	14935.11
Count	3163	2878	3103
	Total Liability	Domestic Interest Rate	Gross Domestic Product
Mean	6905545.19	8.99	189556512157.73
Standard Error	280954.99	0.08	2110472705
Count	3293	5909	5909

Panel b: Depositor Discipline Model (1996-2004)

	Total Assets	Total Deposits	Loan Loss Reserve to Gross Loan	Loan Loss Provision to Net Interest Reserve
Mean	8106025.67	6152173.87	8.50	17414547.49
Standard Error	345885.36	259475.49	0.23	3979779.27
Count	2760.00	2684.00	2467.00	2343.00
	Loan Loss Reserve to Impaired Loan	Impaired Loan to Gross Loan	Total Liability	Total Equity
Mean	39812951.70	13.31	7582093.67	515129.79
Standard Error	6867921.15	0.37	327915.60	22508.67
Count	1780.00	1811.00	2760.00	2760.00

Table 4.2: Correlation Matrix

Panel a: Shaffer (1993) Model (1992-2004)

	Total Equity	Total Assets	Total Deposits	Interest Income	Personnel Income	Interest Expendi-ture	Total Liability	Domestic Interest Rate	Gross Domestic Product
Total Equity	1.00								
Total Assets	0.85	1.00							
Total Deposits	0.84	0.96	1.00						
Interest Income	0.93	0.90	0.92	1.00					
Personnel Income	0.82	0.91	0.93	0.87	1.00				
Interest Expenditure	0.93	0.83	0.85	0.96	0.75	1.00			
Total Liability	0.85	0.99	0.96	0.91	0.91	0.83	1.00		
Domestic Interest Rate	-0.05	-0.14	-0.16	-0.10	-0.14	-0.06	-0.13	1.00	
Gross Domestic Product	0.55	0.53	0.50	0.52	0.57	0.52	0.53	-0.04	1.00

Panel b: Depositor Discipline Model (1996-2004)

	Total Assets	Total Deposits	Loan Loss Reserve to Gross Loan	Loan Loss Provision to Net Internal Reserve	Loan Loss Reserve to Impaired Loan	Impaired Loan to Gross Loan	Total Liabilities	Total Equity
Total Assets	1.00							
Total Deposits	0.97	1.00						
Loan Loss Reserve to Gross Loan	-0.13	-0.12	1.00					
Loan Loss Provision to Net Internal Reserve	-0.02	-0.02	0.10	1.00				
Loan Loss Reserve to Impaired Loan	-0.05	-0.05	0.23	0.04	1.00			
Impaired Loan to Gross Loan	-0.10	-0.09	0.51	0.10	-0.13	1.00		
Total Liabilities	1.00	0.97	-0.12	-0.02	-0.05	-0.10	1.00	
Total Equity	0.80	0.75	-0.16	-0.05	-0.05	-0.13	0.77	1.00

Table 4.3: Depositor Discipline (1996-2004)

	Estimate	P-value	Estimate	P-value	Estimate	P-value	Estimate	P-value	Estimate	P-value
	Indonesia		Korea		Malaysia		Philippines		Thailand	
Panel a: Asset Quality Proxy: Loan Loss Reserve to Gross Loan Ratio (LLRG)										
LLRG	0.01	0.57	0.01	0.00***	0.01	0.00***	0.01	0.53	0.01	0.15
LTA	0.01	0.02**	0.01	0.00***	0.01	0.81	0.01	0.00***	0.01	0.02**
EQTA	-0.67	0.00***	-0.34	0.00***	-0.73	0.00***	-0.57	0.00***	-0.64	0.00***
TDTL	0.91	0.00***	0.90	0.00***	0.62	0.00***	0.79	0.00***	0.84	0.00***
_cons	0.01	0.47	-0.02	0.57	0.33	0.00***	-0.04	0.18	0.06	0.01***
Panel b: Asset Quality Proxy: Loan Loss Provision to Net Internal Reserve (LLRP)										
LLRP	0.01	0.97	0.01	0.55	0.01	0.75	0.01	0.74	0.01	0.30
LTA	0.01	0.00***	0.01	0.00***	0.01	0.46	0.01	0.01***	0.01	0.00***
EQTA	-0.63	0.00***	-0.41	0.00***	-0.71	0.00***	-0.71	0.00***	-0.58	0.00***
TDTL	0.90	0.00***	0.86	0.00***	0.67	0.00***	0.70	0.00***	0.84	0.00***
_cons	0.00	0.99	-0.01	0.83	0.27	0.00***	0.19	0.00***	0.04	0.18

Table 4.3: Contined

	Estimate	P-value	Estimate	P-value	Estimate	P-value	Estimate	P-value	Estimate	P-value
	Indonesia		Korea		Malaysia		Philippines		Thailand	
Panel c: Asset Quality Proxy: Impaired Loan to Gross Loan (ILGL)										
ILGL	0.01	0.41	0.01	0.00***	0.01	0.02**	0.01	0.46	0.01	0.26
LTA	0.01	0.14	0.01	0.16	0.01	0.61	0.01	0.00***	0.01	0.65
EQTA	-0.71	0.00***	-0.74	0.00***	-0.73	0.00***	-0.66	0.00***	-0.82	0.00***
TDTL	0.93	0.00***	0.92	0.00***	0.67	0.00***	0.73	0.00***	0.90	0.00***
_cons	0.01	0.76	0.08	0.00***	0.29	0.00***	0.11	0.00***	0.08	0.00***
Paenl d:										
LLRL	0.01	0.75	0.01	0.00***	0.01	0.06*	0.01	0.52	0.01	0.96
LTA	0.01	0.22	0.01	0.00***	0.01	0.73	0.01	0.01***	0.01	0.57
EQTA	-0.72	0.00***	-0.67	0.00***	-0.75	0.00***	-0.81	0.00***	-0.83	0.00***
TDTL	0.93	0.00***	0.93	0.00***	0.71	0.00***	0.81	0.00***	0.90	0.00***
_cons	0.01	0.59	0.09	0.00***	0.24	0.00***	0.12	0.00***	0.08	0.00***

Note: In the table we present the estimates of equation 4.1 (reproduced below). Focus is on the coefficients of the proxies for asset quality. If the coefficients are significant and negative we have evidence of depositor discipline. On the other hand, if they are not then we do not have evidence.

$$RTDEPGROW_{it} = \theta_0 + \theta_1 ASSETQUALITY_{it} + \theta_2 EQTA_{it} + \theta_3 LTA_{it} + \theta_4 TDTL_{it} + \varepsilon_{it} \text{.....} (4.1)$$

In the above, table we do not get evidence.

'***' significant at the .01 percent level; '**' significant at the .05 percent level; and '*' significant at the .10 percent level.

Table 4.4: Shaffer Model (3SLS)

	Indonesia		Korea		Malaysia	
Parameter	Estimate	P-value	Estimate	P-value	Estimate	P-value
A0	3663300000.00	0.43	-41352400000.00	0.46	-3695140000.00	0.18
A1	-21201800000.00	0.38	-399114000000.00	0.49	-7062300000.00	0.46
A2	-0.02	0.44	0.07	0.45	0.04	0.18
A3	104493000.00	0.38	-9495410000.00	0.49	-401842000.00	0.87
A4	-87230300.00	0.53	2530900000.00	0.43	856990000.00	0.13
A5	0.11	0.38	-0.62	0.49	0.09	0.42
A6	0.00	0.55	0.00	0.40	-0.01	0.15
LAMBDA	0.01	0.73	0.01	0.73	0.01	0.86
B1	-21.01	0.72	-9.97	0.42	-2.18	0.00***
B2	-9.35	0.72	-1.18	0.41	0.25	0.00***
B3	-0.38	0.91	-2.78	0.42	0.07	0.00***
B4	-7.82	0.69	-0.41	0.41	-0.02	0.49
B5	0.00	0.75	0.00	0.38	0.00	0.83

Note: As mentioned in the text, LAMBDA (equation 1.10) is the index of competition adopted from Gruben et al (1997, 1998, and 2003). Beta five (last row) is the dummy variable to test the structural break at 1996, where it takes a value of 0 before that year and 1 afterwards.

$$Q = \alpha_0 + \alpha_1 P + \alpha_2 Y + \alpha_3 PZ + \alpha_4 Z + \alpha_5 PY + \alpha_6 YZ + \varepsilon \quad \text{.....(4.6)}$$

$$P = -\lambda Q/(\alpha_1 + \alpha_3 Z + \alpha_5 Y) + (C/Q)(\beta_1 + \beta_2 \ln Q + \beta_3 \ln W_1 + \beta_4 \ln W_2) - \beta_5 DQ/(\alpha_1 + \alpha_3 Z + \alpha_5 Y) + \xi \quad \text{.....(4.10)}$$

'***' significant at the .01 percent level; '**' significant at the .05 percent level; and '*' significant at the .10 percent level.

Table 4.4: Shaffer Model (3SLS)

	Philippines		Thailand	
Parameter	Estimate	P-value	Estimate	P-value
A0	2737210000.00	0.68	-2477920000.00	0.28
A1	-14061400000.00	0.70	32912800000.00	0.36
A2	-0.04	0.68	0.02	0.29
A3	50367700.00	0.72	-13602900.00	0.98
A4	-187742000.00	0.67	-77500800.00	0.72
A5	0.19	0.72	-0.27	0.37
A6	0.00	0.67	0.00	0.66
LAMBDA	0.00	0.70	0.00	0.61
B1	1.10	0.00***	-5.37	0.00***
B2	-0.27	0.00***	-2.38	0.00***
B3	-0.47	0.00***	-1.10	0.00***
B4	0.24	0.01***	-1.13	0.00***
B5	0.00	0.70	0.00	0.57

Table 4.5: Index of Competition and Index of Depositor Discipline Combined (1996-2004)

	Indonesia	Korea	Malaysia	Philippines	Thailand
Panel a: Index of Competition					
BETA FIVE (3SLS)	.01	.01	.01	.01	.01
Panel b: Index of Depositor Discipline					
Loan Loss Reserve to Gross Loan	.01	.01	.01	.01	.01
Loan Loss Provision to Net Internal Reserve	.01	.01	.01	.01	.01
Impaired Loan to Gross Loan	.01	.01	.01	.01	.01
Loan Loss Reserve to Impaired Loan	.01	.01	.01	.01	.01

Table 4.6: H-Statistics by Year: Based On OLS on Pooled Data

	Indonesia	Korea	Malaysia	Philippines	Thailand
1996	0.528172	0.26573	0.486995	0.654482	0.602894
1997	0.635845	-0.03035	0.411681	0.482115	0.515969
1998	0.510343	0.267491	0.316997	0.552204	-0.07948
1999	0.366977	0.122206	0.499227	0.303658	0.105174
2000	0.134637	0.100838	0.697793	0.266163	0.287981
2001	0.176368	-0.01734	0.265414	0.059796	0.579978
2002	0.444437	0.064629	0.609935	0.387675	0.934896
2003	0.407129	0.267886	0.211135	0.368492	1.414202
2004	NA	0.231417	-1.49969	0.602894	0.824391

Table 4.7: H-Statistics by Country: Based On Several Estimation Techniques (Sample Period: 1996-2004)

	Fixed Effect	Random Effect	Between Effect	OLS
Indonesia	0.81	0.69	0.58	0.60
Korea	0.49	0.48	0.00	0.26
Malaysia	0.70	0.65	0.49	0.55
Philippines	0.82	0.72	0.4	0.58
Thailand	0.82	0.85	1.27	0.90

Appendix D – Chapter 4: Summary of Hypothesis

Equation	Variable Description	Expectation
Dependent Variable: Equation (4.1): *RTDEPGROW*	Growth Rate of Inflation Adjusted Total Deposit	
ASSETQUALITY: Alternatively use *LLRG*, *LLLP*, *LLRL*, *ILGL*	(i) Ratio of Loan Loss Reserve to Gross Loan (*LLRG*); (ii) Ratio of Loan Loss Provision to Net Internal Reserve (*LLLP*); (iii) Loan Loss Reserve to Impaired Loan (*LLRL*); and (iv) Impaired Loan to Gross Loan (*ILGL*).	If the coefficient is negative and significant, then we establish that there is depositor discipline at work.
Equations (4.6) and (4.10): Dependent Variable (4.6): Q; Dependent Variable (4.10): P		
P	Ratio of Interest Income to Total Assets	
Q	Total Assets	
Y	GDP in Constant Dollars	
Z	Deposit Rate	
W1	Ratio of Interest Expense to Total Liabilities	
W2	Ratio of Employee Expense to Total Liabilities	
C	Ratio of Total Expenditure to Total Assets	
D	Year dummy is zero if year is before 1997, and one if it is after.	
β_5 and $\lambda+\beta_5$		If we find that the value of β_5 is negative and large, that will imply that banks significantly increased the riskiness of its behavior after liberalization or privatization.

Appendix D – Chapter 4: Summary of Hypothesis (Continued)

Equation	Variable Description	Expectation
Equation (4.11): Dependent Variable: log of P	Ratio of Gross Interest Revenue to Total Assets	
W1	Ratio of Interest Expense to Total Deposits and Money Market Funding	
W2	Ratio of Personnel Expense to Total Assets	
W3	Ratio of Other Operating and Administrative Expense to Total Assets	
Y1	Ratio of Equity to Total Assets	
Y2	Ratio of Net Loans to Total Assets	
Y3	Logarithm of Total Assets	
PR H-Statistics H = sum of coefficients of log of W1, W2 and W3 variables		
	H<0	Monopoly
	H=1	Perfect Competition
	0<H<1	Monopolistic Competition

Vita

Mohammed Ershad Hussain was born in Dhaka, Bangladesh on the 16th of July, 1971. He received M.A. in Economics from the Univeristy of Texas at Arlington in 2000 (May) and M.S.S. in Scocial Science (Economics) from Dhaka University in 1995. He has worked at the Palli Karma Shayak Foundation (PSKF). He also served as the Assistant Chief of the Planning Commission, Government of Bangladesh between 1996 to 2000. At PKSF he served as a Deupty Manager of Operations dealing with Grameen Bank like Micro-credit Porgrams. Mohammed Ershad Hussain has taught undergaraduate courses in finance, economics and business statistics at the University of New Orleans.