Panel studies on bank risks and crises

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Chapter 1

Introduction

Fear. Breakdown in confidence. Market capitulation. Financial turmoil. These words are different, not just in degree but also in kind. They are more normative, but no less consequential to the real economy. They are indicative of panic conditions. In panics, once firmly held truths are no longer relied upon. Articles of faith are upended. And the very foundations of economies and markets are called into question. Some economists, market participants, and historians--not so long ago--were prepared to relegate these highly charged descriptions of despair to the dustbin of history. Government policies improved, understanding of economics deepened, and markets found a more sustainable equilibrium, or so it was thought.

(Kevin Warsh[1])

1.1 Background and Motivation

The current financial crisis caught most policy makers and researchers by surprise. Research on early-warning signals of financial crises did not foresee the arrival of such a catastrophic financial crisis. Those researchers and policy-makers who noticed a bubble (see, e.g., Case and Shiller, 2003, and Wheaton and Nechayev, 2007) did not expect this severe a crisis. The International Monetary Fund (IMF, 2009) projects that total credit write-downs because of the current crisis will amount to about 4.1 trillion US dollars, of

[1] Kevin Warsh, *The Panic of 2008, FRB Governor's Speech delivered a*t the Council of Institutional Investors 2009 Spring Meeting, Washington, D.C.

which 1 trillion dollars have already realized. Banks will likely bear two-thirds of these 4.1 trillion US dollars. The huge magnitude of theses losses has serious implications for banking and financial sector stability and for market confidence in financial institutions. The crisis once more illustrates the importance of bank risk management, up-to-date supervisory responses to dynamic requirements of the financial systems, and proper appraisal of risks faced by banks and financial systems.

This thesis focuses upon the risks faced by the banks at the firm and the systemic level. The appraisal of such risks is key to the proper risk management of banks and to maintaining financial stability. Before discussing the risks and their impact on bank performance, it is important to discuss what we mean by financial stability. Defining financial sector stability can be an illusive goal because of the variety and the dynamic nature of threats and risks faced by a financial system. However, its importance cannot be underestimated. In most cases, it appears easier to define the absence of financial sector stability, instead of the existence of financial instability. For example, Crockett (1997: p3) says:

"…define financial stability as an absence of instability… a situation in which economic performance is potentially impaired by fluctuations in the price of financial assets or by an inability of financial institutions to meet their contractual obligations."

Schinasi (2004: p8) presents a survey of the definitions of financial stability and defines financial stability as follows:

"*A financial system is in a range of stability whenever it is capable of facilitating (rather than impeding) the performance of an economy, and of dissipating financial imbalances that arise endogenously or as a result of significant adverse and unanticipated events.*"

Financial stability does not refer only to the absence of a financial crisis but also to situations where a financial system may not be in a crisis but is still fragile. To further investigate what constitutes financial stability, it is useful to have a look at the IMF's core set of Financial Soundness Indicators (FSI) which lists (i) capital adequacy, (ii) asset quality, (iii) earnings and profitability, (iv) liquidity, and (v) sensitivity to market risk as indicators of financial soundness.

There are several factors that affect financial stability, including both systemic and non-systemic (i.e., bank-specific) factors. Eichengreen (2006) divides the causes of financial instability into four categories: (i) unsustainable macroeconomic policies, (ii) fragile financial systems, (iii) institutional weaknesses, and (iv) flaws in the structure of international financial markets.

Wrongly timed and *unsustainable macroeconomic policies* can take various forms. For example, imprudent regulation in financial markets and/or sub-optimal competitive forces can increase the vulnerability of a financial system. For example, Allen and Gale (2007: p2) refer to the post Great Depression developments and argue that extensive regulation resulted in the virtual disappearance of banking crises in the United States between 1945-1971, but led to many other problems:

"However, the elimination of crises came at a cost. Because of the extensive regulation and government intervention the financial system ceased to perform its basic function of allocating investment. There were many inefficiencies as a result. This led to calls for deregulation and the return of market forces to the allocation of investment".

An important question that arises is how financial liberalization and other macroeconomic variables affect the likelihood of systemic and non-systemic crises and what role does supervisory control play in this relationship. We address this question in the chapter 2 of our thesis.

Fragile financial systems may also lead to instability in banks and financial institutions. This fragility may be a consequence of a financial crisis, resulting in lower market confidence, or the industrial organization of the banking industry. The recent focus on bank size as a potential risk factor (see, e.g., Tarullo, 2009) is a consequence of the current financial crisis. While both large and small banks showed heightened balance sheet vulnerability, large banks are being criticized more because of the implied systemic risks. Two questions that emerge from the current situation are: (i) do bank size or market power impact the ability of banks to withstand a crisis, and (ii) how do bank growth and profitability depend on bank size? Both of these questions are important from the perspective of the industrial organization of banking firms and reflect what can be labeled

as the built-in risk factors of the financial systems. In this thesis, we examine both questions and check how the impact of financial crisis on earnings volatility depends on the industrial organization of the banking industry.

Institutional weaknesses can refer to both weaknesses in the banking firms' internal governance structure and in supervisory and legal control mechanisms. Weaknesses in the internal governance structure of a bank refer to the inability or unwillingness of bank owners to control the risks of a banking firm. According to Berle and Means (1933), dispersed ownership reduces the effective power of shareholders to control the management of the firm. Moreover, Gomes and Novaes (1999, 2005) argue that large shareholders can have interests that are different from those of minority shareholders. In addition, the bargaining problems due to the presence of multiple controlling shareholders may prevent efficient decision-making. As we show in this thesis, the examination of bank ownership is a necessary constituent of the analysis of bank risk. La Porta *et al.* (1998) argue that small, diversified shareholders are unlikely to be important in countries with weak shareholder protection rights. Therefore, we take shareholder protection rules into account in our empirical model for bank riskiness and also examine how the role of shareholders varies with variation in shareholder protection rights. Moreover, in examining the impact of ownership concentration on bank riskiness, the inter-relationships between the supervisory control effectiveness and ownership concentration have to be taken into account. Demsetz and Lehen (1985) show that in highly regulated industries like the financial sector, ownership monitoring is not an objective pursued by shareholders because it is taken for granted that supervisory agencies take care of this. However, as the level and effectiveness of banking supervision varies significantly from one country to another, ownership monitoring may play an important role in financial industries as well. We show that absence of monitoring from both shareholders and supervisory authority can be detrimental for bank soundness.

Finally, *flaws in the structure of international financial markets* can also lead to financial instability. These flaws can channel into financial instability through currency or debt crises or sub-optimal liberalization of interest rate and capital controls. For example, Devenow and Welch (1996) point out the herding behavior and capital liberalization reversals as the cause of crises, irrespective of other reasons. Moreover,

international financial markets inefficiencies can also give rise to currency and sovereign debt crises. We show in this thesis that currency and sovereign debt crises lead to volatility of bank earnings, which reduces financial soundness. In addition, we examine the role of capital liberalization in the propagation of systemic and non-systemic crises.

It is important to mention here that systemic and bank-specific risks turn out to be highly related. Therefore, another focus in this thesis is the variation of non-systemic risks with overall financial system characteristics. To elaborate on this point, when we examine the effect of ownership structure of banking firms, it is important to examine the supervisory control environment and shareholders protection in the financial system. Arguably, there can be differences in the impact of ownership monitoring at different levels of supervisory control and shareholder protection rights. Similarly, when we examine the impact of financial crises on banking firms, a uniform impact cannot be expected, a priori.

1.2 Outline and the Main Findings

In this thesis, we focus on certain systemic and bank-specific factors that play a crucial role in bank performance and risk management. The overall research question examined in this thesis is: *How do various bank-specific and systemic factors affect the riskiness of banks at firm and systemic level?* To examine this question in detail, we specifically examine the following four research questions:

(a) How does financial reform affect the likelihood of the occurrence of systemic and non-systemic banking crises, conditional on the supervisory environment and level of liberalization?

(b) How do financial crises affect the earnings volatility of banking firms, conditional on bank size and market concentration?

(c) How do bank growth and profitability depend on bank size and how persistent are bank growth and profitability?

(d) How does ownership concentration affect bank riskiness conditional on supervisory control and shareholder protection rights?

The structure of the rest of the thesis is as follows: The second chapter focuses on the causes of systemic and non-systemic banking crises. We specifically examine the role played by financial liberalization on the likelihood that systemic and non-systemic crises occur. Our indicators of systemic and non-systemic banking crises are based on the Honohan and Laeven (2005) dataset, whereas the data on financial liberalization has been taken from Abiad *et al.* (2008). Abiad *et al.* (2008) distinguish between seven different kinds of financial reforms that relate to the presence of (i) credit controls and reserve requirements, (ii) interest rate controls, (iii) entry barriers, (iv) state ownership in the banking sector, (v) capital account restrictions, (vi) prudential regulation and supervision of the banking sector, and (vii) securities market policy. Using these new financial liberalization measures for a large sample of developing and developed countries for the period 1973 to 2002, our multivariate probit modeling results suggest that conditional on adequate banking supervision, certain dimensions of financial liberalization reduce the likelihood of systemic crises. In contrast, there is some evidence that the likelihood of non-systemic crisis increases after financial liberalization. In various sensitivity tests, these results turn out to be very robust.

The third chapter focuses on the impact of financial crises on bank earnings volatility, conditional on bank size and market concentration. Our findings suggest that large banks face lower earnings volatility in the wake of financial crises compared to small banks. Moreover, banks operating in more concentrated banking industries face higher earnings volatility. These findings are in line with the results of Stever (2007), who shows that large banks have a better ability to diversify their risks, and De Nicolo *et al.* (2004), who show that more concentrated banking industries are prone to more banking fragility. Our findings are robust to the use of absolute or relative bank size, causes of financial crises, types of banks, and earning volatility definitions.

In the fourth chapter, we investigate the dynamics that influence the organization of the banking industry through growth and profitability. As we know, the structure and organization of the banking industry influence the risks and profitability of individual banks in a significant way. So in this chapter, we particularly focus on (i) whether bank growth and profitability are persistent, (ii) whether bank growth and profitability depend on bank-size, and (iii) the inter-linkages between growth and profitability of a bank. To

analyze these questions we use the Generalized Method of Moments dynamic panel analysis for a mixed sample of more than 1500 banks from 65 countries. Our results suggest no evidence of persistence in bank growth but we find significant persistence in bank profitability. Moreover, our results show that the growth and profitability dynamics of banks located in OECD and non-OECD countries differ.

In the fifth chapter, we focus upon the link between bank governance and riskiness and examine the impact of bank ownership concentration on two indicators of bank riskiness, namely banks' non-performing loans and capital adequacy. Using balance sheet information for around 500 commercial banks from more than 50 countries averaged over 2005-2007, we find that concentrated ownership (proxied by different levels of shareholding) significantly reduces a bank's non-performing loans ratio, conditional on supervisory control and shareholders protection rights. Furthermore, ownership concentration affects the capital adequacy ratio positively conditional on shareholder protection. At low levels of shareholder protection rights and supervisory control, ownership concentration reduces bank riskiness.

The final chapter summarizes our findings and discusses the policy implications of our five main conclusions. These conclusions are: (i) financial liberalization reduces the likelihood of systemic crises, (ii) an adequate regulatory environment is a pre-requisite for successful financial liberalization, (iii) large banks face lower earnings volatility in the wake of financial crises, (iv) bank growth and profitability dynamics are different in OECD and non-OECD countries, and (v) the presence of a controlling owner in a banking firm can lead to better bank governance.

1.3 Contribution to the Literature

The conclusions drawn from this thesis are important for both financial sector research and policy-making bodies. As we discussed before, a proper appraisal of various risk factors is the fundamental and foremost part of the risk management of the banking industries all over the world. A number of studies[2] report that financial liberalization increases the likelihood of banking crises, however, the data used by these studies is

[2] See, e.g., Demirgüç-Kunt and Detragiache (1998, 2000) and Mehrez and Kaufmann (2000).

rather subjective and mostly one-dimensional. In chapter 2 of this thesis, we show how different kinds of financial reform impact the likelihood of systemic and non-systemic crises conditional on supervisory environment and level of liberalization in the financial system. The results drawn emphasize the importance of up-to-date supervisory control to reap the benefits of financial liberalization. Additionally, we show that financial reform actually reduces the likelihood of systemic crises, if a satisfactory supervisory control environment is available.

Although some studies[3] examine the impact of bank size and business cycles on bank profitability and risk-taking separately, on analysis of the variation in the impact of financial crises on bank profitability with changes in bank size and market concentration is missing in the literature. The results reported in chapter 3 of this thesis suggest that larger banks are better able to withstand financial crises. Moreover, we also show that less concentrated financial systems face lower bank earnings volatility in the wake of financial crises.

Growth and earnings volatility of banks has been researched for five OECD countries by Goddard *et al.* (2004a, 2004b). However, an analysis of differences in the dynamics between banks located in OECD and non-OECD countries is currently missing. As we show in chapter 4 of the thesis, the banking structure in OECD and non-OECD countries is quite different in terms of industrial organization, so differences in dynamics of growth and profitability can be very important. Chapter 4 of this thesis shows persistence in banking profitability and emphasizes the difference in the industrial organization of OECD and non-OECD countries using a dataset on banks operating in 65 countries. The results drawn from this chapter show that bank growth and profitability depend on the historical growth and profitability trends, bank size, and market structure.

Also the analysis of the impact of bank ownership structure on the impaired loans ratio and the capital adequacy ratio is largely missing in the literature. A close and recent paper by Laeven and Levine (2008) examines the impact of ownership concentration on the so-called z-score. However, they only consider ownership stakes of 10 and 20

[3] See Bikker and Haaf (2002), Berger *et al.* (2005) and Stever (2007).

percent, whereas we show in chapter 5 of this thesis that a controlling stake (i.e., ownership with 50 percent or more of the shares) has a different impact. We also show the variation in the role of ownership concentration at different levels of shareholders protection rights and supervisory control in addition to using a much larger dataset as compared to existing studies. Chapter 5 of this thesis underlines the importance of ownership monitoring in banking firms. We show that at different levels of supervisory control, this ownership monitoring can be an important control mechanism.

Chapter 2

Financial Reform and Banking Crises[1]

2.1 Introduction

Financial reform can be defined as measures aiming at the removal of non-competitive market forces in the financial sector, thereby increasing its level of liberalization. Consequently, financial reform improves financial sector development, which, in turn, may enhance economic growth. At the same time, there is some evidence that increasing liberalization induces risk-taking behavior and may cause banking crises (cf. Kaminsky and Reinhart, 1999; Mehrez and Kaufmann, 2000). However, previous studies did not consider the conditioning impact of supervisory control or the overall level of financial liberalization in analyzing the impact of reform on the likelihood of crises. Moreover, the financial liberalization data used in these studies was quite limited and rather subjective. We employ a better methodology and an extensive new data set of financial reform

[1] This chapter is based on joint work with Jakob de Haan. We are highly grateful to Abdul De Guia Abiad from the International Monetary Fund for his generous permission to let us use his data on financial liberalization. The authors are thankful to Laura Spierdijk, Robert Lensink, and participants in seminars at the Netherlands Bank, the University of Groningen, the Annual Conference of the Royal Economic Society, 2009, Surrey, United Kingdom, the Annual Conference of European Economic Association 2009, Barcelona, Spain, the 2nd International Research Forum, 2009, of Europlace Institute of Finance, Paris, France, the XVII International Tor Vergata Conference on Banking and Finance, 2008, Rome, Italy and the workshop at CERES Summer School, 2009, Nijmegen, the Netherlands for their valuable suggestions. The usual disclaimer applies.

recently provided by Abiad *et al*. (2008) to examine the impact of financial reform on banking crises. Our findings suggest that certain dimensions of financial reform reduce the likelihood of systemic banking crises—defined as crises in which much or all bank capital has been exhausted—conditional on adequate banking supervision. This result is broadly in line with the finding of Beck *et al.* (2006) that the presence of regulatory policies and institutions that discourage competition are associated with greater banking system fragility. We also find that once a country has reformed, the introduction of further reforms becomes easier and leads to more stable financial systems. This implies that there is a "learning effect" which has also been pointed out by Abiad and Mody (2005) in a different context. Moreover, we find some evidence that the likelihood of non-systemic crises—defined as crises limited to a small number of banks—increases after financial reform enhancing liberalization. These results therefore suggest that increased competition due to the financial reform may lead to the elimination of some inefficient financial institutions.

We analyze the impact of financial reform on systemic and non-systemic banking crises in 85 countries during the period 1973 to 2002. Our data on banking crises come from Honahan and Laeven (2005). Our indicator of financial form is based on the data set of Abiad *et al*. (2008) indicating the extent to which a financial system is liberalized.[2] This is an extended and updated version of the database as used by Abiad and Mody (2005), covering various dimensions of the financial system. The measures relate to the presence of (i) credit controls and reserve requirements, (ii) interest rate controls, (iii) entry barriers, (iv) state ownership in the banking sector, (v) capital account restrictions, (vi) prudential regulation and supervision of the banking sector, and (vii) securities market policy.

We address the following research questions: (1) does financial reform, conditional on supervisory control, affect the likelihood of a systemic banking crisis, and if so, are there differences among the various dimensions of financial reform that we distinguish? (2) Does the impact of financial reform on banking crises vary at different levels of liberalization of the financial system? and (3) Are

[2] The dataset of Abiad *et al*. (2008) covers 91 countries and a longer period, but many other explanatory variables are not available for all countries, thereby restricting our sample.

systemic and non-systemic crises affected in the same way by financial reform leading to more liberalization?

The rest of the chapter is organized as follows. Section 2.2 provides a discussion on the determinants of banking crises and a brief literature review. It also introduces our measures for financial reform and banking crises. Section 2.3 describes the specification of our model and explains other explanatory variables used in our analysis. Section 2.4 analyses the impact of financial reform on the likelihood of systemic crises. Section 2.5 examines whether the impact of financial reform is conditioned by the level of liberalization. Section 2.6 deals with the impact of financial liberalization on non-systemic crises. Finally, section 2.7 offers a discussion of our results and their policy implications.

2.2 Financial Reform and Banking Crisis

2.2.1 Previous studies

Demirgüç-Kunt and Detragiache (1998) analyze the relationship between banking crises and policies aimed at increasing financial liberalization using data over the period 1980-95 for 53 countries. Their findings suggest that banking crises are more likely to occur in liberalized financial systems. They also find that the impact of financial liberalization on a fragile banking sector is weaker where the institutional environment is strong. The indicator of financial reform used by Demirgüç-Kunt and Detragiache (1998) is a dummy variable taking a value of one for the first year in which some interest rates were liberalized. Although interest rate liberalization is important, it only covers a minor part of financial sector reform. Furthermore, this indicator does account for policy reversals.

Mehrez and Kaufmann (2000) examine how absence of corruption ('transparency') affects the probability of a financial crisis. Using multivariate probit modeling for 56 countries during 1977-97, they report a higher probability of a crisis following financial reform during the following five years. Moreover, they find that the crisis probability is higher in countries with poor transparency than in countries that are transparent. Mehrez and Kaufmann (2000) provide their own

dating of financial reform and construct their reform measure on the basis of these dates.

Focusing on the link between currency and banking crises, Kaminsky and Reinhart (1999) analyze 76 currency crises and 26 banking crises for 20 countries during 1970 to mid-1995. One of their main findings is that financial reform enhancing liberalization often precedes banking crises. Their proxy for increased financial liberalization is two-year lagged domestic credit growth. Again, this is a poor proxy as increased credit growth may also be caused by various other factors than financial reform and it does not capture the diversity of financial reform.

On the basis of a panel analysis, Caprio and Martinez (2000) find that government ownership of banks increases the likelihood of banking crisis. However, Barth *et al*. (2004) using cross-country analysis, do not find that government ownership is significantly associated with increases in bank fragility once they control for the regulatory and supervisory environment.

There are also various papers that do not explicitly include policies aiming at financial liberalization as a potential determinant of banking crises. A good example is the recent study by Beck *et al*. (2006) who examine the impact of bank concentration, bank regulations, and national institutions on the likelihood that a country experiences a systemic banking crisis. They use data from 1980 to 1997 for 69 countries and report that crises are less likely in economies with more concentrated banking systems. Moreover, they find that regulatory policies and institutions that discourage competition are associated with greater banking system fragility.

2.2.2 Data

The studies discussed above use different indicators of banking crises. Our indicator of banking crises is based on the Honohan and Laeven (2005) dataset that updates the work by Caprio and Klingebiel (1999), distinguishing between systemic and non-systemic banking crises that have occurred since the late 1970s.[3] This database

[3] Caprio and Klingebiel (1999) define a systemic banking crisis as a crisis in which much or all bank capital been exhausted. Honohan and Laeven (2005) use the same definition. A non-system banking crisis is a crises limited to a small number of banks. We could not use the updated dataset provided

is one of the most comprehensive banking crises databases. In our analysis of the relationship between (systemic and non-systemic) banking crises and financial reform we use a sample of 85 countries during 1973 to 2002. This selection is primarily dictated by the availability of the financial liberalization index, to be discussed hereafter, and the availability of control variables. Table A1 in the Appendix identifies the years in which the countries in our sample had a crisis.

Our data on financial liberalization come from Abiad *et al*. (2008) who distinguish seven dimensions of the extent to which the financial sector has been liberalized that are graded on scale from 3 (fully liberalized) to 0 (not liberalized). Apart from distinguishing between different dimensions of financial liberalization on an annual basis, the database has the advantage that it allows for policy reversals. The first dimension of liberalization refers to credit controls and excessively high reserve requirements (referred to as credit controls henceforth) focusing on the presence of specific credit ceilings or floors, and reserve requirements. The second dimension is about interest rate controls examining whether they are administered by the government, and whether there are floors, ceilings or bands present. The third dimension is entry barriers, which is based on licensing requirements and restrictions on geographical outreach activities. The fourth dimension covers state ownership in the banking sector, i.e., the share of the assets of the banking sector controlled by state-owned banks. The fifth dimension refers to capital account restrictions and other restrictions on international capital flows. The sixth dimension captures prudential regulations and supervision of the banking sector, including compliance with the Basel standards, and executive influence on the banking supervisory agency. The final dimension refers to securities market policy covering the auctioning of government securities, debt and equity market development, and openness to foreign investors.

Abiad *et al*. (2008) acknowledge that the dimension referring to the supervision and prudential regulation of banks is different from the other dimensions of financial liberalization. A higher score in this case means better (or more) regulation. So in our empirical analysis, we do not treat this as a dimension

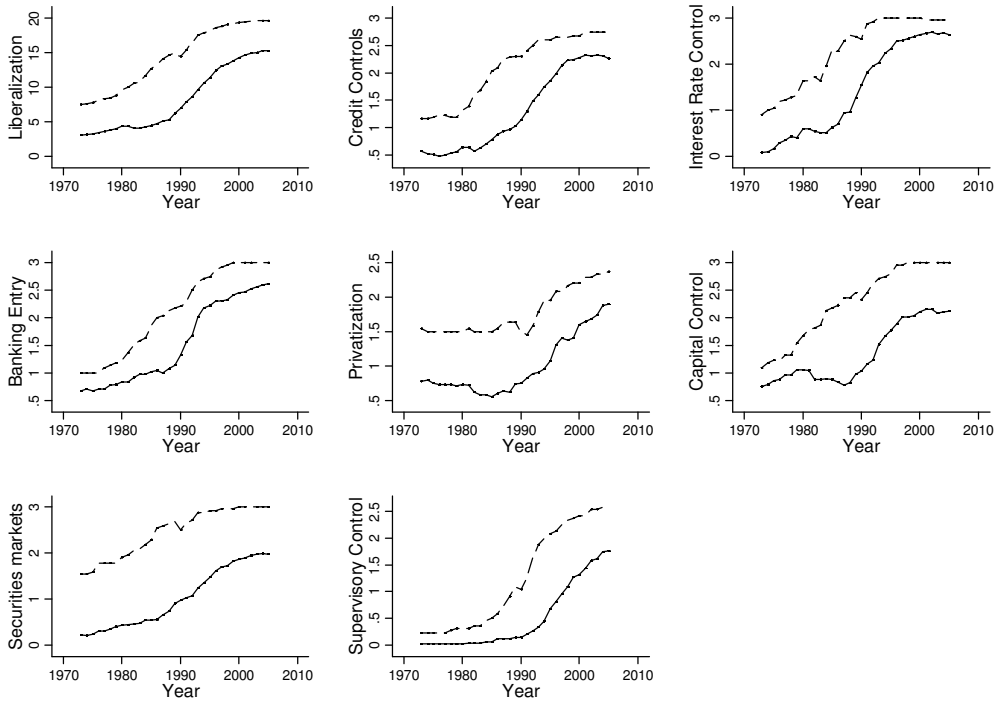
by Laeven and Valencia (2008) as it does not distinguish between systemic and non-systemic crises, while the duration of the crises is also not available.

of financial liberalization. We also exclude it in calculating our overall liberalization measure, which consists of the sum of the scores of the various liberalization dimensions excluding supervision.

Figure 2.1 shows the growth of the different financial liberalization measures and the financial supervision measure over the period of 1973-2005, differentiating between high-income OECD countries and other countries. As follows from Figure 1, the average level of financial liberalization has increased over time, but the financial systems of high-income OECD countries are more liberalized than those of other countries in the sample and they are better supervised as well. Still, the gap between the two groups of countries has decreased over the 1973-2005 period for all liberalization dimensions, except for securities markets and capital controls. However, while financial systems in non-high-income OECD countries have been liberalized substantially, their supervisory control systems have evolved more slowly and the gap with high-income OECD countries has increased. As our results suggest that supervisory control should be complementary to financial reform enhancing liberalization, weaknesses in this respect may result in financial vulnerability.

We take the change of the various liberalization measures as our indicators of financial reform. Table A2 in the appendix shows Spearman's rank correlation coefficients between the different indicators of financial reform. It follows that the various dimensions of financial reform clearly differ from one another.

Figure 2.1 Financial Liberalization and Supervision in High-Income OECD and Other Countries



This figure presents the comparative trends of different types of financial liberalization and bank supervision in high-income OECD and other countries over the period 1973-2005. The dashed lines represent financial liberalization and supervisory control for high-income OECD countries while the solid lines refer to other countries in our sample.

2.3 Model Specification

To analyze the impact of financial liberalization on systemic and non-systemic banking crises, we estimate the following model:

$$\mathbf{Crisis}_{i,t} = \alpha_{i,t} + \lambda(\mathbf{Lib}_{i,0}) + \psi[\sum_{t=1}^{-4}(\Delta\mathbf{Lib})_i] + \theta(\mathbf{Sup}_{i,t}) + \eta[\sum_{t=1}^{-4}(\Delta\mathbf{Lib})_i]*(\mathbf{Sup}_{i,t}) + \gamma(\mathbf{Ctrl}_{i,t}) + \xi \quad (2.1)$$

The dependent variable $\mathbf{Crisis}_{i,t}$ takes a value of 1 if there is a banking crisis and zero if there is no crisis. In section 2.4 the dependent variable refers to systemic

crisis, while in section 2.6 the dependent variable refers to non-systemic crisis. The likelihood of a crisis in country *i* at time *t* is a function of the initial level of liberalization ($\mathbf{Lib}_{i,0}$); reform, taken here as the cumulative change in the level of any liberalization dimension over the current and last four years period ($\sum_{t=1}^{-4}(\Delta \mathbf{Lib})_i$); the level of supervisory control ($\mathbf{Sup}_{i,t}$); and a matrix of control variables ($\mathbf{Ctrl}_{i,t}$). Following Mehrez and Kaufmann (2000), we examine the impact of reform measures taken over a five-years period on the likelihood of a banking crisis thereby minimizing potential problems of endogeneity. To check for the conditioning effect of banking supervision, we introduce an interaction term of financial reform with the level of supervision.

Models with interactive terms cannot be interpreted directly on the basis of the coefficients of the constituent or interaction terms and their significance (Aiken and West, 1991; Brambor *et al*., 2006; and Shehzad *et al*., 2009). Therefore, we follow the approach suggested by Aiken and West (1991) for non-linear models. If Φ is the standard normal cumulative distribution and $X_{i,t}$ denotes the explanatory variables in equation (2.1) then the conditional mean of the crisis variable can be written as:

$$E[\Pr(\mathbf{Crisis})_{i,t} \mid \mathbf{X}_{i,t}] = \Phi[\alpha_{i,t} + \lambda(\mathbf{Lib}_{i,0}) + \psi[\sum_{t=1}^{-4}(\Delta \mathbf{Lib})_i] + \theta(\mathbf{Sup}_{i,t}) + \eta[\sum_{t=1}^{-4}(\Delta \mathbf{Lib})_i] * (\mathbf{Sup}_{i,t}) + \gamma(\mathbf{Ctrl}_{i,t})] = \Phi(.) \tag{2.2}$$

The key hypothesis to test for the marginal effect of financial reform on the probability of a crisis, conditional on supervisory control, is:

$$H_0 = \frac{\partial \Phi(.)}{\partial[\sum_{t=1}^{-4}(\Delta \mathbf{Lib})_i]} = \psi \Phi\ (.) + \eta \Phi(.) * (\mathbf{Sup}_{i,t}) = 0$$

$$H_1 = \frac{\partial \Phi(.)}{\partial[\sum_{t=1}^{-4}(\Delta \mathbf{Lib})_i]} = \psi \Phi(.) + \eta \Phi(.) * (\mathbf{Sup}_{i,t}) \neq 0$$

Where $\psi\Phi$ (.) refers to the direct marginal effect of $\sum_{t=1}^{-4}(\Delta\mathbf{Lib})_i$ and $\eta\Phi(.)$ refers to the marginal effect of the interaction term. The stated hypothesis tests the total marginal impact of $\sum_{t=1}^{-4}(\Delta\mathbf{Lib})_i$ which may vary at different levels of supervisory control.

To address our second research question, we interact financial reforms with the level of liberalization. The resulting model can identify whether the impact of financial reform on systemic crises varies at different levels of liberalization. The corresponding model is:

$$\mathbf{Crisis}_{i,t} = \alpha^{\tau}{}_{i,t} + \psi^{\tau}[\sum_{t=1}^{-4}(\Delta\mathbf{Lib})_i] + \theta^{\tau}(\mathbf{Sup}_{i,t}) + \pi(\mathbf{Lib}_{i,t}) + \eta^{\tau}[\sum_{t=1}^{-4}(\Delta\mathbf{Lib})_i]*(\mathbf{Lib}_{i,t}) + \gamma^{\tau}(\mathbf{Ctrl}_{i,t}) + \zeta \tag{2.3}$$

If Φ is the standard normal cumulative distribution and $\mathbf{X}^{\Gamma}{}_{i,t}$ denotes all explanatory variables in equation (2.3), the conditional mean of the crisis variable can be written as:

$$E[\Pr(\mathbf{Crisis})_{i,t} \mid \mathbf{X}^{\Gamma}{}_{i,t}] = \Phi[\alpha^{\tau}{}_{i,t} + \psi^{\tau}[\sum_{t=1}^{-4}(\Delta\mathbf{Lib})_i] + \theta^{\tau}(\mathbf{Sup}_{i,t}) + \pi(\mathbf{Lib}_{i,t}) + \eta^{\tau}[\sum_{t=1}^{-4}(\Delta\mathbf{Lib})_i]*(\mathbf{Lib}_{i,t}) + \gamma^{\tau}(\mathbf{Ctrl}_{i,t})] = \Phi(\kappa) \tag{2.4}$$

The key hypothesis to test for the marginal effect of financial reform on the probability of a crisis, conditional on different levels of liberalization, can be derived from equation (2.4) as:

$$\mathrm{H}_0 = \frac{\partial\Phi(\kappa)}{\partial[\sum_{t=1}^{-4}(\Delta\mathbf{Lib})_i]} = \psi^{\tau}\Phi(\kappa) + \eta^{\tau}\Phi(\kappa)*(\mathbf{Lib}_{i,t}) = 0$$

$$\mathrm{H}_1 = \frac{\partial\Phi(\kappa)}{\partial[\sum_{t=1}^{-4}(\Delta\mathbf{Lib})_i]} = \psi^{\tau}\Phi\ (\kappa) + \eta^{\tau}\Phi\ (\kappa)*(\mathbf{Lib}_{i,t}) \neq 0$$

Where $\psi^{\tau}\,\Phi\,(\kappa)$ refers to the direct marginal effect of $\sum_{t=1}^{-4}(\Delta\mathbf{Lib})_i$ and $\eta^{\tau}\,\Phi(\kappa)$ refers to the marginal effect of the interaction term. The stated hypothesis tests the total marginal impact of $\sum_{t=1}^{-4}(\Delta\mathbf{Lib})_i$ which may vary at different levels of liberalization.

We include various control variables following previous studies like Kaminsky and Reinhart (1999), Beck *et al.* (2006), and Demirgüç-Kunt and Detragiache (2002). These variables include real GDP growth (one-year lagged), the rate of inflation[4] (change in CPI), the real interest, and the depreciation of the exchange rate. Finally, we include initial level of real GDP per capita (in US$) to control for the level of economic development, and the initial level of financial liberalization. Table 2.1 summarizes the control variables and Table A3 in the appendix gives a list of our dependent and independent variables[5] and also provides their sources and expected signs.

[4] The inflation rate (p) is transformed by the formula (p/100)/(1+(p/100)) to reduce the influence of extreme observations.

[5] Data for certain variables, like bank concentration, corruption, money and quasi-money to GDP ratio, and credit to private sector, was not available for the whole period of analysis. Introducing these variables leads to a considerably smaller sample.

Table 2. 1 Summary Statistics					
Variable	**Mean**	**Standard Deviation**	**Minimum**	**Maximum**	**Observations**
Systemic crises	0.189	0.392	0	1	1459
Non-systemic crises	0.070	0.255	0	1	1459
Liberalization (overall)	11.742	6.062	0	21	1459
Credit controls	1.826	1.058	0	3	1459
Interest rate control	2.101	1.216	0	3	1459
Banking entry	1.912	1.131	0	3	1459
Privatization	1.411	1.191	0	3	1459
Supervisory control	0.888	0.979	0	3	1459
Capital controls	1.870	1.088	0	3	1459
Securities markets	1.734	1.076	0	3	1459
Real GDP growth	0.033	0.038	-0.14	0.17	1459
Log (GDP/capita)	8219.502	9572.304	93.01	38200.41	1459
Real interest rate	7.256	24.615	-97.81	789.80	1459
Inflation	0.104	0.130	-0.11	0.99	1459
Depreciation	-2.331	55.211	-1848.73	1.00	1459
Economic freedom index	24.919	5.432	9.56	36.85	1347
Openness	64.535	38.696	6.32	368.01	1436
Bank concentration	0.671	0.206	0.20	1.00	827
Corruption	3.636	1.436	0.00	6.00	1169
Money and quasi-money/GDP	92.444	764.187	4.70	18798.83	1188
Credit to private sector/GDP	0.518	0.428	0.01	3.45	1390

Table A4 in the Appendix shows the correlation matrix of the control variables, liberalization measures, and our indicators of banking crises. The table shows that the control variables are not highly correlated.

2.4 Financial Reform and Systemic Banking Crisis

2.4.1 Main results

For the analysis of our first research question, i.e., what is the impact of financial liberalization on systemic banking crises conditional on supervisory control, we estimate equation (2.1) using a probit model with random effects.[6] Table 2.2 shows the results, while the outcomes for testing the hypotheses are shown in Figure 2.2.

[6] We cannot use conditional logit or fixed effect models, because initial GDP per capita and initial level of liberalization are time-invariant variables. Furthermore, these techniques drop those

Instead of reporting marginal effects at means, we report average marginal effects as suggested by Bartus (2005) and Cameron and Trivedi (2009). According to these authors, marginal effects computed at means are not good approximations of average marginal effects. Sample means used for the calculation of marginal effects at means might refer to either non-existent or inherently nonsensical observations. Moreover, average marginal effects are more meaningful and easy to interpret.

In column (1), we regress systemic banking crises on control variables only, without using any financial reform measure or interactions. Our findings are in line with those of previous studies and the estimated coefficients are in accordance with the expected signs as shown in Table A2. Real GDP growth, initial GDP/capita, real interest rate, the initial level of liberalization, and depreciation turn out to be significant.

In column (2), we introduce our indicator of overall financial reform. It turns out that the interaction term of overall financial reform with supervision appears significant and has a negative sign. Economically, the effect is modest but still it clearly has a negative impact on the likelihood of systemic crises and in our later tests this effect remains quite robust.

In the remaining columns of Table 2.2 we include the various dimensions of financial reform separately one by one. We observe that the interaction terms of supervision and reforms come up significant except for barriers to entry and securities market reforms. Moreover, all these interaction effects have negative signs.

However, as mentioned before, inference based on the coefficient of financial reform or the interaction term only is insufficient and can lead to deceptive findings.[7] So we provide the marginal effects of financial reforms and their confidence intervals (at 5 percent level of significance) in Figure 2.2. For a marginal effect of reform to be significantly positive (or negative), the marginal effect as well as the upper and lower bound should be in a positive (or negative)

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countries that did not face any crisis during the sample period. Arellano and Hahn (2007) and Green (2004) show that the probit estimator is also not well behaved in the presence of fixed effects.

[7] A similar logic applies to supervisory control and its interaction terms.

quadrant. As the figures show, when supervisory control improves, the effect of financial reform further reduces the likelihood of systemic crises and this effect is significant especially at higher levels of supervisory control. However, this conclusion does not hold for reforms improving bank entry and securities market reforms, which appear insignificant.

Consequently, our results suggest that most dimensions of financial reform reduce the likelihood of systemic crises, conditional on adequate banking supervision. The Wald chi-square tests and Likelihood ratio tests indicate joint significance of our models at the 1% level of significance.

How well do our models correctly predict crises? To examine this issue, we use Brier Scores.[8] Brier Scores can be calculated as

$$\frac{\sum_{i=1}^{N}\sum_{t=1}^{T}[Crisis_{i,t} - \Pr\ (Crisis)_{i,t}]^2}{N*T}$$

Where $Crisis_{i,t}$ is the actual dummy which takes a value of 1 if there is a crisis and 0 if there is no crisis in country i at time t and $\Pr(Crisis)_{i,t}$ is the estimated probability of a crisis in country i at time t. A perfect forecast will result in a Brier score of 0. A forecast that is always wrong will yield a Brier Score of 1, while a forecast that is correct in 50 percent will result in a Brier Score of 0.25. The Brier Score of our models is around 0.14, which indicates that our model is performing well.

2.4.2 Endogeneity

Even though we follow Mehrez and Kaufmann (2000) and examine the impact of reform measures taken over period prior to a crisis, the results presented in section 2.4.1 may suffer from an endogeneity problem, because supervisors may liberalize or reverse the liberalization of their financial systems in the wake of a crisis. We test for this problem using a two-step probit model with endogenous regressors.[9] Our main objective is to control for reverse causality. In order to keep the model

[8] See Schmidt and Griffith (1998) for a detailed discussion on Brier Scores.

[9] We implement the two-step probit model with endogenous regressors and use robust standard errors for the clustering over countries.

simple, we drop the interaction terms. The results of the exercise do not suggest that our findings are caused by reverse causality.

We use two instrument variables. The first one is from the economic freedom index dataset from the Fraser Institute (Gwartney and Lawson, 2008). The economic freedom index data is available from 1970 onwards and has several dimensions of economic freedom like size of government (expenditure, taxes and enterprises), legal structure and security of property rights, access to sound money, freedom to trade internationally and regulation of credit, labor, and business. We drop those dimensions of the economic freedom index that are very similar to our financial liberalization measures. The basic intuition for using this proxy is that financial sector reforms are often part of a broader economic reform program. Secondly, we use the openness of the economy (computed as the sum of exports and imports as a percentage of GDP) as an instrument. We average both instruments over five years.

We check the validity of our instruments by the Amemiya-Lee-Newey minimum chi-square test under the null hypothesis that the used group of instruments is valid, i.e., they are uncorrelated with the error term in the structural equation. As shown in the bottom panel of Table A5 in the appendix, we cannot reject the null hypothesis indicating that our set of instrument is valid. Next, we apply the Wald test of exogeneity under the null hypothesis that the instrumented variable is exogenous. The results as shown in Table A5 suggest that none of the reform measures appears endogenous.

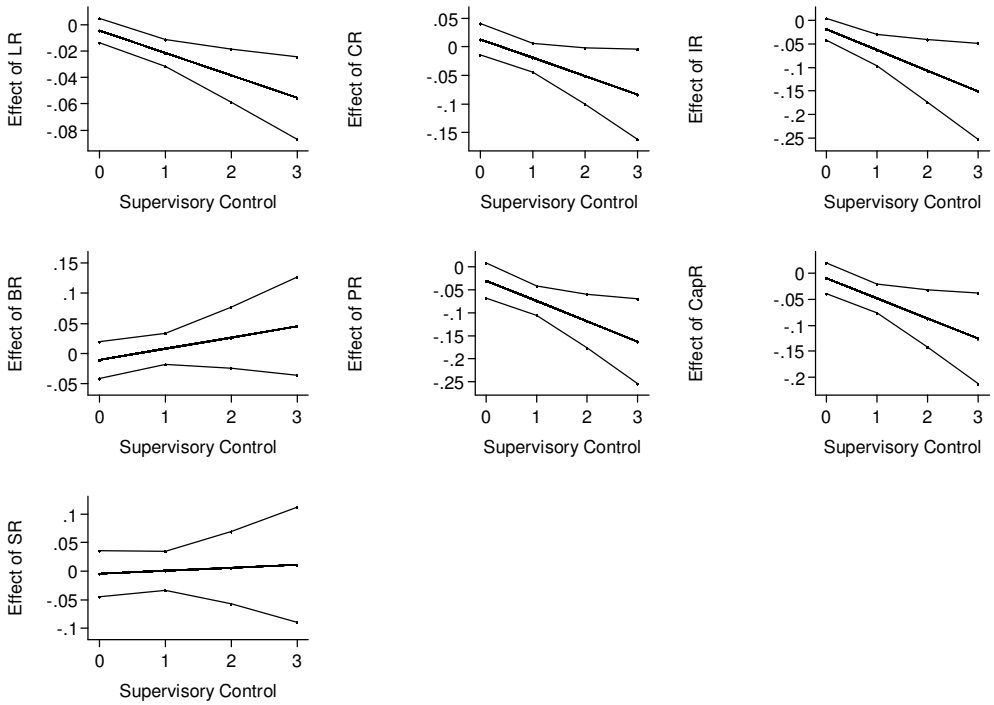
Table 2.2 Effect of Financial Reform on Systemic Crises									
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Real GDP growth $_{(t-1)}$	*Coefficient*	-1.092***	-1.136***	-1.235***	-1.158***	-1.232***	-1.103***	-1.192***	-1.227***
	S.E.	0.221	0.25	0.256	0.251	0.256	0.249	0.253	0.257
Log (initial GDP/capita)	*Coefficient*	-0.056***	-0.061***	-0.059***	-0.062***	-0.059***	-0.064***	-0.058***	-0.058***
	S.E.	0.02	0.021	0.02	0.021	0.02	0.021	0.02	0.02
Real interest rate	*Coefficient*	0.002***	0.002***	0.002***	0.002***	0.002***	0.002***	0.002***	0.002***
	S.E.	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Inflation	*Coefficient*	0.032	0.064	0.081	0.097	0.076	0.027	0.062	0.079
	S.E.	0.107	0.111	0.11	0.11	0.11	0.111	0.11	0.11
Depreciation	*Coefficient*	0.179**	0.142*	0.156**	0.152**	0.166**	0.160**	0.153**	0.163**
	S.E.	0.075	0.076	0.076	0.076	0.076	0.076	0.075	0.076
Initial liberalization	*Coefficient*	-0.019**	-0.021**	-0.021**	-0.019**	-0.020**	-0.020**	-0.021**	-0.020**
	S.E.	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009
Supervisory Control (SC)	*Coefficient*	0.009	0.039**	0.025*	0.016	0.009	0.026*	0.024*	0.013
	S.E.	0.013	0.017	0.015	0.014	0.015	0.014	0.014	0.015
Financial reform (overall) (LR)	*Coefficient*		-0.004						
	S.E.		0.005						
SC*LR	*Coefficient*		-0.017***						
	S.E.		0.006						
Credit controls reform (CR)	*Coefficient*			0.013					
	S.E.			0.014					
SC*CR	*Coefficient*			-0.032**					
	S.E.			0.016					
Interest rate control reform (IR)	*Coefficient*				-0.019				
	S.E.				0.012				
SC*IR	*Coefficient*				-0.044**				
	S.E.				0.019				

Banking entry reform (BR)	*Coefficient*					-0.011			
	S.E.					0.016			
SC*BR	*Coefficient*					0.019			
	S.E.					0.017			
Privatization reform (PR)	*Coefficient*						-0.03		
	S.E.						0.02		
SC*PR	*Coefficient*						-0.044**		
	S.E.						0.019		
Capital controls reform (CapR)	*Coefficient*							-0.01	
	S.E.							0.015	
SC*CapR	*Coefficient*							-0.038**	
	S.E.							0.017	
Securities markets reforms (SR)	*Coefficient*								-0.004
	S.E.								0.021
SC*SR	*Coefficient*								0.005
	S.E.								0.021
No. of Observations		1559	1459	1459	1459	1459	1459	1459	1459
No. of Countries		85	85	85	85	85	85	85	85
Wald Chi-squared		72.735***	87.484***	75.001***	86.585***	72.434***	90.322***	82.027***	72.130***
L Ratio Test		198.398***	202.367***	201.493***	200.785***	199.773***	211.488***	202.104***	195.743***
Brier Score		0.142	0.14	0.142	0.141	0.142	0.141	0.14	0.142

Reported coefficients and corresponding standard errors (S.E.) are average marginal effects and have been calculated following the approach suggested by Bartus (2005).

*** indicates significance at 1 percent level of significance, ** indicates significance at 5 percent level and * indicates significance at 10 percent level of significance.

Figure 2.2 Effect of Financial Reform on Systemic Banking Crises at Different Levels of Supervisory Control



This figure shows the marginal effect of different kinds of financial reform on the likelihood of systemic banking crises at different levels of supervisory control. It corresponds to our results in Table.2.2. The middle line shows the marginal effect of a particular dimension of reform, while the upper and lower lines indicate the upper and lower 95 percent confidence intervals. LR refers to overall reform, CR refers to credit control reform, IR refers to interest rate control reform, BR refers to banking entry reform, PR refers to privatization reform, while CapR refers to capital control reform, and SR refers to securities market reform.

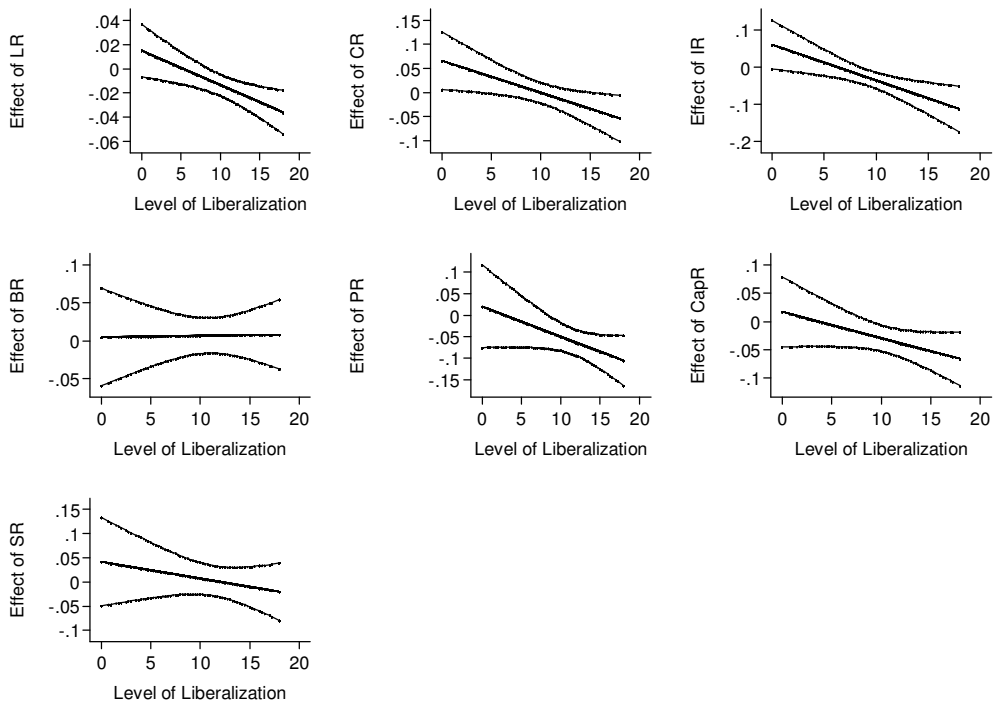
Table 2.3 Effect of Financial Reform on Systemic Crises Conditional on the Level of Liberalization									
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Real GDP growth	*Coefficient*	-1.034***	-1.057***	-1.141***	-1.110***	-1.161***	-1.065***	-1.108***	-1.175***
	S.E.	0.215	0.243	0.248	0.246	0.249	0.244	0.245	0.251
Initial GDP/capita	*Coefficient*	-0.076***	-0.082***	-0.074***	-0.079***	-0.075***	-0.083***	-0.077***	-0.075***
	S.E.	0.019	0.02	0.019	0.019	0.019	0.02	0.019	0.019
Real interest rate	*Coefficient*	0.002***	0.003***	0.002***	0.003***	0.002***	0.003***	0.002***	0.002***
	S.E.	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Inflation	*Coefficient*	0.038	0.129	0.09	0.13	0.078	0.076	0.086	0.079
	S.E.	0.104	0.109	0.107	0.109	0.107	0.109	0.106	0.107
Depreciation	*Coefficient*	0.177**	0.127*	0.142*	0.128*	0.157**	0.154**	0.147**	0.156**
	S.E.	0.073	0.073	0.073	0.073	0.073	0.073	0.073	0.073
Supervisory control	*Coefficient*	0.007	-0.007	0.019	-0.003	0.024	0.017	0.012	0.023
	S.E.	0.016	0.018	0.017	0.018	0.017	0.017	0.017	0.017
Level of liberalization	*Coefficient*	0	0.007*	-0.001	0.003	-0.004	0	0	-0.003
	S.E.	0.003	0.004	0.003	0.003	0.003	0.003	0.003	0.003
Financial reform (overall) (LR)	*Coefficient*		0.015						
	S.E.		0.011						
Liberalization*LR	*Coefficient*		-0.003***						
	S.E.		0.001						
Credit controls reform (CR)	*Coefficient*			0.066**					
	S.E.			0.03					
Liberalization*CR	*Coefficient*			-0.007**					
	S.E.			0.003					
Interest rate control reform (IR)	*Coefficient*				0.060*				
	S.E.				0.033				
Liberalization*IR	*Coefficient*				-0.010***				
	S.E.				0.003				

Banking entry reform (BR)	*Coefficient*					0.005			
	S.E.					0.033			
Liberalization*BR	*Coefficient*					0			
	S.E.					0.003			
Privatization reform (PR)	*Coefficient*						0.02		
	S.E.						0.049		
Liberalization*PR	*Coefficient*						-0.007*		
	S.E.						0.004		
Capital controls reform (CapR)	*Coefficient*							0.017	
	S.E.							0.031	
Liberalization*CapR	*Coefficient*							-0.005*	
	S.E.							0.003	
Securities markets reform (SR)	*Coefficient*								0.041
	S.E.								0.047
Liberalization*SR	*Coefficient*								-0.003
	S.E.								0.004
No. of Observations		1559	1459	1459	1459	1459	1459	1459	1459
No. of Countries		85	85	85	85	85	85	85	85
Wald Chi-squared		70.791***	87.377***	75.847***	86.913***	71.521***	88.965***	79.968***	72.031***
L Ratio Test		200.958***	209.143***	204.744***	203.713***	203.106***	212.532***	204.985***	202.360***
Brier Score		0.144	0.141	0.144	0.142	0.145	0.142	0.143	0.144

Reported coefficients and corresponding standard errors (S.E.) are average marginal effects and have been calculated as suggested by Bartus (2005).

*** indicates significance at 1 percent level of significance, ** indicates significance at 5 percent level and * indicates significance at 10 percent level of significance.

Figure 2.3 Effect of Financial Reform on Systemic Banking Crises at Different Levels of Liberalization

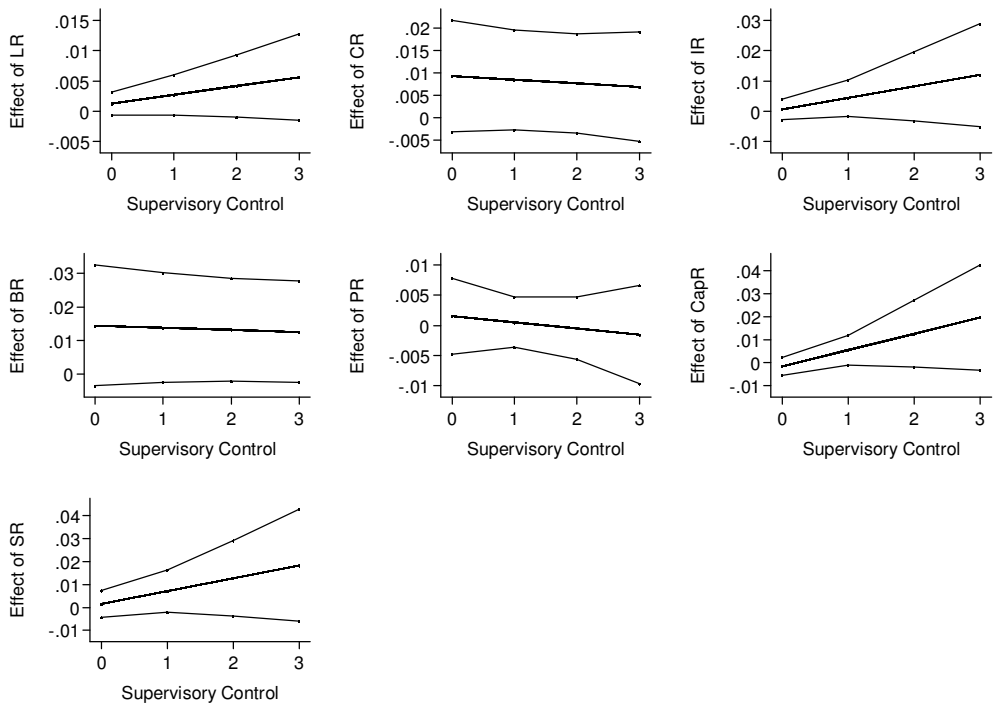


The figure shows the marginal effect of different kinds of financial reform on the likelihood of systemic banking crises at different levels of liberalization. It corresponds to our results in Table 2.3. The middle line shows the marginal effect of a particular dimension of reform, while the upper and lower lines indicate the upper and lower 95 percent confidence intervals. LR refers to overall reform, CR refers to credit control reform, IR refers to interest rate control reform, BR refers to banking entry reform, PR refers to privatization reform, CapR refers to capital control reform, and SR refers to securities market reform.

Table 2.4 Effect of Financial Reform on Non-Systemic Crises									
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Real GDP growth $_{(t-1)}$	*Coefficient*	-0.027	-0.029	-0.026	-0.028	-0.027	-0.036	-0.025	-0.036
	S.E.	0.035	0.038	0.04	0.041	0.04	0.044	0.033	0.039
Log (initial GDP/capita)	*Coefficient*	0	0	0	0.001	0	0.001	0	0.001
	S.E.	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
Real interest rate	*Coefficient*	0	0	0	0	0	0	0	0
	S.E.	0	0	0	0	0	0	0	0
Inflation	*Coefficient*	-0.008	-0.013	-0.004	-0.007	-0.015	-0.005	-0.005	-0.005
	S.E.	0.017	0.021	0.019	0.02	0.022	0.019	0.016	0.017
Depreciation	*Coefficient*	0.002	0.005	0.003	0.002	0.003	0.002	0.001	0.002
	S.E.	0.007	0.011	0.01	0.008	0.01	0.006	0.006	0.007
Initial liberalization	*Coefficient*	0.001	0.002	0.002	0.001	0.002	0.001	0.001	0.001
	S.E.	0.001	0.002	0.002	0.001	0.002	0.001	0.001	0.001
Supervisory Control (SC)	*Coefficient*	0.001	-0.002	0.001	0.001	0	0.001	-0.002	0
	S.E.	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Financial reform (overall) (LR)	*Coefficient*		0.001						
	S.E.		0.001						
SC*LR	*Coefficient*		0.001						
	S.E.		0.001						
Credit controls reform (CR)	*Coefficient*			0.009					
	S.E.			0.006					
SC*CR	*Coefficient*			-0.001					
	S.E.			0.002					
Interest rate control reform (IR)	*Coefficient*				0.001				
	S.E.				0.002				
SC*IR	*Coefficient*				0.004				
	S.E.				0.003				
Banking entry reform (BR)	*Coefficient*					0.014			
	S.E.					0.009			

SC*BR	*Coefficient*					-0.001			
	S.E.					0.002			
Privatization reform (PR)	*Coefficient*						0.002		
	S.E.						0.003		
SC*PR	*Coefficient*						-0.001		
	S.E.						0.002		
Capital controls reform (CapR)	*Coefficient*							-0.002	
	S.E.							0.002	
SC*CapR	*Coefficient*							0.007	
	S.E.							0.004	
Securities markets reform (SR)	*Coefficient*								0.002
	S.E.								0.003
SC*SR	*Coefficient*								0.006
	S.E.								0.004
No. of Observations		1559	1459	1459	1459	1459	1459	1459	1459
No. of Countries		85	85	85	85	85	85	85	85
Wald Chi-squared		4.807	41.847***	29.712***	13.269	39.391***	4.228	29.118***	18.570**
L Ratio Test		175.541	170.146***	168.891***	162.566	168.747***	156.234	169.283***	164.874**
Brier Score		0.067	0.069	0.069	0.069	0.068	0.069	0.07	0.069
Reported coefficients and corresponding standard errors (S.E.) are average marginal effects and have been calculated as suggested by Bartus (2005).									
*** indicates significance at 1 percent level of significance, ** indicates significance at 5 percent level and * indicates significance at 10 percent level of significance.									

Figure 2.4 Effect of Financial Reform on Non-Systemic Banking Crises at Different Levels of Supervisory Control



This figure shows the marginal effect of different kinds of financial reform on the likelihood of non-systemic banking crises at different levels of supervisory control. It corresponds to our results in Table 2.4. The middle line shows the marginal effect of a particular dimension of reform, while the upper and lower lines indicate the upper and lower 95 percent confidence intervals. LR refers to overall reform, CR refers to credit control reform, IR refers to interest rate control reform, BR refers to banking entry reform, PR refers to privatization reform, while CapR refers to capital control reform, and SR refers to securities market reform.

2.4.3 Robustness

We examine the robustness of our results presented in section 2.4.1 in a number of ways. These tests indicate that our results are not sensitive to changes in our sample and model specification.

Firstly, we restrict our sample to non-OECD countries. It reduces our number of observations from 1459 country-year observations for 85 countries to 944 country-year observations for 61 countries. The results are presented in Table A6 in the Appendix, while the corresponding tests of the hypotheses are shown in Figure A1 in the Appendix. The interaction effect of liberalization remains significant and negative, while the tests of the hypotheses are similar to those reported in Figure 2.2. The only change is that the interaction of privatization and supervisory control does not appear significant, but the corresponding hypothesis test does not change.

Secondly, we change the list of control variables by adding corruption as suggested by Mehrez and Kaufmann (2000), banking concentration as suggested by Beck *et al*. (2006), and two-year lagged credit to the private sector following Kaminsky and Reinhart (1999). Moreover, we add the ratio of money and quasi-money to GDP as a control variable, following a number of studies (e.g., Beck *et al*., 2006). In the specification where we introduce our corruption variable the period of analysis is restricted from 1984 to 2002. Corruption only appears significant at 10 percent level of significance in two models and our main results remain unaffected. When we introduce bank concentration as a control variable, the sample is reduced to 80 countries with 827 observations (against 1459 in main results). Bank concentration does not appear significant and our results hold except for credit controls reform, which becomes non-significant. When we introduce money and quasi-money, the sample of analysis is reduced to 1188 observations from 73 countries, but it does not affect our main results. The additional control variable appears insignificant. The introduction of two-year lagged credit to the private sector reduces the sample to 1370 observations from 80 countries and does not affect any of our results although the private sector credit variable appears significant. All results are available on request.

Finally, an objection that can be raised against our findings is that the impact of our control variables on the likelihood of a crisis will be different during a crisis. Following Barrell *et al*. (2009), we have therefore re-estimated the models shown in Table 2.2, dropping all the observations after the start of a crisis until the end of the crisis. This hardly affects our main conclusions (results available on request).

2.5 The Role of the Level of Financial Liberalization

In this section, we argue that financial reform does not only have a direct impact on the likelihood of a crisis, but also an indirect impact. Initial reforms help various players in the financial institutions to learn about the process of liberalization and it makes the outcome of an adverse effect less likely in the aftermath of further reforms. Abiad and Mody (2005) labeled this as "Learning Effect", albeit in a different context.

The main estimation results of equation (2.3) are presented in Table 2.3 and the graphical presentation of the testing of the hypotheses is shown in Figure 2.3. As shown in Table 2.3, the interaction effects of the level of liberalization with financial reforms appear significant with a negative sign. The overall models appear significant at 1 percent level of significance and the Brier Scores also indicate that the models are performing well.

The top-left graph in Figure 2.3 presents the impact of reform at different levels of liberalization. A first thing to note is that the effect of reforms on the likelihood of a crisis appears negative after a certain minimum level of liberalization has been reached. As financial systems become more liberalized, the negative impact on the likelihood of systemic crises of further financial reforms becomes significant. This suggests that financial systems learn from the process of liberalization and leads to less fragility in the long run.

The same result holds for various dimensions of reform. Removal of credit controls, interest rate controls, privatization, and capital account reform all contribute to a more stable banking sector.

2.6 Are Non-Systemic Crises Different?

With the introduction of more competition and transparency in the financial system through market-based reforms, it is very much likely that some inefficient banks are forced to close. Therefore, it seems likely that financial reform will have a different impact on non-systemic crises than on systemic crises. So far, most previous studies do not treat systemic and non-systemic crises differently. We are not aware of studies examining the impact of financial reform on non-systemic crises, even though the effect of financial reform on non-systemic crises is likely to differ from that on systemic crises. Modeling non-systemic crises is a difficult task for two reasons. First, there are many factors that can cause non-systemic crises depending on the heterogeneous specializations and ownership structures of banks[10], and second, it is not necessary that these crises occur because of changes in macroeconomic or financial system variables. Still, we check whether financial reform affects the likelihood of non-systemic crises, thereby addressing our third research question. We estimate equation (2.1) using a panel probit model with non-systemic crises as the dependent variable.

The results are shown in Table 2.4 and the corresponding hypothesis testing outcomes are presented in Figure 2.4. The models appear significant as indicated by Wald Chi-squared test and the Likelihood Ratio tests, except for the models shown in columns (1), (4), and (6). The macroeconomic variables that were significant in the model for systemic crises do not appear significant. Interestingly, the marginal effect of financial reform appears positive for non-systemic crises, although it is not significant. It points to important conclusions. First, systemic and non-systemic crises are driven by different factors and should be modeled accordingly. Second, the impact of financial reform on non-systemic crisis is very different from the impact of reform on systemic crises. If anything, financial reform increases the likelihood of non-systemic crises.

[10] For example, Shehzad *et al*. (2009) show how ownership structures of banking firms affect their risk taking behavior.

2.7 Conclusions and Policy Implications

We have examined the effect of (six dimensions of) financial reform on the likelihood of systemic and non-systemic banking crises. We find that reform that enhances liberalization reduces the likelihood of systemic crises, subject to appropriate supervisory control. Furthermore, financial systems learn from reform, which helps introducing further reforms without adverse outcomes. Moreover, we find that systemic and non-systemic crises are driven by different factors.

Our findings suggest the need to reconsider a widely shared view that has emerged in the wake of the current financial crisis, namely that strict regulation is needed for financial stability. Our results indicate that financial reform conditional on good supervisory control reduces the likelihood of systemic crises, and it therefore important to combine both policies in a meaningful way. In contrast, nowadays many observers seem to believe that reforms that have liberalized financial systems have played an important role in creating the current financial crises. Consequently, there may be a reversal of some of these liberalization measures in the wake of the crisis. However, as pointed out by Allen and Gale (2007), the extensive financial regulation introduced after the Great Depression not only led to the virtual disappearance of crises, it also seriously affected the efficiency of the financial system. Allen and Gale (2007) argue that the complete elimination of crises is neither optimal nor desirable, because it reduces the ability of financial institutions to perform their basic task of efficient allocation of resources. Excessive regulation reduces the incentives for banks to introduce new services and products. In view of the dynamic requirements of economies, the inability to introduce new products can result in sub-optimal risk hedging and exploitation of consumers. There is a possibility that history may repeat itself. Our results suggest that banking supervision needs to be improved but that the process of financial liberalization should not be reversed.

A potential danger highlighted by our results is the inadequate supervisory control in non-OECD economies. Financial reform in non-OECD countries has narrowed the liberalization gap with high-income OECD countries, but as far as supervision is concerned this gap has widened.

Our results also suggest that financial systems learn from reform, helping to create more stable banking systems. A reversal of liberalization will therefore also indirectly lead to more banking instability.

Chapter 3

Financial Crises and Bank Earnings Volatility: The Role of Bank Size and Market Concentration[1]

3.1 Introduction

In this chapter we address the following questions: (i) do financial crises affect earnings volatility[2] of large and small banks differently? (ii) is the effect of financial crises on bank earnings volatility conditioned by the degree of concentration in the banking sector? While previous studies have analyzed the impact of macroeconomic variables and business cycles on bank profitability (see, e.g., Demirgüç-Kunt and Huizinga, 1999 and Bikker and Hu, 2003), a detailed analysis of the impact of financial crises on bank earnings volatility is currently missing in the literature. As firm size and market concentration are two potentially important determinants of profitability (see, e.g., Porter, 1979 and Berger *et al.*, 2005), the objective of this chapter is to investigate whether the impact of financial crises on banks earning volatility is conditioned by bank size and market concentration.

[1] This chapter is based on joint work with Jakob de Haan and Bert Scholtens. The authors are thankful to the participants in the Annual Conference of the Irish Economic Association, 2009 and the SOM PhD Conference, 2009, University of Groningen, the Netherlands, for their helpful comments on earlier versions of this chapter. The usual disclaimer applies.

[2] For the sake of brevity, we take banking profitability and bank earnings as synonyms. Our proxy for these variables is return on assets (or alternatively return on equity, in the sensitivity analysis). A precise definition of earnings volatility is given in section 3.3.

To analyze the impact of financial crises on bank earnings volatility, we use a data set containing more than 1800 banks from OECD and non-OECD economies for the period 1998-2008. We use the three and five year standard deviation of bank earnings (proxied by the return on assets) as our dependent variable. The reason for focusing on volatility is that more volatile earnings may lead to uncertainty about the level of equity capital and can result in a deterioration of banks' soundness (Couto, 2002). The outcomes of some previous studies (e.g., Albertazzi and Gamabacorta, 2009 and Bikker and Hu, 2003) suggest that excess volatility in bank earnings can result in unstable capital structures.

Although there is no study focusing on the effect of bank size on earnings variability, the influence of bank size on bank performance has been analyzed before. The results are mixed. For example, Berger *et al.* (2005) find that small banks have superior ability to allocate capital to risky borrowers. On the other hand, Stever (2007) argues that small banks are riskier because of their limited ability to diversify. Our results indicate that small banks face higher earnings volatility in the wake of financial crises than large banks. This finding suggests that large banks may be better able to withstand a financial crisis than small banks.

As to the role of market concentration, Porter (1979) argues that the higher a firm's market power, the more persistent its profitability will be. However, the analysis of De Nicolo *et al.* (2004), which is based on data for some 100 banks over the period 1993-2000 and z-scores as proxy for riskiness, suggests that more concentrated banking sectors are more fragile. In line with these findings, our results show that banks in more concentrated markets face higher earnings volatility in the wake of financial crises.

The structure of the rest of the chapter is as follows. Section 3.2 discusses the literature on the relationships between bank performance, bank size, and market concentration. Section 3.3 develops our model, while section 3.4 describes our data. Section 3.5 presents the empirical results and section 3.6 offers a sensitivity analysis. Section 3.7 concludes the chapter.

3. 2 Previous Studies

To the best of our knowledge, no previous study has explicitly examined the effect of financial crises on bank earnings volatility. There are, however, two related strands in the literature on which we will draw. First, some studies analyze the impact of macroeconomic developments on bank profitability (see, e.g., Albertazzi and Gamabacorta, 2009 and Bikker and Hu, 2003). Another strand of the literature focuses on the impact of firm and industry characteristics on bank profitability (see, e.g., Berger *et al.*, 2005 and Stever, 2007).

Various studies report that business cycles have a significant impact on bank earnings (Bikker and Hu, 2003, and Albertazzi and Gamabacorta, 2009). In times of booms, profitability increases and during recessions it drops. Similarly, during financial crises profitability reduces and banks face higher earnings volatility. However, banks with different size and operating in different market structures may be affected differently by financial crises.

Although there is no study focusing on *the effect of bank size* on earnings variability, the influence of bank size on bank performance has been analyzed before. Boyd and Runkle (1993) report no significant relationship between the probability of bank failure and bank size. In contrast, Stein (2002) points out that small banks are superior to large banks in allocating capital. Likewise, Berger *et al.* (2005) find that small banks are better in collecting and acting on 'soft' information. According to these authors, large banks are less willing to lend to firms on which they have limited information. However, the question remains whether this ability of small banks translates into more stable earnings. Stever (2007) reports that small banks have fewer opportunities to diversify, which forces them to either pick borrowers whose assets have relatively low credit risk or to make loans that are backed by more collateral. This lower diversification, in turn, may result in higher earnings volatility.

The *influence of market concentration* on bank performance has also been examined before. Carletti and Hartmann (2003) provide a thorough literature survey of the linkages between market concentration, bank competition, and financial stability.

They dismiss the idea that competition increases bank instability.[3] Similarly, various papers do not find a clear relationship between market structure and profitability (see, e.g., Berger, 1995 and Athanasoglu et al., 2005). However, Boyd and de Nicolo (2005) report that in concentrated markets banks have an incentive to become more risky, which, in turn may lead to higher earnings variability notably so in a financial crisis. However, as lack of concentration may induce competition, it is, also possible that the effect of financial crises on earnings volatility will be less significant in markets with low levels of concentration, because competition will make firms more efficient. On the other hand, it may also be the case that if banks lack significant market power, the effects of financial crises on earnings volatility are more severe either because banks have low diversification of investments (Stever, 2007) or deposit-holders have more possibilities to switch to other banks or investments, as suggested by Porter (1979).

We investigate whether the effect of financial crises on the variation in bank earnings is conditioned by bank size and market concentration taking various control variables - like leverage ratio, managerial efficiency, and the macroeconomic environment - into account. In the next section we will specify our model before describing our data in section 3.4.

3.3 Model Specification

Our dependent variable is bank earnings volatility. We take the variation in banks' return on assets (ROA) as proxy for earnings' volatility.[4] We define ROA volatility of bank *i* as the standard deviation of ROA for bank *i* calculated using ROA in the current and previous two years. Alternatively, as part of the sensitivity analysis, we also take ROA in the current and previous four years to calculate volatility. So the earnings volatility for bank *i* in country *c* in year *t* is calculated as follows:

[3] In the literature, concentration has sometimes been used as a proxy for competition; see, e.g., Bikker and Haaf (2002) and Corvoiser and Gropp (2002). However, Claessens and Laeven (2004) do not find any association between concentration and competition.

[4] As in times of crises the ratio of equity to assets can be a volatile portion of the balance sheet, the return on equity (ROE) may not be not very informative. Nevertheless, as part of our sensitivity analysis we will examine whether our results hold if we employ ROE as proxy for earnings volatility.

$$Volatility_{i,c,t} = \sqrt{\frac{1}{T+1}(\sum_{t=1}^{t-T}(ROA_{i,c,t} - \frac{1}{T+1}\sum_{t=1}^{t-T}ROA_{i,c,t,}))^2} \qquad (3.1)$$
$$T = (2,4)$$

In our basic model earnings volatility is assumed to depend on financial crises, bank size, market concentration and other market-specific and bank-specific control variables. So our model is

$$Volatility_{i,c,t} = \alpha_{i,c,t} + \beta_1 Crisis_{c,t} + \beta_2 Concentration_{c,t} + \beta_3 Size_{i,c,t} + \gamma_1 X_{c,t} + \gamma_2 Y_{i,c,t} + \varepsilon_{i,c,t} \qquad (3.2)$$

where *Crisis* is our financial crisis indicator and *Concentration* is our proxy for bank concentration in country *c* in year *t*. *Size* indicates a proxy for bank size of bank *i* in country *c* at time *t*. *X* is a matrix of country-specific control variables while *Y* is a matrix of bank-specific control variables. All variables will be explained in more detail in section 3.4.

As the effect of a financial crisis on earnings volatility can be conditioned by bank size and market concentration, we introduce interaction terms of financial crisis with these two variables to test these relationships:

$$\begin{aligned} Volatility_{i,c,t} = {} & \alpha_{i,c,t} + \beta_1 Crisis_{c,t} + \beta_2 Concentration_{c,t} + \beta_3 Size_{i,c,t} + \\ & \beta_4 Crisis_{c,t} * Size_{i,c,t} + \beta_5 Crisis_{c,t} * Concentration_{c,t} + \\ & \beta_6 Size_{i,c,t} * Concentration_{c,t} + \beta_7 Crisis_{c,t} * Size_{i,c,t} * Concentration_{c,t} + \\ & \gamma_1 X_{c,t} + \gamma_2 Y_{i,c,t} + \varepsilon_{i,c,t} \end{aligned} \qquad (3.3)$$

We will estimate equation (3.3) using panel data techniques. In the next section we describe our data and the choice of the control variables.

3.4 Data Description and Analysis

We use data on financial crises from Laeven and Valencia (2008). Systemic banking crisis[5] is a variable which takes a value of one if there is a crisis in the country in the current or preceding two (or four) years and zero otherwise. Similarly, the currency crisis[6] and debt crisis[7] variables take a value of one if there is a crisis in the current or preceding two (or four) years and zero, otherwise. Our financial crisis variable is the sum of these three dummy variables, so it runs from zero to three.[8] Our data for concentration of the banking sector comes from the November 2008 version of the World Bank's financial structure database (Beck et al., 2000).

Our data for bank size is derived from Bureau Van Dijk's Bankscope (June 2008 version). We check whether the volatility of a bank's earnings depends on both its absolute and relative size. We employ the log of bank assets as a proxy for absolute bank size. Bank size distribution as measured by assets is highly skewed towards the right, i.e., there are many small banks and a few large banks. A distribution that is quite helpful in this situation is the lognormal distribution. A variable has a lognormal distribution if the logarithm of the variable is normally distributed. That is why we use the log of bank assets instead of taking bank assets. To calculate relative bank size, we assume that the log of bank assets is normally distributed. Various studies (for example, Janicki and Prescott, 2006) find that the lognormal distribution fits the distribution of bank size pretty well. For relative bank size, we give a value of 1 if the assets of bank *i* in country *c* exceed the mean of bank assets in country *c* but are less than one standard deviation

[5] Laeven and Valencia (2008) define a systemic banking crisis as a situation when a country's corporate and financial sector experiences a large number of defaults and financial institutions and corporations face great difficulties repaying contracts on time. As a result, non-performing loans increase sharply and all or most of the aggregate banking system capital is exhausted.

[6] Laeven and Valencia (2008) define a currency crisis as a nominal depreciation of the currency of at least 30 percent that is also at least 10 percent increase in the rate of depreciation compared to the previous year.

[7] Laeven and Valencia (2008) define a sovereign debt crisis as the situation where a sovereign defaults to private lending or government debt is rescheduled.

[8] There is a potential endogeneity problem because financial crises may not only affect variation in bank earnings, but earnings variability may also cause systemic banking crises. However, there are two reasons why we think this issue is not driving our results. First, our financial crisis variable is the sum of three types of crises namely, systemic banking crises, currency crises and debt crises. A sensitivity analysis (presented in section 6) shows that our conclusions are robust to the type of crisis used. Second, earnings volatility will not automatically cause a systemic banking crisis. Only if (many) banks have not sufficient equity (or more precisely, a capital adequacy ratio that is to low) to cushion losses, earnings volatility may lead to a systemic banking crisis.

above this mean.[9] We assign a value of 2 if bank *i*'s assets are more than one standard deviation but less than two standard deviations above the national mean. A value of 3 is reserved for banks having assets greater than two but less than three standard deviations above this mean. Finally, a value of 4 is assigned if assets of bank *i* are greater than 3 standard deviations above the national mean. Similarly, for banks smaller than average bank size in the country, we assign a value of -1 for banks between average bank size and one standard deviation below the mean. A value of -2 is for banks between one and two standard deviations below the mean. A value of -3 is reserved for banks between two and three standard deviations below the mean and a value of -4 is for banks having logarithmic bank size less than three standard deviations below the average bank size in the country in which the bank is operating.

Additionally, we use the cost to income ratio of banks as a proxy for their managerial efficiency, and leverage (the ratio of debt to equity) as a proxy for the capital structure of the bank (cf. Demirgüç-Kunt and Huizinga, 1999).

Finally, we include three macroeconomic variables: (i) adjusted inflation[10] as a proxy for the changes in the price level in the country; (ii) GDP growth to capture macroeconomic developments; and (iii) GDP per capita as a proxy for the economic welfare of the country (cf. Demirgüç-Kunt and Huizinga, 1999). We take all our variables, except for GDP per capita, as the averages for a three-year (five-year) period in case volatility is defined over three (five) years. We take the value of GDP/capita in the year before the start of the three-years (five-years) period.

The summary statistics of our dependent and main explanatory variables are provided in Table 3.1. The precise definitions, data sources and expected signs of all variables used are shown in Table B1 in appendix B. To avoid duplication, we take consolidated statements of banks. Only if there is no consolidated statement available, we take unconsolidated statements. Moreover, we skip those banks for which no data are available for three consecutive years over the period 1998-2008. We select banks from all

[9] We take national means and standard deviations to construct our relative size measure and not the mean and standard deviation of our full sample of banks as national banking systems are generally not very well integrated, not even in the European Union.

[10] To adjust for extreme movements, we modify the inflation rate (P) as $\frac{P/100}{1+(P/100)}$.

countries in Bankscope provided there are at least three banks that report data consistent with our requirements.[11] Finally, for some countries data on other control variables is not available. After all these filters, the country-wise decomposition of banks in our sample is reported in Table B2 in Appendix B. Table B3 in the Appendix B shows the correlation matrix of our variables. The low correlation of the explanatory variables suggests that multicollinearity is not a problem in our estimations.

Table 3.1 Summary Statistics

Variable	Mean	Standard Deviation	Minimum	Maximum	Observations
ROA Volatility *(Bank Level)*	0.63	1.34	0.00	29.09	6277
ROE Volatility *(Bank Level)*	3.49	5.17	0.00	46.11	6277
Financial Crisis *(Country Level)*	0.08	0.41	0.00	3.00	6277
Bank Size *(Bank Level)*	0.01	1.35	-4.00	4.00	6277
Bank Concentration *(Country Level)*	0.58	0.23	0.18	1.00	6277
Cost/Income *(Bank Level)*	67.24	31.97	0.26	592.05	6277
Inflation *(Country Level)*	0.04	0.05	-0.04	0.54	6277
Leverage *(Bank Level)*	17.84	83.63	0.00	3476.44	6277
GDP Growth *(Country Level)*	4.03	2.97	-5.37	26.07	6277
GDP/Capita *(US$ 10,000) (Country Level)*	0.20	0.18	0.00	0.81	6277

3.5 Results

We estimate equation (3.3) using a fixed effects model for more than 1800 banks. The Hausman test statistic shows that a fixed effects model should be used instead of a random effects model. Our main results are in models 1-3 in Table 3.2.

Column (1) in Table 3.2 shows the results for all countries, while column (2) in the same table presents the estimates for banks operating in high-income OECD countries, whereas column (3) presents the results for banks operating in the other countries in our sample. In these models, we take bank earnings volatility as the three-year standard deviation of return on bank assets. The F-statistics indicate overall significance of the models at 1 percent level of significance. In line with our expectations, the results suggest that higher inflation increases earnings volatility, while higher GDP growth reduces earnings volatility. Similarly, banks with lower managerial efficiency have higher earning volatility.

[11] If the data is available for less than three banks it is not possible to calculate relative size. However, when we take absolute size (as part of our sensitivity analysis) this restriction does not apply.

Before we turn to the results regarding the impact of financial crises, it is important to note that inference about the significance of financial crises cannot be based on simple t-statistics because the model parameters do not provide substantial information in case of models with multiplicative terms (see Brambor *et al.*, 2006). As Aiken and West (1991) point out, in interactive models one needs to take the derivative of the model with respect to the variable of interest and evaluate its effect on the means of other constituent terms of the derivative.

Our key hypothesis relates to the significance of the marginal effect of financial crises on our dependent variables. Therefore, we want to test:

$$H_0: \beta_1 + \beta_4 (Size_{i,c,t}) + \beta_5 (Concentration_{c,t}) + \beta_7 (Size_{i,c,t} * Concentration_{c,t}) = 0$$
$$H_1: \beta_1 + \beta_4 (Size_{i,c,t}) + \beta_5 (Concentration_{c,t}) + \beta_7 (Size_{i,c,t} * Concentration_{c,t}) \neq 0$$

where *Size* and *Concentration* are the averages of our proxies for bank size and bank concentration level, respectively. Rejection of the null hypothesis implies that financial crises affect bank earnings volatility. In order to assess the significance of the variables of interest, we need to determine confidence intervals for which standard errors can be calculated following the methodology of Aiken and West (1991).

Figure 3.1 examines the impact of financial crises on bank earnings' volatility and corresponds to the main results as given in columns (1)-(3) in Table 3.2. The graphs in the upper part show the marginal effect of financial crises at different levels of relative bank size and the graphs in the lower part show the marginal effect of financial crises at different levels of bank concentration. The graphs on the left-hand side pertain to the model in column (1) where we examine the impact of financial crises for all countries in our sample. The graphs in the middle correspond to the model for the impact of financial crises for high-income OECD countries (column (2) of Table 3.2) and the graphs on the right-hand side represent the impact of financial crises in the other countries in our sample, corresponding to the model in column (3) of Table 3.2. The middle line in the graphs plots the marginal effect of financial crises on bank earnings volatility corresponding to different level of relative bank size (upper part) and market concentration (lower part). The dotted lines present the 95 percent confidence intervals. If

the upper and lower lines of the confidence interval are both either positive or negative, there is a significant positive or negative effect, respectively.

Table 3.2 Empirical Results

		(1)	(2)	(3)	(4)	(5)	(6)
	Countries:	**All**	**OECD**[Ψ]	**Other**[¤]	**All**	**OECD**	**Other**
		Three-year period			**Five-year period**		
Financial Crises	Coefficient	-0.268	-0.252	-0.164	-0.313	-0.716**	0.111
	Standard Error (Robust)	0.359	0.367	0.45	0.319	0.358	0.404
Relative Bank Size	Coefficient	-0.062	-0.15	0.086	-0.496	-0.616	-0.387*
	Standard Error (Robust)	0.117	0.146	0.176	0.346	0.604	0.226
Bank Concentration	Coefficient	0.991***	-0.668	1.390***	0.467	0.474	0.183
	Standard Error (Robust)	0.35	0.579	0.42	0.7	3.051	0.817
Cost/Income	Coefficient	0.006*	0.003	0.008***	0.008**	0.007	0.009***
	Standard Error (Robust)	0.003	0.007	0.002	0.004	0.008	0.003
Inflation	Coefficient	1.084*	-9.792*	0.764	0.133	-15.355	-0.491
	Standard Error (Robust)	0.631	5.334	0.607	0.771	11.999	1.02
GDP Growth	Coefficient	-0.040**	0.02	-0.043***	-0.069***	-0.195***	-0.050*
	Standard Error (Robust)	0.016	0.037	0.016	0.024	0.064	0.027
Leverage	Coefficient	-0.004*	-0.004*	-0.018**	-0.004***	-0.004***	-0.026**
	Standard Error (Robust)	0.003	0.003	0.007	0.001	0.001	0.013
GDP/Capita	Coefficient	0.109	-0.637	-2.741	-0.311	0.568	-12.462
	Standard Error (Robust)	0.332	0.461	2.645	0.468	0.585	13.163
Financial Crises*Bank Size	Coefficient	-0.308	0.238	-0.392	0.17	-0.041	0.251
	Standard Error (Robust)	0.255	0.236	0.338	0.219	0.236	0.293
Financial Crises*Bank Concentration	Coefficient	0.736	0.896	0.544	0.692	1.727**	0.076
	Standard Error (Robust)	0.605	0.975	0.729	0.525	0.73	0.628
Bank Size* Bank Concentration	Coefficient	-0.116	0.101	-0.398	0.772	0.807	0.793**
	Standard Error (Robust)	0.187	0.218	0.289	0.48	0.819	0.401
Financial Crises*Bank Size* Bank Concentration	Coefficient	0.298	-1.070*	0.475	-0.844*	-0.279	-1.037*
	Standard Error (Robust)	0.427	0.601	0.548	0.491	0.525	0.616
Constant	Coefficient	-0.187	1.124*	0.02	0.078	0.225	0.911
	Standard Error (Robust)	0.31	0.66	0.301	0.494	2.16	0.853
Number of Observations		6277	3236	3041	2874	1498	1376
Number of Banks		1818	940	878	1282	653	629
F-Statistics		4.724***	4.245***	4.534***	29.713***	153.447***	2.275**

*** indicates significance at 1 percent level, ** indicates significance at 5 percent and * indicates a significance at 1 percent level

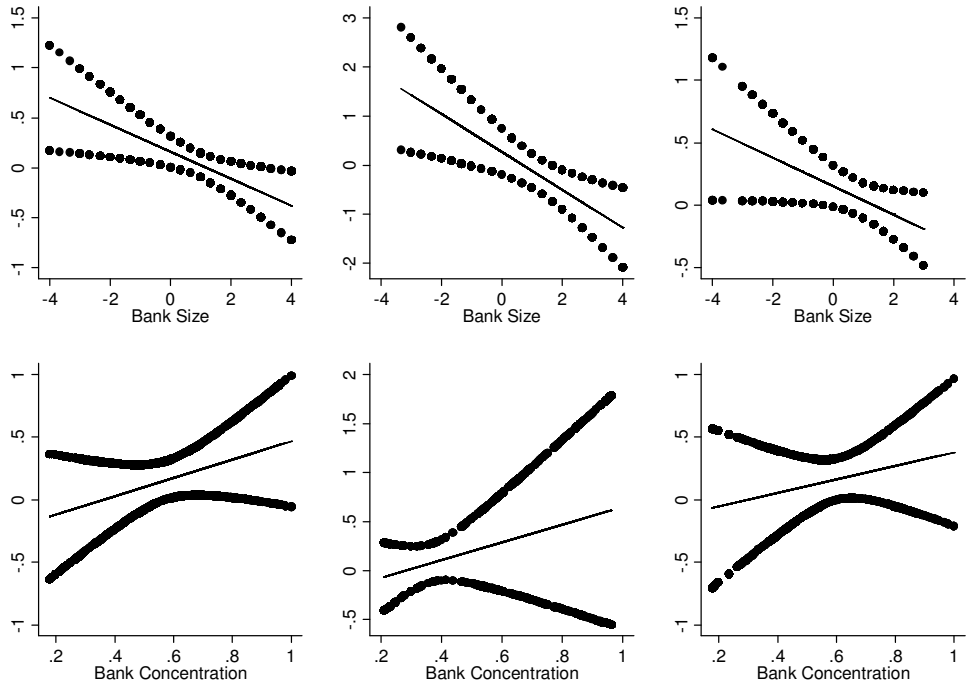
Ψ OECD refers to High-income OECD countries as classified by the World Bank in World Development Indicators.

¤ Other refers to all other countries in our sample (see Table B2).

The graphs in the upper part of Figure 3.1 show that smaller banks face more earnings volatility in the wake of a financial crisis. This follows from the downward sloping marginal effect lines in all three upper graphs, i.e., as bank size increases the effect of financial crises on bank earnings volatility decreases. This result holds

irrespective of whether a bank operates in a high-income OECD country or not. The graphs in the lower part of Figure 3.1 indicate that at higher market concentration, banks face more earnings volatility. Again, this effect holds irrespective of whether a bank is operating in a high-income OECD country or not. These results are consistent with the findings of Boyd and de Nicole (2005) that in concentrated markets banks have an incentive to become more risky.

Figure 3.1 Marginal Effect of Financial Crises On Bank Earnings Volatility



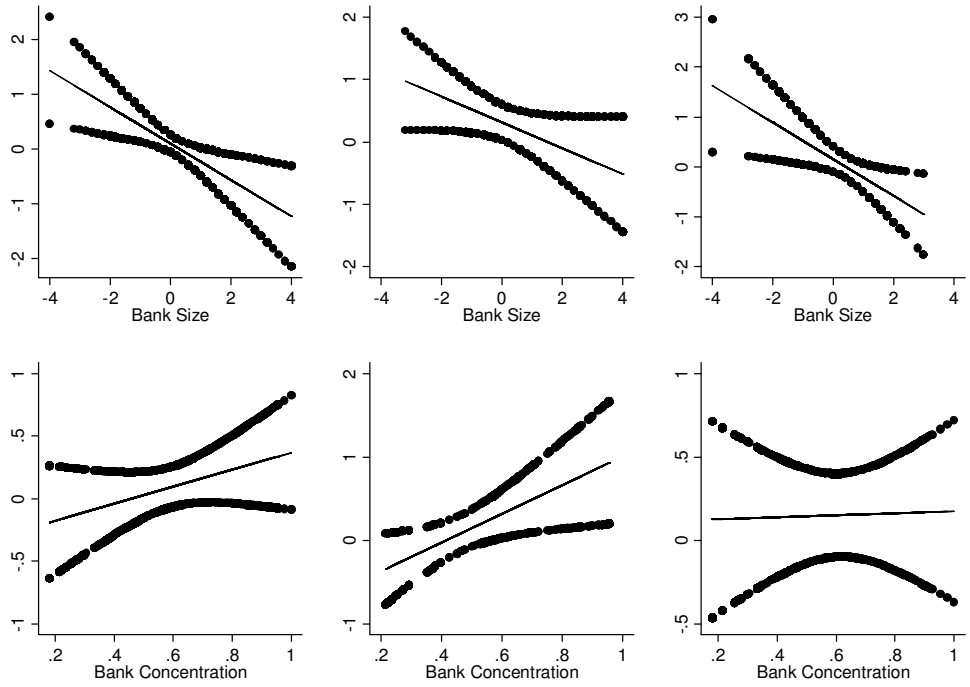
The figure examines the impact of financial crises on bank earning volatility and corresponds to our main results as given in columns (1)-(3) in Table 3.2. The upper panel examines the marginal effect of financial crises at different levels of bank size and the lower panel examines marginal effect of financial crises at different levels of bank concentration. The graphs on the left pertain to column (1) where we examine the impact of financial crises for all countries in our sample. The graphs in the middle correspond to column (2) examining the impact of financial crises for high-income OECD countries and graphs on the right represent the impact of financial crises for the other countries in our sample, corresponding to column (3).

3.6 Robustness and Extensions

This section presents a number of robustness checks. We first examine whether our results hold when we take five-year earnings volatility instead of three-year earnings

volatility. The results are presented in columns (4)-(6) in Table 3.2. The corresponding graphs for testing the hypotheses are presented in Figure 3.2. The results are very similar to our earlier findings. The impact of financial crises on earnings volatility decreases as bank size increases, while the impact of financial crises on earnings volatility increases when the banking sector becomes more concentrated. An anomaly is the plot of marginal effects of financial crises on bank earnings volatility at different levels of market concentration for banks that are not operating in high-income OECD. The plot as shown in the bottom right panel of Figure 3.2 indicates an almost flat curve indicating no variation in marginal effect with change in market concentration.

Figure 3.2 Marginal Effect of Financial Crises
On Bank Earnings Volatility (Averaged for five years period)



The figure examines the impact of financial crises on bank earning volatility and corresponds to our main results as given in columns (4)-(6) in Table 3.2. The upper panel shows the marginal effect of financial crises at different levels of bank size and the lower panel shows the impact of financial crises at different levels of bank concentration. The graphs at the left pertain to column (4) where we examine the impact of financial crises for all countries in our sample. The graphs in the middle correspond to column (5) examining the impact of financial crises for high-income OECD countries and graphs at the right represent the impact of financial crises in the other countries in our sample, corresponding to column (6).

Table 3.3 Sensitivity Analyses							
		(1)	(2)	(3)	(4)	(5)	(6)
	Countries	**All**	**OECD$^{\Psi}$**	**Other$^{¤}$**	**All**	**OECD**	**Other**
		Return on Equity Results			**Bank Size Definition Robustness**		
Financial Crises	Coefficient	-0.669	0.387	-0.689	1.19	-1.39	1.063
	Standard Error (Robust)	1.196	2.027	1.476	0.794	1.16	0.852
Bank Size	Coefficient	0.086	-0.96	0.908	-0.208**	-0.219*	-0.221
	Standard Error (Robust)	0.556	0.729	0.818	0.09	0.115	0.149
Bank Concentration	Coefficient	3.835**	-4.142	6.569***	0.772	-0.762	1.019
	Standard Error (Robust)	1.892	3.084	2.231	1.035	2.602	1.189
Cost/Income	Coefficient	0.022**	0.013	0.029***	0.005	0.003	0.007***
	Standard Error (Robust)	0.011	0.02	0.009	0.003	0.007	0.003
Inflation	Coefficient	8.935***	-24.637	9.079***	0.258	-9.583*	0.38
	Standard Error (Robust)	3.32	19.96	3.361	0.642	5.467	0.612
GDP Growth	Coefficient	-0.202***	0.074	-0.236***	-0.015	0.016	-0.018
	Standard Error (Robust)	0.068	0.15	0.07	0.017	0.038	0.018
Leverage	Coefficient	-0.006	-0.008***	0.190***	-0.003	-0.003	-0.014**
	Standard Error (Robust)	0.004	0.002	0.054	0.002	0.002	0.007
GDP/Capita	Coefficient	1.797	-1.346	0.593	0.711	-0.051	4.382
	Standard Error (Robust)	1.444	2.092	10.033	0.472	0.884	3.927
Financial Crises*Bank Size	Coefficient	-0.637	2.580*	-1.162	-0.228**	0.186	-0.229**
	Standard Error (Robust)	0.939	1.352	1.162	0.093	0.138	0.103
Financial Crises*Bank Concentration	Coefficient	1.69	0.667	1.495	-1.603	5.557*	-1.471
	Standard Error (Robust)	2.236	4.889	2.615	1.23	2.971	1.31
Bank Size* Bank Concentration	Coefficient	-1.103	0.176	-2.373*	-0.062	0.038	-0.065
	Standard Error (Robust)	0.863	0.976	1.401	0.163	0.365	0.162
Financial Crises*Bank Size* Bank Concentration	Coefficient	0.691	-7.095**	1.68	0.378**	-0.717**	0.390**
	Standard Error (Robust)	1.836	3.184	2.146	0.154	0.351	0.17
Constant	Coefficient	-0.091	5.269**	-1.657	1.256*	2.204*	1.325
	Standard Error (Robust)	1.307	2.608	1.472	0.737	1.23	0.957
Number of Observations		6277	3236	3041	6277	3236	3041
Number of Banks		1818	940	878	1818	940	878
F-Statistics		3.985***	7.302***	4.581***	5.836***	8.289***	5.259***

*** indicates significance at 1 percent level, ** indicates significance at 5 percent and * indicates a significance at 1 percent level
Ψ OECD refers to High-income OECD countries as classified by World Bank in World Development Indicators.
¤ Other refers to all other countries in our sample.

Next, we examine whether a change in the definition of earnings or the use of absolute bank size (proxied by the log of bank assets) instead of relative bank size has any impact on the results. This is shown in Table 3.3. The models in columns (1)-(3) correspond to the change in the definition of earnings when we use return on equity (ROE) volatility instead of return on asset volatility. The models in columns (4)-(6) relate to the change in the definition of bank size. Columns (1) and (4) present the results for all countries in the sample, while columns (2) and (5) provide the outcomes for high-income OECD countries. Columns (3) and (6) contain the findings for banks operating in the other countries in our sample. Figures B1 and B2 in Appendix B show the test outcomes. They show that our main result that earnings volatility decreases when bank size increases still holds. It can be observed from the downward sloping marginal effect lines in the upper panels that show the impact of financial crises on bank earnings volatility (volatility in ROE in Figure B1). When we use absolute bank size we find again downward sloping marginal effect lines (Figure B2). Also our result that earnings volatility is positively conditioned by market concentration is reasonably robust. The only exception is that when the return on equity is used, the effect of financial crises on earnings volatility of banks from non-OECD countries is not significant as both upper and lower confidence intervals are in different quadrants. As mentioned before, this may be attributed to the fact that equity can be more volatile compared to assets in times of crises. Moreover, Couto (2002) argues that volatility in emerging market economies is a prime characteristic of such countries.

Finally, Table 3.4 provides the results for different types of financial crises and for different types of banks. In column (1), we look at the impact of systemic banking crises. In column (2), we focus on currency crises, and in column (3) we examine the impact of debt crises. In column (4), we consider the impact of financial crises on earnings volatility of commercial banks, while in columns (5) and (6) we investigate the impact of financial crises on the earnings volatility of savings and investment banks, respectively. The test outcomes regarding the corresponding hypotheses are provided in Figures B3 and B4.

Again, it appears that most results are very similar to our previous findings. One exception is that the impact of debt crises on bank earnings volatility is not significant. However, the marginal effect line conditional on bank size is still downward sloping. A possible reason that debt crises have less impact on bank earnings volatility is that unlike currency crises and systemic banking crises, which affect the credit and foreign exchange businesses of the banks directly, debt crises do not affect the operations of banks directly. It also appears that investment banks operating in more concentrated banking industries face less earnings volatility. However, it needs to be mentioned that the share of investment banks in our sample is rather small and F-statistics of the regression as reported in column (6) of Table 3.4 are lower compared to other samples.

Table 3.4 Sensitivity Analyses							
		(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
		Banking Crises	**Currency Crises**	**Debt Crises**	**Commercial Banks**	**Saving Banks**	**Investment Banks**
Financial Crises	Coefficient	-0.979**	0.471	-2.048	-0.458	-0.876**	1.852
	Standard Error (Robust)	0.487	0.814	1.601	0.319	0.353	1.397
Bank Size	Coefficient	-0.073	-0.069	-0.086	0.015	-0.185**	0.157
	Standard Error (Robust)	0.117	0.12	0.117	0.137	0.089	0.635
Bank Concentration	Coefficient	1.032***	0.943***	0.937***	1.012***	-0.610*	0.24
	Standard Error (Robust)	0.354	0.354	0.341	0.36	0.358	1.565
Cost/Income	Coefficient	0.006*	0.006*	0.006*	0.006	0.005***	0.003
	Standard Error (Robust)	0.003	0.003	0.003	0.004	0.002	0.003
Inflation	Coefficient	1.233**	1.073*	1.207**	1.119*	-0.222	-1.4
	Standard Error (Robust)	0.628	0.618	0.607	0.621	3.022	8.198
GDP Growth	Coefficient	-0.044***	-0.028	-0.049***	-0.031**	-0.01	-0.13
	Standard Error (Robust)	0.016	0.017	0.016	0.015	0.02	0.093
Leverage	Coefficient	-0.004*	-0.005*	-0.005*	-0.008***	0.001	0.000
	Standard Error (Robust)	0.003	0.003	0.003	0	0.001	0.001
GDP/Capita	Coefficient	0.192	-0.013	0.242	-0.276	0.572**	-2.574
	Standard Error (Robust)	0.333	0.341	0.326	0.58	0.257	1.883
Financial Crises*Bank Size	Coefficient	0.009	-0.859	-0.028	-0.094	-0.424*	-1.073
	Standard Error (Robust)	0.343	0.567	1.29	0.22	0.216	0.782
Financial Crises*Bank Concentration	Coefficient	2.123**	0.229	3.731	1.033*	1.532***	-3.245
	Standard Error (Robust)	0.934	1.286	2.62	0.55	0.574	2.703
Bank Size* Bank Concentration	Coefficient	-0.102	-0.1	-0.088	-0.198	0.113	-0.483
	Standard Error (Robust)	0.188	0.189	0.187	0.245	0.109	0.898
Financial Crises*Bank Size* Bank Concentration	Coefficient	-0.429	0.833	-0.232	-0.001	0.13	1.222
	Standard Error (Robust)	0.636	0.957	2.085	0.379	0.381	1.55
Constant	Coefficient	-0.217	-0.19	-0.137	-0.092	0.038	2.045*
	Standard Error (Robust)	0.311	0.313	0.305	0.319	0.262	1.061
Number of Observations		6277	6277	6277	4026	1410	841
Number of Banks		1818	1818	1818	1173	396	249
F-Statistics		4.978***	4.780***	4.350***	234.256***	17.139***	3.143***
*** indicates significance at 1 percent level, ** indicates significance at 5 percent and * indicates a significance at 1 percent level							

3.7 Conclusions

We examine the effect of financial crises on bank earnings volatility (proxied by volatility of ROA) conditional on relative bank size and market concentration for about 1800 banks from both OECD and non-OECD countries in the period 1998-2008. We find that in the wake of financial crises bank earnings volatility is higher for small banks than for large banks. Moreover, we show that in concentrated markets banks face more earnings volatility after a financial crisis. This is in line with the findings of Boyd and de Nicolo (2005).

In our sensitivity tests, we use a number of variations in the definitions of the variables used and samples. It turns out that our results are generally very robust. Using variability of ROE instead of volatility of ROA does not affect our findings. Likewise, employing absolute bank size (proxied by logarithmic bank assets) instead of relative bank size does not lead to qualitatively different results. Similarly, differentiating between systemic banking crises, currency crises, and debt crises does hardly change our results, albeit that the impact of debt crises on bank earnings volatility is not significant. Finally, we show that most of our results do not change for different types of banks. The only exception is that for investment banks, market concentration reduces earnings volatility after a financial crisis.

Chapter 4

Growth and Earnings Persistence in Banking Firms: A Dynamic Panel Investigation[1]

4.1 Introduction

Does firm growth depend on firm size and is firm growth persistent? Although there are many studies analyzing these questions for non-banking firms, there is hardly any empirical research that focuses on banking firms. Still, these issues are important for the banking sector as well. For instance, persistence of high growth rates of banking firms will result in a highly concentrated banking industry.

The literature on this topic has been significantly influenced by Gibrat's (1931) 'Law of Proportionate Effects'. The strong version of Gibrat's 'law' consists of three propositions: (i) the growth rate of each firm over some period is independent of its size; (ii) the variability of a firm's growth rate is independent of the firm's size, and (iii) the firm's growth rates in two consecutive periods are independent of each other. Together these propositions imply that the firm's growth rate follows a random walk. The most extensive work to date on Gibrat's 'law' for banking firms are the studies by Goddard *et*

[1] This chapter is based on joint work with Jakob de Haan and Bert Scholtens. The authors are thankful to participants in the ProBanker European Banking Symposium, 2009, held in Maastricht, Netherlands, for their valuable comments. The usual disclaimer applies.

al. (2004a, 2004b). These authors not only examined Gibrat's 'law', but also analyzed the inter-linkages of bank growth and profitability.

In this chapter we examine the following questions: (i) Are growth and earnings patterns in banking firms persistent? (ii) Are growth and earnings affected by bank size? (iii) Are growth volatility and earnings volatility affected by bank size?, and (iv) What are the inter-linkages between earnings and growth patterns? Using Blundell and Bond's (1998) Generalized Method of Moments (GMM) for dynamic panel models, we analyze a sample of more than 1500 banks operating in 65 emerging and industrial economies for the period 1997-2007.

Our results suggest that bank growth is not persistent, in contrast to bank profitability. Additionally, we find that large banks in industrial economies grow at a slower speed than smaller banks, but bank size does not influence bank growth in emerging markets. In summary, our results suggest that Gibrat's 'law' does not hold for the banking industry in emerging market economies.

This chapter extends previous work in four directions. First, we examine a much bigger data set consisting of more than 1500 banks from 65 countries for the period 1997-2007. Second, our dataset includes banks from 36 emerging market economies, whereas previous research focused on OECD countries. Third, we focus on recent data. As we will show in our data section, the structure of the banking industry significantly changed even for OECD countries during the 1997-2007 period. Finally, previous papers use the Arellano and Bond (1991) procedure for estimating dynamic panel models. However, Blundell and Bond (1998) show that in panels with small T (limited time period) and large N (many banks) the Arellano and Bond (1991) approach produces biased estimates. Therefore, we apply the methodology suggested by Blundell and Bond (1998). Additionally, we extend the list of control variables.

The remainder of the chapter is structured as follows. Section 4.2 discusses the literature on bank growth and earnings and develops our model. Section 4.3 describes our data on bank growth, profitability, and size distribution. Section 4.4 presents the estimation results for the full sample, while section 4.5 examines differences between OECD and non-OECD countries. Section 4.6 concludes the paper.

4.2 Bank Growth and Earnings Patterns

Tschoegl (1983) tested Gibrat's 'Law of Proportionate Effects' for the 100 largest banks of the world from 1969 to 1977 and concludes that the growth rate of banks over this period is independent of their size. However, the variability of bank growth rate declines with increase in bank size. Additionally, he could not find any clear results regarding the relationship between bank growth rates in two consecutive periods. More recently, Benito (2008) tested Gibrat's 'law' for Spanish banks using panel unit root tests and finds that the size-growth relationship is not stable over time but depends on the competitive environment. His results suggest that smaller banks grow faster than larger banks.

Research on Gibrat's Law originally focused on growth, while a separate strand of the literature examined the linkage between size and profitability in banking. These studies focus on profitability and not on the persistence and dynamics of earnings. For instance, analyzing the effect of bank size on bank performance, Stein (2002) and Berger *et al.* (2005) report that small banks have better abilities to allocate capital and to collect and act on 'soft' information regarding their borrowers. However, Stever (2007) finds lower betas for small banks and attributes this result to lower firm diversification. Some papers do not find a strong link between market structure and profitability. For instance, Athanasoglu *et al.* (2005) study the effect of bank-specific, industry-specific, and macroeconomic determinants of bank profitability using the GMM technique for a panel of Greek banks covering the period 1985-2001. They find that all bank-specific determinants, except for size, affect bank profitability significantly in the anticipated way.

Goddard *et al.* (2004a, 2004b) combine both strands of the literature. They use panel and cross-sectional regressions to estimate growth and profit models for a sample of almost 600 banks from five European Union countries over the period 1992-1998. The authors find that profit is an important prerequisite for future growth. When banks become larger, their growth performance tends to improve further. Finally, growth persistence tends to be higher for savings and co-operative banks than for commercial banks.

The model tested by Goddard *et al.* (2004b) to examine the linkages between bank size, growth, and profitability provides an interesting framework. We therefore take

this model as our starting point, but will introduce some adjustments for econometric and theoretical reasons. According to the model, bank growth follows a random walk with drift if all the three propositions of Gibert's 'law' hold:

$$S_{it} - S_{it-1} = \alpha_i + \delta_t + \varepsilon_{it} \tag{4.1}$$

Where S_{it} indicates the log of the size of bank *i* in year *t*, S_{it-1} indicates the log of the size of bank *i* in year *t-1*, and $\alpha_i + \delta_t + \varepsilon_{it}$ indicates that logarithmic bank growth follows a random walk with drift where $\alpha_i + \delta_t$ are individual bank and time effects, respectively.
We can rewrite equation (4.1) as follows:

$$S_{it} - S_{it-1} = \alpha_i + \delta_t + (\beta - 1) S_{it-1} + \varepsilon_{it} \tag{4.2}$$

Where parameter β indicates the relationship between bank size and annual growth. To examine the effect of growth in the previous period, we introduce a lagged dependent variable in the model:

$$S_{it} - S_{it-1} = \alpha_i + \delta_t + (\beta - 1) S_{it-1} + \gamma(S_{it-1} - S_{it-2}) + \varepsilon_{it} \tag{4.3}$$

Using this model, we can test our first three hypotheses. The first hypothesis is:

Hypothesis 1: Bank growth is independent of bank size

To examine the effect of bank size on growth, we test the following hypothesis:

$$H_0 : \beta - 1 = 0$$
$$H_1 : \beta - 1 \neq 0$$

The null hypothesis corresponds to Gibrat's proposition that the growth rate of each bank is independent of its size. If $\beta > 1$, i.e., bigger banks grow faster, concentration will increase and the distribution of bank sizes will become highly skewed.

Hypothesis 2: Bank growth variability is independent of bank size

To test this proposition, we need to examine whether banks are homogeneous, i.e., individual banks effects (α_i) are the same and do not vary with bank size.

$$H_0 : \alpha_i = \alpha$$
$$H_1 : \alpha_i \neq \alpha$$

The null hypothesis corresponds to Gibrat's second proposition and indicates that bank size does not affect growth volatility. To test this hypothesis we plot residuals from our models against bank size and check if there is any systemic variation in residuals with variation in bank size.[2]

Hypothesis 3: Bank growth is not persistent

To examine the persistence of bank growth, we test the following hypotheses:

$$H_0 : \gamma = 0$$
$$H_1 : \gamma \neq 0$$

The third null hypothesis corresponds to Gibrat's third proposition and indicates that current growth does not depend on past growth.

Goddard *et al*. (2004b) extend equation (4.3) by adding lagged profit as an explanatory variable:

$$S_{it} - S_{it-1} = \alpha_i + \delta_t + (\beta - 1) S_{it-1} + \gamma (S_{it-1} - S_{it-2}) + \varphi \prod_{it-1} + \varepsilon_{it} \qquad (4.4)$$

where: $\prod_{it-1}$ indicates profit of bank i in year t-1. Using this extended model, we can test our fourth hypothesis about the linkage between profitability and bank growth.

[2] A satisfactory testing procedure for this hypothesis for dynamic panel models with small T and large N samples is not available. A recent article of Sarfidis *et al.* (2009) presents the unsuitability of other heteroskedastic tests and proposes an alternative solution but that is also not suitable here because we are interested in the variation of residuals against bank size and not the cross sectional dependence itself.

Hypothesis 4: Bank profitability has no effect on bank growth

To analyze the effect of bank profitability on growth, we test

$$H_0 : \varphi = 0$$
$$H_1 : \varphi \neq 0$$

Following Goddard *et al.* (2004b), we include various control variables that will be explained in some detail in the next section. The model therefore becomes:

$$S_{it} - S_{it-1} = \alpha_i + \delta_t + (\beta - 1)S_{it-1} + \gamma(S_{it-1} - S_{it-2}) + \varphi \prod_{it-1} + \zeta X_{it} + \varepsilon_{it} \quad (4.5)$$

where X_{it} is a matrix of control variables for bank *i* in year *t*.

As long as banks are homogeneous, i.e. $\alpha_i = \alpha$, this specification gives unbiased estimates of the model by pooling the data. However, if banks are not homogeneous Breitung and Meyer (1994) show that ($\beta - 1$) becomes a biased and inconsistent estimator. Instead they suggest transforming equation (4.5) as follows:

$$S_{it} - S_{it-1} = (\beta - 1)(S_{it-1} - S_{i0}) + \gamma(S_{it-1} - S_{it-2}) + \varphi \prod_{it-1} + \zeta X_{it} + \xi_{1it} \quad (4.6)$$

where $\xi_{1it} = \alpha_i + \varepsilon_{it} + \beta S_{i0}$. This provides an unbiased and consistent estimation of our model. In equation (4.6), instead of taking the lagged size as the explanatory variable, we take the difference of lagged size and initial bank size. Breitung and Meyer (1994) show that after this transformation ($\beta - 1$) is not affected by heterogeneity.

Now we have derived our model for bank growth. By following the same steps, we can derive our model for profitability. So equation (4.7) below gives the model for the dynamic analysis of profitability:

$$\prod_{it} = (\beta_\pi - 1)(\prod_{it-1} - \prod_{i0}) + \gamma_\pi(S_{it-1} - S_{it-2}) + \zeta_\pi X_{it} + \xi_{\pi 2it} \quad (4.7)$$

where $\xi_{\pi 2it} = \alpha_{\pi i} + \varepsilon_{\pi it} + \beta_\pi \prod_{i0}$. This model will be used to test hypotheses 1-4 using profitability instead of bank growth as dependent variable.

Arellano and Bond (1991) show that due to the presence of individual bank effects and the lagged dependent variable, OLS or fixed effects models cannot be used for estimating equations (4.6) and (4.7). Goddard *et al.* (2004a; 2004b) therefore use the

difference Generalized Method of Moments (GMM) approach as suggested by Arellano and Bond (1991). However, Blundell and Bond (1998) show that if the dependent variable is close to a random walk, the difference GMM approach performs poorly, because past levels convey little information about future changes. Blundell and Bond (1998) suggest instead of transforming the regressors to transform their differences to make them exogenous to the fixed effects. Especially, for small T, large N data in an unbalanced panel setting the Arellano and Bond (1991) method produces biased estimates. As our dataset covers a short period of time, contains many banks and is unbalanced, we estimate equations (4.6) and (4.7) by the system GMM approach suggested by Blundell and Bond (1998), following Roodman (2006) using a two-step system GMM approach for dynamic panel analysis.[3]

4.3 Data Description and Analysis

The banking data for our analysis come from Bureau Van Dijk's Bankscope database (December 2008) version. The data refer to the period 1997-2007 and cover commercial banks operating in more than 65 countries (29 OECD countries and 36 emerging market countries). Table C1 in Appendix C provides the number of banks for the countries in our sample. To avoid the problem of double-counting of banks because of consolidation, we include only banks with consolidated statements. If no consolidated statement for a bank was available, we take data from the unconsolidated statement. Moreover, to keep the sample homogeneous we include only commercial banks. We deliberately exclude banks with a negative equity to asset ratio. After accounting for these changes, our final sample includes more than 3,900 observations for more than 1,500 banks.

We use bank assets as a proxy for bank size and return on average equity as a proxy for bank profitability. We include three bank-specific control variables.[4] They account for the capital structure of the bank (i.e., equity/assets ratio), managerial

[3] Our main results are based on two-step GMM Model, which results in more efficient estimation. However, to check the robustness of our results, we also applied the 2SLS and the one-step GMM model. The results are quite similar to the two-step GMM method (results are available on request).

[4] The bank-specific control variables are very similar to Goddard *et al*. (2004b) except for two major differences. Firstly, we use overhead costs to income of banks and recurring earnings power as two additional variables. These variables incorporate managerial efficiency and earnings stability in the analysis. However, two variables used by Goddard *et al*. (2004b), namely off-balance sheet business of the bank and liquidity, are not used in our model for two reasons. In the first place, both of these variables appeared insignificant for commercial banks in the model of Goddard *et al*. (2004b). In the second place, the availability of data is limited and inclusion would reduce the number of observations.

efficiency of the banks (i.e., overhead costs to net income ratio) and stability of bank earnings (i.e., recurring earning power). The first control variable measures the portion of assets financed by equity. The higher this ratio, the better is the capital adequacy of the bank concerned. The second control variable measures the overhead costs to net income. If a bank has higher overhead costs as a ratio of net income, its profitability declines. The third control variable measures recurring earning power as a proxy of stability of earnings.[5] As such, the recurring earning power reflects net income from the core business of the bank. A higher value indicates that a bank has better and more stable earnings pattern. Additionally, to incorporate macroeconomic conditions and the overall financial sector situation, we include real GDP growth, inflation, and bank concentration.[6] Table 4.1 provides definitions of the dependent and explanatory variables and their sources.

Table 4.1 Variables: Definitions and Sources

Variable:	**Definition:**	**Source:**
Assets	Bank Assets *(in US$ 10000)*	Bankscope
Equity	Bank Equity *(in US$ 10000)*	Bankscope
Asset Growth	$Log(Assets_t) - Log(Assets_{t-1})$	Bankscope
Return on Assets	Returns as a ratio of bank assets	Bankscope
Return on Equity	Returns as a ratio of bank equity	Bankscope
Overhead Costs/Net Income	The ratio of overhead bank costs to net income ratio. Overhead refers to expenses that are necessary to the continued functioning, but do not directly generate profits.	Bankscope
Recurring Earning Power	This is an adjusted ratio of stable net income to assets and excludes non-stable earnings and taxes from net income before the calculation of the ratio.	Bankscope
Equity/Assets	As equity is a cushion against asset malfunction, this ratio measures the amount of protection afforded to the bank by the equity they invested in it. The higher this figure the more protection there is.	Bankscope
Real GDP Growth	$Log(real\,GDP_t) - Log(real\,GDP_{t-1})$	World Development Indicators
Inflation	Change in Consumer Price Index. To adjust for extreme movements, we modify the inflation rate (P) as $\frac{P/100}{1+(P/100)}$	World Development Indicators
Concentration	Fraction of Assets held by three largest banks	Beck *et al.* (2000) - Financial Structures Database

[5] This variable is very different from our dependent variable: the correlation of both variables is only 0.37.
[6] Different from Goddard *et al*. (2004b), we include inflation in the model, as we want to control for the effect of an increasing or decreasing price level on bank assets and profitability.

Table 4.2 provides the summary statistics of our data and Table C2 in Appendix C provides the correlation matrix of the variables. The correlations between the explanatory variables are low suggesting that multicolinearity is not a problem.

Table 4.2 Summary Statistics

Variable:	Mean	Std. Deviation	Minimum	Maximum	Observations
Assets *(in US$ 10000)*	25.70	280.84	0.00	9730.00	7,783
Equity *(in US$ 10000)*	2.79	35.87	0.00	1250.00	7,765
Asset Growth	0.17	0.47	-6.92	4.66	5,759
Return on Assets	1.11	4.76	-111.13	73.17	7,720
Return on Equity	9.85	30.87	-927.38	615.39	7,699
Overhead Costs/Income	3.74	30.69	-1668.39	702.54	7,526
Recurring Earning Power	2.13	4.93	-81.09	96.30	7,713
Equity/Assets	15.68	17.96	0.00	100.00	7,765
Real GDP Growth	0.03	0.02	-0.14	0.26	31,414
Inflation	0.03	0.04	-0.09	0.61	35,392
Concentration	0.41	0.22	0.20	1.00	43,209

Much of our data come from Bankscope. However, Bankscope has been criticized for being not sufficiently representative of the banking systems of the countries covered (see, for instance, Bhattacharya, 2003). To check whether our sample is sufficiently representative we compare our sample of banks in terms of return on assets and return on equity with the World Bank Financial Structure database of Beck *et al*. (2000).[7] As Table C3 in Appendix C shows, the averages in our sample are very similar to the overall banking sector statistics in the World Bank dataset. One possible reason for the small differences is that our sample is based on commercial banks only, whereas the World Bank sample also includes investment, co-operative, and micro-finance banks.

As we are using a large dataset of banking firms, it is useful to discuss some developments in bank size in the period under investigation. Bank size distribution as measured by assets is highly skewed towards the right, i.e., there are many small banks and a few large banks. This pattern is so clear that a normal plot of bank size is not informative (see also Janicki and Prescott, 2006). Therefore, we show the log of bank size

[7] These are the only two variables that are common in both datasets.

for all OECD and non-OECD banks in our sample over the period 1997-2007 in Figure 4.1 and Figure 4.2, respectively. Additionally, we present year-wise skewness, kurtosis and Jarque-Bera test statistics for both OECD and non-OECD countries in Table C4 in Appendix C. Our findings suggest that over the period 1997-2007, the size distribution of banks in the OECD countries converged to the lognormal distribution but this does not hold true for non-OECD countries. In OECD countries the leptokurtosis was reduced, but in non-OECD countries logarithmic bank sizes are still peaked, although there is a trend towards the reduction of kurtosis in these countries too.

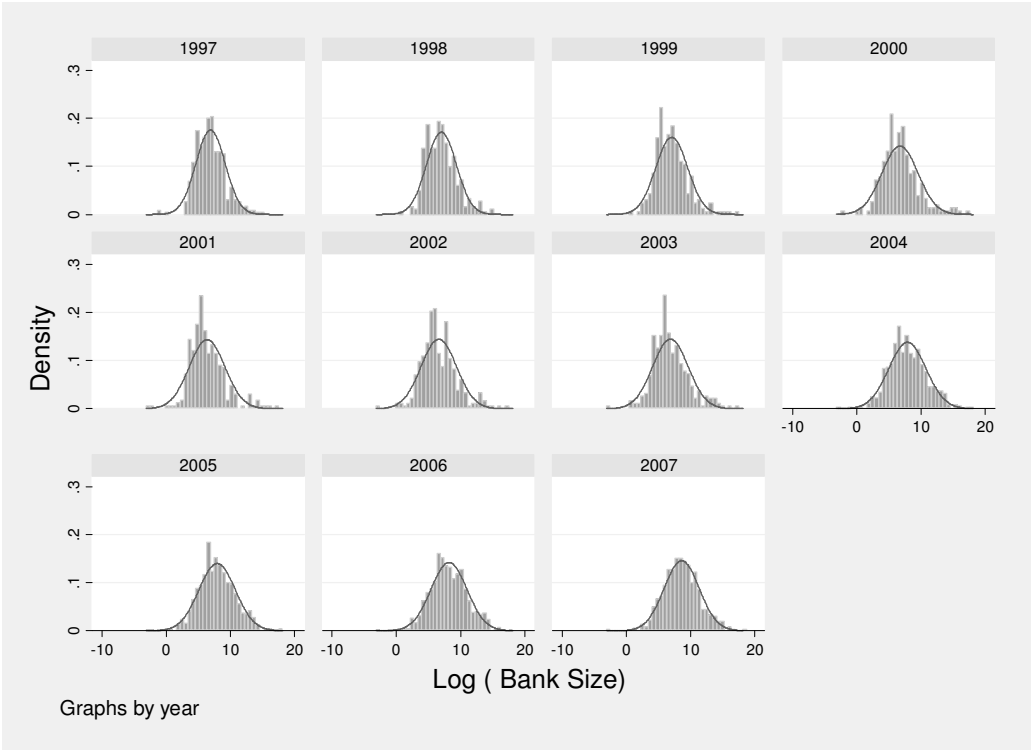


Figure 4.1 Density of the log of Bank Size in OECD Countries

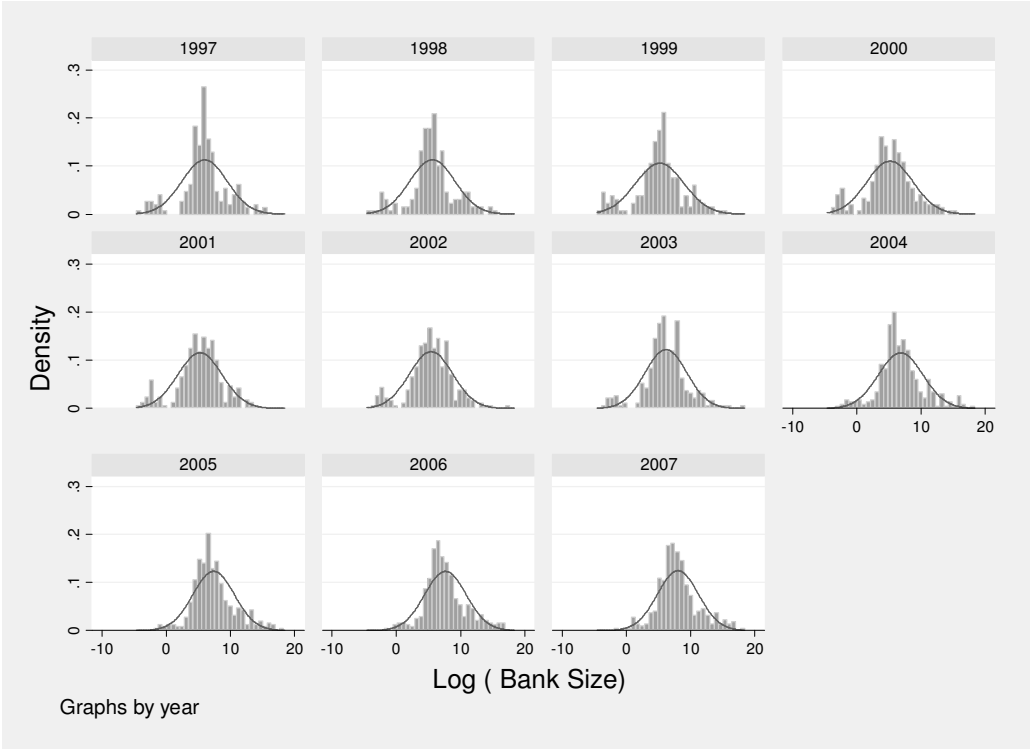


Figure 4.2 Density of the log of Bank Size in non-OECD Countries

4.4 Estimation Results for the Full Sample

The estimation results for the full sample are presented in columns (1)-(3) of Table 4.3 and Table 4.4 for growth and profitability, respectively. In model 1 in Table 4.3 bank growth is regressed on lagged growth and lagged bank size. In model 2, lagged profitability is included as an explanatory variable, while in model 3 all explanatory variables are included. The Wald Chi-squared test is significant at the 1 percent level of significance and the Hansen test of over-identifying restriction appears insignificant. The null hypothesis of the Hansen test is that the population moment conditions are correct and failure to reject the null hypothesis indicates the validity and exogeneity of the instruments.[8] For the consistent estimation of the models, a crucial condition is that the error terms are serially uncorrelated. More specifically, $\Delta\xi_{it}$ should be uncorrelated[9] with

[8] It may be important to mention here that in some models, the Sargan test for the instrument invalidity appears significant. However, as pointed out by Roodman (2006), the Sargan test can be inconsistent, because of the non-sphericity of errors and in that case the Hansen statistic from two-step estimate, which we report in our tables, is a better test.

[9] If errors are serially uncorrelated $\Delta\xi_{i,t}$ are correlated with $\Delta\xi_{i,t-1}$ but not with $\Delta\xi_{i,t-k}$ for $k \geq 2$.

$\Delta\xi_{i,t-k}$ for $k \geq 2$ and this can be examined by the Arellano-Bond test for first and second difference autoregressive processes. The test for the first difference autoregressive process appears significant, while it is insignificant for the second difference indicating that error terms are serially uncorrelated in our models.

Columns (1)-(3) of Table 4.4 provide results for profitability models corresponding to equation (4.7) for the full sample. In model 1, profitability of a bank is regressed on lagged profitability only. In model 2, bank size is included as an explanatory variable, while in model 3 all explanatory variables are taken up. The Wald Chi-squared test is again significant at the 1 percent level of significance and the Hansen test of over-identifying restriction appears insignificant, suggesting the validity and exogeneity of our instruments. Similar to the models for bank growth, the Arellano-Bond test for the first difference autoregressive process appears to be significant and the second difference appears to be insignificant.

Hypothesis 1: Bank growth (profitability) is independent of bank size

To test this hypothesis, we examine the coefficient of logarithmic bank size *(β-1).* For the bank growth equation, the models 1-3 in Table 4.3 show that this coefficient has a negative sign, which implies that large banks grow slower than small banks. This finding is consistent with our observation that bank sizes converge to the lognormal distribution. For the profitability equation results in Table 4.4, models 2-3 reveal that bank size does not affect profitability. Therefore, we cannot reject the hypothesis that $\beta = 0$. This finding suggests that bank profitability is not affected by bank size. This result is very similar to the findings of Goddard *et al*. (2004a) and Athanasoglu *et al*. (2005).

Hypothesis 2: Bank growth (profitability) variability is independent of bank size

To examine the effect of bank size on variability of bank growth and profitability, we plot the residuals of our models 1-3 (as reported in columns (1)-(3) of Tables 4.3 and 4.4 for the full sample) in the upper-most rows of Figures 4.3 and 4.4 for growth and profitability, respectively. The residuals from the bank growth models 1 and 2 do not suggest any systematic variation in the residuals. In model 3, the test for the normality of the residuals shows no significant trend as well. So hypothesis 2 is not rejected for bank

growth. On the other hand, in the profitability models, we find that variation in profitability is slightly higher for smaller banks compared to the banks.

Hypothesis 3: Bank growth (profitability) is not persistent

In Table 4.3, where we present the results for bank growth, lagged bank growth appears insignificant in all three formulations of the model, implying no persistence in bank growth. So hypothesis 3 can be rejected for bank growth. On the other hand, lagged profitability appears significant in all three the models in Table 4.4, indicating persistence of bank profitability. This result is similar to the findings of Goddard *et al*. (2004a; 2004b). Our results imply that lagged bank growth has no predictive power for current year bank growth.

Hypothesis 4: Bank profitability (growth) has no effect on bank growth (profitability)

In some specifications as reported in Table 4.3, profitability predicts growth but this result is not robust as in the full model significance of profitability is rejected. However, in the model for bank profitability the coefficient of lagged growth is significant at the 5% level, suggesting that banks growing faster in the previous period tend to have higher profitability in the current period.

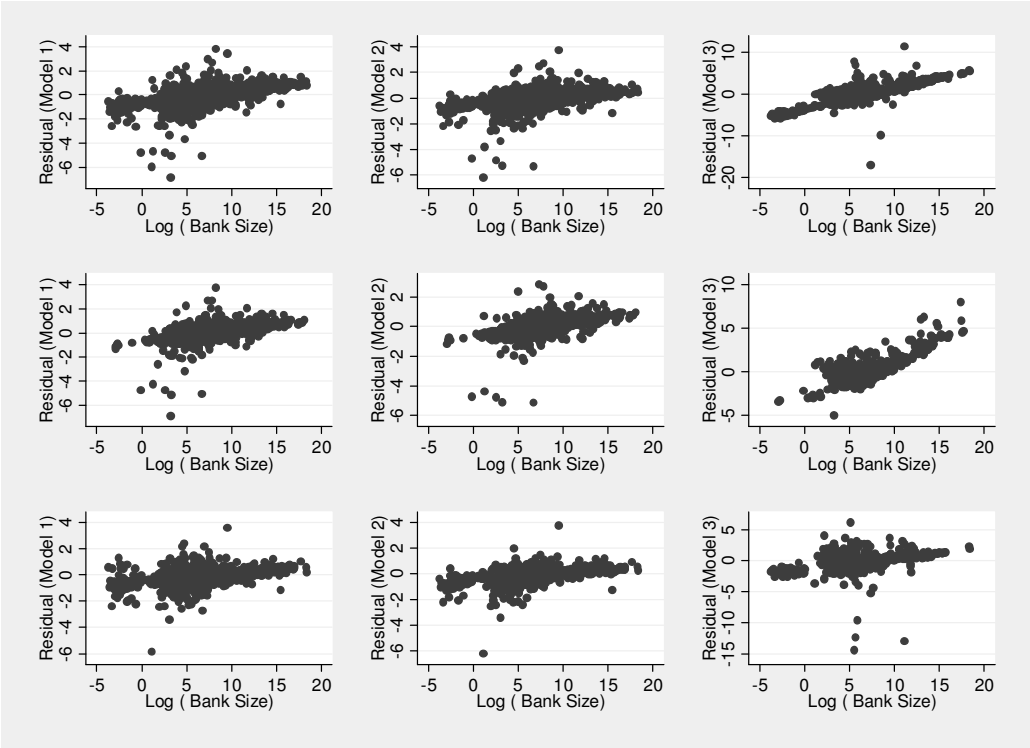
Table 4.3 Dynamic Panel Estimation Results (Dependent Variable is Bank Growth)										
		Full sample			OECD Countries			Non-OECD Countries		
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
		Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Bank Growth (t-1)	Coefficient	0.33	0.009	-0.015	0.143	0.23	0.012	0.817***	0.112	-0.187*
	Std. Error	0.215	0.243	0.044	0.675	0.413	0.047	0.306	0.25	0.101
Bank Size (t-1)	Coefficient	-0.095***	-0.058*	-0.515**	-0.094*	-0.084***	-0.458***	-0.054	-0.049	-0.203
	Std. Error	0.027	0.032	0.202	0.056	0.024	0.11	0.048	0.034	0.148
Return on Equity (t-1)	Coefficient		0.069**	-0.097		0.009	-0.035		0.081***	-0.01
	Std. Error		0.032	0.068		0.041	0.054		0.025	0.081
Equity/Assets Ratio	Coefficient			-0.038**			-0.042***			-0.028*
	Std. Error			0.019			0.013			0.016
Overhead Costs/Income	Coefficient			-0.032			0			0.046*
	Std. Error			0.029			0.008			0.023
Real GDP Growth	Coefficient			2.381			9.428			1.344
	Std. Error			2.248			6.765			1.518
Inflation	Coefficient			0.251			-8.087			1.56
	Std. Error			2.477			12.261			2.476
Recurring Earning Power	Coefficient			0.009			-0.001			-0.076
	Std. Error			0.029			0.015			0.051
Concentration	Coefficient			-0.306			-0.482			0.576
	Std. Error			0.771			0.751			0.717
Number of Observations		3972	3484	1879	2390	2054	1014	1582	1430	865
Number of Banks		1569	1451	838	989	908	449	580	543	389
Number of Instruments		13	21	19	12	18	19	13	21	19
AB test for AR(1)		-2.095	-1.664	-1.201	-0.707	-1.471	-1.532	-2.57	-1.556	-1.417
Prob (AB test for AR(1))		0.036	0.096	0.23	0.479	0.141	0.126	0.01	0.12	0.156
AB test for AR(2)		0.996	0.202	0.423	0.181	0.583	-1.064	0.287	0.901	1.069
Prob (AB test for AR(2))		0.319	0.84	0.672	0.856	0.56	0.287	0.774	0.368	0.285
Hansen Test of Over identifying Restrictions		14.345	20.568	9.592	8.301	12.151	5.745	11.85	19.504	3.674
Prob (Hansen Test of Over identifying Restrictions)		0.214	0.302	0.477	0.599	0.668	0.836	0.375	0.361	0.961
Wald Chi2 Test		107.295***	141.082***	35.387***	93.687***	95.410***	98.976***	121.063***	119.207***	32.370***

*** represents significance at 1%, while ** represents significance at 5% and * represents significance at 10%
Standard Errors reported are heteroskedasticity-robust. AB – Arrelano/Bond

Table 4.4 Dynamic Panel Estimation Results (Dependent Variable is Bank Profitability)										
		Full sample			**OECD Countries**			**Non-OECD Countries**		
		(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
		Model 1	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
Return on Equity (t-1)	Coefficient	0.916***	0.959***	0.655***	0.943***	0.977***	0.591***	0.850***	0.908***	0.926***
	Std. Error	0.029	0.035	0.172	0.034	0.075	0.078	0.058	0.078	0.181
Bank Size (t-1)	Coefficient		-0.031	0.048		-0.024	-0.094		-0.109	0.014
	Std. Error		0.053	0.038		0.105	0.107		0.103	0.034
Bank Growth (t-1)	Coefficient			0.926**			0.828*			0.11
	Std. Error			0.445			0.485			0.332
Equity/Assets Ratio	Coefficient			-0.001			-0.007			-0.008**
	Std. Error			0.003			0.009			0.003
Overhead Costs/Income	Coefficient			-0.022**			-0.031***			-0.014*
	Std. Error			0.009			0.006			0.008
Real GDP Growth	Coefficient			1.385			8.995***			-0.922
	Std. Error			1.72			2.559			1.643
Inflation	Coefficient			2.86			2.546			-0.435
	Std. Error			2.169			2.407			1.086
Recurring Earning Power	Coefficient			0.061***			0.045***			0.068***
	Std. Error			0.011			0.006			0.013
Concentration	Coefficient			0.962***			0.660**			0.431
	Std. Error			0.357			0.277			0.585
Number of Observations		4625	4625	1763	2766	2766	945	1859	1859	818
Number of Banks		1522	1522	795	953	953	425	569	569	370
Number of Instruments		8	16	21	8	14	20	8	16	21
AB test for AR(1)		-7.803	-7.864	-4	-5.997	-5.734	-2.775	-5.092	-4.97	-3.027
Prob (AB test for AR(1))		0	0	0	0	0	0.006	0	0	0.002
AB test for AR(2)		0.994	0.983	-1.176	1.256	1.249	0.239	0.176	0.163	-0.743
Prob (AB test for AR(2))		0.32	0.326	0.24	0.209	0.212	0.811	0.86	0.871	0.457
Hansen Test of Over identifying Restrictions		1.94	17.445	17.348	6.11	14.139	5.103	3.379	20.989	14.296
Prob (Hansen Test of Over identifying Restrictions)		0.963	0.233	0.137	0.527	0.292	0.926	0.848	0.102	0.282
Wald Chi2 Test		966.360***	3180.503***	16647.399***	787.501***	3906.085***	5719.356***	216.047***	1868.898***	7750.279***

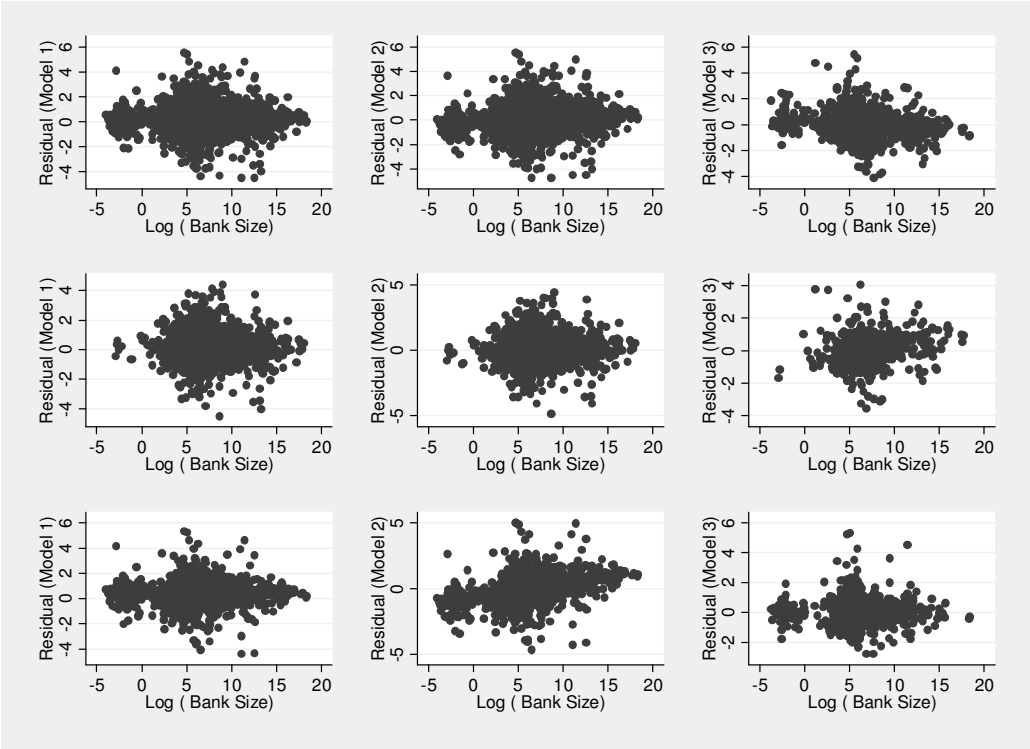
*** represents significance at 1%, while ** represents significance at 5% and * represents significance at 10%
Standard Errors reported are heteroskedasticity-robust. AB – Arrelano/Bond

Figure 4.3 Residual Plots of Growth Regressions against Bank Size



This figure plots the residuals form our model 1-3 against logarithmic bank size corresponding to results reported in Table 4.3. The uppermost row draws the residuals of model 1-3 against logarithmic bank size for all countries as reported in columns (1)-(3) of Table 4.3. The middle row plots the residuals of models 1-3 estimated for the OECD countries only as reported in columns (4)-(6) in Table 4. 3. The bottom row presents the graphs corresponding to columns (7)-(9) of Table 4.3 where we estimate our models 1-3 for non-OECD countries only.

Figure 4.4 Residual Plots of Profitability Regressions against Bank Size



This figure plots the residuals form our model 1-3 against logarithmic bank size corresponding to results reported in Table 4.4. The uppermost row draws the residuals of model 1-3 against logarithmic bank size for all countries as reported in columns (1)-(3) of Table 4.4. The middle row plots the residuals of models 1-3 estimated for OECD countries only as reported in columns (4)-(6) in Table 4.4. The bottom row presents the graphs corresponding to columns (7)-(9) of Table 4.4 where we estimate our models 1-3 for non-OECD countries only.

Impact of Other Control Variables

We also examine the effect of other control variables, like equity to assets ratio, overhead costs to income ratio, real GDP growth, inflation, recurring earning power, and concentration, on bank growth and profitability. For the growth models, as reported in Table 4.3, our results indicate that a higher equity to assets ratio has a negative impact on the bank growth. This result is significant at the 5% level. Other variables do not appear to be significant. Regarding bank profitability, we find that an increase in the overhead costs to income ratio reduces bank profitability. However, an increase in recurring earning power increases the profitability and increased concentration also results in higher profitability. A possible explanation for the positive relationship between concentration and profitability is that more concentration may imply less competition, which, in turn, may increase profit margins.

4.5 OECD vs. non-OECD Countries

As shown in the data analysis section, the structure of the banking system of OECD countries is quite different from that of non-OECD countries. Therefore, we estimate models 1-3 for both groups of countries. Our samples for OECD and non-OECD countries contain more than 900 and 500 banks, respectively. However, because of the unavailability of data for some control variables, the number of banks drops in model 3 (with all control variables). Table 4.3 presents the results for bank growth for OECD countries in columns (4)-(6) and for non-OECD countries in columns (7)-(9). For both samples, the models are significant at 1 percent level of significance as shown by the Wald chi-square test. Moreover, the Hansen test of over-identifying restrictions always appears insignificant implying that the null hypothesis of correct population moment conditions is not rejected indicating validity and exogeneity of the instruments. The Arellano-Bond test for the first difference autoregressive process appears significant and the test for the second difference autoregressive process appears insignificant implying that our modeling techniques are suitable.

The main difference between both samples is that bank size is not significant in all models for bank growth for non-OECD countries. In contrast, for OECD countries the coefficient of bank size comes up with a negative sign and is significantly different from zero. Similarly, the equity to assets ratio is significant at the 1 percent level for OECD countries, whereas it is only significant at the 10 percent level for non-OECD countries. Recall that in the total sample, this variable was significant at the 5 percent level.

Table 4.4 presents the results for growth in profitability for OECD and non-OECD countries. The results for OECD countries are presented in columns (4)-(6) and for non-OECD countries in columns (7)-(9). The significance of the Wald-Chi-square tests, at 1 percent level of significance, implies that all models are significant for both OECD and non-OECD countries. Similarly, the insignificance of the Hansen test of over-identifying restriction implies that the instruments are exogenous, while the Arellano-Bond test results for differences in first-order and second-order autoregressive process indicate no autoregressive process at second stage.

The effect of lagged profitability remains significant for both OECD and non-OECD countries, indicating persistence of bank profitability. Similarly, the effect of bank size appears insignificant for both OECD and non-OECD countries, which implies that bank size does not affect growth of profitability. However, lagged bank growth does not have a significant impact on bank profitability for banks located in non-OECD countries. A possible explanation for this result can be a weakness in the banking firms, which cannot channel growth into profitability.

Most results concerning the control variables in the models for the subsamples are similar to our results for the overall sample. However, one interesting difference is that concentration does not result in higher profitability in non-OECD countries. This could reflect the presence of a few large unprofitable banks. As pointed out by others (see, e.g., Bonin *et al.,* 2005), some non-OECD countries have large state-run banks with low profitability. A second interesting difference is that real GDP growth appears significant for banks in OECD countries with the expected positive sign but is insignificant for banks located in non-OECD countries. The insignificance of GDP growth for bank profitability has been documented before (see, e.g., Demirgüç-Kunt *et al*., 1999). In line with our findings, Bikker and Hu (2003) report a positive impact of GDP growth on bank profitability of 26 industrial countries.

4.6 Conclusions

We examine Gibrat's 'Law of Proportionate Effects' for more than 1500 banks from 65 OECD and non-OECD countries. Following Goddard *et al.* (2004a, 2004b), we also check the interlinkages between bank growth and profitability. Our analysis shows that concentration in the banking sector has decreased in both OECD and non-OECD countries, but non-OECD countries still have a more peaked distribution of banks. We model bank size and profitability growth using the Blundell and Bond (1998) two-step GMM approach. Our findings suggest that (i) bank growth is not persistent, (ii) bank profitability is persistent, (iii) bank size does not affect bank growth for banks located in non-OECD countries but in OECD countries large banks grow at lower speed (iv) variability in bank growth is not influenced by bank size, and (v) smaller banks face more variation in profitability. Overall these results imply that Gibrat's Law of Proportionate

Effects does not hold for the banking industry. Additionally, we show that banks with lower managerial efficiency observe lower growth in profitability. Moreover, banks in more concentrated banking sectors have higher profitability.

Chapter 5

The Impact of Bank Ownership Concentration on Impaired Loans and Capital Adequacy [1]

5.1 Introduction

How does concentrated ownership affect bank riskiness? The corporate finance literature comes up with different answers to this question. According to Berle and Means (1933), dispersed ownership reduces the effective power of shareholders to control the management of the firm. Similarly, Shleifer and Vishny (1986) argue that ownership concentration enhances corporate control by improving the monitoring of management. With diffused ownership, shareholders have little incentives to monitor. With concentrated ownership, the cost of shirking will be mostly borne by large shareholders who therefore have a strong incentive to monitor the firm's management.

However, other studies suggest that ownership concentration may not reduce bank riskiness. For example, Burkart *et al.* (1997) argue that tight outside ownership constitutes an expropriation threat that reduces managerial initiatives and non-contractible investments. According to Gomes and Novaes (1999, 2005), large shareholders can have interests that are different from those of minority shareholders.

[1] This chapter is based on joint work with Jakob de Haan and Bert Scholtens. The authors are thankful to participants in the ESRC seminar on Corporate Governance, Regulation and Development, University of Birmingham, Birmingham, United Kingdom, XVII International Tor Vergata Conference on Banking and Finance, University of Rome, Rome, Italy, and the Corporate Finance Day, Erasmus University, Rotterdam for their valuable suggestions. The usual disclaimer applies.

Moreover, the bargaining problems due to the presence of multiple controlling shareholders may prevent efficient decision-making. Demsetz and Lehen (1985) argue that in heavily regulated industries, such as the financial sector, regulation leads to more effective disciplining of managers. This, in turn, reduces the potential benefits of ownership control.

In this chapter, we test the traditional Berle-Means position that ownership concentration improves banking firm performance against the view that ownership concentration does not matter for banks' riskiness, using non-performing loans and capital adequacy as indicators of riskiness.[2] There are two important issues that have to be taken into account when testing these competing hypotheses in the context of the banking industry: the protection of minority shareholders and the protection of deposit holders.

If minority shareholders are hardly protected they may be unable to exert effective control over management (Shleifer and Vishny, 1997). La Porta *et al.* (1998) report that for non-financial firms concentration of ownership is negatively related to investor protection. This is consistent with the hypothesis that small, diversified shareholders are unlikely to be important in countries that fail to protect their rights. Therefore, we need to take shareholder protection rules into account in our empirical model.

In addition, we have to take an important difference between a non-financial firm and a banking firm into account. The difference being that banks have depositors and non-financial firms do not. Consequently, bank shareholders may collude with managers against deposit holders to extend high-risk loans, which may result in a high level of impaired loans and inadequate bank capital (Boyd *et al.*, 1998). To some extent, supervisory authorities act as the representative of deposit holders and safeguard their interests, while deposit insurance schemes protect the wealth of deposit holders. However, these deposit insurance schemes can reduce market discipline (Demirgüç-Kunt and Detragiache, 2002; Demirgüç-Kunt and Huizinga, 2004). Moral hazard problems may arise as bank managers and owners do not bear the full consequences of their

[2] Surprisingly, only few studies examine the effect of ownership concentration on bank riskiness. In a recent study, Iannotta *et al*. (2007) compare the performance and risk of a sample of 181 large banks from 15 European countries and report that ownership concentration is associated with better loan quality, lower asset risk, and lower insolvency risk.

actions. Consequently, supervisory agencies will want to keep a check on bank policies.[3] Therefore, we need to incorporate the role of supervisory agencies and deposit insurance regulation into our empirical model.

We analyze data for around 500 banks from more than 50 countries averaged over 2005-2007. We examine whether ownership concentration (i) improves risk-weighted capital adequacy ratios through better risk-taking policies by management, and (ii) decreases the impaired loans to gross loans ratio by reducing the potential moral hazard problem. We find that concentrated ownership significantly reduces a bank's non-performing loans ratio, conditional on supervisory control and shareholders protection rights. Furthermore, ownership concentration improves the capital adequacy ratio conditional on the extent of shareholder protection.

There are two papers that are related to our study. Caprio *et al*. (2007) assess the impact of ownership structure of banks and shareholders protection laws on bank valuation using data on 244 banks in 44 countries. They find that ownership structure is an important mechanism for governing banks as (i) larger cash-flow rights by the controlling owner boost valuation, and (ii) weak shareholders protection laws lower bank valuation. In contrast to Caprio *et al*. (2007), we focus on impaired loans and capital adequacy instead of the value of the bank. Furthermore, our data set is much broader.

The study that comes closest to the present paper is from Laeven and Levine (2008) who assess theories on the relationship between risk taking by banks, their ownership structures and national bank regulations. In line with our findings, these authors report that ownership concentration affects risk taking, conditional on shareholder protection rights and the supervisory environment. However, there are various important differences between both studies. First, Laeven and Levine (2008) only consider ownership stakes of 10 and 20 percent, whereas our results suggest that at higher levels of ownership concentration the results may be different. Second, these authors proxy bank risks by the so-called Z-score whereas we take the impaired loans ratio and the capital adequacy ratio as proxies for risk. Third, Laeven and Levine (2008) use data for some 300 banks

[3] Park and Peristiani (2007) analyze the moral hazard problem in the context of banking firms and examine whether bank shareholders have incentives to transfer wealth from the deposit insurer by pursuing riskier strategies. These authors show that tighter capital rules and more rigorous supervision reduce moral hazard incentives in the banking system.

whereas we have a much larger dataset. Finally, we follow Aiken and West (1991) in examining interaction effects and do not draw conclusions on the basis of the (in)significance of interaction terms.

The organization of the remainder of this chapter is as follows. Section 5.2 describes our model, while section 5.3 discusses the data. Section 5.4 reports the main estimation results and the outcomes of a sensitivity analysis. Finally, section 5.5 offers the conclusions and discusses some implications of our findings.

5.2 The Model

We use two dependent variables: the impaired loans to gross loans ratio and the capital adequacy ratio. Both variables may be considered as indicators of bank riskiness.[4] The impaired loans to gross loans ratio is a standard proxy for a bank's asset risk. The capital adequacy ratio plays a central role in the international bank solvency standards of the Basel Committee of the Bank for International Settlements (BIS) and is a proxy for bank capitalization. Demirgüç-Kunt *et al*. (2006) and Podpiera (2004) show that low capitalization implies that the bank is more risky.

Our explanatory variables are ownership concentration, a proxy for shareholder protection, a proxy for supervisory control, and various control variables that have been suggested in the literature. As argued in the previous section, shareholder protection and supervisory control may condition the effect of ownership concentration and we therefore include various interaction terms.[5]

Our control variables include (i) cost/income ratio, as a proxy for bank efficiency; (ii) bank size (measured by equity), as small banks can behave differently from large

[4] Both variables arguably compensate each other. A bank with a higher asset risk should have a higher capital ratio. However, if a bank's impaired loans ratio goes up and the bank does not respond by attracting new capital, the capital ratio will decline.

[5] In some corporate finance studies, ownership concentration is considered endogenous to firm value. However, we do not consider this to be a problem for our model because of three reasons. First, ownership patterns of firms are generally stable over time and depend on particular histories of corporations (La Porta, 2002). Second, our variables of interest are not bank valuation as such. We assume that loan quality and capital adequacy will be directly reflected in banking spreads. Third, bank balance sheets are considered quite opaque. So, we expect that the effect of loan losses and capital adequacy on the choice of ownership concentration will be very marginal, if any.

banks; (iii) activities restrictions, following Boyd *et al*. (1998)[6], (iv) loan growth as a proxy for a bank's growth opportunities (Caprio *et al*., 2007); (v) bank concentration, as a proxy for competition in the banking system (Beck *et al.,* 2006); (vi) a dummy indicating whether the bank is listed or not (Iannotta *et al*., 2007)[7]; and (vii) income per capita of the country in which the bank is located (Beck *et al*., 2006). So our model is:

$$Q_{ij} = \beta_0 + \beta_1(OC_{ij}) + \beta_2(SPR_i) + \beta_3(OC_{ij}*SPR_i) + \beta_4(SC_i) + \beta_5(OC_{ij}*SC_i) + \beta_6(SPR_i*SC_i) + \beta_7(OC_{ij}*SPR_i*SC_i) + \beta_8(Efficiency_{ij}) + \beta_9(Size_{ij}) + \beta_{10}(Activities\ Restrictions_i) + \beta_{11}(Loan\ Growth_{ij}) + \beta_{12}(Concentration_i) + \beta_{13}(Listed_i) + \beta_{14}(GDP\ per\ capita_j) \quad (5.1)$$

Where Q_{ij} is the dependent variable (i.e., the impaired loans to gross loans ratio or the capital adequacy ratio) of bank *i* in country *j*, *OC* is an indicator of bank ownership concentration, *SPR* is our proxy for shareholder protection rights, *SC* is a proxy for supervisory control, *Efficiency* is the cost to income ratio as proxy for managerial efficiency, *Size* is an indicator of bank size, *Loan Growth* is an indicator of loan growth, *Activities Restrictions* is an indicator showing the extent to which banks are allowed to have various activities, *Concentration* is an indicator of the concentration in the banking industry, *Listed* is a dummy indicating whether the bank is listed, and *GDP per capita* is income per capita of the country in which the bank is located. Table 5.1 gives the sources of the data and shows the expected signs of the variables used.

[6] According to Boyd et al. (1998), allowing banks to diversify their activities improves their profitability but also increases risk-taking behavior.

[7] According to Iannotta et al. (2007), listed banks may face different monitoring and pressure on the management as compared to unlisted banks.

Table 5.1. Data Sources and Expected Signs			
Dependent variables:	**Expected Sign:**		**Data Source:**
Impaired Loans/Gross Loans			Bankscope
Risk-Weighted Capital Adequacy			Bankscope
Explanatory variables:	**Impaired Loans/ Gross Loans Ratio**	**Capital Adequacy Ratio**	
Ownership Concentration (OC)	Positive/ Negative	Positive/ Negative	Bankscope
Shareholder Protection Rights (SPR)	Negative	Positive	Djankov *et al.* (2008)
Supervisory Control (SC)	Negative	Positive	Barth *et al.* (2001)
Cost/ Income (Efficiency)	Positive	Positive/ Negative	Bankscope
Bank Equity (Size)	Negative	Positive	Bankscope
Activities Restrictions	Positive	Positive/ Negative	Barth *et al*. (2001)
Loan Growth	Negative	Positive	Bankscope
Bank Concentration	Positive	Positive/ Negative	Beck *et al*. (2000)
Listed Bank	Positive/Negative	Positive/ Negative	Bankscope
GDP per capita	Negative	Positive	World Development Indicators of the World Bank

5.3 Data Description

Our data on bank ownership concentration come from Bureau Van Dijk's Bankscope database. This indicator characterizes the degree of independence of a company with regard to its shareholders. We collected data for all banking companies for 2005-2007 as reported in the December 2008 version of the Bankscope database. The sample used in the empirical analysis consists of around 500 banks from more than 50 countries. Table 5.2 shows the distribution of banks according to ownership. Almost two thirds of the banks in our sample have an owner with more than 50 percent shareholding. Furthermore, 8 percent of the banks had no shareholder with more than 10 percent ownership stake; 14 percent had one or more owners with more than 10 percent of the shares, but none of them had more than 25 percent of the shares, and 8 percent of the

banks had one or more shareholders with at least 25 percent of the shares but less than 50 percent.

Table 5.2 Distribution of Ownership Concentration

COUNTRY	Less than 10%	10 - 25 %	25 -50%	More than 50 %
ARGENTINA	0.00	0.13	0.06	0.81
AUSTRALIA	0.07	0.43	0.00	0.50
AUSTRIA	0.03	0.05	0.28	0.64
BELGIUM	0.04	0.04	0.00	0.92
BRAZIL	0.03	0.05	0.00	0.92
BULGARIA	0.00	0.00	0.00	1.00
CANADA	0.00	0.00	0.00	1.00
CHILE	0.33	0.00	0.00	0.67
CHINA-PEOPLE'S R	0.16	0.44	0.08	0.32
COLOMBIA	0.00	0.00	0.00	1.00
CROATIA	0.00	0.17	0.25	0.58
CZECH REPUBLIC	0.00	0.00	0.00	1.00
DENMARK	0.38	0.06	0.25	0.31
ECUADOR	0.09	0.00	0.27	0.64
EGYPT	0.00	0.00	0.00	1.00
EL SALVADOR	0.00	0.00	0.00	1.00
FINLAND	0.00	0.67	0.00	0.33
FRANCE	0.02	0.06	0.04	0.88
GERMANY	0.00	0.08	0.18	0.74
GHANA	0.25	0.08	0.17	0.50
GREECE	0.08	0.23	0.31	0.38
HONG KONG	0.00	0.08	0.04	0.88
HUNGARY	0.00	0.00	0.00	1.00
ICELAND	0.00	0.50	0.00	0.50
INDIA	0.06	0.13	0.19	0.63
INDONESIA	0.00	0.00	0.22	0.78
IRELAND	0.18	0.00	0.00	0.82
ITALY	0.06	0.08	0.13	0.73
JAMAICA	0.00	0.00	0.00	1.00
JAPAN	0.11	0.00	0.22	0.67
KAZAKHSTAN	0.20	0.20	0.00	0.60
KENYA	0.00	0.43	0.00	0.57
KOREA REP. OF	0.00	0.50	0.00	0.50
LATVIA	0.00	0.00	0.09	0.91
LUXEMBOURG	0.06	0.00	0.00	0.94
MALAYSIA	0.00	0.00	0.00	1.00
MEXICO	0.00	0.00	0.00	1.00
MOROCCO	0.00	0.00	0.60	0.40
NETHERLANDS	0.04	0.00	0.04	0.93
NEW ZEALAND	0.00	0.00	0.00	1.00
NIGERIA	0.29	0.57	0.00	0.14
NORWAY	0.00	0.33	0.33	0.33

PAKISTAN	0.00	0.36	0.27	0.36
PANAMA	0.00	0.00	0.13	0.87
PHILIPPINES	0.00	0.31	0.50	0.19
POLAND	0.00	0.00	0.00	1.00
PORTUGAL	0.09	0.00	0.09	0.82
ROMANIA	0.00	0.13	0.13	0.75
RUSSIAN FEDERATION	0.12	0.39	0.06	0.43
SINGAPORE	0.00	0.17	0.17	0.67
SLOVAKIA	0.00	0.00	0.33	0.67
SOUTH AFRICA	0.00	0.08	0.15	0.77
SPAIN	0.22	0.22	0.05	0.51
SRI LANKA	0.00	0.33	0.33	0.33
SWEDEN	0.00	0.25	0.25	0.50
SWITZERLAND	0.08	0.04	0.00	0.88
TAIWAN	0.38	0.38	0.00	0.25
THAILAND	0.00	0.00	0.50	0.50
TUNISIA	0.08	0.25	0.25	0.42
TURKEY	0.00	0.00	0.00	1.00
UGANDA	0.00	0.00	0.00	1.00
UKRAINE	0.09	0.18	0.00	0.73
UNITED KINGDOM	0.02	0.02	0.02	0.95
URUGUAY	0.00	0.05	0.00	0.95
USA	0.17	0.00	0.00	0.83
VENEZUELA	0.11	0.11	0.00	0.78
ZIMBABWE	0.00	0.00	0.20	0.80
Total	0.08	0.14	0.08	0.70

In our empirical analysis we employ three indicators of ownership concentration. *Ownership concentration 1* is a dummy that is one in case there is at least one owner with shareholdings greater than 10 percent and zero otherwise. *Ownership concentration 2* is a dummy that is one in case there is at least one owner with shareholdings above 25 percent and zero otherwise. *Ownership concentration 3* is a dummy that is one in case there is a controlling owner with more than 50 percent of the shares and zero otherwise.[8]

From the Bankscope database we also obtained the impaired loans to gross loans ratio, the capital adequacy measure, the cost to income ratio (our proxy for efficiency), equity (our proxy for size), and loan growth. The capital adequacy measure is Tier 1

[8] Although it is quite common to use a threshold of 10 percent ownership, under two important accounting standards, i.e., the International Financial Reporting Standards (IFRS) and the US Generally Accepted Accounting Principles (US GAAP), inter-corporate ownership less than 20 percent is considered as minority passive shareholding. Similarly, an ownership stake greater than 20 percent but less than 50 percent is considered to be minority active, and only ownership of more than 50 percent is considered to be a controlling stake.

capital (i.e., the shareholder funds plus perpetual non-cumulative preference shares) as a percentage of risk-weighted assets and off balance sheet risks as measured under the Basel rules. The cost to income ratio measures overhead costs, mainly consisting of salaries.

Our indicator of shareholders protection (*SPR*) is derived from Djankov *et al*. (2008), who recently updated the study of La Porta *et al*. (2002). This indicator includes legal provisions, like cumulative voting or proportional representation of minorities on the board of directors, presence of oppressed minorities mechanism, and proxy votes by mail. It has a scale from 1 (low protection) to 5 (high protection).

We use data on bank concentration from the World Bank's 2007 Database on Financial Development and Structure. The bank concentration variable used represents the assets of the three largest banks as a percentage of the assets of all commercial banks in the country concerned.

Finally, we calculate variables measuring activities restrictions and supervisory control from the World Bank's 2007 Regulation and Supervision database. As to activities restrictions (AR), we consider the conditions under which banks can engage in (i) securities activities, (ii) insurance activities, and (iii) real estate activities. The variable ranges from 1 (unrestricted) to 4 (each of the activities is prohibited).

We combine two indicators to construct our proxy for the supervisory regime (*Control*). The first indicator refers to supervisory agency control and is the total number of affirmative answers to the following questions: (i) is an external audit a compulsory obligation for banks?; (ii) can the supervisory authority force a bank to change its internal organizational structure?; (iii) can the supervisory agency legally declare that a bank is insolvent?; (iv) can the supervisory authority intervene and suspend some or all ownership rights of a problem bank?; (v) can the supervisory agency supersede shareholders rights?; (vi) can the supervisory agency remove and replace management?; (vii) can the supervisory agency remove and replace directors? (viii) is the minimum capital adequacy requirement greater than 8 percent?; (ix) can the supervisory authority ask banks to increase minimum required capital in the face of higher credit risk?; (x) can the supervisory authority can banks to increase minimum required capital in the face of higher market risk?; and (xi) can the supervisory authority ask banks to increase

minimum required capital in the face of higher operational risk? The second indicator of the supervisory regime measures deposit insurance agency control and is the total number of affirmative answers to the following questions: (i) can the deposit insurance agency legally declare that a bank is insolvent?; (ii) can the deposit insurance agency intervene and suspend some or all ownership rights of a problem bank?; (iii) can the deposit insurance agency supersede shareholders rights?; (iv) can the deposit insurance agency remove and replace management?; and (v) can the deposit insurance agency remove and replace directors? We aggregate the supervisory control and insurance agency control indicators to construct the regulatory control variable.

In our analysis, we average data on impaired loans to gross loans ratio, risk-weighted capital, equity, cost to income ratio, and bank concentration for the period 2005 to 2007 in order to cancel out short-term fluctuations. Table 5.3 shows the summary statistics of our key variables used, while Table D1 in Appendix D shows the correlation matrix.

Table 5.3 Summary Statistics

Variable	Observations	Mean	Std. Dev.	Minimum	Maximum
Impaired Loans/Gross Loans	755	3.32	5.34	0.00	85.81
Risk-Weighted Capital Adequacy	518	15.21	11.22	-30.83	79.97
Ownership Level 1 (Threshold 10%)	2255	0.94	0.23	0.00	1.00
Ownership Level 2 (Threshold 25%)	2255	0.57	0.49	0.00	1.00
Ownership Level 3 (Threshold 50%)	2255	0.48	0.50	0.00	1.00
Shareholder Protection Rights (SPR)	1914	3.33	1.00	1.00	5.00
Supervisory Control (SC)	1851	8.83	2.91	2.00	13.00
Cost/Income (Efficiency)	1412	63.10	34.48	0.00	578.98
Bank Equity (Size) (in US $ 100,000)	1424	0.32	3.56	0.00	112.01
Activities Restrictions	2038	7.23	1.79	3.00	12.00
Loan Growth	1369	0.15	1.34	-1.51	39.66
Bank Concentration	2196	0.51	0.23	0.18	1.00
Listed Bank	2255	0.19	0.40	0.00	1.00
GDP per capita (in US $ 100,000)	2170	0.18	0.15	0.00	0.52

5.4 Empirical Results

We estimate a country random effects model. The use of a fixed effects model is not feasible here because many variables like shareholder protection rights, supervisory control environment, bank concentration and per capita income are the same for all banks in a country. Our main results are shown in Table D2 in Appendix D.

In the model for the capital adequacy ratio the coefficients of the control variables have the expected signs, except for the dummy for listed banks. Banks with more growth potential (proxied by loan growth) have higher capital adequacy ratios. The coefficient is significant at the 1 percent significance level. The coefficient of the cost to income ratio is negative, implying that banks with lower managerial efficiency have lower capital adequacy ratios. However, the coefficient is only significant at the 10 percent level. Surprisingly, listed banks appear to have lower capital adequacy ratios; this finding is significant at the 1 percent significance level. The model appears significant at the 1 percent level of significance according to the Wald Chi-square test. Moreover, it also explains more than 30 percent of the variation in the data.

The model for the impaired loans ratio is significant at the one percent significance level as indicated by the Wald chi-square test. All variables have the expected sign. However, the only variable that appears significant after controlling for our main variables is the proxy for activities restrictions. It comes up with a positive sign, which indicates that banks that face more restrictions are more risk-taking, which results in lower asset quality.

Before we turn to the results regarding the impact of ownership concentration, it is important to note that inference cannot be based on simple t-statistics because model parameters do not provide substantial information in case of models with multiplicative terms (Brambor *et al*., 2006). Looking at our results without the correct treatment of interaction terms would suggest that ownership does not matter. However, this is a deceptive finding. As Aiken and West (1991) point out, in interactive models we need to take the derivative of the model with respect to the variable of interest and evaluate its effect on the means of other constituent terms of the derivative. Our key hypotheses

relate to the significance of the marginal effect of ownership concentration on our dependent variables. So, we are interested in testing the hypotheses that

$$H_0: \beta_1 + \beta_3 (\mathbf{SPR}_i) + \beta_5 (\mathbf{SC}_i) + \beta_7 (\mathbf{SPR}_i * \mathbf{SC}_i) = 0$$

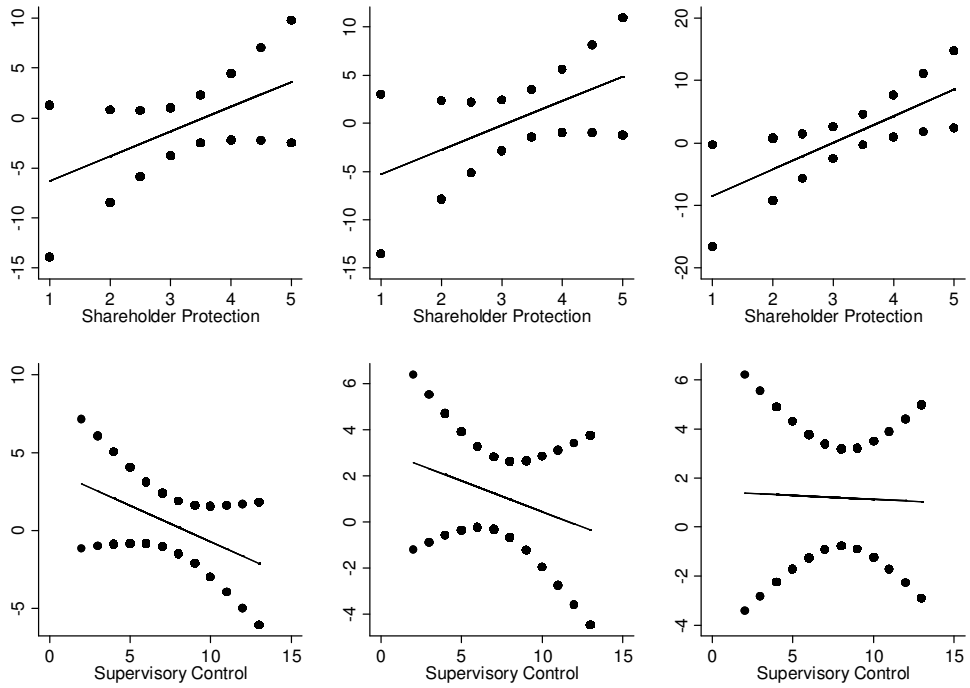
$$H_1: \beta_1 + \beta_3 (\mathbf{SPR}_i) + \beta_5 (\mathbf{SC}_i) + \beta_7 \mathbf{SPR}_i * \mathbf{SC}_i) \neq 0$$

where **SPR** and **SC** are average shareholder protection rights and supervisory control regime, respectively. Rejection of the null hypothesis implies that ownership concentration affects the impaired loans to gross loans ratio or the capital adequacy ratio. In order to assess the significance of the variables of interest, we need to draw confidence intervals, for which standard errors can be calculated following the methodology of Aiken and West (1991).

5.4.1 Results for the capital adequacy ratio

The basic objective of the paper is to compare banks without shareholders with significant control with banks that do have shareholders with significant control. As pointed out in the previous section, we employ three dummies indicating ownership concentration. The marginal effects and confidence intervals (at a 5 percent significance level) are shown in Figure 5.1. The upper panel shows the marginal effect of ownership concentration on the capital adequacy ratio at different levels of shareholder protection rights. The bottom panel of Figure 5.1 shows the same marginal effect conditional on different levels of regulatory control.

Figure 5.1 Marginal Effect of Ownership Concentration on Capital Adequacy Ratio



This figure examines the impact of ownership concentration on capital adequacy ratio and corresponds to our main results as given in Table D2 in Appendix D. The upper panel examines the marginal effect of ownership concentration at different levels of shareholder protection and the lower panel examines the same at different supervisory control levels. The left graphs in upper and lower panel pertain to model 1 where we examine the impact of ownership concentration greater than 10 percent. The middle graphs correspond to model 2 examining the impact of ownership greater than 25 percent and the right graphs represent the ownership concentration greater than 50 percent.

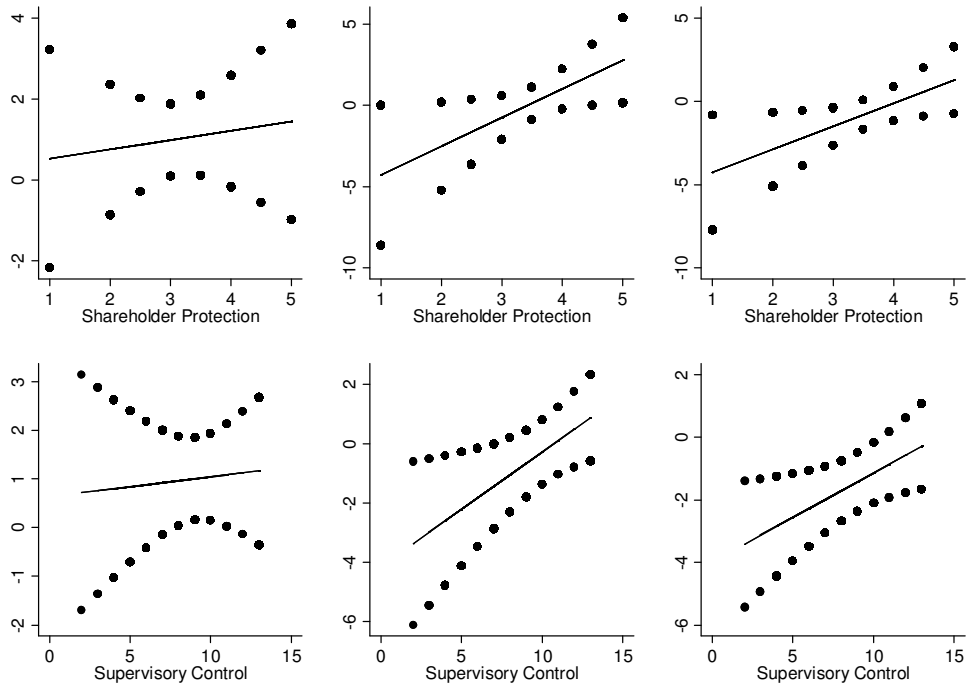
Let us start with the results in case we assume that there is concentrated ownership when one or more shareholders own 10 percent of the bank's shares (*ownership level 1*). As Figure 5.1 shows, ownership concentration has no significant impact on the capital adequacy ratio when we use this 10 percent cut-off point of control. The same result shows up if ownership concentration is defined using a 25 percent ownership stake (*ownership level 2*). However, if ownership concentration is defined using a 50 percent threshold (*ownership level 3*) it has a significant and positive effect on the capital adequacy ratio. Moreover, Figure 5.1 also shows that as shareholder protection improves the effect of ownership concentration becomes positive. However, as supervisory control increases the impact reduces. This is in line with the view of Demsetz and Lehen (1985) that in heavily regulated industries, such as the financial sector,

regulation leads to more effective disciplining of managers and this, in turn, reduces the benefits of ownership control. So ownership concentration matters less when regulatory control is stronger.

5.4.2 Results for the impaired loans ratio

The results for the marginal impact of ownership concentration on the impaired loans ratio, conditional on shareholder protection rights and the supervisory control, are shown in Figure 5.2. The results for *Ownership concentration level 1* show a positive impact of ownership concentration on non-performing loans. However, there is a negative impact of ownership concentration on impaired loans when concentration is defined using cut-off points of 25% and 50% (level 2 and level 3 ownership, respectively), although it is only significant for the latter. This suggests that when concentration exceeds 10 percent, ownership concentration increases the volume of non-performing loans. However, when it is above 50 percent, ownership concentration reduces the volume of non-performing loans. These results indicate that when two or three shareholders have blocks of ownership, the quality of the portfolio of the bank may deteriorate for the reasons explained by Gomes and Novaes (1999, 2005). In contrast, when there is one controlling owner, the monitoring of the bank's management is more efficient, leading to a lower impaired loans ratio.

Figure 5.2 Marginal Effect of Ownership Concentration On Impaired Loans to Gross Loans Ratio



This figure examines the impact of ownership concentration on impaired loans to gross loans ratio and corresponds to our main results as given in Table D2 in Appendix D. The upper panel examines the marginal effect of ownership concentration at different levels of shareholder protection and the lower panel examines the same at different supervisory control levels. The left graphs in upper and lower panel pertain to model 1 where we examine the impact of ownership concentration greater than 10 percent. The middle graphs correspond to model 2 examining the impact of ownership greater than 25 percent and the right graphs represent the ownership concentration greater than 50 percent.

Another important finding that follows from the lower panel of Figure 5.2 is that in case of weaker supervisory control the impact of controlling ownership concentration is negative and significant. This result is in line with the view of Demsetz and Lehen (1985). Furthermore, our results suggest that with higher levels of supervisory control the impact of ownership concentration is not significant, but in the case of a poorer supervisory control regime the impact can be negative and significant.

5.4.3 Sensitivity analysis

To check whether our results are robust, we (i) applied our analysis to non-OECD banks only, and (ii) used five-year averages instead of three-year averages. The use of only non-OECD countries does not affect our results. However, the explanatory power of the

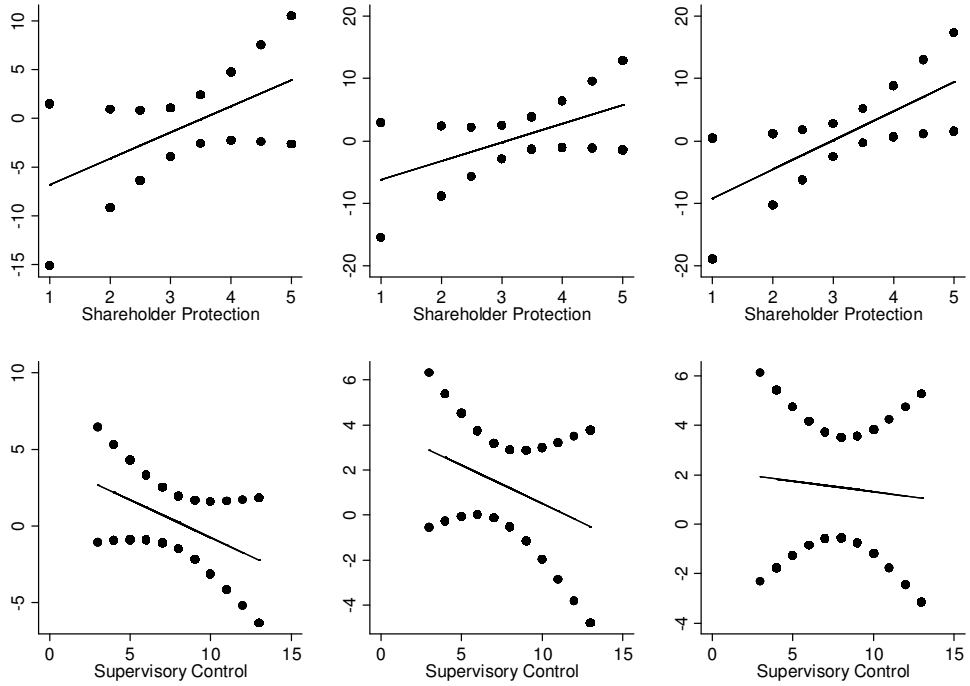
model as indicated by the R-squared is higher. All interaction terms and marginal effects retain their signs. Similarly, the use of five-year instead of three-year averages does not affect our main conclusions (results available on request).

Finally, we have taken the type of ownership into account as this may matter (Ianotta *et al.*, 2007). However, it turned out that more than two thirds of the fully owned firms in our sample were held by some kind of banking conglomerate, while other types of ownership (like government ownership) were less represented in our sample. Furthermore, it turned out that when a bank is owned by a banking conglomerate the latter very often has more than 50 percent of the shares of the bank. Including a dummy for ownership by a bank holding company in our model would therefore imply a high degree of collinearity with one of our ownership concentration variables. We therefore decided to re-estimate our model dropping all banks that are not owned by a banking conglomerate.[9]

The estimation results are shown in Table D3 in Appendix D, accompanied by Figures 5.3 and 5.4, which are congruent with Figures 5.1 and 5.2. The two figures reveal that these results are very similar to those for the full sample.

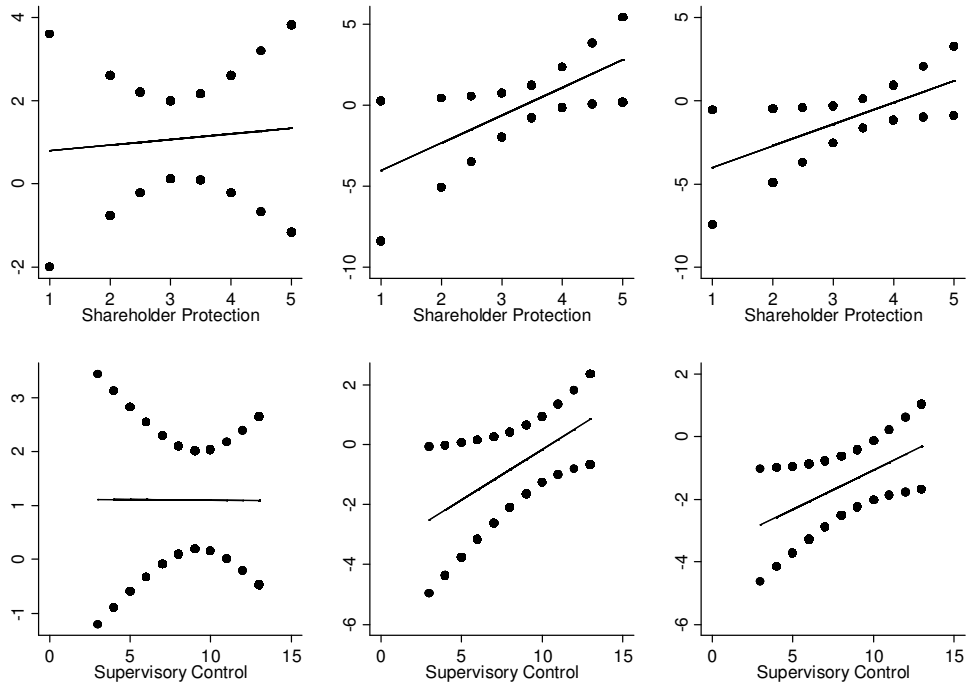
[9] Estimating the model for those observations that were dropped does not make sense, in view of the sample size.

Figure 5.3 Marginal effect of Ownership Concentration on Capital Adequacy Ratio Controlling for Ownership Type



This figure examines the impact of ownership concentration on capital adequacy ratio and corresponds to our sensitivity results as given in Table D3 in Appendix D. The upper panel examines the marginal effect of ownership concentration at different levels of shareholder protection and the lower panel examines the same at different supervisory control levels. The left graphs in upper and lower panel pertain to model 1 where we examine the impact of ownership concentration greater than 10 percent. The middle graphs correspond to model 2 examining the impact of ownership greater than 25 percent and the two right graphs represent the ownership concentration greater than 50 percent.

Figure 5.4 Marginal effect of Ownership Concentration on Impaired Loans to Gross Loans Ratio Controlling for Ownership Type



This figure examines the impact of ownership concentration on impaired loans to gross loans ratio and corresponds to our sensitivity results as given in Table D3 in Appendix D. The upper panel examines the marginal effect of ownership concentration at different levels of shareholder protection and the lower panel examines the same at different supervisory control levels. The left graphs in upper and lower panel pertain to model 1 where we examine the impact of ownership concentration greater than 10 percent. The middle graphs correspond to model 2 examining the impact of ownership greater than 25 percent and the two right graphs represent the ownership concentration greater than 50 percent.

5.5 Conclusions and Policy Implications

We examine the effect of ownership concentration on impaired loans and capital adequacy ratios for a sample of about 800 banks from 50 countries. We find that ownership concentration significantly affects loan quality and bank capitalization, although the results sometimes differ depending on the definition of ownership concentration used. As for the capital adequacy ratio, the effect of ownership concentration is positive and results in a better risk-weighted capitalization, while its effect is negative on the non-performing loans ratio at least if ownership is above 50 percent of the shares. We find some evidence for the view of Demstez and Lehen (1985)

who argue that ownership concentration matters less in regulated firms, like banks. However, an important extension to their theory is the level of supervisory control as our results suggest that in case of weak supervisory control, ownership concentration matters. Moreover, our findings tend to support the Berle-Means (1933) view that ownership concentration is to be associated with superior firm performance. Furthermore, it turns out that shareholder protection matters as suggested by Shleifer and Vishny (1997): with limited shareholders protection rights, the impact of dispersed ownership is insignificant for the capital adequacy ratio, but when protection and/or regulatory control are weak ownership concentration becomes significant.

Our findings may also be relevant for policymakers. First, it is important for supervisors to consider the different impact that their policies may have on banking firms subject to their ownership pattern. Second, our results indicate that when shareholders protection rights are weak, ownership concentration is beneficial for the banking firm. It can compensate for lower shareholder protection and, given a satisfactory level of supervisory control, ownership concentration improves bank performance. Finally, attention needs to be paid to the impact of multiple shareholders with none of them having a controlling stake. Our results suggest that this kind of banks can be a victim of sub-optimal bargaining problems as suggested by Gomes and Novaes (1999, 2005). The design of control mechanism for such special banks should be considered in policy design.

Chapter 6

Conclusions and Policy Implications

6.1 Main Findings

The analysis of bank risks is the first step towards proper risk management and the achievement of the goal of financial stability at both systemic and firm level. However, financial crises will continue to occur, as they have occurred all over the world for hundreds of years. The objective of risk management is to make crises less frequent and reduce their costs. A financial system that strives for the total elimination of the financial crises is neither optimal nor desirable (Allen and Gale, 2007).

The key objective of this thesis is a proper appraisal of different kinds of risks faced by banking systems and individual banking firms. As mentioned in chapter 1 of this thesis, we specifically examine:

(a) How does financial reform affect the likelihood of the occurrence of systemic and non-systemic banking crises, conditional on the supervisory environment and level of liberalization of the financial system?

(b) How do financial crises affect the earnings volatility of banking firms, conditional on bank size and market concentration?

(c) How do bank growth and profitability depend on bank size and how persistent are bank growth and profitability?

(d) How does ownership concentration affect bank riskiness conditional on supervisory control and shareholder protection rights?

Based on these research questions, we draw five main conclusions from this thesis and focus on the policy implications of these conclusions in the rest of this chapter. The conclusions are: (i) financial liberalization reduces the likelihood of systemic crises, (ii) an adequate regulatory environment is a pre-requisite for successful financial liberalization, (iii) large banks face lower earnings volatility in the wake of financial crises, (iv) bank growth and profitability dynamics are different in OECD and non-OECD countries, and (v) the presence of a controlling owner in a banking firm can lead to better bank governance.

6.2 Financial Liberalization and Banking Crises

We focus on the interrelationships between financial liberalization and banking crises in chapter 2 of this thesis. Financial liberalization is a step towards the removal of uncompetitive market forces and corrects pricing of risk and return in the banking business. Consequently, it improves financial sector development and enhances economic growth. At the same time, there is some evidence as well that liberalization induces risk-taking behavior and may cause banking crises (Demirgüç-Kunt and Detragiache, 1998, 2000; Mehrez and Kaufmann, 2000). Using better and more comprehensive data on different dimensions of financial liberalization, we argue that financial liberalization reduces the likelihood of systemic banking crises, conditional on adequate banking supervision.

Allen and Gale (2007) argue that the complete elimination of crises is neither optimal nor desirable because it reduces the ability of financial institutions to perform their basic task of efficient allocation of resources. Excessive regulation reduces the incentives for banks to introduce new services and products. In view of the dynamic requirements of economies, the inability to introduce new products can result in sub-optimal risk hedging and exploitation of consumers. In the wake of the financial crisis of 2008, there are various calls for "better" regulation. However, an important point is to make sure that this will not lead to a repetition of the post Great Depression financial

sector policies where crises virtually disappeared but so did the efficiency of financial systems (Allen and Gale, 2007).

6.3 Adequate Regulatory Environment

An adequate regulatory environment has been discussed in chapter 2 and chapter 5 of this thesis. In chapter 2, we show that successful implementation of financial liberalization is conditional on adequate regulatory control. If the regulatory environment does not cope with the changes in the market forces in the financial system, it can result in sub-optimal risk-taking by the banks. This is illustrated by the current crisis. On the one hand, new products like credit derivatives and mortgage loans were introduced, but on the other hand the regulators and bank risk managers could not comprehend the excessive exposure to these products and fell short of precise risk-weighted capital adequacy and did not implement necessary prudential regulations.

In chapter 5, we show how the presence of controlling ownership reduces the risk faced by banking firms, conditional on supervisory control. Demsetz and Lehen (1985) argue that in heavily regulated industries, such as the financial sector, regulation leads to more effective disciplining of managers. This, in turn, reduces the potential benefits of ownership control. However, we show that where supervisory control is inadequate, one controlling shareholder can improve the monitoring of banks and can compensate for poor supervisory control. However, absence of both effective supervisory control and dispersed ownership can increase bank riskiness.

6.4 Large and Small Banks

The financial crisis of 2007/2008 affected large as well as small banks. However, our examination covering more than 1800 banks operating in more than hundred countries over the last ten years shows that large banks are better equipped to cope with financial crises. We show in chapter 3 that irrespective of the use of relative or absolute size, larger banks face less earning volatility as compared to small banks in the wake of financial crises. Their ability to better cope with crises probably stem from the scale of their operations and more diversification of risks. Stever (2007) shows that the reduced ability of small banks to diversify forces them to either pick borrowers whose assets have

relatively low credit risk or make loans that are backed by more collateral. Similarly, in chapter 4 where we use dynamic panel techniques to analyze bank earnings volatility, we find that smaller banks have more earnings volatility compared to large banks

Nevertheless it is important to analyze the riskiness of too-big-to-fail banks on more close levels. As Federal Reserve Bank Chairman Ben Bernanke recently[1] said

supervisors--as we are already doing--must vigorously address the weaknesses at major financial institutions with regard to capital adequacy, liquidity management, and risk management. Firms whose failure would pose a systemic risk must receive especially close supervisory oversight and be held to the highest prudential standards.

6.5 Growth and Profitability Dynamics in OECD and non-OECD Countries

We show that over the last ten years period the logarithmic distribution of bank assets in OECD countries converged to the normal distribution. However, in non-OECD countries this is not the case. One of the reasons is that large banks in OECD countries grow at slower rates compared to large banks in non-OECD countries. Moreover, we find that lagged growth affects bank profitability positively. However, we do not find that bank growth in both OECD and non-OECD countries are persistent, but profitability persistence cannot be rejected.

Together these results imply that bank growth and profitability are not random events and are affected by market and bank characteristics. Banking supervisors need to acknowledge the characteristics of the bank growth and profitability in individual financial systems to check how far competitive forces are reduced by these factors. It is possible that certain elements, as discussed above, may be putting a specific group of banks at a comparative disadvantage resulting in lack of competitive forces in the banking industry.

[1] *The Financial Crisis and Community Banking*, Speech on March 20, 2009 at the Independent Community Bankers of America's National Convention and Techworld, Phoenix, Arizona.

6.6 Ownership Concentration and Bank Riskiness

The role of ownership concentration for the risk appetite of banks is unclear from a theoretical perspective. As we mentioned before, Demsetz and Lehen (1985) argue that in heavily regulated industries, such as the financial sector, regulation leads to more effective disciplining of managers. This, in turn, reduces the potential benefits of ownership control. However, variation in the degree and effectiveness of regulatory control can still result in a more prominent role of ownership in banking firms. Shleifer and Vishny (1986) argue that ownership concentration enhances corporate control by improving the monitoring of management as with diffused ownership, shareholders have little incentives to monitor. However, with concentrated ownership, the cost of shirking will be mostly borne by large shareholders who therefore have a strong incentive to monitor the firm's management. On the other hand, according to Gomes and Novaes (1999, 2005), large shareholders can have interests that are different from those of minority shareholders. Moreover, the bargaining problems due to the presence of multiple controlling shareholders may prevent efficient decision-making.

As we show in chapter 5 that ownership monitoring can improve the quality of bank risk-taking, their role should not be underestimated. The presence of a controlling owner improves the bank capital adequacy ratio and reduces the volume of non-performing loans. These findings underline the importance of the role of ownership and their monitoring of the management of banks. Supervisors can promote more stable banking organizations by influencing the ownership monitoring and reducing the owner-manger conflicts by effective prudential regulations.

Bibliography

Abiad, A.G. and Mody, A. (2005) "Financial Reform: What Shakes It? What Shapes It?", American Economic Review, 95 (1), 66-88.

Abiad, A.G., Tressel, T. and Detragiache, E. (2008) "A New Database of Financial Reforms", IMF Working Paper No. 08/266.

Aiken, L. and West, S. (1991) "Multiple Regression: Testing and Interpreting Interactions", Sage Publications, London.

Albertazzi, U. and Gambacorta, L. (2009) "Bank Profitability and the Business Cycle", Journal of Financial Stability, (forthcoming).

Allen F. and Gale, D. (2007) "Understanding Financial Crises", Oxford University Press, New York, USA.

Arellano, M. and Bond, S. (1991) "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations", Review of Economic Studies, 58(2), 277-97.

Arellano, M. and Bover, O. (1995) "Another Look at the Instrumental Variable Estimation of Error-components Models", Journal of Econometrics, 68(1), 29-51.

Arellano, M. and Hahn, J. (2007) "Understanding Bias in Nonlinear Panel Models: Some Recent Developments" in R. Blundell, W. Newey, and T. Persson (eds.), Advances in Economics and Econometrics, Ninth World Congress, Cambridge University Press Cambridge, UK.

Athanasoglou, P., Brissimis P., Sophocles N. and Matthaios D. (2005) "Bank-Specific, Industry-Specific and Macroeconomic Determinants of Bank Profitability", Bank of Greece Working Paper No. 25.

Barrell, R, Davis, P.E., Karim D. and Liadze, I. (2009) "Bank Regulation, Property Prices, and Early Warning Systems for Banking Crises in OECD Countries", NIESR and Brunel University, mimeo.

Barth, J.R., Caprio G. and Levine R. (2001) "The Regulation and Supervision of Banks Around the World - A New Database", World Bank Policy Research Working Paper No. 2588.

Barth, J.R., Caprio G. and Levine, R. (2004) "Bank Regulation and Supervision: What Works Best?", Journal of Financial Intermediation, 13, 205-248.

Bartus, T. (2005) "Estimation of Marginal Effects using Margeff", Stata Journal, StataCorp LP, 5(3), 309-329.

Beck T., Demirgüç-Kunt, A. and Levine, R. (2000) "A New Database on Financial Development and Structure", World Bank Economic Review 14, 597-605.

Beck, T., Demirgüç-Kunt, A. and Levine, R. (2006) "Bank Concentration, Competition, and Crises: First Results", Journal of Banking & Finance, 30, 1581-1603.

Benito, E. (2008) "Size, Growth and Bank Dynamics", Banco de España Working Paper No. 0801.

Berger, A.N. (1995) "The Profit-Structure in Banking – Tests of Market Power and Efficient Structure Hypotheses", Journal of Money, Credit and Banking, 27, 2 404-431.

Berger, A.N., Miller, N.H., Peterson, M.A., Rajan, R.G. and Stein, J.C. (2005) "Does Function Follow Organizational Form? Evidence from the Lending Practices of Large and Small Banks", Journal of Financial Economics, 76, 237-269.

Berle, A. and Means G. (1933) "The Modern Corporation and Private Property", MacMillan, New York.

Bhattacharya, K. (2003) "How Good is the BankScope Database? A Cross-Validation Exercise With Correction Factors for Market Concentration Measures", BIS Working Paper No. 133.

Bikker, J. and Hu, H. (2003) "Cyclical Patterns in Profits, Provisioning and Lending of Banks", DNB Staff Report No. 86.

Bikker, J. and Haaf, K. (2002) "Competition, Concentration and their Relationship: An Empirical Analysis of the Banking Industry", Journal of Banking and Finance 26, 2191-2214.

Blundell, R. and Bond, S. (1998) "Initial Conditions and Moment Restrictions in Dynamic Panel Data Models", Journal of Econometrics, 87(1), 115-143.

Bonin J.P., Hasan, I. and Wachtel, P. (2005) "Bank Performance, Efficiency and Ownership in Transition Countries", Journal of Banking & Finance, 29, (1), 31-53.

Boyd, J.H. and De Nicolo, G. (2005) "The Theory of Bank Risk Taking and Competition Revisited", Journal of Finance, 60(3), 1329-1343, 06.

Boyd, J.H. and Runckle, D. (1993) "Size and Performance of Banking Firms", Journal of Monetary Economics, 31, 47-67.

Boyd, J.H., Chang, C. and Smith B.D. (1998) "Moral Hazard under Commercial and Universal Banking", Journal of Money, Credit, and Banking 30, 426-468.

Brambor, T., Clark W.R. and Golder M. (2006) "Understanding Interaction Models: Improving Empirical Analyses", Political Analysis, 14, 1-20.

Breitung, J. and Meyer, W. (1994) "Testing for Unit Roots in Panel Data: Are Wages on Different Bargaining Levels Cointegrated?", Applied Economics, 26(4), 353-61.

Burkart, M., Gromb D. and Panunzi, F. (1997) "Large shareholders, Monitoring, and the Value of the Firm", Quarterly Journal of Economics 112, 693-728.

Cameron, C.A. and Trivedi, P.K. (2009) "Microeconometrics using Stata", Stata Press Publication, StataCorp LP, College Station, Texas.

Caprio, G. and Klingebiel, D. (1999) "Episodes of Systemic and Borderline Financial Crises", Mimeograph, The World Bank.

Caprio, G. and Martinez, E.A. (2000) "Avoiding Disaster: Policies to Reduce the Risk of Banking Crises", Egyptian Centre for Economic Studies Working Paper No. 47.

Caprio, G., Laeven, L. and Levine, R. (2007) "Governance and Bank Valuation", Journal of Financial Intermediation 16, 584-617.

Carletti, E., and Hartmann P. (2003) "Competition and Stability: What's Special about Banking?" in Paul Mizen, (eds.), Monetary History, Exchange Rates and Financial Markets: Essays in honor of Charles Goodhart, Vol. 2, Edward Elgar, Cheltenham.

Case K.E. and Shiller R.J. (2003) "Is There a Bubble in the Housing Market?" Brookings Papers on Economic Activity, No. 2.

Claessens, S. and Laeven, L. (2004) "What Drives Bank Competition? Some International Evidence", Journal of Money, Credit and Banking, 36, 563-584.

Corvoisier, S. and Gropp R. (2002) "Bank Concentration and Retail Interest Rates", Journal of Banking and Finance, 26, 2155-2189.

Couto, R. (2002) "Framework for the Assessment of Bank Earnings", Financial Stability Institute, Bank for International Settlements, Ch-4002, Basel, Switzerland.

Crockett, A. (1997) "The Theory and Practice of Financial Stability," GEI Newsletter Issue No. 6 (United Kingdom: Gonville and Caius College Cambridge), 11–12, July.

De Nicolo, G. (2000) "Size, Charter Value and Risk in Banking: An International Perspective", International Finance Discussion Paper No. 689, Board of Governors of the Federal Reserve System.

De Nicolo, G., Philip, B., Zaman, J. and Zephirin, M. (2004) "Bank Consolidation, Conglomeration and Internationalization: Trends and Implications for Financial Risk", Financial Markets, Institutions and Instruments, 13, 173-217.

Demirgüç-Kunt, A. and Detragiache, E. (1998) "Financial Liberalization and Financial Fragility", World Bank Policy Research Working Paper No. 1917.

Demirgüç-Kunt, A. and Detragiache, E. (2000) "Monitoring Banking Sector Fragility: A Multivariate Logit Approach", World Bank Economic Review, 14(2), 287-307.

Demirgüç-Kunt, A. and Detragiache, E. (2002) "Does Deposit Insurance increase Banking System Stability? An Empirical Investigation", Journal of Monetary Economics, 49, 1373-1406.

Demirgüç-Kunt, A. and Huizinga, H. (1999) "Determinants of Commercial Bank Interest Margins and Profitability: Some International Evidence", World Bank Economic Review, 13 (2), 379-408.

Demirgüç-Kunt, A. and Huizinga, H. (2004) "Market Discipline and Deposit Insurance", Journal of Monetary Economics, 51, 375-399.

Demirgüç-Kunt, A., Detragiache, E. and Tressel T. (2006) "Banking on the Principles: Compliance with Basel Core Principles and Bank Soundness", World Bank Policy Research Working Paper No. 3954.

Demsetz, H. and Lehen, K. (1985) "The Structure of Corporate Ownership: Causes and Consequences", Journal of Political Economy, 93, 1155-1177.

Devenow, A. and Welch, I. (1996) "Rational Herding in Financial Economics", European Economic Review, 40: 603–15.

Djankov, S., La Porta, R., Lopez-de-Silanes, F. and Shleifer, A. (2008) "The law and Economics of Self-dealing", Journal of Financial Economics, 88, 430-465.

Dreher, A. (2004) "The Influence of IMF Programs on the Re-election of Debtor Governments", Economics and Politics, 16(1), 53-75.

Eichengreen B. (2006) "Financial Stability", chapter in Secretariat of the International Task Force on Global Public Goods. Expert Paper Series Three: Financial Stability. Stockholm, Sweden.

Gibrat, R. (1931) Les Inégalités Economiques. Recueil Sirey, Paris.

Goddard, J., Molyneux, P. and Wilson, J.O.S. (2004b) "Dynamics of Growth and Profitability in Banking.", Journal of Money, Credit, and Banking, 36(6), 1069-90.

Goddard, J., Molyneux, P. and Wilson, J.O.S. (2004a) "The Profitability of European Banks: a Cross-Sectional and Dynamic Panel Analysis", Manchester School, 72(3), 363-381, 06.

Gomes, A.R. and Novaes, W. (1999) "Multiple Large Shareholders in Corporate Governance", unpublished Working Paper. The Wharton School, Philadelphia, PA.

Gomes, A.R. and Novaes, W. (2005) "Sharing of Control as a Corporate Governance Mechanism", PIER Working Paper No. 01-029.

Green, W. (2004) "The Behaviour of the Maximum Likelihood Estimator of Limited Dependent Variable Models in the Presence of Fixed Effects", Econometrics Journal, 7(1), 98-119.

Gwartney, J., Lawson, R. and Norton, S. (2008) "Economic Freedom of the World", Annual Report. The Fraser Institute. Data retrieved from www.freetheworld.com.

Honahan, P. and Laeven, L. (2005) "Systemic Financial Distress: Containment and Resolution", Cambridge University Press, Cambridge (UK).

Iannotta, G., Giacomo, N. and Sironi, A. (2007) "Ownership Structure, Risk and Performance in the European Banking Industry", Journal of Banking & Finance 31, 2127–2149.

IMF. (2009) "Global Financial Stability Report", April, International Monetary Fund, Washington DC.

Janicki, H.P. and Prescott, E.S. (2006) "Changes in the Size Distribution of U.S. Banks: 1960-2005", Economic Quarterly, Federal Reserve Bank of Richmond, issue Fall, 291-316.

Kaminsky, G.L. and Reinhart, C.M. (1999) "The Twin Crises: The Causes of Banking and Balance-of-Payment Problems", American Economic Review, 89 (3), 473-500.

La Porta, R., López-de-Silanes, F. and Shleifer, A. (2002) "Investor Protection and Corporate Valuation", Journal of Finance, 57, 1147-1170.

La Porta, R., López-de-Silanes, F., Shleifer, A. and Vishny, R.W. (1998) "Law and Finance", Journal of Political Economy 106, 1113-1155.

Laeven, L. and Levine, R. (2008) "Bank Governance, Regulation, and Risk Taking", NBER Working Paper No. 14113.

Laeven, L. and Valencia, F. (2008) "Systemic Banking Crises: A New Database", IMF Working Paper No. 08/224, 1-78.

Mehrez, G. and Kaufmann, D. (2000) "Transparency, Liberalization and Banking Crises", World Bank Policy Research Working Paper No. 2286.

Park, S. and Peristiani, S. (2007) "Are Bank Shareholders Enemies of Regulators or a Potential Source of Market Discipline?", Journal of Banking & Finance 31, 2493–2515.

Podpiera, R. (2004) "Does Compliance with Basel Core Principles bring any Measurable Benefits?", IMF Working Paper No. 04/204.

Porter, M.E. (1979) "How Competitive Forces Shape Strategy?", Harvard Business Review 57 (2) 137-145.

Roodman, D. (2006) "How to Do xtabond2: An Introduction to "Difference" and "System" GMM in Stata", Working Paper No. 103, Center for Global Development.

Sarafidis V., Yamagata, T. and Robertson, D. (2009) "A Test of Cross Section Dependence for a Linear Dynamic Panel Model with Regressors", Journal of Econometrics, 148 (2), 149-161.

Schinasi, G.J. (2004) "Defining Financial Stability", IMF Working Paper No. 04/187.

Schmidt, C.H. and Griffith J.L. (1998) "Multivariate Classification Rules: Calibration and Discrimination". In Encyclopedia of Biostatistics, ed. P. Armitage and T. Colton, 2844-2850. New York: Wiley.

Shehzad, C. T., De Haan, J. and Scholtens, L.J.R. (2009) "The Impact of Bank Ownership Concentration on Impaired Loans and Capital Adequacy", Journal of Banking & Finance (forthcoming).

Shleifer, A. and Vishny, R.W. (1986) "Large Shareholders and Corporate Control", Journal of Political Economy, 94, 461-488.

Shleifer, A. and Vishny, R.W. (1997) "A Survey of Corporate Governance", Journal of Finance, 52, 737-783.

Stein, J.C. (2002) "Information Production and Capital Allocation: Decentralized versus Hierarchical Firms", Journal of Finance, 57 (5), 1891-1921.

Stever, R. (2007) "Bank Size, Credit and the Sources of Bank Market Risk", BIS working Paper No 238, Bank for International Settlements, Ch-4002, Basel, Switzerland.

Tarullo, D.K. (2009) "Large Banks and Small Banks in an Era of Systemic Risk, Regulation", Speech delivered at the North Carolina Bankers Association Annual Convention, Chapel Hill, North Carolina.

Tschoegl, A.E. (1983) "Size, Growth, and Transnationality among the World's Largest Banks", Journal of Business, 56(2), 187-201.

Wheaton, W.C. and Nechayev, G. (2007) "The 1998-2005 Housing 'Bubble' and the Current 'Correction': What's Different this Time?", Journal of Real Estate Research, American Real Estate Society, 30(1), 1-26.

Appendices

Appendix A

Table A1. Systemic and Non-systemic Crises in Our Sample		
Country	Systemic Crises	Non-systemic Crises
Albania	1992-96	
Algeria	1990-92	
Argentina	1980-82, 1989-90,1995, 2001-02	
Australia		1989-92
Austria		
Azerbaijan	1995-96	
Bangladesh	1988-96	
Belarus		1995-02
Belgium		
Bolivia	1986-88, 1994-02	
Brazil	1990, 1994-99	
Britain		1974-76, 1980-89
Bulgaria	1996-97	
Burkina-Faso	1988-94	
Cameroon	1987-93, 1995-98	
Canada		1983-85
Chile	1976, 1981-83	
China	1990-02	
Colombia	1982-87	
Costa Rica	1994-96	
Cote d'Ivoire	1988-91	
Czech Republic	1989-91,	
Denmark		1987-92
Dominican Rep		
Ecuador	1980-84, 1996-01	
Egypt	1980-84	1991-95
El Salvador	1989	
Estonia	1992-95	1998
Ethiopia		1994-95
Finland	1991-94	
France		1994-95
Georgia	1991-96	
Germany		1976-79
Ghana	1982-89	1997-02
Greece		1991-95
Guatemala		1990-02
Hong Kong		1982-86, 1988
Hungary	1991-95	
India		1993-02
Indonesia	1997-02	1994
Ireland		
Israel	1977-83	
Italy		1990-95
Jamaica	1996-00	1994
Japan	1992-02	
Jordan		1989-90
Kazakhstan		
Kenya	1985-89, 1992-95	1996-02
Korea	1997-02	
Kyrgyz Rep	1990-02	
Latvia	1995-96	

Lithuania	1995-96	
Madagascar	1988	
Malaysia	1997-01	1985-88
Mexico	1981-91, 1994-00	
Morocco	1980-84	
Mozambique	1987-95	
Nepal	1988	
Netherlands		
New Zealand		1987-90
Nicaragua	1986-02	
Nigeria	1991-95	1997
Norway	1990-93	
Pakistan		
Paraguay	1995-00	2001-02
Peru	1983-90	
Philippines	1983-87, 1998-02	
Poland	1992-95	
Portugal		
Romania	1990-96	
Russia	1995, 1998-99	
Senegal	1988-91	
Singapore		1982
South Africa		
Spain	1977-85	
Sri Lanka	1989-93	
Sweden	1991-94	
Switzerland		
Taiwan	1997-98	1983-84, 1995
Tanzania		
Thailand	1983-87, 1997-02	
Tunisia		1991-95
Turkey	1982-85, 2000-02	1994
Uganda	1994-96	
Ukraine	1997-98	
United States		1988-91
Uruguay	1981-84, 2002	
Uzbekistan		
Venezuela	1994-95	1976-89
Vietnam	1997-02	
Zimbabwe	1995-96	

Source: Honohan and Laeven (2005)

Table A2. Spearman's Rank Correlation Coefficients of Different Dimension of Financial Reform								
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Δ Liberalization (1)	1.00							
Δ Credit Controls (2)	0.39	1.00						
Δ Interest Rate Control (3)	0.44	0.12	1.00					
Δ Banking Entry (4)	0.38	0.02	0.03	1.00				
Δ Privatization (5)	0.36	0.00	0.07	0.08	1.00			
Δ Supervisory Control (6)	0.36	0.03	-0.03	0.10	-0.01	1.00		
Δ Capital Controls (7)	0.47	0.05	0.13	0.08	0.05	0.00	1.00	
Δ Securities Markets (8)	0.35	0.09	0.06	0.01	0.02	-0.03	0.10	1.00

Table A3. Variable Description and Sources		
Dependent Variables		
Variable:		***Source:***
Systemic crises		Honahan and Laeven (2005)
Non-systemic crises		Honahan and Laeven (2005)
Explanatory Variables		
Variable:	***Expected sign:***	***Source:***
Liberalization (overall)	+/-	Abiad *et al*. (2008)
Credit controls	+/-	Abiad *et al*. (2008)
Interest rate control	+/-	Abiad *et al*. (2008)
Banking entry	+/-	Abiad *et al*. (2008)
Privatization	+/-	Abiad *et al*. (2008)
Supervisory control	-	Abiad *et al*. (2008)
Capital controls	+/-	Abiad *et al*. (2008)
Securities markets	+/-	Abiad *et al*. (2008)
Real GDP growth	-	World Development Indicators
GDP/Capita	-	World Development Indicators
Real interest rate	+	World Development Indicators
Inflation	+	World Development Indicators
Depreciation	+	World Development Indicators
Economic Freedom index	+/-	Gwartney and Lawson (2008)
Openness	+/-	World Development Indicators
Bank concentration	-	Beck *et al*. (2000)
Corruption	+	ICRG
Money and quasi-money/GDP	+/-	World Development Indicators
Credit to private sector/GDP	+/-	World Development Indicators

Table A4. Correlation Matrix																					
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**
Systemic crises (1)	1																				
Non-systemic crises (2)	-0.13	1																			
Liberalization (overall) (3)	-0.15	0.06	1																		
Credit controls (4)	-0.07	0.09	0.79	1																	
Interest rate control (5)	-0.08	0.07	0.82	0.63	1																
Banking entry (6)	-0.04	-0.01	0.75	0.54	0.57	1															
Privatization (7)	-0.18	-0.01	0.7	0.45	0.47	0.42	1														
Supervisory control (8)	-0.13	0.03	0.78	0.58	0.52	0.55	0.45	1													
Capital controls (9	-0.15	0.08	0.83	0.56	0.65	0.5	0.51	0.59	1												
Securities markets (10)	-0.17	0.1	0.83	0.6	0.59	0.55	0.49	0.63	0.71	1											
Real GDP growth (11)	-0.12	-0.02	0.01	0.07	-0.01	-0.05	0.02	0	0	0	1										
GDP/capita (12)	-0.2	0.01	0.57	0.41	0.36	0.28	0.39	0.5	0.53	0.65	-0.08	1									
Real interest rate (13)	0.07	-0.02	0.06	0.06	0.11	0.06	0.03	0.03	0.05	0.01	-0.06	-0.04	1								
Inflation (14)	0.14	0	-0.36	-0.36	-0.21	-0.19	-0.27	-0.33	-0.32	-0.33	-0.23	-0.3	-0.07	1							
Depreciation (15)	0.02	0.01	-0.02	-0.01	0	-0.01	-0.02	-0.03	-0.02	-0.03	-0.02	-0.02	0	0.02	1						
Economic Freedom index (16)	-0.21	0.07	0.69	0.58	0.44	0.35	0.49	0.55	0.67	0.68	0.05	0.68	0.13	-0.55	-0.01	1					
Openness (17)	-0.05	-0.07	0.32	0.22	0.19	0.3	0.31	0.25	0.25	0.24	0.08	0.13	-0.02	-0.07	0.02	0.3	1				
Bank concentration (18)	-0.05	-0.12	-0.14	-0.06	-0.18	-0.05	-0.1	-0.08	-0.12	-0.13	0.06	0	-0.11	0.08	0.01	-0.03	0.11	1			
Corruption (19)	-0.22	0.03	0.44	0.32	0.31	0.23	0.31	0.36	0.39	0.46	-0.05	0.67	0.01	-0.21	0	0.53	0.14	0.21	1		
Money & Quasi-money/GDP (20)	-0.03	-0.02	-0.05	-0.09	-0.09	-0.09	0.05	-0.03	-0.02	-0.02	-0.04	-0.01	0	-0.01	0	-0.03	-0.02	-0.08	0.03	1	
Credit to private sector/GDP (21)	-0.08	-0.05	0.52	0.38	0.32	0.27	0.44	0.42	0.49	0.56	-0.03	0.74	-0.03	-0.35	0	0.68	0.25	-0.09	0.51	0.01	1

Table A5. Effect of Financial Reform on Systemic Crises - Instrumental Probit Results								
		(1)	(2)	(3)	(4)	(5)	(6)	(7)
Real GDP growth $_{(t-1)}$	Coefficient	-5.148***	-4.988**	-3.172	-5.115*	-5.290***	-4.814**	-3.832
	S.E.	1.982	2.361	6.578	2.699	1.969	2.076	3.247
Log (Initial GDP/capita)	Coefficient	-0.301***	-0.212	-0.238	-0.214	-0.324***	-0.286***	-0.262**
	S.E.	0.101	0.178	0.332	0.207	0.096	0.1	0.126
Real interest rate	Coefficient	0.006	0.008	0.005	0.004	0.005	0.005	0.004
	S.E.	0.006	0.006	0.005	0.006	0.007	0.006	0.006
Inflation	Coefficient	-0.115	-0.219	0.502	-0.645	-0.341	-0.304	-0.348
	S.E.	0.906	0.867	0.889	0.959	0.859	0.913	0.941
Depreciation	Coefficient	0.509	0.619	0.435	0.661	0.714	0.685	0.71
	S.E.	0.461	0.524	0.739	0.528	0.47	0.475	0.483
Initial level of liberalization	Coefficient	-0.033	-0.051*	-0.002	-0.055	-0.027	-0.031	-0.032
	S.E.	0.034	0.029	0.042	0.038	0.031	0.028	0.027
Supervisory control	Coefficient	-0.035	-0.063	-0.213	-0.021	0.016	-0.017	-0.079
	S.E.	0.098	0.091	0.167	0.09	0.144	0.097	0.114
Financial reform (overall)	Coefficient	-0.092						
	S.E.	0.16						
Credit controls reform	Coefficient		-0.775					
	S.E.		0.786					
Interest rate control reform	Coefficient			-0.985				
	S.E.			0.757				
Banking entry reform	Coefficient				-0.743			
	S.E.				1.142			
Privatization reform	Coefficient					-0.428		
	S.E.					0.768		
Capital controls reform	Coefficient						-0.271	
	S.E.						0.402	

Securities markets reform	Coefficient							-0.634
	S.E.							0.901
Constant	Coefficient	1.868***	1.558**	1.894	1.572**	1.893***	1.620**	1.655***
	S.E.	0.724	0.735	1.366	0.767	0.71	0.656	0.633
No. of Observations		1164	1164	1164	1164	1164	1164	1164
Wald Chi-squared		35.887***	72.969***	183.900***	63.209***	40.660***	40.014***	46.675***
Probability (Wald Test of Exogeniety)		0.99	0.49	0.663	0.609	0.842	0.728	0.546
Probability (Amemiya-Lee-Newey Statisitc)		0.891	0.723	0.779	0.335	0.938	0.989	0.609
*** indicates significance at 1 percent level of significance, ** indicates significance at 5 percent level and * indicates significance at 10 percent level of significance.								

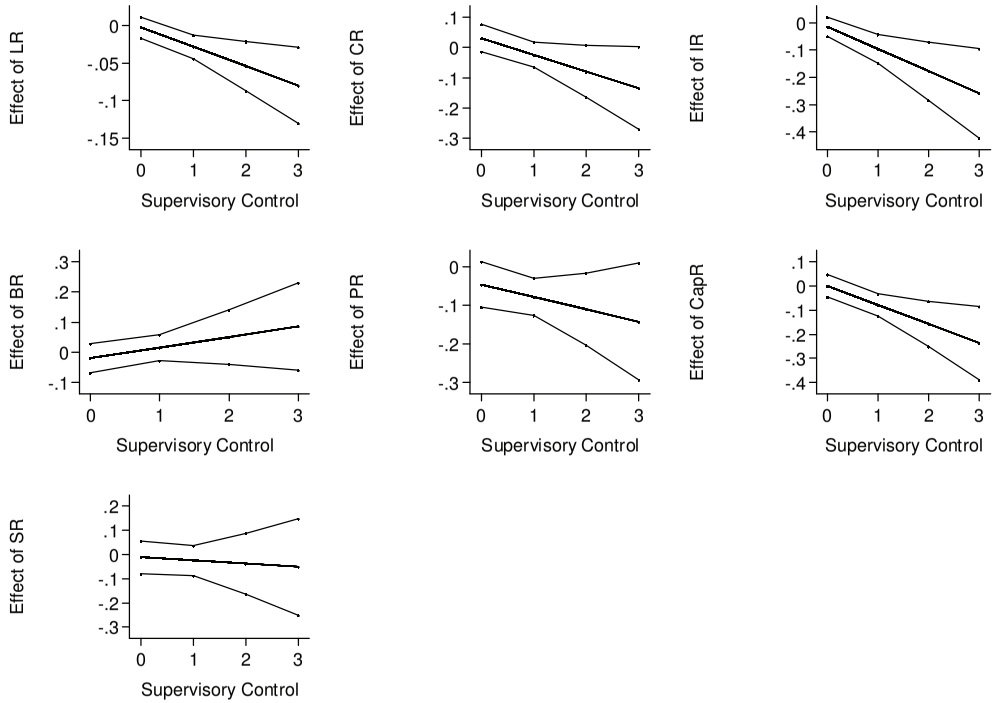
Table A6. Effect of Financial Reform on Systemic Crises - Developing Economies									
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Real GDP growth $_{(t-1)}$	*Coefficient*	-1.175***	-1.265***	-1.393***	-1.306***	-1.414***	-1.287***	-1.329***	-1.377***
	S.E.	0.313	0.358	0.36	0.356	0.359	0.359	0.356	0.361
Log (Initial GDP/capita)	*Coefficient*	-0.046	-0.065*	-0.066*	-0.074**	-0.066*	-0.067*	-0.064*	-0.064*
	S.E.	0.036	0.037	0.036	0.037	0.036	0.037	0.037	0.036
Real interest rate	*Coefficient*	0.003***	0.003***	0.003**	0.003***	0.003***	0.003***	0.003***	0.003***
	S.E.	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Inflation	*Coefficient*	0.057	0.081	0.107	0.131	0.106	0.059	0.071	0.109
	S.E.	0.165	0.172	0.17	0.17	0.17	0.172	0.17	0.17
Depreciation	*Coefficient*	0.218*	0.188	0.198*	0.197	0.210*	0.205*	0.196*	0.204*
	S.E.	0.117	0.121	0.12	0.121	0.12	0.12	0.119	0.12
Initial level of liberalization	*Coefficient*	-0.025*	-0.028*	-0.028*	-0.026*	-0.026*	-0.026*	-0.028*	-0.026*
	S.E.	0.014	0.015	0.015	0.015	0.014	0.015	0.015	0.014
Supervisory control (SC)	*Coefficient*	-0.012	0.046	0.019	0.017	-0.013	0.009	0.018	0.002
	S.E.	0.025	0.031	0.027	0.027	0.028	0.027	0.026	0.028
Reform (LR) (overall)	*Coefficient*		-0.003						
	S.E.		0.007						
SC*LR	*Coefficient*		-0.026***						
	S.E.		0.01						
Credit controls reform (CR)	*Coefficient*			0.031					
	S.E.			0.023					
SC*CR	*Coefficient*			-0.055**					
	S.E.			0.028					
Interest rate control reform (IR)	*Coefficient*				-0.014				
	S.E.				0.018				
SC*IR	*Coefficient*				-0.082***				
	S.E.				0.03				
Banking entry reform (BR)	*Coefficient*					-0.019			

	S.E.					0.025			
SC*BR	*Coefficient*					0.035			
	S.E.					0.029			
Privatization reform (PR)	*Coefficient*						-0.046		
	S.E.						0.03		
SC*PR	*Coefficient*						-0.032		
	S.E.						0.031		
Capital controls reform (CapR)	*Coefficient*							0.001	
	S.E.							0.023	
SC*CapR	*Coefficient*							-0.079***	
	S.E.							0.03	
Securities markets reform (SR)	*Coefficient*								-0.012
	S.E.								0.034
SC*SR	*Coefficient*								-0.013
	S.E.								0.04
No. of Observations		1000	944	944	944	944	944	944	944
No. of Countries		61	61	61	61	61	61	61	61
Wald Chi-squared		37.252***	51.463***	43.737***	52.390***	41.651***	49.291***	49.829***	41.292***
L Ratio Test		132.369***	134.574***	133.979***	132.115***	133.158***	140.819***	136.700***	126.530***
Brier Score		0.181	0.177	0.179	0.177	0.179	0.179	0.177	0.179

Reported co-efficient and corresponding Standard Errors (S.E.) are Average Marginal Effects and have been calculated as suggested by Bartus (2005)

*** indicates significance at 1 percent level of significance, ** indicates significance at 5 percent level and * indicates significance at 10 percent level of significance.

Figure A1. Effect of Financial Reform on Systemic Banking Crises at Different Levels of Supervisory Control (Developing Economies)



The figure shows the marginal effect of different kinds of financial reform on the likelihood of systemic banking crises at different levels of supervisory controls for non high-income OECD countries. It corresponds to our results in Table A6. The middle line shows the marginal effect of a particular dimension of reform while the upper and lower lines indicate the upper and lower 95 percent confidence intervals. LR refers to overall reform, CR refers to credit control reform, IR refers to interest rate control reform, BR refers to banking entry reform, PR refers to privatization reform, CapR refers to capital control reform, and SR refers to securities market reform.

Appendix B

Table B1. Data Sources and Expected Signs			
Variable	**Definition**	**Expected Sign**	**Data Source**
Dependent Variables			
ROA Volatility	3 or 5 year standard deviation of Return on Assets		Bankscope
ROE Volatility	3 or 5 year standard deviation of Return on Equity		Bankscope
Explanatory Variables			
Banking Crisis	Laeven and Valencia (2008) define a systemic banking crisis when a country's corporate and financial sector experiences a large number of defaults and financial institutions and corporations face great difficulties repaying contracts on time. As a result, non-performing loans increase sharply and all or most of the aggregate banking system capital is exhausted.	Positive	Laeven and Valencia (2008)
Currency Crises	Laeven and Valencia (2008) define a currency crisis as a nominal depreciation of the currency of at least 30 percent that is also at least 10 percent increase in the rate of depreciation compared to the previous year.	Positive	Laeven and Valencia (2008)
Debt Crises	Laeven and Valencia (2008) define a sovereign debt crisis when a sovereign defaults to private lending or debt is rescheduled.	Positive	Laeven and Valencia (2008)
Bank Size	The number of standard deviations above or below mean logarithmic bank size in a country	Negative/Positive	Bankscope
Bank Concentration	Assets of three largest banks in the financial system	Negative/Positive	Beck *et al*. (2000)
Cost/Income	Cost as a percentage of bank income	Positive	Bankscope
Inflation	Consumer Price Index (P) was adjusted for extreme fluctuations as P/100)/[1+(p/100)]	Positive	World Economic Outlook
Savings Bank	Dummy which takes a value of 1 for savings banks and zero otherwise	Negative/Positive	Bankscope
Investment Bank	Dummy which takes a value of 1 for investment banks and zero otherwise	Negative/Positive	Bankscope
Commercial Banks	Dummy which takes a value of 1 for commercial banks and zero otherwise	Negative/Positive	Bankscope
Leverage	Debt/ Equity Ratio	Negative	Bankscope
GDP Growth	Log (GDP) - Log (GDP t-1)	Negative	World Economic Outlook
GDP/Capita *(US$ 10,000)*	Gross Domestic Product/ Capita	Negative	World Economic Outlook

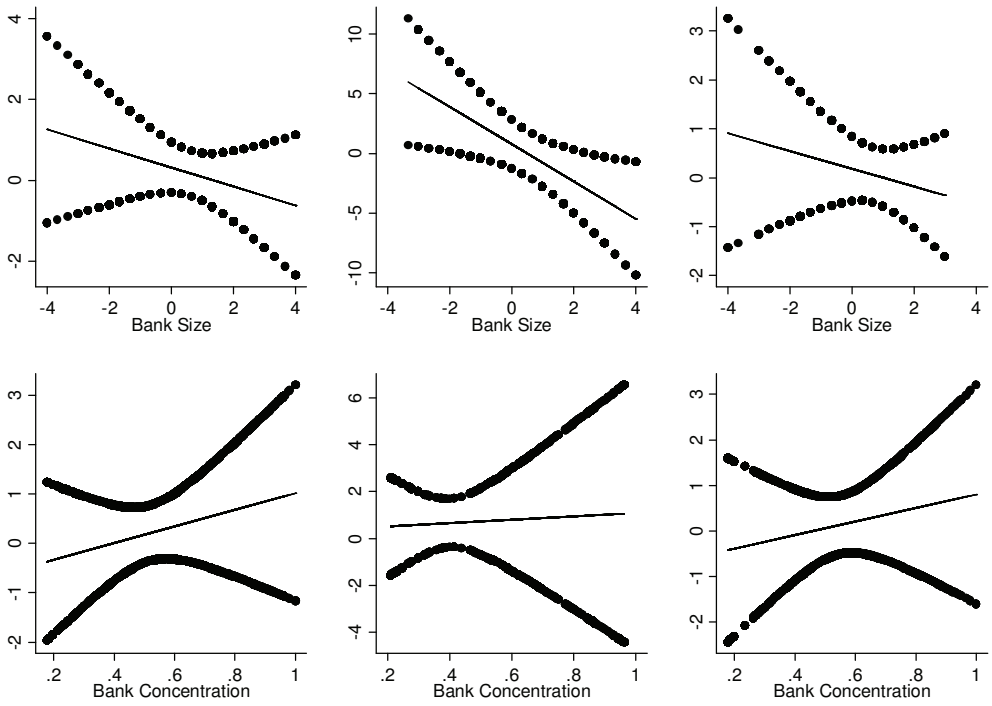
Table B2. Country-wise Decomposition of Banks			
Country	**Number of Banks**	**Country**	**Number of Banks**
ALBANIA	4	LUXEMBOURG$^{\Psi}$	22
ALGERIA	4	MACEDONIA	3
ANGOLA	6	MALAWI	4
ARGENTINA	21	MALAYSIA	20
ARMENIA	3	MALTA	4
AUSTRIA$^{\Psi}$	40	MAURITANIA	3
AZERBAIJAN	9	MAURITIUS	7
BAHAMAS	13	MEXICO	8
BAHRAIN	2	MOLDOVA REP. OF	2
BANGLADESH	5	MONGOLIA	3
BELARUS	5	MOROCCO	2
BELGIUM$^{\Psi}$	8	MOZAMBIQUE	5
BELIZE	2	NEPAL	4
BOSNIA-HERZEGOVI	10	NETHERLANDS$^{\Psi}$	13
BRAZIL	76	NEW ZEALAND$^{\Psi}$	3
BULGARIA	8	NICARAGUA	2
CAMBODIA	5	NIGER	2
CANADA$^{\Psi}$	18	NIGERIA	32
CHILE	9	NORWAY$^{\Psi}$	33
CHINA-PEOPLE'S R	31	PAKISTAN	16
COLOMBIA	8	PANAMA	29
COSTA RICA	15	PARAGUAY	3
CROATIA	14	POLAND	9
CYPRUS	2	PORTUGAL$^{\Psi}$	6
CZECH REPUBLIC$^{\Psi}$	4	ROMANIA	10
DENMARK$^{\Psi}$	17	RUSSIAN FEDERATION	126
DOMINICAN REPUBL	17	RWANDA	2
ECUADOR	20	SENEGAL	3
EL SALVADOR	8	SINGAPORE	7
ESTONIA	2	SLOVAKIA$^{\Psi}$	5
ETHIOPIA	2	SLOVENIA	2
FRANCE$^{\Psi}$	44	SOUTH AFRICA	3
GEORGIA REP. OF	4	SPAIN$^{\Psi}$	8
GERMANY$^{\Psi}$	102	SRI LANKA	5
GHANA	4	SUDAN	4
GREECE$^{\Psi}$	2	SWAZILAND	2
GUATEMALA	2	SWEDEN$^{\Psi}$	82
HONDURAS	6	SWITZERLAND$^{\Psi}$	198
HONG KONG	10	TAIWAN	21
HUNGARY$^{\Psi}$	9	THAILAND	15
INDIA	26	TRINIDAD AND TOB	3
INDONESIA	17	TUNISIA	7
IRAN	2	TURKEY	9
IRELAND$^{\Psi}$	13	UGANDA	1
ITALY$^{\Psi}$	20	UKRAINE	19
JAMAICA	8	UNITED KINGDOM$^{\Psi}$	66
JAPAN$^{\Psi}$	39	URUGUAY	24
KAZAKHSTAN	6	USA$^{\Psi}$	177
KENYA	10	UZBEKISTAN	6

KOREA REP. OF$^{\Psi}$	12	VENEZUELA	20
KUWAIT	4	VIETNAM	5
KYRGYZSTAN	4	YEMEN	2
LATVIA	6	ZAMBIA	3
LEBANON	6	**Total**	**1819**
LIBYAN ARAB JAMA	2		
LITHUANIA	3		

Ψ indicates a high income OECD country in our sample as per World Bank ' World Development Indicator dataset.

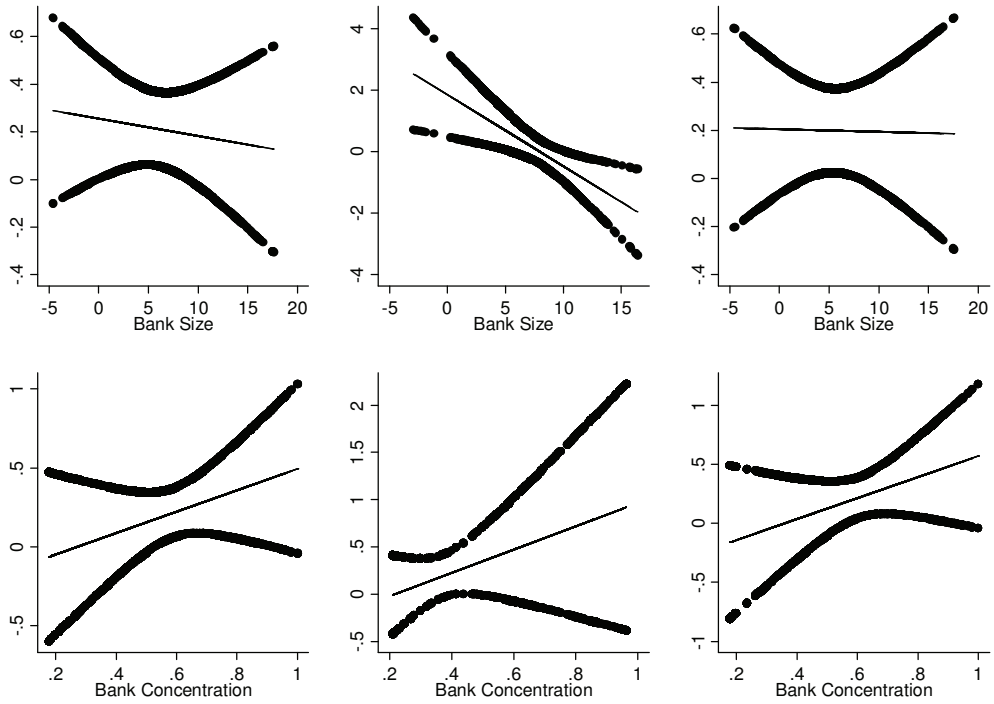
Table B3. Correlation Matrix													
	ROA Volatility	**ROE Volatility**	**Financial Crisis**	**Bank Size**	**Bank Concentration**	**Cost/Income**	**Inflation**	**Savings Bank**	**Investment Bank**	**Commercial Banks**	**Leverage**	**GDP Growth**	**GDP/Capita**
ROA Volatility	1												
ROE Volatility	0.6191	1											
Financial Crisis	0.1639	0.1428	1										
Bank Size	-0.1666	-0.017	0.0078	1									
Bank Concentration	-0.0863	-0.1375	-0.0723	-0.0259	1								
Cost/Income	0.1992	0.1908	0.0369	-0.1527	0.015	1							
Inflation	0.1482	0.1804	0.2787	0.0284	-0.2424	-0.0091	1						
Savings Bank	-0.2033	-0.2357	-0.0983	-0.0599	0.5047	-0.0342	-0.3092	1					
Investment Bank	0.2083	0.1132	-0.0196	-0.0069	-0.1062	0.0668	-0.1014	-0.2117	1				
Commercial Banks	0.029	0.1247	0.0995	0.057	-0.3638	-0.0177	0.3411	-0.7198	-0.526	1			
Leverage	-0.0707	-0.0122	-0.0157	0.083	0.0596	-0.0173	-0.0746	0.0776	0.0589	-0.1093	1		
GDP Growth	-0.0328	0.0338	-0.2505	0.0244	-0.1757	-0.1287	0.3039	-0.2773	-0.0386	0.2688	-0.0158	1	
GDP/Capita	-0.1477	-0.1992	-0.1311	-0.0334	0.3611	0.003	-0.5733	0.5585	0.0164	-0.4977	0.1109	-0.483	1

Figure B1. Marginal Effect of Financial Crises On Bank Earnings Volatility (Return on Equity Volatility)



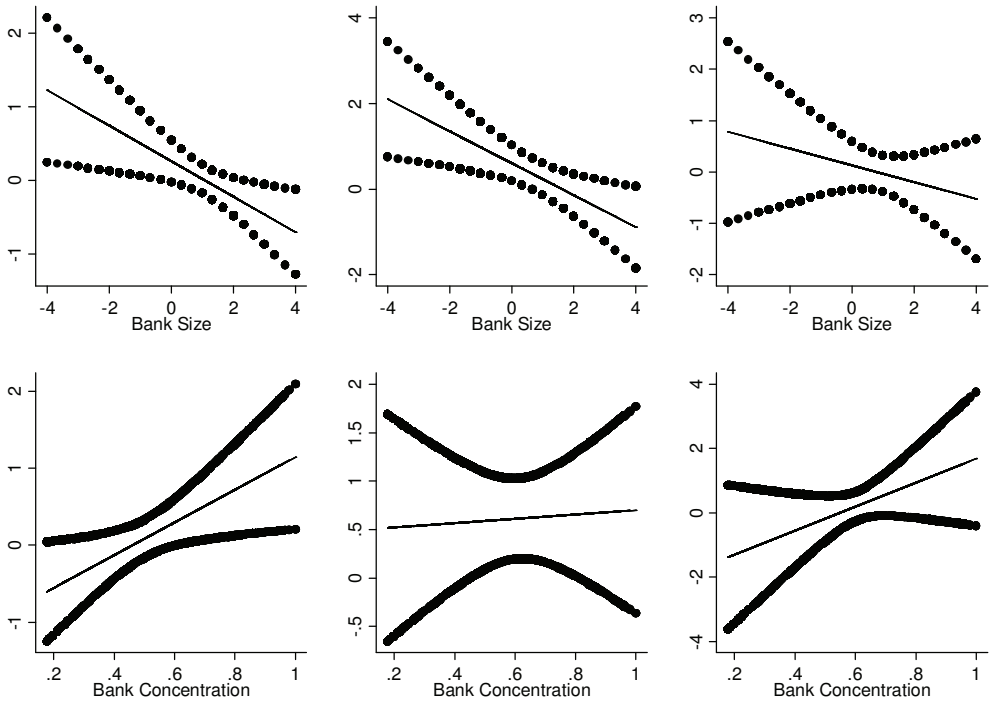
The figure examines the impact of financial crises on bank earnings volatility and corresponds to our sensitivity analysis results as given in columns (1)-(3) in Table 3.3. The upper panel examines the marginal effect of financial crises at different levels of bank size and the lower panel examines the effect of financial crises at different levels of bank concentration. The graphs on the left pertain to column (1) where we examine the impact of financial crises for all countries in our sample. The graphs in the middle correspond to column (2) examining the impact of financial crises for high-income OECD countries and the graphs on the right represent the impact of financial crises on the other countries in our sample, corresponding to column (3).

Figure B2. Marginal Effect of Financial Crises On Bank Earning Volatility (Absolute Bank Size)



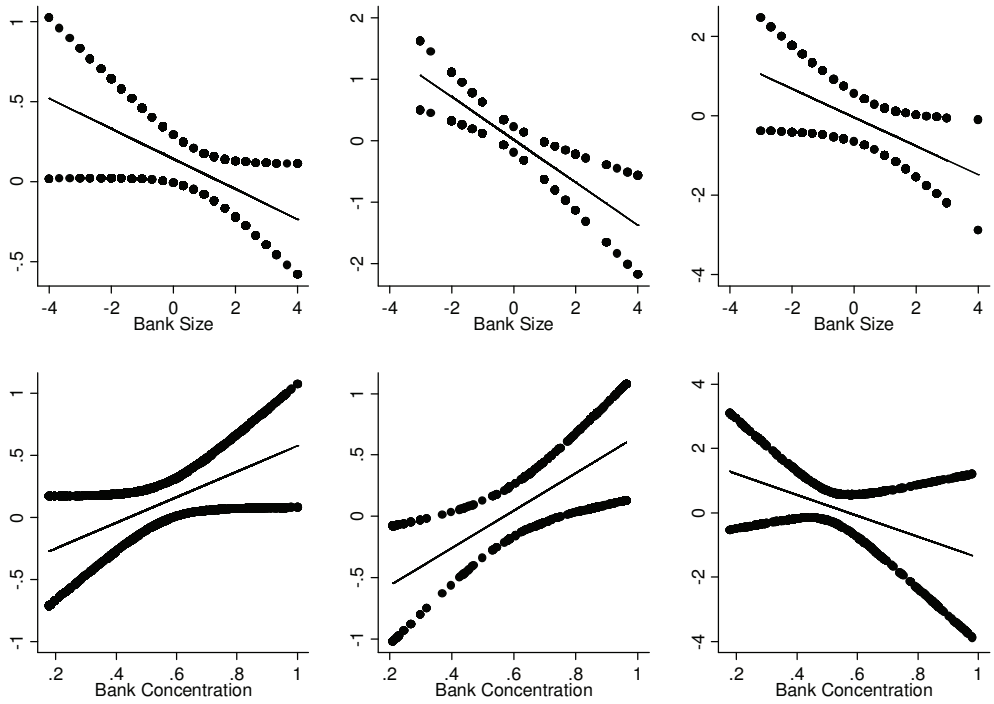
The figure examines the impact of financial crises on bank earning volatility and corresponds to our sensitivity analysis results as given in columns (4)-(6) in Table 3.3. The upper panel examines the marginal effect of financial crises at different levels of bank size and the lower panel examines the same at different bank concentration levels. The left graphs in upper and lower panel pertain to column (4) where we examine the impact of financial crises for all countries in our sample. The middle graphs correspond to column (5) examining the impact of financial crises for high-income OECD countries and the right graphs represent the impact of financial crises on countries that are not high-income OECD countries, corresponding to column (6).

Figure B3. Marginal Effect of Financial Crises On Bank Earnings Volatility (Different Types of Crises)



This figure examines the impact of financial crises on bank earning volatility and corresponds to our sensitivity analysis results as given in columns (1)-(3) in Table 3.4. Here we look at the different types of crises. The upper panel shows the marginal effect of financial crises at different levels of bank size and the lower panel shows the marginal effect of financial crises at different levels of bank concentration. The graphs on the left pertain to column (1) where we examine the impact of systemic banking crises for all countries in our sample. The graphs in the middle correspond to column (2) examining the impact of currency crises for all countries and the graphs at the right represent the impact of debt crises on all countries, corresponding to column (3).

Figure B4. Marginal Effect of Financial Crises On Bank Earnings Volatility (Different Bank Types)



This figure examines the impact of financial crises on bank earnings volatility and corresponds to our sensitivity analysis results as given in columns (4)-(6) in Table 3.4. Here we use different types of banks. The upper panel shows the marginal effect of financial crises at different levels of bank size and the lower panel shows the marginal effect of financial crises at different levels of bank concentration. The graphs on the left pertain to column (4) where we examine the impact of financial crises on earnings volatility of commercial banks. The graphs in the middle correspond to column (5) examining the impact of financial crises on earnings volatility of saving banks and the graphs on the right represent the impact of financial crises on earnings volatility of investment bank, corresponding to column (6).

Appendix C

Table C1. Country-wise Distribution of Banks in Sample			
Country	**Banks**	**Country**	**Banks**
ARGENTINA	27	KOREA REP. OF	3
AUSTRALIA	19	KUWAIT	1
AUSTRIA	51	LUXEMBOURG	31
BANGLADESH	6	MALAYSIA	20
BELGIUM	19	MALI	2
BELIZE	3	MEXICO	18
BRAZIL	82	MOROCCO	8
BURUNDI	1	NETHERLANDS	32
CANADA	21	NEW ZEALAND	4
CHAD	1	NIGERIA	37
CHILE	10	NORWAY	9
CHINA-PEOPLE'S R	58	OMAN	3
COLOMBIA	12	PAKISTAN	14
CROATIA	22	PANAMA	52
CYPRUS	5	PHILIPPINES	26
CZECH REPUBLIC	8	POLAND	34
DENMARK	24	PORTUGAL	18
EGYPT	2	QATAR	1
ESTONIA	2	ROMANIA	14
FINLAND	6	SINGAPORE	8
FRANCE	78	SLOVAKIA	9
GABON	1	SOUTH AFRICA	24
GERMANY	57	SPAIN	47
GHANA	6	SRI LANKA	4
GREECE	19	SWEDEN	17
HUNGARY	11	SWITZERLAND	55
ICELAND	4	TURKEY	14
INDIA	28	UNITED ARAB EMIR	1
INDONESIA	17	UNITED KINGDOM	91
IRELAND	20	USA	138
ITALY	140	VENEZUELA	28
JAMAICA	6	VIETNAM	14
JAPAN	26	**Total**	**1569**

Table C2. Correlation Matrix											
	Assets	**Equity**	**Asset Growth**	**Return on Assets**	**Return on Equity**	**Overhead Costs/Income**	**Equity/Assets**	**Real GDP Growth**	**Concentration**	**Inflation**	**Recurring Earning Power**
Assets	1.000										
Equity	0.952	1.000									
Asset Growth	0.014	0.012	1.000								
Return on Assets	0.009	0.013	0.079	1.000							
Return on Equity	0.011	0.012	0.096	0.528	1.000						
Overhead Costs/Income	-0.003	-0.003	0.011	0.006	0.007	1.000					
Equity/Assets	-0.025	-0.011	-0.185	0.095	-0.076	0.000	1.000				
Real GDP Growth	0.035	0.038	0.127	0.005	0.096	0.004	-0.111	1.000			
Concentration	0.014	0.009	0.087	-0.011	0.000	0.008	0.034	-0.005	1.000		
Inflation	0.079	0.044	0.050	0.072	0.043	0.021	0.089	-0.177	0.124	1.000	
Recurring Earning Power	0.007	0.012	0.049	0.790	0.376	0.003	0.143	-0.040	-0.045	0.124	1.000

Table C3. Comparison of Samples					
		Our Sample		World Bank Sample	
	Statistics	Return on Assets	Return on Equity	Return on Assets	Return on Equity
Non-OECD Countries	Mean	1.68	11.85	1.31	11.92
	Std. Deviation	5.36	36.46	2.12	11.14
	Maximum	73.17	615.39	8.57	57.65
	Minimum	-111.13	-927.38	-13.66	-50.55
	Observations	2991	2989	8076	8076
OECD Countries	Mean	0.76	8.58	1.01	10.30
	Std. Deviation	4.30	26.64	0.74	6.15
	Maximum	73.01	558.26	5.95	102.70
	Minimum	-82.58	-321.46	-8.48	-124.22
	Observations	4729	4710	35033	35033
Total	Mean	1.11	9.85	1.06	10.61
	Std. Deviation	4.76	30.87	1.14	7.38
	Maximum	73.17	615.39	8.57	102.70
	Minimum	-111.13	-927.38	-13.66	-124.22
	Observations	7720	7699	43109	43109

Table C4. Tests for Normality of Logarithmic Bank Size						
	Non-OECD Countries			OECD Countries		
Year	Skewness	Kurtosis	Jarque-Bera Test Statistic	Skewness	Kurtosis	Jarque-Bera Test Statistic
1997	-0.25	4.05	12.23	0.41	4.21	34.25
1998	-0.14	3.85	6.39	0.64	3.56	25.15
1999	-0.30	3.58	5.62	0.92	4.75	73.31
2000	-0.15	3.62	4.35	0.78	4.81	60.96
2001	-0.43	3.59	11.29	0.82	5.24	90.03
2002	-0.24	4.05	15.15	0.63	4.41	46.29
2003	-0.14	4.76	37.41	0.64	4.25	42.92
2004	0.35	4.15	25.76	0.19	3.31	6.15
2005	0.56	3.88	32.29	0.20	3.52	13.10
2006	0.44	3.75	20.07	0.14	3.20	3.37
2007	0.49	3.79	21.35	0.15	3.35	5.49

Appendix D

Table D1. Correlation Matrix													
Variable	Ownership Level 1	Ownership Level 2	Ownership Level 3	Shareholder Protection Rights	Supervisory Control	Impaired Loans/Gross Loans	Risk-Weighted Capital Adequacy	Activities Restrictions	Bank Equity	Cost/ Income	Loan Growth	Bank Concentration	Listed Bank
Ownership Level 1	1.00												
Ownership Level 2	0.48	1.00											
Ownership Level 3	0.35	0.73	1.00										
Shareholder Protection Rights	0.08	0.14	0.19	1.00									
Supervisory Control	-0.12	-0.19	-0.12	0.10	1.00								
Impaired Loans/Gross Loans	0.08	-0.03	-0.19	-0.06	-0.10	1.00							
Risk-Weighted Capital Adequacy	0.10	0.18	0.25	0.25	0.07	-0.07	1.00						
Activities Restrictions	-0.11	-0.19	-0.24	-0.59	0.24	0.23	-0.08	1.00					
Bank Equity	0.03	0.08	0.11	-0.05	-0.05	-0.01	-0.03	-0.12	1.00				
Cost/ Income	0.02	0.04	-0.06	0.04	0.02	0.00	0.03	0.03	0.02	1.00			
Loan Growth	0.01	0.04	0.05	0.04	-0.04	0.03	-0.04	-0.07	0.00	0.01	1.00		
Bank Concentration	0.04	0.15	0.08	-0.03	-0.39	-0.06	-0.10	-0.11	0.07	-0.12	0.03	1.00	
Listed Bank	-0.17	-0.17	-0.27	-0.01	0.06	0.13	-0.23	0.15	-0.02	-0.06	0.01	0.07	1.00

Table D2. Estimation Results of Base Model							
		Impaired Loans/ Gross Loans			Capital Adequacy Ratio		
		1	2	3	1	2	3
Ownership Concentration (OC)	Coefficient	-3.011	2.072	0.093	23.210**	24.090**	26.744**
	Standard Error (Robust)	7.633	5.18	4.109	10.776	10.818	11.165
Shareholder Protection Rights (SPR)	Coefficient	-2.155	1.071	0.559	1.864	1.392	2.172
	Standard Error (Robust)	2.324	1.824	1.364	3.239	2.826	2.4
Supervisory Control (SC)	Coefficient	-1.132	0.046	-0.228	0.218	-0.247	0.196
	Standard Error (Robust)	0.86	0.79	0.64	1.676	1.596	1.326
OC*SPR	Coefficient	1.118	-1.904	-1.248	-5.912*	-6.435**	-7.760**
	Standard Error (Robust)	2.425	1.86	1.366	3.177	3.152	3.251
OC*SC	Coefficient	0.331	-0.814	-0.576	-3.210**	-3.200**	-3.960**
	Standard Error (Robust)	0.878	0.765	0.608	1.553	1.615	1.613
SPR*SC	Coefficient	0.277	-0.168	-0.056	0.022	0.095	-0.105
	Standard Error (Robust)	0.275	0.254	0.191	0.501	0.422	0.336
OC*SPR*SC	Coefficient	-0.089	0.368	0.264	0.842*	0.899*	1.205**
	Standard Error (Robust)	0.287	0.254	0.19	0.466	0.471	0.481
Bank Size	Coefficient	-0.011	0.03	0.090**	0.18	0.133	0.098
	Standard Error (Robust)	0.061	0.051	0.042	0.139	0.143	0.13
Cost/Income	Coefficient	0.007	0.006	0.005	-0.010*	-0.011**	-0.008
	Standard Error (Robust)	0.009	0.009	0.009	0.005	0.005	0.006
Activities Restrictions	Coefficient	0.381***	0.360**	0.424***	0.594	0.617	0.576
	Standard Error (Robust)	0.146	0.142	0.134	0.544	0.532	0.47
Loan Growth	Coefficient	-0.675	-0.633	-0.56	2.745***	2.721***	2.627***
	Standard Error (Robust)	0.473	0.458	0.446	0.764	0.748	0.761
Bank Concentration	Coefficient	-0.262	0.072	0.223	-2.721	-2.617	-2.528
	Standard Error (Robust)	1.074	0.993	0.916	4.03	4.01	3.23
Listed	Coefficient	0.519	0.61	0.316	-5.050***	-4.901***	-4.351***
	Standard Error (Robust)	0.498	0.539	0.505	1	1.013	0.956
GDP/Capita	Coefficient	-1.517	-1.404	-0.817	4.533	4.046	4.687
	Standard Error (Robust)	1.912	1.876	1.815	7.354	7.171	6.204
Constant	Coefficient	7.87	1.069	1.721	4.475	7.197	5.991
	Standard Error (Robust)	7.447	5.202	4.252	12.245	12.447	11.119
Number of Observations		501	501	501	312	312	312
R-Squared		0.105	0.292	0.306	0.276	0.296	0.329
Wald Chi Squared		78.226***	64.016***	70.461***	54.852***	54.281***	59.811***
*** indicates significance at 1% level, ** indicates significance at 5% level and * indicates significance at 10% level							

Table D3. Sensitivity Analysis: Banks held by a Banking Conglomerate							
		Impaired Loans/ Gross Loans			Capital Adequacy Ratio		
		1	2	3	1	2	3
Ownership Concentration (OC)	Coefficient	-3.431	2.114	-0.04	24.732**	27.274**	28.947**
	Standard Error (Robust)	7.708	5.212	4.184	11.956	12.524	12.724
Shareholder Protection Rights (SPR)	Coefficient	-2.021	1.193	0.677	2.598	2.421	3.098
	Standard Error (Robust)	2.367	1.827	1.388	3.142	2.308	2.034
Supervisory Control (SC)	Coefficient	-0.984	0.18	-0.129	0.494	0.216	0.683
	Standard Error (Robust)	0.881	0.8	0.663	1.638	1.371	1.157
OC*SPR	Coefficient	1.397	-1.733	-1.086	-6.306*	-7.168*	-8.218**
	Standard Error (Robust)	2.459	1.856	1.378	3.533	3.718	3.89
OC*SC	Coefficient	0.411	-0.79	-0.528	-3.435**	-3.659**	-4.291**
	Standard Error (Robust)	0.89	0.768	0.617	1.725	1.86	1.913
SPR*SC	Coefficient	0.249	-0.192	-0.077	-0.072	-0.053	-0.245
	Standard Error (Robust)	0.28	0.254	0.196	0.492	0.351	0.287
OC*SPR*SC	Coefficient	-0.127	0.346	0.239	0.902*	1.018*	1.291**
	Standard Error (Robust)	0.291	0.254	0.193	0.518	0.556	0.591
Bank Size	Coefficient	-0.032	0.007	0.076*	0.144	0.067	0.025
	Standard Error (Robust)	0.064	0.056	0.046	0.154	0.156	0.137
Cost/Income	Coefficient	0.008	0.008	0.007	-0.006	-0.005	0.001
	Standard Error (Robust)	0.01	0.009	0.01	0.008	0.007	0.007
Activities Restrictions	Coefficient	0.358**	0.339**	0.414***	0.567	0.555	0.462
	Standard Error (Robust)	0.157	0.156	0.145	0.548	0.49	0.423
Loan Growth	Coefficient	-0.724	-0.698	-0.614	2.980***	2.945***	2.866***
	Standard Error (Robust)	0.501	0.491	0.482	0.633	0.621	0.618
Bank Concentration	Coefficient	-0.049	0.181	0.323	-2.664	-2.422	-2.283
	Standard Error (Robust)	1.264	1.21	1.111	4.016	3.466	2.709
Listed	Coefficient	0.477	0.598	0.383	-5.305***	-5.177***	-4.456***
	Standard Error (Robust)	0.543	0.568	0.54	1.191	1.172	1.061
GDP/Capita	Coefficient	-2.971	-2.817	-1.939	3.695	2.864	2.833
	Standard Error (Robust)	2.092	2.072	1.99	7.188	6.298	5.382
Constant	Coefficient	7.152	0.396	1.13	2.332	3.98	2.9
	Standard Error (Robust)	7.633	5.396	4.488	11.891	10.412	9.519
Number of Observations		426	426	426	269	269	269
R-Squared		0.122	0.283	0.284	0.282	0.308	0.339
Wald Chi Squared		74.879***	62.108***	65.009***	58.904***	62.927***	73.453***
*** indicates significance at 1% level, ** indicates significance at 5% level and * indicates significance at 10% level							

Samenvatting

Dit proefschrift gaat over systeem- en bankspecifieke factoren die een cruciale rol spelen bij de prestaties en het risicomanagement van banken. De hoofdvraag van mijn proefschrift wordt geïntroduceerd in hoofdstuk 1 en gaat over hoe verschillende systeem- en bankspecifieke factoren de risico's beïnvloeden van banken op bedrijfs- en systeemniveau. Hoofdstuk 2 laat zien dat financiële liberalisatie de kans verkleint dat een systeem crisis zich voordoet. Een noodzakelijke voorwaarde hierbij is dat er goed toezicht wordt gehouden op de financiële sector. Verder blijkt dat de banken leren banken van eerdere hervormingen en dit verkleint de waarschijnlijkheid van een systeemcrisis. Hoofdstuk 3 laat zien dat financiële crises de volatiliteit van de opbrengsten van kleine en grote bankbedrijven in verschillende mate beïnvloeden. Deze beweeglijkheid van de opbrengsten is ook afhankelijk van de dichtheid van de markt. Door de diversificatie van hun leningen hebben grote banken een betere kans om een financiële crisis te weerstaan dan kleine banken, ondanks hun falen in de huidige financiële crisis. Hoofdstuk 4 analyseert de groei van banken en de dynamiek van hun winstgevendheid. Banken die opereren in OESO landen met een hoog inkomen worden vergeleken met banken die werkzaam zijn in andere landen. Het blijkt dat er significante verschillen in de groei en de winstgevendheid bestaan en dat de variaties hierin afhankelijk zijn van de grootte van de bank. Hoofdstuk 5 van het proefschrift laat zien dat wanneer het toezicht op het bankwezen zwak is, concentratie van eigendom een alternatief kan zijn om het risiconiveau van banken te beperken. Verder wordt de rol van de eigendomsverhoudingen

beïnvloed door de beschermingsrechten van de aandeelhouders. Hoofdstuk 6 vat het proefschrift samen en geeft enkele beleidsimplicaties.

Na de introductie van de onderzoeksvragen in het eerste hoofdstuk, concentreert het tweede hoofdstuk zich op de oorzaken van systeem- en overige crisissen. We kijken specifiek naar de rol van de financiële liberalisatie op de waarschijnlijkheid dat een crises zich voordoet. Gebruikmakend van nieuwe indicatoren voor financiële liberalisatie voor een grote steekproef van ontwikkelingslanden en ontwikkelde landen in de periode van 1973 tot 2002, suggereren onze resultaten dat bepaalde dimensies van financiële liberalisatie de waarschijnlijkheid van een systeemcrisis verkleinen, mits er sprake is van een adequaat toezicht op het bankwezen. Tegengesteld daaraan lijkt er enig bewijs te zijn dat de waarschijnlijkheid van een niet-systeem crisis toeneemt na financiële liberalisatie. Ten slotte laten we zien dat banken leren van eerdere hervormingen en dat dit helpt om de waarschijnlijkheid van crisissen te verkleinen door verdere hervormingen. In verschillende sensitiviteitstesten blijken deze resultaten erg robuust.

Het derde hoofdstuk concentreert zich op de invloed van financiële crisissen op de volatiliteit van de winst van banken, conditioneel op bankgrootte en marktconcentratie. Onze bevindingen suggereren dat grote banken een lagere volatiliteit kennen na een financiële crisis dan kleinere banken. Verder hebben banken die opereren in een sector met een hoge concentratie een hogere volatiliteit van hun winst. Deze bevindingen komen overeen met onderzoeken die laten zien dat grote banken beter hun risico kunnen spreiden. De resultaten zijn robuust voor wijzigingen in het meten van bankgrootte, oorzaken van financiële crisissen, banksoort en de definitie van winst.

In het vierde hoofdstuk onderzoeken we de dynamiek van de groei en winstgevendheid van banken. Onderzocht wordt (i) of bankgroei en winstgevendheid persistent zijn, (ii) of bank groei en winstgevendheid afhankelijk zijn van bankgrootte en (iii) welke relatie er bestaat tussen groei en winstgevendheid van een bank. Onze resultaten suggereren dat bankgroei niet persistent is, maar bankwinsten zijn wel persistent. Bovendien laten onze resultaten zien dat de dynamiek van groei en

winstgevendheid van banken in OESO landen verschilt van die van banken in niet-OESO landen.

In het vijfde hoofdstuk gaan we in op de relatie tussen bank governance en het risico van banken. Meer specifiek: we analyseren de invloed van de concentratie van het eigendom van banken op twee indicatoren van risico, namelijk non-performing loans en capital adequacy. Dit hoofdstuk concludeert dat een hoge concentratie van eigendom non-performing loans significant neerwaarts beïnvloed, op voorwaarde van adequate controle door de toezichthouder en bescherming van aandeelhoudersrechten. Verder heeft de concentratie van eigendom een positieve invloed op capital adequacy op voorwaarde van voldoende aandeelhoudersbescherming. Als er sprake is van een laag beschermingsniveau van aandeelhoudersrechten en slecht toezicht, dan verkleint de concentratie van eigendom het risico van banken.

Het laatste hoofdstuk vat onze conclusies samen en bespreekt de beleidsimplicaties van de conclusies.