AN EMPIRICAL INVESTIGATION OF BANK RISK

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<td>2SLS</td>
<td>Two Stage Least Squares</td>
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<tr>
<td>BC</td>
<td>Bank Capital</td>
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<tr>
<td>BCBS</td>
<td>Basel Committee on Banking Supervision</td>
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<tr>
<td>BHCs</td>
<td>Bank Holding Companies</td>
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<td>BIS</td>
<td>Bank for International Settlements</td>
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<td>CRI</td>
<td>Creditor Rights Index</td>
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<tr>
<td>CV</td>
<td>Charter Value</td>
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<tr>
<td>DIDMCA</td>
<td>Depository Institutions Deregulation and Monetary Control Act of 1980</td>
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<tr>
<td>DS</td>
<td>Datatream</td>
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<tr>
<td>DY</td>
<td>Dividend Yield</td>
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<tr>
<td>ECB</td>
<td>European Central Bank</td>
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<tr>
<td>EDGAR</td>
<td>Electronic Data Gathering, Analysis and Retrieval System</td>
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<tr>
<td>FDIC</td>
<td>Federal Deposit Insurance Corporation</td>
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<tr>
<td>FDICIA</td>
<td>Federal Deposit Insurance Corporation Improvement Act of 1991</td>
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<tr>
<td>FE</td>
<td>Fixed-Effects</td>
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<tr>
<td>FTSE</td>
<td>Financial Times and London Stock Exchange</td>
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<tr>
<td>GLBA</td>
<td>Gramm-Leach-Bliley Act of 1999</td>
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<tr>
<td>GLS</td>
<td>Generalized Least Squares</td>
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<tr>
<td>GSGDIA</td>
<td>Garn-St. Germain Depository Institution Act of 1982</td>
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<td>IBBEA</td>
<td>Riegle-Neal Interstate Banking and Branching Efficiency Act of 1994</td>
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<td>I/B/E/S</td>
<td>Institutional Brokers Estimate System</td>
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<tr>
<td>IMF</td>
<td>International Monetary Fund</td>
</tr>
<tr>
<td>LM</td>
<td>Lagrange Multiplier</td>
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<tr>
<td>LR</td>
<td>Likelihood Ratio</td>
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<td>M&amp;A</td>
<td>Mergers and Acquisitions</td>
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<td>MD</td>
<td>Market Discipline</td>
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<td>MSCI</td>
<td>Morgan Stanley Composite Index</td>
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<td>OBS</td>
<td>Off-balance Sheet Activities</td>
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<td>OLS</td>
<td>Ordinary Least Squares</td>
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<td>OPL</td>
<td>Operating Leverage</td>
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<td>S&amp;L</td>
<td>Savings and Lending</td>
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<td>SEC</td>
<td>Securities and Exchange Commission</td>
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<td>SIC</td>
<td>Standard Industrial Classification</td>
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<tr>
<td>SRI</td>
<td>Shareholder Rights Index</td>
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<tr>
<td>TBTF</td>
<td>Too-Big-To-Fail</td>
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<td>UD</td>
<td>Uninsured Deposits</td>
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<td>WB</td>
<td>World Bank</td>
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ABSTRACT

This thesis examines the determinants of bank equity risk and credit risk as well as providing an analysis of the change in bank equity risk following the formation of Economic and Monetary Union (EMU). It is motivated by the increasing interest in bank risk research particularly since the formation of EMU and the global financial crisis. The topic of bank risk is also growing in importance as banks have become larger, more diversified and complex.

This study addresses the following research questions (RQ1A, RQ1B and RQ2):

RQ1A: Do bank regulation, off-balance sheet activities and market discipline explain the bank risk, in particular equity risk and credit risk?

RQ1B: Does bank risk sensitivity to bank regulation, off-balance sheet activities and market discipline change with creation of the Economic and Monetary Union (EMU)?

RQ2: Is there a structural change in European bank equity risk with the formation of Economic and Monetary Union (EMU)?

With regard to RQ1A and RQ1B, the study considers a range of financial institutions including bank holding companies (BHCs), commercial banks, cooperatives and savings banks across two data sets. The first dataset used in analysis of this question consists of 15 Western European countries for the period 1996-2005. For both euro-zone and non-euro-zone Western European countries the total number of listed shares stands at 117 resulting in the bank-year sample of 1029 observations. The second dataset includes banks from 36 countries in addition to the Western European countries. The total number
of listed banks stands at 758 in the final version of the second dataset resulting in the final bank-year sample observation to 4,680.

With regard to RQ2, the study constructs a sample of 96 euro-zone European banks and 85 non-euro zone European banks from the DataStream International database from January 1995 to April 2006 periods. Approximately, 64 banks are eliminated from the first dataset (European banks) due to lack of accounting information.

In terms of methodology, the primary estimation method for the regression equations was pooled-OLS and two stage least squares (2SLS) with robust standard errors. The robustness of the findings was also tested by other estimation methods such as random effects and fixed effects panel data analysis.

With regard to research question 1 (RQ1A and RQ1B), the findings on European bank analysis show: (i) off-balance sheet activities are positively associated with equity risk (total risk, systematic risk and idiosyncratic risk) and credit risk; (ii) charter value is positively associated with equity risk but negatively related to credit risk; (iii) bank capital is non-linearly related with systematic risk and credit risk; (iv) uninsured deposits are negatively associated with systematic risk while positively related to credit risk, total risk and idiosyncratic risk; (v) large banks exhibit greater systematic risk and total risk but lower credit risk and idiosyncratic risk. While these bank characteristics are important in explaining bank risk, the findings also confirm that civil-law country banks tend to be less risky than common-law country banks over the period of the study. Similar findings are also evident in separate world and regional analysis.

As to the possibility of structural change between the pre-EMU and post-EMU
periods, the results show the magnitude of charter value fell dramatically in the post-EMU period with regard to equity risk and credit risk. The findings also confirm that the non-linearity between bank capital and systematic risk is most evident after the formation of EMU. The findings generally show an increase in the importance of off balance sheet activities in the post-EMU period. These results were robust to various estimation specifications.

With regard to research question 2 (RQ2), the findings reveal that, with the exception of Germany, there was a decline in bank risk across the euro zone countries. Total risk decreased for 70% of the euro zone banks with a statistically significant decline in total risk observed for 51% of the sample. A similar result is evident for systematic risk and idiosyncratic risk. These findings are robust to financial crisis effect and test specifications. Moreover, this study finds evidence of a decrease in bank equity risk for a sample of neighboring non-euro zone European countries, consistent with the existence of some spill-over effects.

This study contributes to the existing bank risk literature by showing that bank regulation (bank capital and charter value), off-balance sheet activities and market discipline are important determinants of bank equity risk and credit risk. In addition, it is one of the first studies to provide evidence of changes in the importance of factors affecting bank risk between the pre- and post-EMU periods. This is also one of the first studies to provide empirical evidence of bank capital non-linearity for European banks as well as for the broader world bank analysis.
STATEMENT OF AUTHORSHIP

I hereby, declare that this submission is my own work and except where due reference is made; this thesis contains no material previously published or written by another person(s).

This thesis does not contain material extracted in whole or in part from a thesis or report presented for another degree or diploma at RMIT University or any other education institution.

I also declare that the intellectual content of this thesis is the product of my own work, except to the extent that assistance from others in the project’s design and conception or in style, presentation and linguistic expression is acknowledged.

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Mamiza Haq

July 2010
THESIS-RELATED RESEARCH OUTCOME

Refereed Publications:


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CHAPTER 1
INTRODUCTION

1.1 INTRODUCTION

This thesis investigates the determinants of European bank equity risk and credit risk. Particularly, it examines the relevance of regulatory discipline (i.e., bank capital and charter value), off-balance sheet activities, and market discipline (subordinated debt and uninsured deposits) to both equity risk and credit risk. It also explores the determinants of bank risk for the world banking system with separate regional analysis. Finally, the study analyses the structural changes in European bank equity risk with the formation of Economic and Monetary Union (EMU).

The Global Financial Crisis (GFC) 2007-09 highlights the inherent weaknesses in the existing banking system around the world particularly in developed countries in controlling excessive risk taking by banks.¹ Both bank regulators and investors consider bank risk to be important. The systemic problems with the sub-prime crisis indicate the importance of an improved understanding of the determinants of bank risk. Yet, the

¹ For example, in the U.S., the collapse of one of the world’s oldest investment bank Lehman Brothers in 2008. The Merrill Lynch, once high-profile Wall Street firm, made an overall loss of USD 27.6 billion and eventually was sold to Bank of America to avoid bankruptcy. In Europe, United Bank of Switzerland wrote down USD 42.5 billion on its sub-prime related assets since the beginning of the turmoil. Further, in the UK, the government took control 84% of the Royal Bank of Scotland in 2008 and guaranteed some USD 62 billion in toxic assets. In September 2008, Lloyds-TSB took over Halifax Bank of Scotland (HBOS) and subsequently in October 2008, the British government bailed out the Lloyds-HBOS. The nationalization of Northern Rock in 2007 is also well-publicized. Hong Kong Shanghai Banking Corporation, the largest bank in Europe by market value, reported approximately 70% drop in their profits in 2008. However, in the mid of GFC, the World Economic Forum (2008) proclaims the banking system in Canada to be the safest in the world, followed by Sweden, Luxembourg and Australia. Typically, banks in Canada maintain a larger capital reserves compare to those in the U.S. and even more so than those in Europe. Although the Imperial Bank of Commerce in Canada sold USD 2.94 billion worth of shares to cover its losses, there were basically no government bailouts.
change in bank equity risk is important because changes in equity risk can have repercussions for investors, borrowers and regulators. While decreases in the systematic risk of bank equity may be associated with increased market value, an increase in idiosyncratic risk is of importance to regulators who are very much concerned with the performance of individual banks. Generally, well-diversified investors focus on systematic risk while undiversified investors are more concerned with total risk including idiosyncratic (bank-specific) risk. Banks benefit from both economies of scale and economies of scope and larger cost reduction leads to greater diversification. However, the GFC teaches us that there could be an optimum size beyond which larger size and greater diversification increases bank idiosyncratic risk (Stelzer 2009). Since bank regulators are responsible for ensuring a stable and sound financial system, they (including implicit and explicit safety net providers) are interested in total risk. Interest rates have also become more volatile in recent decades and this additional funding risk (Flannery and James 1984) is certainly worthy of further analysis.

To that end, evidence is sought on the effect of bank discipline, off-balance sheet activities and market discipline on each of the five bank risk measures (systematic, idiosyncratic, total, interest rate and credit risks) for 15 European countries in analysis of the impact of the formation of EMU. The result of the multivariate regression analysis reveals that off-balance sheet activities increase all bank risk measures. However, the results for market discipline (as proxied by uninsured deposit), and bank discipline (capital ratio and charter value) are mixed. For instance, uninsured deposits is negatively related to systematic risk while positively related to both credit risk and idiosyncratic risk. There is also some evidence of a non-linear relation between bank capital and bank
risk.

With regard to bank risk for the world sample, evidence is also sought for the existence of a relation between bank discipline, off-balance sheet activities and market discipline with bank risk. Similar to the findings for European banks, the results present a positive association between off-balance sheet activities and bank risk while there is no evidence of the bank disciplinary effect of charter value for bank equity risk for the world. These results are robust to different estimation techniques.

In relation to structural changes in European bank equity risk with the formation of EMU, multivariate regression analysis shows mainly a decrease in bank equity risk for euro-zone countries except for Germany.

The remainder of the chapter is organized as follows. Section 1.2 provides the background and motivation of this thesis. This helps to identify the research objectives and the associated research questions discussed in Section 1.3. The data, methodology and major findings are then summarized in Section 1.4. Section 1.5 outlines the academic contribution and implications. Finally Section 1.6 concludes the chapter, describing the structure of the remaining chapters of this thesis.

1.2 BACKGROUND AND MOTIVATION

Financial intermediaries such as banks are a major part of an economy in their own right. They influence securities markets and promote economic growth by providing liquid financial markets. Banks also encourage diversification and specialization (Diamond and Dybvig 1983). The background and motivation of this thesis is discussed below in the following sub sections. Section 1.2.1 presents the changes in International
banking system. Section 1.2.2 discusses the aspects of the banking system in recent times. Section 1.2.3 presents the growth of off-balance sheet activities and market discipline. Finally, Section 1.2.4 presents a discussion on the impact of the formation of EMU.

1.2.1 Changes in international banking system

The European markets have become more integrated since EMU and this has allowed the banks to expand their activities through increased cross-border/domestic branch networks. However, it is possible that, continued macroeconomic stability, strong regulatory and supervisory framework, greater international cooperation, and strong bank risk management have contributed to the resilience of the European Union (EU) banking sector over the last decade (Trichet 2004).

It has been argued that formation of EMU was the most important systemic change in world financial markets in recent times. This change has been associated with increased competition across the European banking sector. It is argued that it compelled the banks to reassess their strategic orientation, leading to greater internationalization, greater geographical diversification and further bank consolidation, particularly in the euro-area banking industry (ECB 2005). Thus, analysis of bank risk is particularly important given the current level of European banking industry concentration and the

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2 The establishment of EMU and the commencement of a single currency the Euro, was meant to ease trade, eliminate exchange rate risk, remove transaction costs incurred in exchanging currencies, enhance globalization through increased integration and competition along with maintenance and preservation of fiscal policy among the European markets. This modification has had a significant impact on the European financial system (banking industry and financial market) in terms of competition and consolidation (Francis and Hunter 2004).
decline in the number of banks since 1985 (ECB 2005). For example, in the euro-area the bank concentration ratio (measured by the share of five largest banks as a percentage of total assets of the banking sector) increased from 46% in 1997 to 59% in 2006 (ECB 2007). The degree of concentration is particularly prevalent in smaller European countries such as Belgium, Finland and the Netherlands where a small number of banks dominate the national market. In these countries, the concentration ratio as a percentage of total banking assets is high (86% in 2007). Among the non-euro zone European countries, the UK banking market is relatively concentrated with a concentration ratio (measured by the share of five largest banks in terms of total assets) increasing from 34% in 2003 to 40.70% in 2007.

Moreover, the total number of mergers from 1995 to 2004 in euro area was 901, of which only 23.2% were cross-border acquisitions. Total banking assets have continued to increase and a 54% increase in total banking assets is observed in EU-27 member countries by 2007. However, Germany, with a fragmented banking system, continues with some 518 different savings bank institutions which continue to perform well-below European averages. However, the big banks like Deutsche bank, Commerzbank and HVB are not considered to be the core problem or solution. Inability to consolidate appears to be a critical issue in Germany (The Banker 2004).

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3 Indeed, the largest acquisition in the history of the European banking industry took place on 17 October 2007 with the Royal Bank of Scotland, through RBS Holdings, and its acquisition of ABN AMRO Holding NV.

4 The characteristics of a fragmented German banking system includes the five largest credit institutions account for only 20% of the total assets, lags behind their European peers in terms of returns and efficiency. Consolidation has been urged for years but the banks seem to be unwilling to change their age-old banking structure.
Among emerging countries, the banking sector also faces major reorganization. For example, there has been considerable merger activity in South East Asian countries in the wake of Asian Financial Crisis 1997. The financial deregulation in Korea created 24 merchant banks. Among twelve (12) largest Korean banks, five (5) are majority foreign-owned and another two have foreign ownership participation (Park and Lee 2005). In early 2009, the Korean authorities decided to privatize Korea’s biggest state-owned bank, the Korea Development Bank, by 2012. The two Asian exceptions to this crisis-driven distress scenario are Singapore and Taiwan. In particular, Singapore banks have been active in cross-border mergers in Asia. However, the banks in Taiwan have also expanded into Asia and the US. Similarly, Indian banks have acted on the opportunities to expand globally.

1.2.2 Aspects of banking regulation

Regulators have relied on charter value to reduce the moral hazard problem that arises in presence of an explicit and implicit safety net. In the face of increased competition, bank disciplinary tools such as charter value can help regulators to prevent banks from taking excessive risk. The deregulatory forces that increase bank competition may also reduce bank incentives to act prudently with respect to risk taking (Keeley 1990) and the following analysis provides further insight into the impact of this trade-off following the formation of EMU. The bank deregulation literature generally deals with USA banks and while it is found that deregulation can result in increased bank risk it can also foster better risk management (Craig and Santos 1997; Houston and Stiroh 2006). Perhaps, one of the important objectives of the EMU is to achieve greater levels of competition and it has been argued that a consequence of increased competition is
increased bank risk as banks seek out more risky high yielding investments in order to maintain profit margins (Bundt, Cosimano and Halloran 1992; Park 1994; Galloway, Lee and Roden 1997). Thus, the formation of EMU provides an opportunity to study the impact of EMU driven deregulation and bank charter value on European bank equity risk.

A further motivation for this thesis concerns the move to change capital adequacy requirements, particularly the new directive or new capital adequacy requirements.\textsuperscript{5} The new directive supports a risk-sensitive supervisory framework with greater reliance on market discipline to encourage effective capital allocation and increase competition in the European banking industry. However, the recent sub-prime crisis questions whether capital requirement is adequate to prevent banks from taking excessive risk. However, subsequent to the sub-prime crisis the Bank for International Settlement (BIS) encouraged banks to increase their capital requirement and boost the standards for the so called “tier 1” capital requirement which refers to the quality of the assets that banks have on their books in relation to their deposits. It is argued that banks should focus on prudent risk taking\textsuperscript{6} and so from a regulators perspective, banks with high credit risk should hold a relatively high level of bank capital. Nevertheless, it has been argued that more risk

\textsuperscript{5} In parallel with the revision of the capital adequacy requirements regulatory bodies are considering revision of the directive on the deposit guarantee scheme. More importantly, the Lamfalussy process for the banking sector is still under review. This process includes regulation that can adapt to new market developments and practices and support integration, enhance competitiveness and strengthen cross-border cooperation among supervisory authorities (Thomopoulos 2006).

\textsuperscript{6} As of 2008, the tier 1 ratio in developed economies ranged from 6.1% to 13.6% between periods 1996-2006. Interestingly, the Japanese tier 1 ratio is as high as 16.6% in 2006, yet it is 2.71% in 1999. Among the emerging markets, the Thai banks show a dip in the tier 1 ratio during 1997-1999, for example Siam City Public Bank LTD maintained 2.91% in 2000 and then increased to 13% in 2001. Yet, the top three Malaysian banks (Hong Leong Financial Group Bhd, Public Bank Berhad and Maybank) maintained tier 1 ratio above average and over 10%.
sensitive capital adequacy regulation may reduce banks willingness to take on risk.\textsuperscript{7}

In addition, as this study is based on multi-country analysis, it is essential to account for bank heterogeneity. In a number of European countries the savings and cooperatives provide similar services to their customers to those provided by the commercial banks. For example, in Norway, there is relatively large number of locally based savings banks and a smaller number of large commercial banks. In general, the average buffer capital for these savings banks has been higher than their commercial counterparts. While the capital of these savings banks, consist of accumulated retained earnings and hybrid capital, the capital of commercial banks includes equity capital, subordinated debt and accumulated retained earnings. Banks are also different from non-bank corporations in that they fall under a safety net based on the deposit insurance and specific capital adequacy based regulation. These institutional characteristics can complicate analysis of the association between bank capital and risk taking. Hence it is important to understand how the capital ratio of different banks, different groups and different countries relate to bank risk.

1.2.3 Growth of off-balance sheet activities and market discipline

Innovations in the European banking industry such as growth in securitization, expansion in the derivatives area and changes in technology also affect bank risk. Off-balance sheet activities have both risk increasing and risk decreasing attributes. However,

\textsuperscript{7} If banks are able to risk-adjust their total capital more than that implied by Basel I, then replacing Basel I with Basel II may have little impact on the capital to asset ratio or risk profile of banks portfolio (Lindquist 2004). It is critical to understand the relationship between bank capital and bank risk before the new capital requirement becomes effective.
while market making in derivatives is mainly limited to large banking organizations, small to medium banks have also increased their reliance on fee income. By 2007, the average exposure to off-balance sheet financial vehicles across the euro-zone was around 6% of total loans and it has been reported that the 21 largest euro-zone banks had off-balance sheet exposures in the region of USD 359 billion, or 3% of GDP (ECB 2007). Indeed, according to ECB, risk to euro-zone financial system stability has increased significantly by the end of December 2007 and that the growth in these risky activities is of major concern. Consistent with these concerns, regulators have proposed including off-balance sheet activities as part of bank minimum capital requirements.

Some of the big losses reported in Europe include the failure of Baring bank in 1995, losses (£77 million) of NatWest bank in 1996, unquantifiable derivative losses by UBS reported in 1998 and loss from foreign exchange trades by Allied Irish Bank in 2001-2002. Off-balance sheet activities (OBS) are also observed outside Europe. In the USA, the majority of large banks are involved in off-balance sheet activities. For example in 2003, 530 of over 7800 US banks held the off-balance sheet derivatives exposure while the largest 25 banks held 99.5% of the derivatives outstanding. In 2001, J.P Morgan and Chase Manhattan were exposed to USD 2.25 billion on credit derivatives. Moreover, US banks total loan commitment grew from USD 2000 billion to USD 5000 billion from 1994 to 2003 and in 2005, 80% of all commercial and industrial lending in USA was made under loan commitments. In Australia the OBS activities increased from only a fraction of GDP (0.50% in 1995) to 1.05% in 2006.

The recent debate on market discipline raises concern as to its effect on bank risk. Market discipline is a market based incentive in which investors in bank liabilities such
as subordinated debt and uninsured deposits penalize banks for taking excessive risk. These market based disciplinary tools can make risk-taking by the banks more costly. For example, policy initiatives have included mandatory issue of subordinated debt (Evanoff and Wall 2002). The Basel Committee on Banking Supervision (BCBS) also supports the use of market discipline as banking activities become increasingly complex. The revised Basel Accord II incorporates the view to encourage more disclosure in Pillar 3 in order to strengthen market discipline. Hence, it becomes critical to evaluate whether market discipline is related to bank risk.

It has been argued that subordinated debt has the most influence on major bank credit supply (Horiuchi and Shimizu 1998). For example, Japanese banks in the early 1990s issued subordinated debt to support their declining capital base. This helped them to recapitalize in the face of increasing non-performing loans. From a banker’s view point issuing subordinated debt may be a convenient substitute for direct recapitalization through the issuing of stock which can entail substantial agency cost under information asymmetry (Myers and Majluf 1984). However, while large banks are engaged in issuing subordinated debt it may be difficult for small banks to issue subordinated debt. This makes it even more crucial to ascertain the relation between bank risk and subordinated debt to better understand whether subordinated debt can be treated as a substitute to bank capital.

1.2.4 Impact of Economic and Monetary Union (EMU)

Although the literature dealing with European banks provides little guidance as to

\[8\] Japanese bank tier II capital included 47% of subordinated debt.
the expected impact of EMU on listed banks, Allen and Song (2005) argue that some fundamental economic changes accompany EMU. In particular, they find that euro-zone banks, compared with banks, in Asia or the USA, exhibit greater levels of financial integration with the formation of EMU. It is important to analyze the impact of EMU on bank equity risk because the banks play a key role in the allocation of resources, mobilization of savings, and diversification of risk (Williams and Gardener 2003). These institutions have an important impact on the profitability of investment and productivity of an economy (Francis and Hunter 2004).

Given the relevance of the above factors on bank risk taking, there is a gap in understanding of the determinants of bank risk both in European banking industry as well as in the international banking literature. This study focuses on this gap by investigating the relation that exist between charter value, capital adequacy, off-balance sheet activities, market discipline and bank risk (both equity risk and credit risk). A gap in the literature also exists in relation to the structural changes in European bank equity risk that occurred with the formation of EMU. The research question, data, methodology and findings and contribution and policy implications of this study are discussed in the following Sections.

1.3 RESEARCH QUESTIONS

As mentioned previously in Section 1.1, this thesis investigates the determinants of bank equity risk and credit risk. With regard to the determinants of bank equity risk, the key research aim is to assess whether bank systematic risk, total risk, idiosyncratic risk, interest rate risk and credit risk are influenced by bank regulation (bank capital and charter value), market discipline and off-balance sheet activities after controlling for
other bank specific and country specific factors. Further, it examines the changes in bank equity risk with a fundamental change in an economic system, Economic and Monetary Union (EMU). The analysis focuses on banking in Europe as well as across the world. Thus, the first set of research questions that this thesis addresses are:

RQ1A: Do bank regulation, off-balance sheet activities, market discipline and explain the bank risk, in particular equity risk and credit risk?

RQ1B: Does bank risk sensitivity to bank regulation, off-balance sheet activities and market discipline change with creation of the Economic and Monetary Union (EMU)?

The second research question assesses the impact of structural change in bank equity risk that occurs with the formation of Economic and Monetary Union (EMU). The increased number of consolidations and concentration in the European banking industry further motivates this study. The main focus is to explore whether bank equity risk, particularly in the euro-zone countries, increased or decreased with the formation of EMU. Thus the second research question addresses the impact of EMU on bank risk:

RQ2: Is there a structural change in European bank equity risk with the formation of Economic and Monetary Union (EMU)?

1.4 DATA, METHODOLOGY AND FINDINGS

This section discusses data, methodology and the empirical findings. Section 1.4.1 discusses the data and methodology considered in this study. Section 1.4.2 presents a summary of the findings of the three empirical analyses.
1.4.1 Data and methodology

With respect to the two research questions discussed earlier in Section 1.3, a large amount of data has been collected from the BankScope and Osiris database provided by Bureau Van Dijk and Compustat. This data is then matched with market information extracted from DataStream International from Thomson Reuters. Ultimately, there is a focus on listed bank shares across 36 countries. In relation to the first research question (RQ1), cross-country bank-level data, over the period from 1996 to 2005, is used in analysis of bank equity risks and bank credit risk. A range of financial institutions are considered including bank holding companies, commercial banks, cooperatives and savings banks across 15 Western European countries (Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Norway, Spain, Sweden, Switzerland, and the United Kingdom). With respect to the world analysis, 36 countries are examined in addition to the Western European countries. The initial bank-year observations collected from BankScope resulted in a total sample of 7,843. However, the final bank-year sample is reduced to 4,680 with the loss of 3,163 observations due to the lack of market discipline information, particularly for US banks.

The fundamental assumption for consistency of least squares estimators is that model residuals are uncorrelated with the regressors. However, if this assumption fails the OLS estimator is inconsistent. Considering, bank capital and charter value could be endogenous, two stage least squares (2SLS), pooled-OLS with both lagged bank capital and lagged charter value and pooled-OLS analysis (considering bank capital and charter value as exogenous variables) are all used in the analysis.

In relation to research question 2 (RQ2), a test for structural change in bank
equity risk is conducted for the major banks in both euro-zone and non-euro-zone Western European countries. The study constructs a sample of 95 euro-zone European banks and 85 non-euro zone European banks from the DataStream International database for the end of the period from January 1995 to April 2006.

1.4.2 Summary of findings

The following discussion focuses on some of the major findings on European bank risk analysis, research question 1 (RQ1A and RQ1B) and research question 2 (RQ2) as mentioned in Section 1.3.

The empirical results indicate the relevance of including off-balance sheet activities in the calculation of bank capital for regulation purposes. More specifically, the findings show that higher the off-balance sheet activities the higher are bank equity risk and credit risk. Further, there is support for the argument that bank capital is non-linearly related to bank systematic risk and credit risk. This finding is consistent with the theoretical work of Calem and Rob (1999) suggesting that banks initially reduce risk with the increase in bank capital but at higher levels of capital, there is a tendency for banks to take on higher levels of risk.

Regulators often argue that non-insured deposits or creditor claims can encourage creditors to monitor bank risk behavior. Creditors can impose market discipline, particularly, on risky institutions through withdrawal of deposits, requiring collateral for guarantees against deposits or seek higher interest rates corresponding to risk. Yet, the findings from this thesis suggest that market discipline may not be related to the equity and credit risk measures used in this thesis in the way expected by regulators.
There is mixed evidence of charter value disciplining bank risk. Although there is evidence of a disciplinary role with regard to credit risk, this disciplinary role diminishes with regard to equity risk (total risk, systematic risk and idiosyncratic risk).

Size plays an important role in explaining bank risk levels. It would appear that large banks are more capable of diversifying idiosyncratic risk and credit risk both geographically and by industry compared to small banks. However, it is also evident that large banks differ from small banks in the composition of their asset portfolio and thus large banks have higher total risk and systematic risk compared to the small banks.

Further, European commercial banks exhibit greater credit risk, systematic risk and total risk compared to other bank classifications. It is also apparent that euro-zone banks exhibit lower equity risk and credit risk than non-euro zone European banks.

Research question 1 (RQ1A), is also examined by extending the analysis to a broader sample of international banks. Some of the major findings are discussed below. This broader analysis provides evidence, bank around the world show that higher risk is associated with evolving and expanding bank activities. Thus, off-balance sheet activities are associated with higher equity risk and credit risk and this effect is generally evident in regions like Asia-Pacific, Eastern Europe, Western Europe, Middle-East and Africa (MENA) and North America.

The findings from the world analysis confirm that charter value deters banks from increasing credit risk. Similar results are evident in separate regional analysis (Asia-Pacific, Middle East and Africa, North America and Western Europe). With regard to equity risk (systematic risk, idiosyncratic risk and total risk), banks, in the Middle-East
and Africa region behave as if they charter value has some disciplinary effect. Yet, it is evident that the disciplinary role of charter value diminishes with regard to equity risk in regions like Eastern Europe, North America, South America and Western Europe.

The empirical evidence in this thesis suggests that higher capital levels are associated with reduced bank equity risk and credit. This result provides some support for capital regulation by various regulatory authorities. This finding is observed in the world analysis as well as in the separate regional analysis, particularly, the Asia-Pacific, Middle-East and Africa, North America and Western European regions. The world analysis also supports the existence of a non-linear association between bank capital and systematic risk. There is no appreciable evidence of non-linearity with regard to total risk and idiosyncratic risk in either the world analysis or separate regional analysis. Finally, bank capital is negatively related with credit risk particularly, in the regional analysis for Asia-Pacific, North America and Western Europe.

With regard to total risk, the world analysis supports the argument that because subordinated debt and interbank deposits are not explicitly insured, investors will demand a higher return from banks that take on more risk. Thus, there is a market disciplinary role of uninsured deposits. Similar evidence is also observed for idiosyncratic risk and credit risk. The regional analysis also presents similar findings with regard to equity risk in Middle East and Africa region. Developed economies including North America and Western Europe experience the market discipline effect of subordinated debt and interbank deposits with respect to systematic risk and credit risk. However, there are some contradictory findings across the regions.

Large banks tend to exhibit greater levels of systematic risk in this analysis. This
finding is evident both in world analysis and regional analysis, particularly, Asia-Pacific, Middle-East and Africa, North America and Western European regions. Similar evidence is also observed with regard to total risk and idiosyncratic risk. Further, with regard to credit risk, the world analysis supports the argument that large banks are more capable of reducing credit risk. This finding is also observed in Asia-Pacific, South America and Western European regions. The findings indicate that large bank in the transition (Eastern Europe) and developing (Middle East and Africa) economies exhibit greater levels of credit risk, suggesting that these economies may provide insufficient access to capital markets.

Deposit insurance is associated with increased bank equity risk and credit risk. This finding is evident in both the world analysis and the regional analysis. Further, market-based systems tend to have riskier banks on average with evidence at the regional level particularly for Asia-Pacific region. Nevertheless, banks in market-based systems within European tend to be less risky on average with regard to equity risk.

It is also found that commercial banks exhibit lower total risk and idiosyncratic risk in the world analysis as well as in regional analysis. North American commercial banks are also more aggressive in the credit market compared to their counterparts in Asia-Pacific, Eastern Europe and South American regions. Finally, the empirical results suggest that common-law country banks exhibit greater equity risk and credit risk.

In answer to research question 1 (RQ1B), it is evident that while bank charter value decreased in the post-EMU period, bank capital increased in the post-EMU period. Likewise, the importance of bank off-balance sheet activities and uninsured deposits increased in the post-EMU period. In general, it is evident that the formation of the EMU
has had an impact on the sensitivity of bank risk to some of the key variables included in
the model though the variation in the findings is associated more with changes in the
magnitude of coefficients rather than their sign.

The findings relating to research question 2 (RQ2), indicate that there is a decline
in bank risk across euro-zone countries with the formation of EMU. It is interesting to
find that total risk declined in 70% of the euro-zone banks in the sample with a
statistically significant decrease in total risk observed for 51% of the banks. Similar
findings are also observed for idiosyncratic risk and systematic risk. These results are
robust to different test specifications. Moreover, consistent with some spill-over effects,
the results show a decline in bank equity risk in neighboring non-euro-zone European
countries.

1.5 CONTRIBUTIONS AND IMPLICATIONS

As far as it could be ascertained, this is the first study to test for structural change
in European bank equity risk with the formation of EMU in 1999. The period is marked
by increasing competition, changes in regulation, and increased numbers of mergers and
acquisitions both in euro-zone and non-euro-zone countries. With regard to the
determinants of bank equity risk and credit risk, as far as it could be ascertained, no prior
study has examined the effect of bank regulation (bank capital and charter value), off
balance sheet activities and market discipline on bank risk across the world with
additional regional analysis This study explores the impact of bank capital and charter
value on bank risk. Moreover, few studies have attempted to compare the factors
explaining bank equity risk across the pre-EMU (before 1999) and post-EMU (post 1999)
periods. This study also provides an attempt to test for changes in the importance of the
factors affecting bank equity risk with the formation of EMU.

Market based risk measures provide a clear view of the impact on risk of various bank-specific factors such as bank capital, charter value and market discipline. This study also considers credit risk using an accounting based risk measure, to capture this bank-specific characteristic. Although some argue that accounting based risk measures are backward-looking (Stiroh 2006), credit risk is an important risk measure for the banking industry and has became more important since the Basel Accord I came into place.\(^9\) Moreover, banks across the world have increased their exposure to credit risk and while bank lending has expanded, loan loss provisions have declined and credit standards have not been tightened.

This study is perhaps the first to provide international evidence of a non-linear relationship between bank risk and bank capital. Based on the theoretical underpinnings proposed by Calem and Rob (1999), this study hypothesizes that banks with low capital tend to reduce risk as capital is increased though if capital is further increased risk will eventually start to increase with further capital increases.

The answers to the two research questions mentioned earlier in Section 1.3 should prove useful to policymakers, bank regulatory bodies and supervisory agencies that exercise regulatory authority over financial institutions and also to potential bank investors as well as academics. Particularly for European banks, policymakers should perhaps focus on gaining a better understanding of what European bank capabilities

\(^9\) From 1988 which required banks to put greater emphasis on the banks’ internal credit risk measures Yet, the revised version, Basel Accord II proposed in 2000, recognizes the role of the market, and this leads to banks adopting capitalization level consistent with risk profile (Sironi and Zazzara 2003).
helped them to reduce equity market risk while adapting to a rapidly changing economic climate. From the point of view of EMU, the major policy implication of this analysis is perhaps one of unintended consequences. While there was little academic discussion concerning the impact of EMU on the banks, it appears that EMU has tended to reduce European bank equity risk. An important exception is Germany.\textsuperscript{10}

Analysis of the behavior of banks across the world provides policymakers with further insight into the impact of capital on bank risk. This may be of interest to regulators who use bank capital in their management of risk. The results also reveal that off-balance sheet activities increase bank risk and hence with the banks around the world moving towards greater levels of fee income generating activity, investors and policymakers need to seek more transparency regarding bank non-interest income generating activity. Further, evidence on market discipline suggests that subordinated debt may not be a good substitute for bank capital. Indeed, subordinated debt may not be particularly useful in managing agency problems. It appears that banks may engage in excessive risk taking even when subordinated debt levels are high.

1.6 STRUCTURE OF THESIS

This section outlines the structure of the remainder of the thesis. Chapter 2 presents a critical review of both theoretical and empirical studies of bank risk for European banks and banks around the world. This discussion further highlights research

\textsuperscript{10}Evidence suggests an increase in bank equity risk for the German banking industry. Germany is dominated by Sparkassen-Finanzgruppe which includes savings and Landesbanken. This peculiarity of the German banking system is said to have limited bank consolidation, lowered market concentration, and facilitated continuing fragmentation in the market and may well explain the risk increases that is observed in this study.
gaps in the literature and formulates hypotheses relating to the research questions.

Chapter 3 discusses the empirical research design used to test these hypotheses. It starts with sample selection including, data source and sampling procedures. It then presents the selected variables used in hypothesis testing. It also provides discussion on the estimation techniques used in the analysis. The chapter concludes with univariate analysis, including descriptive statistics and pair-wise correlation analysis for the variables used in later analysis.

Chapter 4 provides the first empirical analysis and this focuses on research question 1(RQ1A and RQ1B) with respect to European banks. This is followed by discussion of robustness analyses and a summary of the results.

Chapter 5 documents the results from the empirical analysis relating to research question 2 (RQ2). This chapter focuses on tests for structural changes in bank equity risk for both individual banks and bank portfolios. Again robustness analyses are then reported and a summary concludes the chapter.

Chapter 6 discusses the final empirical analysis. This focuses on the first research question but uses a large sample covering banks drawn from across the world. Discussion of the results and robustness tests are followed by a summary at the end of the chapter.

Finally, Chapter 7 summarizes the thesis. It revisits the research questions, and provides a synopsis of the hypotheses, methodology and findings. The academic contributions and policy implications of the findings are then identified. The chapter ends with a discussion of the limitations of the study as well as identification of directions for future research.
CHAPTER 2

LITERATURE REVIEW AND HYPOTHESES

DEVELOPMENT

2.1 INTRODUCTION

This chapter focuses on the literature and hypothesis development in relation to the two research questions developed earlier in Chapter 1. This chapter is structured into six sections. Section 2.2 presents a theoretical discussion on bank risk theory and evidence. Section 2.3 discusses the determinants of bank risk. Section 2.4 discusses other variables such as size and additional bank-specific and country-level variables. Section 2.5 identifies determinants of bank risk with the formation of EMU. Section 2.6 focuses on the impact of EMU on European bank risk. Finally, Section 2.7 concludes the Chapter.

2.2 BANK RISK THEORY AND EVIDENCE

Banks are defined as financial intermediaries as they provide liquidity services to depositors in the form of liquidity insurance (Diamond and Dybvig 1983). As an intermediary, a bank also designs securities to protect uninformed investors from the costs they incur when trading with investors who have superior information (Gorton and Pennachi 1990). Further, banks provide monitoring services as they are delegated monitors for investors and thus mitigate duplication of monitoring costs (Diamond 1984). Economies of scale, in terms of savings in screening and monitoring costs due to diversification, may also allow large banks to reduce risk relative to small banks (Diamond 1984; Boyd and Prescott 1986; Williamson 1986).
Bank shareholders are subject to limited liability and benefit from upside risk and are protected from downside risk. Yet, the bank depositors are generally entitled to an implicit and explicit safety net. The numbers of bank failures in past decades have created a debate over the risk portfolio of the banking industry. It is well known that banks prefer to invest in more risky assets because of inappropriate pricing of deposit insurance. Increased attention has been directed toward bank motives to undertake risk as well as possible changes in regulation to maintain stability in the banking system (Kim and Santomero 1988).

Analysis of the moral hazard problem arising from the classical agency conflict between shareholders and debt holders in a levered firm is the first step in explaining bank shareholder incentives for risk taking. This moral hazard problem refers to the possibility that the agent (i.e shareholders) may take actions *ex-post* that are a detriment to the principal (i.e. debtholders). Banks have small dispersed depositors (debt holders), who cannot restrain bank shareholders from undertaking risky investment by initiating “complete” debt contracts on an *ex-ante* basis due to information asymmetry (Dewatripoint and Tirole 1994).

Further, with respect to bank risk, bank deposit insurance has proven successful in protecting banks from runs, but this is not without cost, arising from the moral hazard problem. Deposit insurance protects depositors but diminishes the depositor’s incentive to monitor the bank and to demand an interest payment proportionate to the bank risk. Further, the banks generally pay a flat rate premium under deposit insurance but do not internalize the full cost of risk and thereby tend to take on excessive risk.

A number of theoretical papers suggest that banks take less risk in absence of
deposit insurance. Further, Kareken and Wallace (1978) argue that under the Federal Deposit Insurance Corporation (FDIC) type deposit insurance scheme, where bank liabilities are insured, the banking industry is inclined to hold more risky assets. One of the regulatory requirements within these schemes is the requirement to hold a minimum capital to asset ratio. Thus, the authors argue this regulation in itself cannot reduce the risk of bankruptcy though regulation is a necessary support to deposit insurance schemes. Ronn and Verma (1986) suggest that in absence of deposit insurance, riskier banks incur a higher cost of funding via higher deposit rates. This higher cost of funding acts as “built-in market-regulation” which provides incentive to limit excessive risk taking by banks.

The bank failures and losses to the Federal Deposit Insurance Corporation (FDIC) in US have increased sharply and low capital ratios have proven to be sustainable only under increased government intervention (Kaufman 1991). A majority of the literature on deposit insurance analyses whether the flat rate premium charged by the Federal Deposit Insurance Corporation (FDIC) in US represents the fair value of the insurance. For example, Merton (1977) shows that increased risk is achieved through increased asset risk or decreased capital to asset ratio. Merton’s (1977) argument is based on the premise that markets are complete and the provider of deposit insurance has full knowledge of the risk of the bank’s assets. Under this situation, there is no question of bank run or panic. Merton (1977) analyzes the bank moral hazard problem associated with bank deposit insurance using an option pricing model. In this approach deposit insurance is viewed as a put option written on the value of the bank’s assets with a strike price equal to the promised maturity value of its debt. When the insurance risk premium is risk insensitive,
the bank can increase the value of the put option by increasing asset risk or decreasing the capital to asset ratio. Thus, “fair” deposit insurance is equal to the value of the put option. In contrast, Chan, Greenbaum and Thakor (1992) argue that, under information asymmetry, the insurance provider requires that banks maintain certain capital to asset ratios and that the banks charge a given insurance premium per unit of deposits. In the presence of adverse selection, it is almost impossible to set incentive compatible deposit pricing because banks become indifferent to their capital structure when insurance is priced fairly. Thus, the banks prefer a lower level of insurance premium for any positive level of deposits. This results in high risk institutions choosing contracts similar to those chosen by low risk institutions as long as these institutions choose a positive level of deposits.

Buser, Chen and Kane (1981) argue that the explicit deposit insurance premium charged by FDIC is deliberately under-priced and that bank capital regulation and other regulations and supervisory activity are put in place with the intention of serving as an additional implicit premium. Yet, Marcus and Shaked (1984) using an option-pricing based model, found empirical evidence of over-pricing on the part of the FDIC. Nevertheless, economists have argued in favour of risk-adjusted deposit insurance as it proves to be more efficient and more equitable than the flat rate premiums (Ronn and Verma 1986).

2.3 DETERMINANTS OF BANK RISK

This section discusses the literature and develops the hypotheses in relation to research question 1 (RQ1). In the following sub sections, bank discipline measures including charter value and bank capital are discussed. These measures are relied upon to
manage the moral hazard problem associated with deposit insurance schemes as
discussed in Section 2.2. Next, the literature and hypotheses in relation to off- balance
sheet activities and market discipline are covered.

2.3.1 Charter/franchise value

Bank charter value is defined as the present value of the future profits that a bank
earns as a going concern (Demsetz, Saidenberg and Strahan 1996). Charter value helps to
reduce the moral hazard problem in relation to an explicit or implicit safety net (Acharya
1996). Consistent with this argument, it is evident that charter value has a negative
relationship with total risk, systematic risk and idiosyncratic risk (Demsetz, Saidenberg
and Strahan 1996; Anderson and Fraser 2000; Konishi and Yasuda 2004).

In contrast, other studies identify a positive relationship between charter value and
bank risk. Perhaps, this positive relationship indicates the possibility that charter value
captures growth opportunities. Indeed, a bank’s charter value may originate from taking
on more risky, though positive NPV, activities and so if limits are placed on individual
bank risk this could restrict the bank’s charter value (Saunders and Wilson 2001).

Charter value, which varies across banks, can only act as an efficient tool when it
is complemented with effective regulation (Galloway, Lee and Roden 1997; Park 1997).
Thus, charter value is not a substitute for bank regulation and if less regulation
encourages banks to build-up charter value this could have an adverse impact on the
banking sector. It is evident that bank risk taking increased with deregulation in the US in
the 1980s and the 1990s.

Empirical studies provide an alternative explanation for this positive association
between charter value and bank-specific risk. It is argued that this reflects the impact of financial liberalization and increased competition which may have diminished the disciplining effect of charter value (Marcus 1984; Keeley 1990; Hellmann, Murdock and Stiglitz 2000; Matutes and Vives 2000). For instance, Marcus (1984) and Keeley (1990) state that higher charter value makes it easier for regulators to prevent banks from taking advantage of deposit insurance. US banks during the 1980s increased risk to recover from bank losses that damaged their capital level and to deal with competition that reduced their bank charter value. Further, González (2005) demonstrate that banks in countries with fewer regulatory restrictions have higher charter value which provides banks with an incentive to decrease risk particularly, credit risk and total risk. Lower charter value encourages banks to increase risk, particularly in countries with strict regulation. Hence, a private incentive for banks to act prudently appears to be absent in highly regulated countries where regulators actively limit bank opportunities to undertake risk.

It has been also argued that ‘excessive competition’ may lead to socially undesirable events such as bank runs, panics and, eventually, banking crises leading to overall financial instability (Boyd and de Nicolo 2005). Competition may also tend to diminish bank charter value\(^\text{11}\) (Staikouras and Fillipiaki 2006). There is more recent evidence of a negative relation between charter value and risk. While increased competition has been noted among the Spanish banks with liberalization of the European banking industry, the greater level of European bank competition accompanying liberalization has been associated with a reduction in European bank charter value as well

\(^{11}\text{Maintenance of bank charter value may act to discipline banks and avoid excessive risk taking.}\)
as increases in bank risk taking (Salas and Saurina 2003; Gropp and Vesala 2004). Similar results are also observed in the US banking industry (Galloway, Lee and Roden 1997; Park 1994). Yet, Stolz (2005) does not find any evidence that increased competition led to erosion of charter value or increased bank risk taking by European banks. The findings show that while charter value fell, banks raised their capital buffers such that increasing competition did not appear to have weakened the European banking industry.

While there are divergent views with respect to charter value as a bank disciplinary mechanism the first testable hypothesis related to research question 1 (RQ1) is stated as follows:

**Hypothesis H1:** Bank risk (equity risk and credit risk) decreases with charter value.

### 2.3.2 Capital adequacy requirement

For the past two decades bank capital regulation and supervision have been addressed by both academics and policymakers. The focus is on the relationship between bank capital and bank risk. Given moral hazard, banks can enhance shareholder wealth by increasing the return of their portfolio beyond that which they would choose in an unprotected environment (Milne and Whalley 2001). However, where deposit insurance is in place, it is generally accepted that banks invest in higher risk portfolios in order to achieve greater returns, and so the regulators require banks to maintain a capital buffer to allow the banks to absorb greater losses associated with these riskier portfolios. Thus, the development of risk-based capital regulation provides an upper bound on the probability of insolvency and that the weights attached to bank capital are independent of bank
preferences which provide an effective means of meeting regulator safety goals (Kim and Santomero 1988; Furlong and Keeley 1989; Keeley and Furlong 1990; Rime 2001). Yet, risk based capital standards can contribute towards a credit crunch where banks are encouraged to invest in government securities or mortgaged backed securities which require low levels of capital rather than making business loans which have higher capital requirements (Kaufman 1991).

The effect of capital requirements on bank asset portfolios has been challenged by Furlong and Keeley (1987, 1989) and Keeley and Furlong (1990). The authors argue that imposition of tighter capital controls may decrease total risk for well-capitalized banks and leave the optimal asset composition unchanged. Tightened bank capital could motivate some banks to lower their capital requirement and compensate this lower capital from investments in less risky assets (Park 1997).

The preservation of higher capital requirements for banks is not without dispute. For example, higher capital levels may induce banks to increase asset portfolio risk and the probability of default, thereby defeating the original purpose of capital controls (Kahane 1977; Koehn and Santomero 1980; Orgler and Taggart 1983; Gennotte and Pyle 1991; Shrievies and Dahl 1992; Berger, Herring and Szegő 1995; Besanko and Kanatas 1996; Blum 1999). The authors reason that regulatory constraints on bank leverage lead to substitution from debt into more risky assets. Thus, banks that maintain increased capital due to regulation can attain their desired level of total risk by increasing asset risk.

Thus, a higher level of capital buffer may result in bank shareholders being exposed to greater levels of downside risk.
This view suggests a positive relationship between bank capital and risk among banks which operate at or near the minimum regulatory capital requirement. This is also evident in a dynamic framework; a capital requirement can actually increase risks thereby increasing the insolvency risk of banks (Blum 1999). Thus, capital adequacy requirements reduce bank profits and, if future profits are low banks may not be motivated to avoid default (Blum 1999). However, a contrary result occurs when applied to non-US banks. For example, Rime (2001) applied a modified version of the model developed by Shriever and Dahl (1992) to Swiss commercial banks and they found that while regulatory pressure has a positive and significant impact on bank financial leverage there was no discernable impact on bank risk taking. Moreover, Swiss banks exhibit a positive and significant relationship between changes in risk and changes in bank capital to total assets but there is no relationship observed between changes in risk and changes in risk based bank capital. These results suggest that banks may choose to increase their bank capital to total assets ratio following an increase in bank risk to keep their risk-based bank capital constant. Hence, it has been argued that setting minimum capital standards may improve bank stability but it increases potential costs, some of which may be rather subtle, and this will lead to inefficiency (Bhattacharya, Boot and Thakor 1998).

The capital requirement or ‘forcing policy’ allows regulators to impose constraints on bank use of financial leverage (Boyd and de Nicolo 2005). The Basle standards are almost universally employed by bank regulators although a continuing

13Alternatively, the leverage effect of capital increases the value of equity. So, in order to raise the equity tomorrow it may be optimal for the bank to increase risk today.
debate concerns the effectiveness of such policy standards (Boyd and de Nicolo 2005). For example, Blum (1999) and Stanton (1998) show that capital adequacy regulation may actually increase bank risk. Blum (1999) identifies two major effects of this regulation: first, capital requirements may decrease profits, which may motivate banks to increase risk as these banks have less to lose in the event of default and, second, the leverage effect of capital increases the value of bank equity and encourages the bank to invest in more profitable though more risky assets. Similarly, Calem and Rob (1999) derived a more complex and novel relationship between bank capital and bank risk taking. Under a dynamic model, where bank capital varies among individual banks the model shows a U shaped relationship between bank capital and bank risk which implies that both undercapitalized and well capitalized banks take more risk. Undercapitalized banks can afford to increase their risk level because on default they can easily transfer the costs of default to the authorities. The risky investments of these banks are subsidized, which reflects the moral hazard problem arising from deposit insurance. Well-capitalized banks increase risk only if they believe that the probability of bank default is very remote. The authors argue that risk based capital standards lead well-capitalized banks to increase both risk and capital to meet the standards. This theoretical argument is also supported by prior empirical work for US banks (e.g., Berger and Udell 1994; Hancock and Wilcox 1994).

Early empirical work by Saunders, Strock and Travlos (1990) find no significant relationship between bank capital and bank risk (total risk, idiosyncratic risk, systematic risk and interest rate risk) during the period, 1978-1985, for U.S. bank holding companies. In contrast, Kwan and Eisenbeis (1997) find that interest rate risk is
positively and significantly related to bank capital while credit risk is negatively related to bank capital irrespective of bank size. Similar results are also observed for Japanese and Australian commercial banks (Dennis and Jeffrey 2002; Konishi and Yasuda 2004) and for US bank holding companies (Galloway, Lee and Roden 1997).  

From the above discussion it is evident that, capital regulation is designed to reduce bank risk. However, it is also feasible that following Calem and Rob (1999), bank risk may initially reduce with increases in bank capital, but as the capital buffer builds-up banks may eventually choose to increase their risk levels. Thus, the two sets of testable hypotheses with respect to bank capital in relation to research question 1 (RQ1) is as follows:

**Hypothesis H2A**: Bank risk (equity risk and credit risk) decreases with bank capital

**Hypothesis H2B**: Bank risk (equity risk and credit risk) initially decreases and then increases with increases in bank capital

2.3.3 Off-balance sheet items as non-interest generating activity

Off-balance sheet activities are a contingent liability to the banks and it becomes important for the banks to honor such guarantees (Boot 2003). This non-interest generating activity includes commercial letters of credit, loan commitments and stand-by letters of credit. Although, financial institutions are involved in providing traditional banking services and interest generating activities, recently, the banks particularly in developed economies have moved towards taking on greater levels of off-balance sheet

14This result may imply either the regulatory authorities have met the desired goal of regulating bank capital without increased risk or that Japanese banks have changed their attitude towards bank risk due to the credit crunch that occurred during 1993-1999.
activities. These activities help banks, particularly in times of increased competition, to expand their revenue sources without altering their capital structure (Yildirim and Philippatos 2007a). Banks with higher levels of off balance sheet items are found to be more cost and profit efficient (Yildirim and Philippatos 2007a) and it has been argued that off-balance sheet exposures promote a more diversified, margin generating asset-base compared to deposits or equity financing (Angbazo 1997). Off balance sheet exposures may also induce banks to reduce their risk (total risk and systematic risk) (Brewer, Koppenhaver and Wilson 1986; Lynge and Lee 1987; Boot and Thakor 1991; Hassan, Karels and Peterson 1994; Angbazo 1997). Similarly, Esty (1998) argues that contingent liabilities can reduce equity and asset volatility as they have an impact on asset allocation and bank capital requirements. Thus, even at low levels of net worth (charter value) the banks with lower level of contingent liabilities hold a smaller proportion of risky assets.

The increase in the amount of off-balance sheet activities and the increased escalation in bank failures have raised concern about the possible relationship that exists between bank risk and off-balance sheet items. US commercial banks exhibited a positive correlation between bank interest rate risk and off-balance sheet activities including letters of credit, options and net securities lent (Angbazo 1997). This supports the moral hazard hypothesis that off-balance sheet activities increase bank risk (Wagster 1996; Lynge and Lee (1987) and Hassan, Karels and Peterson (1994) focused on US commercial banks and found that off-balance sheet activities are significantly negatively related to bank total risk but they found no relationship with bank systematic risk. Brewer, Koppenhaver and Wilson (1986) found that standby letters of credit reduce systematic risk while loan commitments and commercial letters of credit do not affect systematic risk.
In essence, based on increased bank competition, and divergent capital rules, the banks across the world have shifted towards non-traditional activity. These activities do not appear on the balance sheet and they involve the creation of contingent assets and liabilities. Hence, due to the nature of these activities and the fact that they have become increasingly widespread it is difficult for investors and regulators to identify the actual level of risk a bank faces in a given period of time. Given the potential losses (Barings bank failure in 1995 etc.) that can be derived from excessive off-balance sheet activities, the regulator approach has been to incorporate these items in the calculation of capital adequacy requirements. In this regard, the proposed hypothesis in relation research question1 (RQ1) is as follows:

**Hypothesis H3**: Bank risk (equity risk and credit risk) increases with bank off-balance sheet activities.

### 2.3.4 Uninsured liabilities/market discipline

Both regulators and academics consider ‘uninsured liabilities’ of banks as another important market disciplinary device. Two of the critical components of uninsured liabilities are inter-bank deposits and subordinated debt. Inter-bank deposits are the deposits received from other banks that are not covered by explicit or implicit insurance schemes. Almost 70% of unsecured deposits are interbank deposits accounted in the euro-zone (ECB 2005). Likewise, Rochet and Tirole (1996) develop a model of interbank lending which explains that the existence of the interbank exposure and the incentives for interbank monitoring. They further argue that there is a trade-off between the negative
effect on bank risk due to peer monitoring and a positive effect on bank systematic risk due to increased inter-bank linkages.

The European bank subordinated debt market is concentrated. The largest European banks issue subordinated debt on average twice a year and the average ratio of outstanding subordinated debt to total assets is approximately 2%. This debt is traded in an illiquid secondary market, with few infrequent large transactions (Sironi 2003). However, some effort has been put into the implementation of market discipline mechanisms which help to prevent banks from undertaking excessive risk. For example, in the early 1980s a mandatory subordinated debt policy (MSDP) was drafted by academics and regulators and forms part of the 2000 Basel Capital Accord II revised proposal. The importance of market discipline is clear in both the documents.

The arguments supporting subordinated debt are two-fold. First, the yield spreads of subordinated debt contain information about bank riskiness. Second, and more importantly, subordinated debt provides direct market discipline. Subordinated debt holders require a higher premium from riskier banks and thus risky banks face higher costs of debt financing. It is argued that this higher debt financing cost will encourage banks to maintain a lower level of risk (Blum 2002; Nier and Baumann 2006).

The market disciplinary role of subordinated debt is evident as banks move into riskier activities (Morgan and Stiroh 2001). It has been argued that subordinated debt directly affects bank risk through the higher funding costs that riskier banks face and through derived discipline and from the tax benefits of debt (Estrella 2000; Evanoff and Wall 2002). These benefits include; the provision of a signal of bank riskiness or asset quality to market regulators and investors. Based on the signal the banks can lower their
cost of capital and/or increase their capital requirements. Regardless, rational subordinated debt holders require a higher premium from riskier banks as compensation for the higher risk they bear. This in turn means market prices and interest rates should reflect individual bank riskiness.

There are alternate arguments, for example Blum (2002) argues that if a bank is committed to a level of risk then the presence of subordinated debt can help to reduce bank risk but if the bank is not committed to a specific level of risk, the issue of subordinated debt may flag higher risk than under a full deposit insurance regime. This is possible because in the case of default, the banks do not cover the full costs of default due to limited liability. For example, after having set a low interest rate corresponding to a low level of risk, a bank has some incentive to increase its risk. Rational creditors anticipate this behavior and demand a higher interest rate. This higher interest payment induces bank to take even higher risk because the “option to go bankrupt” becomes more valuable. Thus, if a bank can adjust its level of risk in response to changes in interest rates, subordinated debt may actually raise the level of bank riskiness. Demirguc-Kunt and Huizinga (2004) empirically support this argument.

Avery, Terrence and Goldberg (1988) examine the relationship between market discipline and bank risk. They measure bank risk in terms of Moody’s ratings, Standard and Poor’s ratings and the FDIC index. Market discipline is measured in terms of the option-adjusted interest rate spread between subordinated debt and treasury securities for year-end 1983 and 1984. Their results show a weak relationship between Moody’s and Standard and Poor’s ratings and subordinated debt and little relationship with the FDIC index. Similarly, Gorton and Santomero (1990) find little evidence of market discipline
effects in the subordinated debt market. Their study uses contingent claims valuation in order to obtain an explicit pricing model for subordinated debt.

Flannery and Sorescu (1996) criticized the work of Avery, Terrence and Goldberg (1988) and Gorton and Santomero (1990). Flannery and Sorescu (1996) argue that the prior two studies used a relatively small data set focusing on shorter time periods and that bank spreads were fairly homogenous across the banks in early periods such as 1983-1984. Flannery and Sorescu (1996) identified correlation between market discipline and bank risk over a longer time period. They propose that asset risk and leverage should affect subordinated debt in a non-linear manner rather than the linear relationship tested for in previous studies. Finally, they argue that the use of option adjusted subordinated debt measures and Black–Cox’s closed form valuation approach may induce large measurement errors. Flannery and Sorescu (1996) find that both asset quality and market leverage have an impact on subordinated debt while there is little evidence of a relation between interest rate risk and subordinated debt. However, these arguments should be judged with some caution as Calem and Rob (1999) show that subordinated debt may have little impact on the portfolio allocation decision of a well-capitalized bank. Further, Imai (2006) showed that the risk-return sensitivity of bank subordinated debt is closely related to regulatory regime and the conjectural guarantee of uninsured debt. For example in Japan the regulatory regime changes frequently and hence subordinated debt may not be an appropriate regulatory tool in this environment.

Empirical evidence exists in relation to the market disciplinary effect of subordinated debt. For example, Sironi (2003), Gropp and Vesala (2004) and Nier and Baumann (2006) find that subordinated debt investors in the European banking industry,
excluding government owned or guaranteed institutions, are sensitive to bank risk. Nier and Baumann (2006) use a number of market discipline variables including uninsured liabilities (sum of subordinated debt and inter-bank deposits) and they find that uninsured liabilities are positively related to bank capital ratios which create an incentive for the banks to limit their risk of insolvency by choosing a higher capital buffer for a given level of risk.

Hence, market discipline offers a way of enhancing the effectiveness of bank capital regulation at a lower cost as it deters regulatory arbitrage and rewards the bank for managing their overall risk of insolvency (Herring 2004). Based on the above discussion the fourth testable hypothesis in relation to research question 1 (RQ1) is as follows:

**Hypothesis H4**: Bank risk (equity risk and credit risk) decreases with bank uninsured deposits.

### 2.4 OTHER EXPLANATORY VARIABLES

This section discusses other bank-specific variables and macro economic variables used in the analysis of research question 1 (RQ1). The relevant bank-specific determinants are bank size, loan to total assets, dividend yield and operating leverage. The macro-economic variables are the Economic Freedom Index, bank specialization, legal origin, explicit deposit insurance, governance quality (such as creditor rights index and anti-director rights index) and the level of bank development variables (such as bank concentration and net interest margin). Variables also include market liquidity frequently proxied by stock market turnover ratio.
2.4.1 Size

The European banking industry faced profound changes with the merger waves that followed EMU. The most obvious outcome of the mergers and acquisitions that occurred in the period is a sharp increase in the average size of the banking organizations. This leads to the empirical question of whether large banks are more risky than small banks. However, size is one of the motivations for mergers. Another important incentive for bank consolidation is to take advantage of diversification benefits. It is evident that large banks are internally diversified and this provides one means of reducing bank idiosyncratic risk (Konishi and Yasuda 2004; Stiroh 2006). However, diversification does not typically lessen risk (Acharya, Hasan and Saunders 2002). Nevertheless, banks may offset these gains by undertaking riskier activities (like commercial and industrial lending) and by employing more financial leverage. A shift toward risky non-interest generating activity is a way that large banks may choose to apply the benefits created from their internal diversification advantages (Saunders, Travlos and Strock 1990; Boyd and Runkle 1993; Demsetz, Saidenberg and Strahan 1996; Demsetz and Strahan 1997). A similar result is also expected for bank total risk that appears to explain the diversification effect (Stiroh 2006)

Moreover, regulatory environment can affect the relationship between bank size and bank risk. Deregulatory periods can encourage a positive relationship between bank size and bank total risk. Further, the imposition of “too-big-to-fail” policies can increase the incentive of large banks to take on risk during periods of greater regulation (Saunders, Travlos and Strock 1990; Galloway, Lee and Roden 1997). Finally, large banks with greater sensitivity to the general market movements may exhibit a positive relationship
with bank systematic risk (Saunders, Travlos and Strock 1990; Anderson and Fraser 2000). The positive relation between systematic risk and bank size may also result from large banks pursuing a different mix of activities, lending to different sectors and holding less equity capital compared to smaller banks (Demsetz, Saidenberg and Strahan 1996). Based on the above arguments that bank size could have differential effect on bank risk, the two testable hypotheses related to bank size to address research question (RQ1) are as follows:

**Hypothesis H5A**: Bank systematic risk increases with bank size.

**Hypothesis H5B**: Bank credit risk, interest rate risk, idiosyncratic risk and total risk decrease with bank size.

### 2.4.2 Other bank-specific variables

The other variables of concern that form part of the following analysis include the ratio of loans to total assets, dividend yield and operating leverage. It is expected that loans to total assets is positively related to bank risk measures. This is because commercial banks tend to be more aggressive in credit markets (García-Marco and Robles-Fernandez 2008).

Dividend yield could also relate to bank risk-taking. Dividend payments provide a signal concerning bank expectations about future income. Further, it could also indicate high growth banks tend to retain a proportion of their net income which implies that more risky banks will pay less dividends. Accordingly, Lee and Brewer (1987) find that low dividend yield reflects greater bank risk. Hence, in this thesis a negative association between dividend yield and bank risk measures is predicted. With regard to operating
leverage, Mandelker and Rhee (1984) and Saunders Strock and Travlos (1990) consider operating leverage in a similar way to financial leverage with increases in operating leverage resulting in increases in bank risk. Thus, the analysis considers that operating leverage will be positively related to our bank risk measures. Based on the above discussion the following three hypotheses are formulated:

**Hypothesis H6:** Bank risk (equity risk and credit risk) increases with total loans.

**Hypothesis H7:** Bank risk (equity risk and credit risk) decreases with dividend yield.

**Hypothesis H8:** Bank risk (equity risk and credit risk) increases with operating leverage.

### 2.4.3 Macroeconomic variables

There is no theoretical support for a particular relationship between regulatory restrictions and bank risk taking. The Economic Freedom Index (EFI) is used to measure the regulatory restrictions, with higher EFI scores reflecting reduced level of regulation. Higher levels of the EFI may result in greater stability of the banking system through greater diversification. Alternatively, it could reflect banks taking on greater risk where regulation is inadequate (González 2005). Claessens and Laeven (2004) find that lower restrictions lead to higher competition. In turn, this increase in competition can have negative effect on profits and charter value of the banks encouraging greater risk taking.

The hypothesis is developed on the assumption that high EFI scores are associated with deregulation, implementation of legislation such as EU directives in 1992, formation of EMU in 1999 and increasing merger and acquisitions in the European banking industry. Thus, a negative relationship is predicted between bank risk and EFI.

Ownership type or bank specialization could also affect bank risk. The ownership
or bank specialization dummy indicates whether the institution is a commercial bank. Commercial banks are the largest group of depository institutions measured by asset size in Denmark, France, Greece and Spain where as in Italy savings banks prevail. The German banking industry is dominated by Sparkassen-Finanzgruppe which includes savings and Landesbanken. Further, bank holding companies (BHCs) and commercial banks dominate in the U.S. and U.K. respectively. It could reasonably be expected that commercial banks would involve higher bank equity risk, interest rate risk and credit risk compared to other institutions as they do invest in risky loans.

A legal origin dummy variable is also incorporated in the model. The theoretical work by Aghion and Bolton (1992) and Hart and Moore (1992, 1994), proposed that the risk taking behaviour of banks is affected by country legal origin and the prevailing structure in terms of more openness in banking practice. Specifically, in countries with better legal protection the banks have an incentive to take on higher portfolio risk since they face less risk of expropriation by borrowers. In other words, banks can extend more risky loans due to the lower expected loss per loan in common-law countries or British legal origin because of the superior creditor protection in these countries.

Civil-law countries generally provide weak investor protection relative to common-law countries (LaPorta, Lopez-de-Silanes, and Shleifer 1998). Yet, the quality of law enforcement tends to be highest in Scandinavian and German civil law countries and lowest in French civil-law countries while common-law countries fall somewhat between the two groups (LaPorta, Lopez-de-Silanes, and Shleifer 1998; González 2005). Thus, a negative relationship is predicted between bank risk and the legal origin dummy reflecting that, due to strict law enforcement, the civil-law country banks have lower
bank risk compared to common-law country banks.

Another variable of interest is the geographical proximity. It can be reasonably hypothesized that with the formation of EMU, the euro-zone banks have better ability to deal with risk and hence it can be expected that bank credit risk and equity risk will be lower in this region (Haq and Heaney 2009) compared to non-euro zone countries.

Furthermore, the nature of governance quality in a country could also be relevant to bank risk. Hence, following existing literature, this thesis considers two proxies of governance quality that broadly measure investor protection - a creditor rights index and an anti-director rights index (LaPorta, Lopez-de-Silanes, and Shleifer 1998). In countries where shareholder control is greater than managerial control, bank risk, specifically bank total risk and idiosyncratic risk, is considered to be high. This is consistent with the notion that bank shareholders have incentives to take on more risk due to moral hazard problem arising from deposit insurance. Creditor rights are captured using a specific index while an anti-director rights index is used to capture the level of protection provided to minority shareholders relative to managers and dominant shareholders. Thus, this study anticipates that bank equity risk and credit risk negatively relate to both anti-director rights and creditor rights index.

A number of additional country level factors could also be important in relation to bank risk taking such as stock market liquidity, market-based vis-à-vis bank-based

17With respect to research question 1 (RQ1), Bangladesh, Cyprus, Luxembourg and Mauritius have no information on creditor rights index and anti-director rights index. Bulgaria, Lithuania, Morocco, Romania do not have information on anti-director rights index only. Hence, the analysis will be based on a sub-sample of banks.
economy and nature of safety net. Stock market turnover ratio is used to capture stock market liquidity which is crucial for economic growth (Levine and Zervos 1998). This variable captures the proxies for the speed at which information is reflected in the stock price (Demsetz and Strahan 1997; Anderson and Fraser 2000; Konishi and Yasuda 2004). Liquidity has been found to be positively associated with the variance of equity price. Hence, the expectation for the sign of this coefficient is positive suggesting that those banks whose shares are more frequently traded are exposed to a higher level of risk.

Further, the long standing debate on the relative importance of market-based and bank-based systems is also relevant for bank risk analysis. A market (arm’s length)-based versus bank (relationship)-based dummy is incorporated in order to capture this effect. Financial intermediaries are often considered to be delegated monitors who reduce the costs of acquiring and processing information and thus, reduce agency costs (Diamond 1984; Boyd and Prescott 1986) and eliminate wasteful duplication in collecting information. Bank monitoring can also help to eliminate the moral hazard problem (Boot and Thakor 1997; Chakraborty and Ray 2006). Thus, financial intermediaries can promote growth by pooling risks, providing liquidity and monitoring risky innovations (Greenwood and Jovanovic 1990; Bencivenga and Smith 1991; de la Fuente and Marin 1996). It is often argued that market-based systems convey price signals which help firms in making meaningful investment decisions while bank-based systems may lead to encourage weak firms to undertake imprudent investments (Rajan and Zingales 1998, 1999).18 Policymakers have advocated a shift toward financial markets, particularly in

18Market-based systems are observed in USA and UK while Germany and Japan have advocated bank-
Eastern Europe and Latin America, similar to those operating in the USA (Allen and Gale 2000). These considerations suggest the following hypothesis:

**Hypothesis H9**: Bank risk (equity risk and credit risk) is lower in a bank based system than in a market based system.

Two other bank development related variables include net interest margin and bank concentration. Net interest margin provides a control for the degree of efficiency in bank operations. Bank concentration provides a control for competition. Essentially, firms specializing in granting of loans are more exposed to credit risk and, hence, a positive relationship may be expected with net interest margin. Further, banks that assume greater market risk work with higher interest margins as banks require higher premium at the margin. Similarly, the greater the uncertainty on the loans granted (credit risk) the greater will be the margin (Maudos and Fernández de Guevara 2004). Bank concentration ratio can show a positive or a negative relationship with bank risk depending on the intensity of bank competition. A brief literature review is provided for bank concentration and bank risk in Section 2.5.

Every country is subject to some level of implicit safety net. It is observed that in 1995 only 49 countries were subject to explicit deposit insurance schemes while by 2003 the number stood at 87. This increase is particularly evident in Eastern European countries where EU Directives encouraged these countries to adopt explicit deposit insurance. Deposit insurance benefits risky banks if these banks can opportunistically

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\footnote{Increased competition and concentration can lead banks to reduce net interest margin and thereby can reduce credit risk and interest rate risk (Maudos and Fernández de Guevara 2004).}
exploit loopholes in the risk control features of the system to extract net subsidies from tax payers and safer banks which provide implicit capital by accepting responsibility for helping to recapitalize the system (Demirguc-Kunt, Kane and Laeven 2006). Indeed, credible deposit insurance can enhance financial stability by reducing the probability of depositor runs, however, if insured institution capital position and risk taking is not supervised this can lead to instability in the financial system. Demirguc-Kunt and Detragaiche (2002) and Beck and Laeven (2006) argue that deposit insurance is likely to increase banking crises for countries whose contracting environment structure is weaker than countries whose contracting environment is stronger. For example, Mexico introduced a deposit insurance scheme during 1991-2004. The scheme maintained minimum capital regulation but had a weak governance system in place. This encouraged banks to undertake excessive risk which led to higher default rates that required tax-payer bailouts. Bank runs on loss making banks in Germany and the United Kingdom (example Northern Rock) highlighted inadequacies in the European safety net system. Moreover, over-insurance among the EU accession countries could exacerbate moral hazard problems by distorting the incentives of poorly capitalized domestic banks (Nenovsky and Dimitrova 2003). Based on the above discussion, it could be reasonably hypothesized that deposit insurance increases both bank equity risk and credit risk.

**Hypothesis H10: Bank risk (equity risk and credit risk) increases with deposit insurance.**

**2.5 THE IMPACT OF EMU ON THE DETERMINANTS OF BANK RISK AND THE RELEVANT HYPOTHESES**

As mentioned earlier in Chapter 1, no prior research has studied the impact of EMU on determinants of bank risk. Thus, this thesis proposes to fill the gap in the
literature by addressing question “Does bank risk sensitivity to bank regulation, off-balance sheet activities and market discipline change with the creation of the Economic and Monetary Union (EMU)?”

It is evident that the formation of EMU is one of the most dramatic change in the world financial market. Increasing integration is observed not only among the EU countries but also between EU and non-euro-zone European countries. Yet, the focus of the consolidation process has gradually shifted from domestic to cross-border mergers and acquisitions. The banking sector consolidation accelerated in early 1990s and peaked in 2000. It resulted in a reduction of the number of banks and an increase in average size and concentration of the European banking sector suggesting that integration has been significantly stimulated with the formation of EMU (Baele, Ferrando, Hördahl, Krylova and Monnet 2004).

With regard to charter value, deregulation, financial liberalization and increased competition can decrease bank charter value (Marcus 1984; Keeley 1990; Hellmann, Murdock and Stiglitz 2000; Matutes and Vives 2000). Thus, given the discussion above in sub-section 2.3.1 on charter value, it is possible that it may have decreased in the post-EMU period. Further, with respect to bank capital (as discussed above in sub-section 2.3.2) it is reasonable to hypothesize that the importance of bank capital will increase with the formation of EMU due to the forces shaping the world banking industry including consolidation, advances in information and communication technology, new capital adequacy requirement and in case of EMU, the ongoing economic and monetary integration.

The European banks in particular have moved towards increased concentration in
non-traditional banking business (Maudos and Fernandez de Guevara 2004; Carbó and Fernandez 2005). This trend is observed because integration and liberalization of European financial markets has placed considerable pressure on the banks traditional line of business (Goddard, Molyneux, Wilson and Tavakoli 2007). Thus, banks have engaged in re-engineering value chains through securitization of their loan portfolio. For instance, ECB reports the securitization issue amounted to over €245 billion in 2004 of which nearly one half is related to residential mortgages. As a consequence of financial innovation banks conducted a growing proportion of their business activity off-balance sheet. Thus, it is reasonable to hypothesize that with the formation of EMU, off-balance sheet activities have grown in importance. Market discipline (including subordinated debt and inter-bank deposits) is an important mechanism in controlling bank risk (a discussion is provided above in sub-section 2.3.4). Hence, with financial deregulation market discipline increases resulting increase market based monitoring of bank risk. This leads to the hypothesis that market discipline increases in the post-EMU period.

Therefore, based on the above discussion the following hypotheses are formulated:

**Hypothesis H11A**: Bank charter value decreased in the post-EMU period.

**Hypothesis H11B**: Bank capital decreases then increases in the post-EMU period.

**Hypothesis H11C**: Bank off-balance sheet activities increased in the post-EMU period.

**Hypothesis H11D**: Bank uninsured deposits increased in the post-EMU period.

### 2.6 STRUCTURAL CHANGES IN EUROPEAN BANK EQUITY RISK

This section focuses on research question 2 (RQ2). Section 2.5.1 presents the
theoretical and empirical evidence on bank competition and Section 2.5.2 discusses literature in relation to European bank consolidation and diversification and then develops the related hypotheses.

2.6.1 Bank competition-theory and evidence

The commonly held view regarding bank consolidation is that it generates a more concentrated banking system and a less competitive one. However, the literature fell short in providing an unequivocal analytical support to this view. From a theoretical perspective the relationship between bank concentration and bank competition is ambiguous.\(^{20}\) The first theoretical strand is the *structure-conduct-performance paradigm*. This paradigm states that increased concentration facilitates collusion and anti-competitive behaviour (Gual and Neven 1993). The second strand of theory draws on *contestability theory* which argues that a concentrated banking industry can behave competitively if the restrictions on market entry can be surmounted by new entrants to the market (Baumol 1982). This theory stresses that with high price elasticity a contestable market is effectively competitive even if it has a small number of active firms. Finally, the *efficiency theory* states that if a bank enjoys a higher degree of efficiency than its competitors it can adopt two different strategies. First, the bank can maximize profits given the present level of prices and firm size. Second, profit maximization can be achieved through reducing prices, expanding firm size and market share. The most

\(^{20}\)Empirically, Claessens and Laeven (2004) and Schaeck, Cihak and Wolfe (2009) find that concentration and competition describe different characteristics of the banking system. Thus, concentration cannot be a proxy for bank competition, as it gives rise to misleading inferences and measurement problems. For example, measures like the concentration ratio tend to overstate the level of concentration in small countries and become increasingly unreliable when the number of banks is small (Bikker 2004).
efficient banks gain market share and greater bank efficiency leads to market concentration. The contestability theory and the efficiency theory assume that the overall competitive environment does not necessarily depend on the degree of market concentration.

Theoretically, from a bank risk perspective, higher competition may have a harmful impact on financial system stability if it leads to erosion of charter value. Further, while increased competition makes borrowers and depositors better off, bank shareholders are left worse-off (Besanko and Thakor 1993). Hence, greater competition encourages banks to undertake greater risk due to the moral hazard problem associated with a deposit insurance scheme which requires a flat rate premium (Boot and Greenbaum 1993; Cerasi and Daltung 2000; Matutes and Vives 2000). Further, greater competition can lead to an increased likelihood of banking crises (Uhde and Heimeshoff 2009; De Nicoló, Bartholomew, Zaman and Zephirin 2004). However, prudent regulation can reduce bank risk taking incentives. For example, with risk-adjusted deposit insurance premiums, deposit rates and asset risk are lower compared to a flat-rate pricing scheme and thereby banks can credibly commit to a lower cost of fund and lower asset risk (Matutes and Vives 2000; Cordella and Yeyati 2002).

According to the classical “concentration fragility” view it is argued that a concentrated banking system is more likely to display the “too big to fail problem (TBTF)” whereby large banks increase their risk exposure anticipating a bailout (Boyd and Runkle 1993; Hughes, Lang, Mester and Moon 1999; Mishkin 1999). Further, banks with more loan market power could demand high interest rates from their clients. This leads to difficulties in repayment of the loan by the borrowers, thereby exacerbating the
bank moral hazard problem by shifting into riskier activities and possibly choosing riskier clients due to adverse selection (Boyd and De Nicolò 2005). However, it is possible that banks can increase their equity capital or other risk mitigating techniques and hence, prevent charter value erosion (Berger, Klapper and Turk-Ariss 2009).

Empirical evidence of the relationship between bank concentration and financial stability in the banking literature is however, inconclusive. For instance, consistent with the above argument Salas and Saurina (2003) found greater competition among Spanish banks, with the liberalization in the European banking industry, resulting in a reduction in the market power and the economic profits of these institutions. Similar results were also reported for US bank holding companies (Bundt, Cosimano and Halloran 1992; Dickens and Philippatos 1994; Park 1994; Galloway, Lee and Roden 1997). Typically, high competition increases bank costs while lowering their income. This could encourage banks to undertake high risk, high yield projects to recover their lost profit margins.

Several studies also examine the effect of banking market structure on bank risk based on the “charter value hypothesis”. It is suggested that banks try to protect their charter value, created by market power and associated with high concentration, by keeping their risk level low (Keeley 1990). For example, banks in a concentrated local market such as that observed in the US market, have smaller portfolio shares in construction and land development loans, a relatively risky type of lending (Bergstresser 2001). Further, Hellman, Murdock and Stiglitz (2000) argue that regulatory devices such as deposit rate control would increase bank charter values and encourage banks to act prudently. Yet, it is often argued higher charter value increases the opportunity cost of going bankrupt and so bank managers and shareholders may not accept risky investments.
that will reduce their future profit levels (Park and Peristiani 2007).

With regard to the effect of bank concentration, several multi-country analyses support the “concentration stability” view (Allen and Gale 2000; Kwast and De Nicoló 2002; Boyd, De Nicoló and Smith 2004; Demirguc-Kunt and Levine 2006; Demirguc-Kunt and Levine 2007).\(^{21}\) That is, a concentrated banking system with few large institutions is more stable because banks are profitable, well-diversified and easier to monitor and therefore more resilient to the macro economic shocks and liquidity shocks. Yet, it has been argued that competitive environment can help to halt a long term credit crunch (Kaufman 1991).\(^{22}\) Staikouras and Wood (2000), Schaeck and Cihák (2007) and Schaeck, Cihak and Wolfe (2009) examined the impact of bank concentration and competition and bank stability for European banks. Their findings show no evidence of a trade-off between market competition and bank risk taking behavior. However, the banks tend to hold more capital when operating in a more competitive environment. Comparable results are also observed for the US and Canada (Bordo, Redish and Rockoff (1995). However, Hoggarth, Milne and Wood (2000) report a trade-off between competition and stability in a comparative analysis of banks in the U.K. and Germany.

With regard to the risk implication of the EMU, the effect of deregulation on the health of the European banking sector remains an important concern. Although the core objective of the formation of EMU includes increased competition and integration, the

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\(^{21}\)Further, Rhodes and Rutz (1982) found that bank concentration is negatively related to the risk proxies including non-performing loans ratio, debt-to-assets ratio and profit volatility.

\(^{22}\)Thus, a competitive, profitable banking industry that is not excessively risky should be able to attract capital (Kaufman 1991).
European banking literature provides little guidance to the impact of EMU on euro-zone bank equity risk.\textsuperscript{23} Greater competition through financial deregulation and integration may affect bank incentives for prudent risk taking (Smith 1984; Keeley 1990; Repullo 2004). Compared to banks in other countries, US banks operate in a more deregulated environment with the enactment of Depository Institutions Deregulation and Monetary Control Act (DIDMCA) of 1980, Garn St. Germain Depository Institutions Act (GDIA) of 1982, the Riegle-Neal Interstate Banking and Branching Efficiency Act (IBBEA) of 1994, and the Gramm-Leach-Bililey Act (GLBA) of 1999. The bank risk implications of these acts are mixed. For example, DIDMCA 1980 enables banks to reduce their systematic risk and hence contributes to bank shareholders wealth (Aharony, Saunders and Swary 1988). Yet, deregulation including the relaxation of entry barriers could improve the welfare of the borrowers and savers at the expense of bank shareholders (Besanko and Thakor 1993). Some mixed findings are evident. For example, Hogan, Sharpe and Volker (1980) for the Australian banking sector, and Hogan and Sharpe (1984), Brooks, Faff and McKenzie (2000) for the US bank industry, found a negative relationship between systematic risk and regulation. Yet, Brooks, Faff and Ho (1997) observed an increase in the systematic risk of banks over the period from 1976 to 1994 but this increase was not related to the level of regulation. A similar result was observed for Australian and Canadian banks (Harper and Scheit 1992; Amoako-Adu and Smith 1995). Indeed, deregulation of the bank industry not only generated opportunities to

\textsuperscript{23}The degree of competition is comparable between Canadian and European banks (Nathan and Neave 1989; Bikker and Groeneveld 1998) while the degree of competition is higher in European banks relative to Japanese banks (Lloyd-Williams, Molyneux and Thornton 1994; Bikker and Groeneveld 1998).
increase risk but also better equipped the banks to control, share and manage risk (Smirlock 1984; Amoako-Adu and Smith 1995; Houston and Stiroh 2006).

### 2.6.2 Consolidation and diversification

European bank diversification increased with the merger waves that followed EMU. Craig and Santos (1997) and Hogan and Sharpe (1984) also argue that bank mergers reduce risk as a result of diversification benefits through more extensive bank branching. For example, it has been argued that increased diversification led large Spanish commercial banks to lower their risk levels (García-Marco and Robles-Fernandez 2008). In contrast, Demsetz and Strahan (1997) argue that despite large US bank holding companies being better diversified (than small ones), this does not necessarily lower bank risk. They showed that both the asset side and the liability side of the balance sheet can adds to the risk of many of the US banks, with risky loans and higher leverage respectively. With regard to systematic risk for European banks, this thesis argues that there will be a decrease in bank systematic risk as bank concentration increases with formation of EMU due to mergers and acquisitions. It is evident that domestic mergers lead to an increase in market concentration through reduced costs, reduction in branch overlap and increase or maintenance of market power. European Union wide branching allows banks to diversify geographically and lessen the risk of unfavorable local economic conditions which could result in bank failure. Hence, it is suggested that large banks engage in cross border activities that provide additional economies of scale and scope through geographical risk diversification (Meon and Weill 2005). Further, large banks can achieve functional diversification as they enjoy higher levels of economies of scale and economies of scope and thus can reduce loan-portfolio
risk more efficiently (Boyd and Prescott 1986).

The establishment of EMU has had a significant impact on the European bank industry in terms of competition and consolidation (Altunbas and Ibanez 2008; Francis and Hunter 2004). The development of this new financial system with the introduction of the European Central bank (ECB) and Euro-bond market, along with the steps taken to harmonize and assimilate the securities markets, has given the banking system greater access to funds. Moreover, bank consolidation could result from an increase in the substitutability of banking services leading to stiffer competition (Matutes and Vivas 2000; Cordella and Yeyati 2001).

There has been little change in the euro-zone banking legislation over the period of the study as much of the critical regulation was in place by 1992. The banking industry is often considered to be one of the more regulated industries in Europe and elsewhere with the impact of the Basel Accord, adopted in 1988 and designed to monitor bank risk exposures (Francis and Hunter 2004), and the more recent European Union (EU) Bank Directives. Even with these regulatory frameworks in place, bank failures occur and these include the sub-prime mortgage crisis (2007-present), the Scandinavian (Norway, Sweden and Finland) Banking Crisis (1988-1992) and the Barings bank debacle (1995). Further, the past two decades includes the broader economic crises that accompanied the Russian rouble crisis (1998), the internet bubble (2000) and the economic downturn that

\[24\] During 1983-1985 the Norwegian banks were willing to lend as much as 85% of Norway’s GDP. In turn, this led to a moral hazard problem and ultimately to a banking crisis. The Norwegian banking crisis was systemic (this crisis spread to Sweden and Finland) and economically significant (Ongena, Smith and Michalsen 2003). It has been argued that the deregulatory banking environment may have encouraged the Norwegian banks to increase their risk as competition increased (Benink and Benston 2005).
followed this collapse. While these events have led banking regulators to be more cognizant of bank risk taking activity, it has been argued that the liberalization of the European banking industry via the abolition of interest rate restrictions, credit controls and barriers to entry (Francis and Hunter 2004) may have allowed European banks to better deal with greater levels of competition and the crises that have occurred during the period of our study. The formation of EMU may also have had a spill-over effect into neighboring non euro-zone European countries. It is evident that financial institution consolidation that has occurred with EMU has also played an important role in financial integration between euro-zone and non-euro-zone countries and contributed to the integration of European financial markets more generally (Allen and Song 2005; Bartram, Taylor and Wang 2007).

There have been recent takeover waves in Europe with the formation of the EMU, particularly the dramatic increase in merger and acquisition activity from 1998 onwards. While it is possible that some common factor is responsible for both the change attributed to EMU and the observed increase in takeovers that has occurred with EMU this seems unlikely. Euro-zone bank consolidations have been quite profitable for the acquiring banks, particularly cross-border acquisitions, which have been simplified with EMU (Altunbas and Ibanez 2008). Bank consolidation has also had a dramatic impact on the banking systems of a number of the euro-zone countries. For example, Staikouras and Fillipaki (2006) report a 17% reduction in the number of credit institutions for the EU-15 group of nations over the period 1998 to 2002. There is considerable cross country

25The need to maintain bank franchise value could provide an alternative explanation for mergers and acquisitions.
variation with EMU. For example, while an increase in the number of credit institutions of 3.4% is reported for Greece, there was a 27% decrease in the number of credit institutions in Germany over the same period.

Bank consolidation can lead to diversification, particularly with cross border acquisitions, and it is often argued that the more extensive the bank branch network the lower the bank risk (Hogan and Sharpe 1984; Craig and Santos 1997). In particular, increased diversification led large Spanish commercial banks and US bank holding companies to lower their systematic risk exposure (Mamun, Hassan and Lai 2004; García-Marco and Robles-Fernandez 2008).

While diversification arguments generally predict that bank risk decreases, Demsetz and Strahan (1997) propose that despite large US bank holding companies being better diversified (than small ones) this does not necessarily lower their risk level. They showed that the asset side and the liability side of the balance sheet of many of the large US banks consist of risky loans and higher leverage respectively. This may mask the true risk of these banks. Hughes, Lang, Mester and Moon (1996) also observe that increased diversification (geographic and/or depositor diversification), while correlated with decreases in the price of risk, could motivate US bank holding companies to undertake greater levels of risk to increase their returns.

2.6.3 Hypotheses related to research question 2 (RQ2)

Bank total risk is important for bank regulators, borrowers and managers as they are concerned about the possibility of bank failure. Changes in total bank equity risk may be either due to changes in systematic or idiosyncratic risks. In this regard, EMU has
allowed banks to increase their lending and maintain customer-banking relationship, diversify human capital and, overall, increase efficient allocation of resources. Thus, these benefits suggest a decrease in bank total risk. The total risk hypothesis is as follows:

**Hypothesis H12:** Total bank equity risk (increases) decreases with EMU.

It is also important to look into how idiosyncratic and systematic risk change in the post-EMU period. With regard to idiosyncratic risk, it is possible that idiosyncratic risk may increase with the formation of the EMU. This could arise from diversification of bank activities and increased competition. With greater competition banks may choose to increase leverage to increase profits but this will also increase idiosyncratic risk because the shareholders bear a greater share of the diversifiable cash flow risk of the firm (Campbell, Lettau, Malkiel and Xu 2001). Moreover, financial innovation linked to EMU may increase idiosyncratic risk (Stein 1987). It is also likely that increased derivative instrument exposure increases bank idiosyncratic risk where troubled banks facing greater competition use derivatives to bolster profits but at the cost of increase diversifiable bank risk (Dewatripont and Tirole 1994).

Yet, Altunbas and Ibanez (2008) suggest that large efficient European banks have tended to merge with relatively small well-capitalized banks resulting in more diversified sources of income. This may help the European banks to decrease their idiosyncratic risk. Similarly, for the US banks, it is evident that revenue diversification and ease of investment opportunities that arise from deregulation reduced the idiosyncratic risk of the

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26 However, Campbell, Lettau, Malkiel and Xu (2001) find during 1990s the decrease in US corporate leverage led to an increase in idiosyncratic risk.
US commercial banks after 1998 (Houston and Stiroh 2006). Thus, the formation of EMU has given the European banking industry the opportunity to diversify risk by varying their activities, which may allow banks to reduce their idiosyncratic risk. This leads to formulate the second hypothesis:

**Hypothesis H13**: Bank equity idiosyncratic risk (increases) decreases with EMU.

With regard to systematic risk, it can be argued that there will be a decrease in bank systematic risk as European bank concentration increases due to increased domestic merger activity following the formation of EMU. It is often argued that domestic mergers lead to increased market concentration through reduced costs, reduction in branch overlap and increased market power. For example, Europe wide branching would lessen the risk of bank failure arising from unfavorable local economic conditions. Yet skeptics have argued that increased competition following the introduction of the EMU, which could have an unfavorable impact on the European banking industry (Carletti and Hartman 2003; Marquez 2002).

Moreover, mergers can create an internal money market, either through diversification or internationalization that aids banks in dealing with future macroeconomic shocks (Carletti, Hartmann and Spagnolo 2006). Furthermore, deregulation (such as the Depository Institutions Deregulatory and Monetary Control Act 1980 introduced in the US) can benefit bank shareholders resulting in a reduction in systematic risk (Aharony, Saunders and Swary 1988). Further, Akihgbe and Whyte (2004) examine the long-term shift in risk after the passage of Gramm-Leach-Bililey Act 1999 in the US. They find that increased financial integration led to a decrease in bank systematic risk. In essence, financial integration helped the banking system to cope with
local shocks through diversification (Strahan 2006). Thus, reduces the relative risk of the industry.

It is possible to argue that, bank systematic risk need not decrease with bank concentration. If mergers are cross-border mergers, then banks will spread their activities geographically and, as a result, banks may be more exposed to Europe wide shocks as distinct from country specific shocks. Furthermore, the easing of barriers to entry and exit and the increased competition that accompanies these changes may lead to banks investing in riskier projects. Since EMU, a number of investment banks have entered the euro-zone and there has been rapid development of Euro-bond markets and securities markets. This could lead to increased competition and may threaten future bank profitability. Based on the above discussion the third hypothesis can be formulated as follows:

**Hypothesis H14:** Systematic bank equity risk (increases) decreases with EMU.

### 2.7 SUMMARY

This chapter provides a literature review and develops hypotheses in relation to the two research questions identified earlier in Chapter 1. In relation to research question 1(RQ1), this literature review provides insights into bank equity risk and credit risk and their determinants including bank regulation (including charter value and bank capital), market discipline and off-balance sheet activities. With respect to bank capital and charter value, their importance derives from the role these characteristics play in banks soundness and risk taking incentive. The Basel Capital Accord has been endorsed by banks across the world and the literature review highlights its importance. But although
banks should maintain the regulatory capital buffer in order to maintain safety and soundness of the financial system as bank capital builds-up the banks may have incentive to engage in excessive risk-taking. This is observed for well-capitalized as well as under-capitalized banks.

It is also evident from the literature that off-balance sheet activities are considered to be both risk increasing and risk decreasing in their effect. Earlier research mostly considered off-balance sheet activities to be risk reducing while in the past two decades the explanation for these activities has become complex and hence the Basle Accord I and II requires that banks should incorporate these activities in their risk-adjusted bank capital requirement. There has been a long-standing debate on market discipline. And this literature review provides further discussion about their relation that exist between market discipline and bank risk. The findings in the literature are mixed concerning whether subordinated debt can truly reflect the market disciplinary behaviour.

The above discussion also focuses on important macro economic variables such as bank concentration, competition, deregulation and its relation to bank risk and overall financial stability that could affect variations in bank risk. Yet, there is mixed findings on the effect of bank concentration and competition on bank risk taking and overall financial stability. A number of country-specific variables are also discussed including, bank concentration, economic freedom index, net interest margin, stock market turnover ratio have been discussed. Finally, in relation to research question 2 (RQ2) the literature review addresses the structural changes in European bank equity risk with the formation of EMU, particularly focusing on the literature related to bank competition, consolidation, and deregulation. A summary of the research questions and relevant
hypotheses are provided in Table 2.1.
Table 2.1
Summary of research questions and hypotheses development

RQ1A: Do bank regulation, off-balance sheet activities and market discipline explain the bank risk, in particular equity risk and credit risk?

H1: Bank risk (equity risk and credit risk) decreases with charter value.

H2: Bank risk (equity risk and credit risk) relates to bank capital.

H2A: Bank risk (equity risk and credit risk) decreases with bank capital (linear expectation).

H2B: Bank risk (equity risk and credit risk) initially decreases and then increases with bank capital (non-linear expectation).

H3: Bank risk (equity risk and credit risk) increases with bank off-balance sheet activities.

H4: Bank risk (equity risk and credit risk) decreases with bank uninsured deposits.

H5: Bank risk (equity risk and credit risk) relates to bank size

H5A: Bank systematic risk increases with bank size

H5B: Bank credit risk, interest rate risk, idiosyncratic risk and total risk decrease with bank size

H6: Bank risk (equity risk and credit risk) increases with total loan.

H7: Bank risk (equity risk and credit risk) decreases with dividend yield.

H8: Bank risk (equity risk and credit risk) increases with operating leverage.

H9: Bank risk (equity risk and credit risk) decreases in a bank based system and increases in a market based system.

H10: Bank risk (equity risk and credit risk) increases with deposit insurance.

RQ1B: Does bank risk sensitivity to bank regulation, off-balance sheet activities and market discipline change with the creation of the Economic and Monetary Union (EMU)?

H11A: Bank charter value decreased in the post-EMU period.

H11B: Bank capital increased in the post-EMU period.

H11C: Bank off-balance sheet activities increased in the post-EMU period.

H11D: Bank uninsured liabilities increased in the post-EMU period

RQ2: Is there a structural change in European bank equity risk with the formation of Economic and Monetary Union (EMU)?

H12: Total bank equity risk decreases with EMU.

H13: Bank equity idiosyncratic risk decreases with EMU.

H14: Systematic bank equity risk decreases with EMU.
CHAPTER 3
DATA AND METHODOLOGY

3.1 INTRODUCTION

This chapter describes the data and methodology for testing the hypotheses associated with two research questions developed earlier in Chapter 2. The remainder of this chapter is divided into five sections. Section 3.2 provides detail on the sample, data sources, sampling procedure, composition and coverage. Section 3.3 presents definition of variables selected for the analysis. Section 3.4 is devoted to research methodology. In particular, Sub-section 3.4.1 specifies the regression model and estimation method used for testing hypotheses related to research question 1 (RQ1A and RQ1B). Sub-section 3.4.2 then covers the methodology applied to test hypotheses related to the second research question (RQ2). Section 3.5, presents descriptive statistics and correlation analysis for the variables used in the empirical analysis and finally Section 3.6 provides a summary of the chapter.

3.2 SAMPLE SELECTION

This section discusses sample selection for the thesis. In relation to the first research question (RQ1), the study uses cross-country bank-level data over the period from 1996 to 2005. The study considers a range of financial institutions including bank holding companies (BHCs), commercial banks, cooperatives and savings banks across two data sets. The first dataset consists of 15 Western European countries (Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Norway, Spain,
Sweden, Switzerland, and the United Kingdom). For both euro-zone and non-euro-zone Western European countries the total number of listed shares stands at 117. The sample composition is reported in Table 3.1 on the next page. The complete sample is dominated by commercial banks followed by savings banks, bank holding companies (BHCs) and cooperatives. The total number of banks in euro-zone countries is 61, which include 4 bank holding companies (BHCs), 51 commercial banks, no cooperatives and 6 savings banks. The total number of banks in non-euro-zone European countries is 56, comprising 8 bank holding companies, 40 commercial banks, 1 cooperative and 7 savings banks. The non-euro-zone commercial bank sample is dominated by Danish banks.

One critical contribution of this study is the careful selection of the sample banks. The annual reports of each of the banks are checked to ensure that subsidiaries are not double counted. For example, subsidiaries are excluded from the sample where they are reported separately in the data base as well as being included in the consolidated statements of another financial institution. Bank level information, including the balance sheet and income statement are extracted from the BankScope and the Osiris databases.

The initial sample is based on bank list from BankScope which provides data on 254 listed banks. From this sample 97 banks are eliminated due to inadequate market data or have less than two years of bank level accounting information.

27 While European commercial banks are a critical part of the European economy it is important to note that the study specifically include publicly listed cooperatives and savings banks that offer similar commercial banking services. These institutions are important in countries like Italy, Norway, Spain, Sweden, and Switzerland.

28 The comprehensive data provided by BankScope is consistent with the European Central Bank (ECB) declaration of the number of banks and is often used by the ECB in its cross-country analysis.
Table 3.1

Sample composition of Western European countries

This table presents the sample composition of Western European countries in relation to research question 1 (RQ1). The sample includes 91 listed bank shares from both euro-zone and non-euro-zone European countries. These includes bank holding companies (BHCs), commercial banks, savings banks and cooperatives from Belgium, Finland, Denmark, France, Germany, Greece, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom. The complete sample is dominated by commercial banks followed by savings banks, bank holding companies and cooperatives. The total number of banks in euro-zone countries stands at 61 which include 4 bank holding companies, 51 commercial banks, no cooperatives and 6 savings banks. The total number of banks in non-euro-zone European countries stands at 56, comprising 8 bank holding companies, 40 commercial banks, 1 cooperative and 7 savings banks. The non-euro-zone commercial bank sample is dominated by Danish banks. The list of banks is provided in Appendix in Table A3.1.

<table>
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<tr>
<th>Country</th>
<th>Bank Holding Company</th>
<th>Commercial banks</th>
<th>Cooperatives</th>
<th>Savings bank</th>
<th>Total</th>
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</thead>
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<tr>
<td>Total</td>
<td>8</td>
<td>40</td>
<td>1</td>
<td>7</td>
<td>56</td>
</tr>
</tbody>
</table>

| Total number of listed shares for both Euro-zone and non-euro-zone countries | 12 | 91 | 1 | 13 | 117 |

A further 40 financial institutions are excluded that are legally controlled by other institutions (subsidiaries). This leaves 117 listed banks observed over a 10 year sample period from 1996 to 2005, giving an unbalanced panel of 1029 bank-year observations in the final sample. The time period, 1996-2005, is chosen to include the formation of EMU.

The sample is not survivorship bias free, since dead or de-listed bank shares are not available on either the BankScope or the Osiris databases.
in 1999 and so the sample period is divided into two comparable periods, pre-euro period (1996-1998) and post-euro period (1999-2005) in order to facilitate the study of the impact of changes in regulation on bank risks arising from the EMU.

The second data set includes banks from 36 countries in addition to the Western European countries that make up the final dataset. The initial bank-year observations are collected from BankScope resulting in a total sample of 7,843. However, the final bank-year sample observation is reduced to 4,680. The loss of 3,163 (=7843-4680) observations is due to the lack of market discipline information particularly for US banks.

For this study the sample collection phase is extended by a year and hence the coverage is from 1996-2006. To incorporate this additional year the study rearranges the European bank sample set by incorporating year 2006 and three additional European countries which are Cyprus, Luxembourg and Turkey. This gives a total of 1400 bank-year observations. Due to merger and acquisition activities there could be some differences in the number of banks across the two samples.

The study now explains the sample unit for each region. The break-down of the sample is provided in Table 3.2 in the next page.

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30 Similar to the European dataset as mentioned in footnote 3, this broad sample set is not survivorship bias free as both BankScope and DataStream International eliminate banks which have been acquired, failed or delisted.
Table 3.2
Sample composition of Western Europe and rest of the world
This table represents the sample size for the banks around the world. The sample includes 758 listed bank shares. These include bank holding companies, commercial banks, savings banks and co-operatives across Asia-Pacific, Eastern Europe, Latin America, Middle East and Africa, Western Europe and North America. The total sample consists of 258 financial institutions from Asia-Pacific, 25 from Africa and Middle East, 18 from Eastern Europe, 133 from Western Europe, 42 from South America and finally 282 from North America. The complete sample is dominated by United States of America with 274 bank holding companies followed by Japan with 82 commercial banks. The list of banks is provided in Appendix in Table A3.1.

<table>
<thead>
<tr>
<th>Country</th>
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<th>Cooperatives</th>
<th>Savings bank</th>
<th>Total</th>
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**South America**

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</tr>
<tr>
<td>Colombia</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Ecuador</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Mexico</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Peru</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Venezuela</td>
<td>1</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>6</td>
<td>36</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

**North America**

<table>
<thead>
<tr>
<th>Country</th>
<th>Bank Holding Company</th>
<th>Commercial banks</th>
<th>Cooperatives</th>
<th>Savings Bank</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>0</td>
<td>8</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>United States of America</td>
<td>274</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>274</td>
<td>8</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

**Total number of listed bank shares**

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>318</td>
<td>428</td>
<td>2</td>
<td>10</td>
<td>758</td>
</tr>
</tbody>
</table>

The initial search in the BankScope database returns a total of 108 banks in Eastern Europe. However, the sample size is reduced by 90 banks in countries such as Bosnia-Herzegovina, Croatia, Latvia, Macedonia, Moldova, Russia, Serbia, Slovakia and Ukraine due to lack of market return and market index data in DataStream International.
database. Thus, the final sample includes 18 banks for this region mainly from Bulgaria, Czech Republic, Hungary, Lithuania, Poland and Romania. This gives a total number of bank-year observations of 169. The bank list for South and Central America as generated from the BankScope identifies a total of 145 banks. Due to a lack of market information the study eliminates 102 banks from countries such as Bahamas, Barbados, Bermuda, Bolivia, Costa Rica, El Salvador, Guyana, Honduras, Jamaica, Nicaragua, Panama, Paraguay, Saint Lucia, Saint Kitts and Nevis, Suriname and Trinidad and Tobago. This leaves a final sample size of 43 banks with a total of 382 bank-year observations drawn from countries such as Argentina, Brazil, Chile, Colombia, Ecuador, Mexico, Peru and Venezuela.

The sample composition for Asia-Pacific is dominated by the Japanese banks followed by India, Bangladesh and Indonesia. Japanese banks accounted for 89 of the 258 banks across the Asia-Pacific region. The total number of bank-year observations for this region is 2,769.

For Middle-East and Africa the study mainly focus on countries such as Egypt, Israel, Mauritius, Morocco and South Africa. Although BankScope provides information on banks in countries such as Bahrain, Botswana, Ghana, Jordan, Kuwait, Ivory Coast, Lebanon, Kenya, Muscat, Namibia, Nigeria, Oman, Qatar, Saudi Arabia, Tunisia, UAE and Zimbabwe, these countries could not be included in the study due to incomplete market information. Hence, from a total of 1,000 bank-year observations the sample size is reduced by 730 observations leaving a final sample of 270 bank-year observations for Middle East and Africa.

Finally, this study considers North American banks including Canadian
commercial banks and U.S. bank holding companies (BHCs). A search in the EDGAR filings reveals those BHCs with standard industrial classification (SIC) code 6021 and 6022 for which the top tiered subsidiary is either a national or a state commercial bank.

This criteria is chosen to create a more homogenous sample such that commercial banking is the primary business of the entire regional sample. This results in a sample of 2,869 bank-year observations for North America region. The sample size is reduced to 1,093 due to lack of market discipline data for many of the US bank holding companies.

In relation to research question 2 (RQ2), that is, to test the structural changes in bank equity risks for the major banks in both euro-zone and non-euro-zone Western European countries, the study constructs a sample of 96 euro-zone European banks and 85 non-euro zone European banks from the DataStream International database from January 1995 to April 2006 periods. Both the A and B shares for one Finnish bank are incorporated in the sample, giving a total of 97 listed banking shares that make up the final sample. Hence, the total number of listed bank shares is 182 (total number of banks is 181). The sample composition is reported in Table 3.3. The complete list of banks incorporated in the study is reported in Appendix in Table A3.1.

The sample includes commercial banks, savings banks, and bank holding companies. Continuously compounded monthly returns are estimated for the major banks in euro-zone Western European countries Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Portugal, the Netherlands and Spain and non euro zone European countries Denmark, Norway, Sweden, Switzerland and United Kingdom. The sample considers survivorship bias and includes delisted and merged banks in the sample, particularly for country bank portfolio construction. All returns before and after the
formation of EMU are calculated in Euro.
Table 3.3
Sample composition of Western European countries
This table presents the sample composition of western European countries in relation to research question 2 (RQ2). The sample includes 181 listed bank shares from both euro-zone and non-euro-zone European countries. These includes bank holding companies, commercial banks, savings banks and co-operatives from Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom. The sample consists of savings banks, bank holding companies and cooperatives. The complete sample is dominated by Danish commercial banks. The total number of banks in euro-zone Western European countries stands at 96 and the total number of banks in non-euro-zone European countries stands at 85.

<table>
<thead>
<tr>
<th>Country</th>
<th>Total number of bank shares</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Euro zone countries</strong></td>
<td></td>
</tr>
<tr>
<td>Austria</td>
<td>5</td>
</tr>
<tr>
<td>Belgium</td>
<td>3</td>
</tr>
<tr>
<td>Finland</td>
<td>6</td>
</tr>
<tr>
<td>France</td>
<td>7</td>
</tr>
<tr>
<td>Germany</td>
<td>11</td>
</tr>
<tr>
<td>Greece</td>
<td>9</td>
</tr>
<tr>
<td>Ireland</td>
<td>4</td>
</tr>
<tr>
<td>Italy</td>
<td>28</td>
</tr>
<tr>
<td>Netherlands</td>
<td>3</td>
</tr>
<tr>
<td>Portugal</td>
<td>6</td>
</tr>
<tr>
<td>Spain</td>
<td>14</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>96</strong></td>
</tr>
<tr>
<td><strong>Non euro zone European countries</strong></td>
<td></td>
</tr>
<tr>
<td>Denmark</td>
<td>44</td>
</tr>
<tr>
<td>Norway</td>
<td>2</td>
</tr>
<tr>
<td>Sweden</td>
<td>5</td>
</tr>
<tr>
<td>Switzerland</td>
<td>26</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>85</strong></td>
</tr>
<tr>
<td><strong>Total number of listed shares for both Euro-zone and non-euro-zone countries</strong></td>
<td><strong>181</strong></td>
</tr>
</tbody>
</table>

In addition, the MSCI individual country equity market index, MSCI Europe equity market index and the MSCI world equity market index have been extracted fromDataStream International for estimation of equity systematic risk.

3.3 SELECTED VARIABLES

This section discusses the selected variables related to the research questions.
mentioned earlier in Chapter 1. Sub-section 3.3.1 discusses the risk measures underlying
the research questions. Sub-section 3.3.2 presents bank-specific and country-specific
variables related to research question 1 (RQ1A and RQ1B) for the European bank sample
and Sub-section 3.3.3 deals with variables that make up the second data set that spans
banks across the world. Finally, Sub-section 3.3.4 presents the variables for research
question 2 (RQ2).

### 3.3.1 Bank equity risk and credit risk measures

The study focuses on bank equity risk and credit risk of European banks as well
as banks from the rest of the world. The bank risk variables, broadly referred to as Risk in
the following sections, cover both bank equity risk and credit risk. The bank equity risk
measures include systematic risk, idiosyncratic risk, interest rate risk and total risk.
Following Lynge and Zumwalt (1980), Flannery and James (1984) and Kane and Unal
(1988), two factor market model as presented in equation (1), is used to estimate
systematic risk, interest rate risk and idiosyncratic risk for each individual bank. The risk
estimates are calculated each year for each bank using weekly return observations
available during the year of interest.

This provides a set of risk estimates for each bank for each year over the study
period. The two factor model takes the form:

\[
R_{it} = \alpha_i + \beta_{mi} R_{Mt} + \beta_R R_{it} + \epsilon_{it}
\]  

(1)

where \( R_{it} \) = weekly stock return of bank \( i \) at date \( t \);

\( R_{Mt} \) = weekly return on the market. Based on the geographical exposure either the
MSCI country index or the MSCI world index or the MSCI Europe index is
used.\textsuperscript{31}

\[ R_{t} = \text{weekly change in the long term interest rate for each country at date } t \text{ and;} \]

\[ \varepsilon_{t} = \text{residual term.} \]

The equity market beta, $\beta_{m}$, is used as a proxy for systematic risk and the interest rate beta, $\beta_{i}$, captures equity interest rate risk. The equity market beta is estimated using either the MSCI country index, the MSCI world index or the MSCI Europe index depending on the banks business exposure. Where the bank business is focused in one country, as occurs with the Danish banks, the study uses the country equity market index for beta (systematic risk) calculation, where the bank business is focused in the European region a Europe index and where a bank has a more international focus a world index is used in estimating its systematic risk.\textsuperscript{32}

The study follows the work of Kane and Unal (1988) and chooses the long term interest rate in the model because long term interest rates are considered to better explain bank returns.\textsuperscript{33} The natural log of the residual variance from the two factor market model is used as an estimate of idiosyncratic risk for each of the banks and the natural log of the variance of bank equity returns is used as a proxy for total risk. The variance of bank

\textsuperscript{31} MSCI stands for Morgan Stanley Composite Index (MSCI).

\textsuperscript{32} Systematic risk is also estimated using the local country index for each of the banks in the sample with little change in the results.

\textsuperscript{33} However, there are debates on whether to use a two factor market model or to use a one factor market model. Due to multicollinearity between interest rates and market factors some authors orthogonalize changes in the interest rate factor (Chance and Lane 1980; Flannery and James 1984). Giliberto (1985) argues that this approach can bias the t-statistics against one or other of the two factors. As a result, this study follows the work of Kane and Unal (1988) and Maher (1997), who do not attempt to orthogonalize the interest rate factor.
equity returns is calculated each year for each bank using weekly return data available in that year and is defined as follows:

\[ \sigma^2_{\text{R}_i} = \frac{1}{N} \sum_{t=1}^{N} (R_{it} - \overline{R})^2 \]  

(2)

where \( \sigma^2_{\text{R}_i} \) = the total risk or variance of bank returns for bank \( i \);

\( R_{it} \) = bank \( i \) return per week;

\( \overline{R} \) = the average bank \( i \) return and;

\( N \) = the number of observations.

Bank credit risk\(^{34}\) is defined as:

\[ CR_{i,j,t} = \frac{LLP_{i,j,t}}{TA_{i,j,t}} \]  

(3)

where \( CR_{i,j,t} \) = the credit risk measure for bank \( i \) in country \( j \) in period \( t \);

\( LLP_{i,j,t} \) = the loan loss provision for bank \( i \) in country \( j \) in period \( t \) and bank \( i \);

\( TA_{i,j,t} \) = the total assets of bank \( i \) in country \( j \) in period \( t \).

The analysis uses weekly individual bank equity returns, MSCI market index values,\(^{35}\) market value of equity observations and 10 year government bond yields. All market data are extracted from the DataStream International database. For comparability purpose, the market value of equity is converted into euro currency for non-euro-zone countries such as Denmark, Norway, Sweden, Switzerland and the United Kingdom. For instance, a cross rate has been applied to convert from local currency (that is Danish

\(^{34}\) The loan loss reserves as a credit risk measure could not be used due to lack of information in the BankScope database, particularly for Danish banks.

\(^{35}\) In some cases the analysis includes MSCI price indices where MSCI total return indices are unavailable. The correlation between MSCI price index and MSCI return index ranges from 96% to 98.99% for those countries where both indices are available and so this should result in little bias in the risk estimates.
Krone, Norwegian Krone, Swedish Krona, Swiss France, British Pound) to USD and then the EM exchange rate-US$ per Euro (average) was applied to convert the pre-euro market value of equity into euro and then the US$ to Euro (GTIS)-exchange rate to convert the post-euro market value of equity into euro for non-euro-zone European countries. Tests of research question 2 (RQ2) also rely on these risk measures.

Due to lack of data, particularly, weekly interest rate information for emerging markets in DataStream International, the study applies a one factor market model (Smirlock 1984; Bundt, Cosimano and Halloran 1992) for equity risk estimation for larger banks from across the world dataset, the second dataset used in analysis of research question 1 (RQ1).

\[ R_i = \alpha_i + \beta_m R_m + \epsilon_i \]  \hspace{1cm} (4)

where \( R_i \) = weekly stock return of bank \( i \) at date \( t \);

\( R_m \) = weekly return on the market. Based on the geographical exposure either the MSCI country index or the MSCI world index or the MSCI Europe index is used;

\( \epsilon_i \) = residual term.

The equity market beta, \( \beta_m \), is used as a proxy for systematic risk. The equity market beta is estimated using the MSCI market index for all developed countries except for Cyprus where Cyprus DataStream market index has been used. S&P/IFC market index has been used for all developing countries except for Bangladesh, China, Czech Republic, Egypt Hong Kong, Hungary, India, Israel, Peru, Philippines, Poland, Malaysia,
Morocco, South Africa, Sri Lanka, Taiwan and Thailand where the study uses the MSCI market index.

3.3.2 Explanatory variables for European bank sample

The empirical analysis related to research question 1 (RQ1A and RQ1B) uses two data sets, one for European banks and the other draws on banks from across the world. This section discusses the common dataset for both analyses. The study uses independent variables which include bank discipline variables such as bank charter value and bank capital and market discipline variables such as uninsured deposits. The variables are described below.

Following Keeley (1990), charter value is the sum of the market value of equity and book value of liabilities divided by the book value of total assets. Bank capital is proxied by the ratio of total capital to total assets. Given the possibility of a non-linear relationship (Calem and Rob 1999) between bank capital and bank risk, a squared bank capital term is also included in the analysis. The key measures of market discipline are uninsured deposits and off-balance sheet activities. Uninsured deposits are the sum of the subordinated debt and inter-bank deposits divided by total liabilities. Off-balance sheet activities are proxied by the ratio of the total value of off-balance sheet activities to total liabilities. Bank asset management is estimated using the ratio of loans to total assets. The natural logarithm of bank market capitalization is used to capture the impact of bank size. The list of explanatory variables and macroeconomic variables with their detailed

36 However, for Bangladesh and Cyprus the market index used are Bangladesh Stock Exchange All Shares and Cyprus DataStream market index respectively.
definitions and sources are provided on next page in Table 3.4.

Other bank-specific variables included in the analysis of the European analysis are operating leverage, defined as the ratio of fixed assets (assumed to mimic fixed costs) to total assets (Saunders, Strock and Travlos 1990; Galloway, Lee and Roden 1997) and dividend yield (total dividend divided by share price) and these are extracted fromDataStream International for individual banks.

Furthermore, a dummy variable representing bank specialization is also used with one of two values, 1 = commercial banks, 0 = other sample institutions. To consider differences in bank regulation and supervision across euro-zone and non-euro-zone European countries the analysis incorporates an Economic Freedom Index (EFI). This variable captures a range of factors that might affect the efficiency of the banking sector. Higher scores indicate greater freedom in bank regulation and supervision. Other country-level governance variables such as legal origin (with a one of four values, 1 = English common-law countries, 2 = French civil law countries, 3 = German civil-law countries and 4 = Scandinavian civil law countries)\textsuperscript{37}, geographical dummy variable (one of two values, 1 = euro-zone countries, 0 = non-euro-zone European countries), creditor rights index (La Porta, Lopez de Silanes, Shleifer and Vishny 1998) and anti director rights index (La Porta, Lopez de Silanes, Shleifer and Vishny 1998) are also included in the analysis of research question 1 (RQ1).

\textsuperscript{37}The study uses a scaled variable for legal origin in an attempt to capture the variation that is evident across the civil law countries.
### Table 3.4
#### Definition of selected variables

This table defines risk measures as well as bank specific and country specific variables used in analysis. The variable column presents the dependent variables, explanatory variables and control variables used in the models. The dependent variables consist of four alternate equity based risk measures which are the total risk, systematic risk, interest rate risk, idiosyncratic risk and a variable to capture credit risk. The base model for study includes uninsured deposits, charter value, bank capital and bank capital squared, off-balance sheet activities, loan to total assets and control variables such as size and economic freedom index. The extended model includes the additional variables, operating leverage, dividend yield, ownership dummy, legal origin dummy, geographical dummy, creditor rights index and shareholder rights index. The table also presents potential references for these variables and the source of data.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Definition</th>
<th>Reference</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dependent variables</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total risk</td>
<td>standard deviation of the bank return</td>
<td>Lynge and Zumwalt (1980); Flannery and James (1984); Kane and Unal (1988);</td>
<td>DataStream</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Anderson and Fraser (2000); Konishi and Yasuda (2004).</td>
<td></td>
</tr>
<tr>
<td>Interest rate risk</td>
<td>estimated from equation 1</td>
<td>Lynge and Zumwalt (1980); Flannery and James (1984); Kane and Unal (1988);</td>
<td>DataStream</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Anderson and Fraser (2000); Konishi and Yasuda (2004).</td>
<td></td>
</tr>
<tr>
<td>Systematic risk</td>
<td>estimated from equation 1 and equation 4</td>
<td>Lynge and Zumwalt (1980); Flannery and James (1984); Kane and Unal (1988);</td>
<td>DataStream</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Anderson and Fraser (2000); Konishi and Yasuda (2004).</td>
<td></td>
</tr>
<tr>
<td>Idiosyncratic risk</td>
<td>variance of the residual from the two index model from equation 1 and equation 4</td>
<td>Lynge and Zumwalt (1980); Flannery and James (1984); Kane and Unal (1988);</td>
<td>DataStream</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Anderson and Fraser (2000); Konishi and Yasuda (2004).</td>
<td></td>
</tr>
<tr>
<td>Credit risk</td>
<td>loan loss provision /total liabilities = ex-post realized risk</td>
<td></td>
<td>BankScope and Osiris</td>
</tr>
<tr>
<td><strong>Bank- specific variables</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating leverage(OPL)</td>
<td>fixed assets/total assets</td>
<td>Saunders, Strock and Travlos (1990); Galloway, Lee and Roden (1997).</td>
<td>BankScope</td>
</tr>
<tr>
<td>Dividend yield (DY)</td>
<td>dividend per share divided by price per share (subordinated debt + inter-bank deposits)/total liabilities</td>
<td>Nier and Baumann (2004)</td>
<td>DataStream and BankScope</td>
</tr>
<tr>
<td>Uninsured deposits (UD)</td>
<td></td>
<td></td>
<td>BankScope and Osiris</td>
</tr>
<tr>
<td>Variable</td>
<td>Description</td>
<td>Source</td>
<td></td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Bank capital or financial leverage (endogenous variable) (BC)</td>
<td>Capital or equity/total assets</td>
<td>Berger, Herring and Szegö (1995); Saunders, Strock and Travlos (1990)</td>
<td></td>
</tr>
<tr>
<td>Bank capital squared (endogenous variable) (BC^2)</td>
<td>(Capital or equity/total assets)^2</td>
<td>Calem and Rob (1999)</td>
<td></td>
</tr>
<tr>
<td>Off-balance sheet items (OBS)</td>
<td>This includes contingent liabilities, loan commitments, standby letters of credit, acceptances, guarantees, documentary and commercial Letter of credits and operating leasing commitments</td>
<td>Angbazo (1997)</td>
<td></td>
</tr>
<tr>
<td>Loans/total assets (LTA)</td>
<td>Total loans/total assets</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Size</td>
<td>Natural logarithm of total market value of equity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Country specific variables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Economic freedom index (EFI)</td>
<td>The overall score is considered for the analysis. The score includes: business freedom, trade freedom, fiscal freedom from government, monetary freedom, investment freedom, financial freedom, property rights, freedom from corruption and labor freedom.</td>
<td>González (2005)</td>
<td></td>
</tr>
<tr>
<td>Ownership dummy (D_1)</td>
<td>D_1=1 if commercial banks and D_1=0 otherwise</td>
<td>Reynolds and Flores (1989); La Porta, Lopez de Silanes, Shleifer and Vishny (1998); González (2005).</td>
<td></td>
</tr>
<tr>
<td>Legal origin (D_2)</td>
<td>The legal origin dummy. D=1 for common law countries or English origin countries, D=2 for French civil-law countries, D=3 German civil law countries and D=4 for Scandinavian civil law countries.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geographical proximity (D_3)</td>
<td>D_3=1 if euro zone countries and D_3=0 otherwise</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Creditor rights (D_4)</td>
<td>The index is formed taking into account (1) the country imposes restrictions such as creditor’s consent or minimum dividends to file for reorganization, (2) secured creditors are able to gain possession of their security once the reorganization petition has been approved, (3) secured creditors are ranked first in the distribution of the proceeds that result from the disposition of the assets of a bankrupt firm, (4)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
the debtor does not retain the administration of its property pending the resolution of the reorganization. A score is calculated by adding one for each of these characteristics. The index ranges from 0 to 4.

| Anti-director rights ($D_5$) | Legal protection for minority shareholders is calculated taking into account whether a country protects minority shareholders, has one share-one vote score, allows proxy by mail allowed, shares are not blocked before meeting, allows cumulative voting, rights exist for oppressed minority, allows preemptive rights to new issue, a percentage of share capital allowed to call an extraordinary shareholder meeting. These six rights are scored (1 if allowed or 0) and added to give an aggregate score. The anti director rights index ranges from 0 to 6. | La Porta, Lopez de Silanes, Shleifer and Vishny (1998); González (2005). | Company law or commercial code |
The creditor rights index is an index aggregating different creditor rights. The index is formed by adding 1 when (1) the country imposes restrictions, such as creditors’ consent or minimum dividends to file for reorganization, (2) secured creditors are able to gain possession of their security once the reorganization petition has been approved (no automatic stay), (3) secured creditors are ranked first in the distribution of the proceeds that result from the disposition of the assets of a bankrupt firm and (4) the debtor does not retain the administration of its property pending the resolution of the reorganization. A score is calculated by adding one for each of these characteristics. The index ranges from zero to four (4).

The anti-director rights index measure how strongly the legal system favors the minority shareholders against managers or dominant shareholders in the corporate decision making process including voting process. The index is formed by adding 1 when (1) the country allows the shareholders to mail their proxy vote to the firm, (2) shareholders are not required to deposit their shares prior to their general shareholders’ meeting, (3) cumulative voting or proportional representation of minorities in the board of directors is allowed, (4) an oppressed minorities mechanism is in place, (5) the minimum percentage of share capital that entitles a shareholder to call for an extraordinary shareholders’ meeting is less than or equal to 10 percent, and (6) shareholders’ have pre-emptive rights that can be waived only by a shareholders’ vote. This index ranges from zero to six. However, in this study the sample ranges from zero to five.
3.3.3 Explanatory and country-level variables for banks from across the world

The bank equity risks and credit risk measures along with bank-level variables are already described in sub-section 3.3.1 and summarized in Table 3.4. Further, the study takes into account some additional country-level variables in order to answer research question 1 (RQ1A and RQ1B) using the sample of banks from across the world.

Table 3.5 presents the institutional characteristics of sample countries and detail description of the variables and sources are provided in Table 3.6.

Following Beck and Al-Hussainy (2007), the study incorporates variables such as net interest margin, bank concentration ratio and stock market turnover ratio. The net interest margin represents an efficiency measure and is calculated as the accounting value of bank's net interest revenue as a share of its interest-bearing (total earning) assets.

The break down by country income level in Table 3.5, shows that transition economies have the highest net interest margin at 8.3% while developed and developing economies have the lowest at approximately 3.5%. The regional breakdown shows that South America has the highest net interest margin at 9.8% while Asia-Pacific has the lowest at 2.8%.

The bank concentration ratio represents the structure of financial markets. It is measured by assets of three largest banks as a share of assets of all commercial banks. The break down by region in Table 3.5, reveals that bank concentration ratio is the lowest in North America at 26.4% and the highest in the Middle East and Africa region at 71.2% and similar approximation in Western Europe region. It is lowest for banks operating in
industrialized countries at 40.7% and highest for developing countries at 52.1%.

Finally stock market turnover ratio representing market liquidity is estimated by the ratio of the value of total shares traded to average real market capitalization. The denominator is deflated using the following method (Beck and Al-Hussainy 2007):

\[ T_t/P_{a_t} / \left(0.5 \times \left\{ M_t/P_{e_t} + M_{t-1}/P_{a_{t-1}} \right\} \right) \]

where \( T_t \) is total value traded, \( M_t \) is stock market capitalization, \( P_{e_t} \) is end-of-period CPI, \( P_{a_{t-1}} \) is beginning of period CPI and \( P_{a_t} \) is average annual CPI.

Table 3.5

<table>
<thead>
<tr>
<th>Market structure, Efficiency and Regulation, Selected Aggregates 1996-2006</th>
</tr>
</thead>
<tbody>
<tr>
<td>All banks</td>
</tr>
<tr>
<td>Developed</td>
</tr>
<tr>
<td>Transition</td>
</tr>
<tr>
<td>Developing</td>
</tr>
</tbody>
</table>

Region

<table>
<thead>
<tr>
<th>Region</th>
<th>Bank concentration</th>
<th>Net interest margin</th>
<th>Stock market turnover ratio</th>
<th>Economic Freedom index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asia Pacific</td>
<td>0.458</td>
<td>0.028</td>
<td>0.959</td>
<td>64.068</td>
</tr>
<tr>
<td>Eastern Europe</td>
<td>0.599</td>
<td>0.048</td>
<td>0.382</td>
<td>59.672</td>
</tr>
<tr>
<td>Middle East and Africa</td>
<td>0.712</td>
<td>0.034</td>
<td>0.305</td>
<td>60.578</td>
</tr>
<tr>
<td>North America</td>
<td>0.264</td>
<td>0.041</td>
<td>1.478</td>
<td>77.620</td>
</tr>
<tr>
<td>South America</td>
<td>0.450</td>
<td>0.098</td>
<td>0.171</td>
<td>61.419</td>
</tr>
<tr>
<td>Western Europe</td>
<td>0.710</td>
<td>0.037</td>
<td>0.850</td>
<td>66.802</td>
</tr>
</tbody>
</table>

The stock market turnover ratio is the highest for the industrialized nations followed by developing nations. Region wise break-down in Table 3.5, reveals that North America has the highest stock market turnover ratio at 1.478 followed by Asia Pacific region 0.959. The lowest ratio is observed for Middle East and Africa region at approximately 0.31. Table 3.6 presents the detail definition, reference and source of this ratio.

The final column in Table 3.5 is the Economic freedom index, which is one of the
institutional variables used in the analysis as mentioned in Section 3.3.2. Developed economies have the highest score followed by the transition economies. North America region has the highest score at 78% followed by Western Europe at 66.80. Eastern Europe and Middles East and Africa regions have the lowest score at approximately 60.

In addition, the study includes a deposit insurance dummy, market based dummy and high income country dummy. Table 3.6 presents the detail definition, reference and source of these country-level variables.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Definition</th>
<th>Reference</th>
<th>Source</th>
</tr>
</thead>
</table>
| Stock market turnover| Ratio of the value of total shares traded to average real market capitalization, the denominator is deflated using the following method:  
  \[ \frac{T}{P - a_t} / (0.5) \times \left[ \frac{M}{P - e_t} + M_{t-1} / P - e_{t-1} \right] \]  
  where \( T \) is total value traded, \( M \) is stock market capitalization, \( P - e_t \) is end-of period CPI, \( P - e_{t-1} \) is beginning of period CPI and \( P - a_t \) is average annual CPI. | Beck and Al-Hussainy (2007)                    | http://econ.worldbank.org/staff/tbeck |
| Deposit insurance    | Explicit deposit insurance=1 otherwise =0                                | Demirguc-Kunt and Sobaci (2001); Demirguc-Kunt, Kane and Levine (2006) | http://econ.worldbank.org/staff/tbeck |
| High income dummy    | High income countries dummy=1 otherwise=0                                | Demirguc-Kunt and Levine (1999)               | http://econ.worldbank.org/staff/tbeck |

The deposit insurance dummy=1 if a country has explicit deposit insurance or
otherwise the dummy = 0. Almost all developed and developing nations have explicit deposit insurance in place. Yet, some nations like Australia, China, Egypt, Hong Kong, Israel, Mauritius, Morocco, Pakistan Singapore and South Africa have no explicit deposit insurance but an implicit safety net is effective during the period of the study.

This study incorporates a dummy which takes a value of 1 (one) if the country is market-based and takes a value of 0 (zero) if the countries are bank-based (Demirguc-Kunt and Levine 1999; Levine 2002). The study uses the “structure index” as developed by Demirguc-Kunt and Levine 1999.

In the sample, the market-based countries are Australia, Brazil, Canada, China, Colombia, Czech Republic, Denmark, Hong Kong, Korea, Malaysia, Peru, Singapore, South Africa, Sweden, Switzerland, Taiwan, Thailand, the United Kingdom and the United States of America. Interestingly, among the emerging markets Chile, Mexico, Philippines and Turkey reflect significant development of their stock markets since the second half of 1980s thus they are termed as the market based country (Demirguc-Kunt and Levine 1999). The bank based countries are Argentina, Bangladesh, Belgium, Bulgaria, Cyprus, Ecuador, Egypt, France, Germany, Greece, Hungary, Israel, Ireland, Italy, Japan, Lithuania, Luxembourg, Mauritius, Morocco, Norway, Poland, Portugal, Romania, Spain, Sri Lanka and Venezuela. Yet, India, Indonesia and Pakistan have seen some development in their stock markets but they are classified as bank based since banks still play a major role in their respective financial system.

---

38 Park (1993) considers Korea to be dominated by large banks however; Demirguc-Kunt and Levine (1999) define Korea as market based because the total value traded to GDP ratio is high for Korea. Non banks issue more credit to the private sector than banks in Korea. Hence non banks share the centre stage with banks.
Finally, the analysis could not incorporate the creditor rights index and anti-director rights index for the whole sample due to lack of information for countries such as Bangladesh, Cyprus, Lithuania, Romania, Luxembourg and Mauritius. The definitions of these two variables are the same as mentioned earlier in Table 3.4. Yet, the study includes a sub-sample analysis to incorporate these two variables. The empirical results are reported in Chapter 6.

### 3.3.4 Variables related to research question 2 (RQ2)

In relation to research question 2, the study uses the one factor market model as explained by equation 4 in sub-section 3.3.1. The definitions of the risk measures such as systematic risk, idiosyncratic risk and total risk are already discussed in sub-section 3.3.1 and summarized in Table 3.4. The study extends the market model by introducing a dummy variable to capture the possibility of a structural change in systematic risk. In the analysis, the dummy variable takes on a value of zero for the months from January 1995 to December 1998, and a value of one from January 1999 to April 2006.

### 3.4 METHODOLOGY

This section discusses the methodology applied in the empirical analysis to test hypotheses developed in Chapter 2 related to the two research questions mentioned in Chapter 2. Sub-section 3.4.1 discusses the estimation method used for analysis. Sub-section 3.4.2 presents the methodology in relation to research question 1. Sub-section 3.4.3 describes the method used in the analysis of research question 2.

#### 3.4.1 Empirical model related to research question 1 (RQ1A and RQ1B)

The study uses pooled-OLS, two stage least squares (2SLS) and pooled OLS with
lagged bank capital and charter value. The fundamental assumption for consistency of least squares estimators is that the model error is uncorrelated with the regressors. However, if this assumption fails the OLS estimator is inconsistent. The two-stage least squares (2SLS) estimator provides a consistent estimator under the assumption that valid instruments exist and the instruments are variables that are correlated with the regressors. This estimation method accounts for endogenous regressors\(^{39}\). Practically, it can be difficult to identify valid instruments. Even where such instruments exist these may be weakly correlated with endogenous regressors. This study incorporates the lag value of the two endogenous variables (bank capital and charter value) and is called the just-identified case, where the number of instruments exactly equals the number of regressors.

Additionally, under the 2SLS estimation technique the instruments must be relevant. This means after controlling for remaining exogenous variables, the instruments must account for significant variation in dependent variable. The stronger the identification between instruments and endogenous variables the stronger will be the identification of the model. A test for endogeneity is conducted using the Wu-Hausman test and the Durbin-Wu-Hausman test (Cameron and Trivedi 2009). This provides a test of whether a regressor is endogenous. If there is little difference between OLS and 2SLS then there is no need to use instruments and hence the regressors are exogenous.

Moreover, as part of robust testing, panel techniques are applied to control for individual bank heterogeneity. As panel data suggests individual banks, or countries, are

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\(^{39}\) A variable is considered to be endogenous meaning it arises within a system that influences the error term, while exogenous variable arises outside the system and is unrelated to the error term.
heterogeneous, time series and cross sectional methods that do not control for this heterogeneity can result in biased results (Baltagi 2005). However, the fixed effects or least squares dummy variable approach (LSDV) may not provide feasible estimation if \( N \) is very large since the model incorporates \( N - 1 \) dummies. Fixed effects estimator cannot estimate the effect of time invariant variables like explicit deposit insurance, legal origin, geographical proximity or regulation and supervision index. These time invariant variables must be eliminated from the regression\(^{40}\)

Given large \( N \) the random effects model is a more appropriate specification if \( N \) individuals are drawn from the population randomly. Under this model, the individual effect is characterized as random. Taylor (1980) found that feasible GLS is more efficient than LSDV for all but the fewest degrees of freedom. However, it is daunting task to decide which method to apply. A specification test proposed by Hausman (1978) is widely used to identify between the fixed and random effects estimators. In this regard, Mundlak (1978) argued that the random effects model assumes exogeneity of all the regressors while fixed effects allows for endogeneity of all the regressors. This study incorporates a number of time invariant variables and thus the resulting model focuses a random effects approach.

The initial model considered for the study includes a large number of explanatory variables based on the literature survey. Both t-tests and F-tests are used to reduce this very general model down to a more parsimonious model. This process is repeated for

\(^{40}\)Hence, as \( T \to \infty \), the fixed effects estimator is consistent. However, if \( T \) is fixed and \( N \to \infty \), then the fixed effects estimator of the individual effects not consistent since the number of these parameters increases as \( N \) increases (Baltagi 2005; Lancaster 2000).
each of the 10 cross-sectional analyses (from 1996 through to 2005). The final parsimonious model arising from this process is represented in equation (5). In estimation of this final model each of the risk measures is regressed on bank-specific and country-specific variables. Both two-stage least squares (2SLS)\(^{41}\) and pooled-OLS are used in estimation of the model to account for possible endogeneity problems noted in the literature (e.g., Galloway, Lee and Roden 1997; Saunders and Wilson 2001; Gonzalez 2005).

The test hypotheses discussed in Chapter 2, that the following model (equation 5) of European bank equity risk and credit risk is used.

\[
RISK_{ijt} = \left[ \alpha_0 + \beta_1 UD_{ijt} + \beta_2 CV_{ijt} + \beta_3 BC_{ijt} + \beta_4 BC_{ijt}^2 + \beta_5 OBS_{ijt} + \beta_6 LTA_{ijt} + \beta_7 Size_{ijt} + \right] 
\gamma_1 EFI_{ijt} + \sum \phi Y_{ijt} + \epsilon_{ijt}
\]

(5)

where \( UD_{ijt} \) = natural log of uninsured deposits for bank \( i \), in country \( j \) at period \( t \)

\( CV_{ijt-1} \) = natural log of charter value for bank \( i \), country \( j \) at period \( t \);

\( BC_{ijt-1} \) = natural log of bank capital for bank \( i \), in country \( j \) at period \( t \);

\( BC_{ijt-1}^2 \) = square of the natural log of bank capital for bank \( i \), in country \( j \) at period \( t \);

\( OBS_{ijt} \) = natural log of off-balance sheet activities for bank \( i \), in country \( j \) at

\(^{41}\) As noted by Intriligator (1978), 3SLS can be sensitive to specification or measurement error, under these condition 2SLS may be preferred.
period $t$;

$LTA_{i,j,t} =$ loan to total assets for bank $i$, in country $j$ at period $t$;

$Size_{i,j,t} =$ natural log of market value of equity for bank $i$, in country $j$, period $t$;

$EFI_{j,t} =$ economic freedom index for country $j$ at period $t$,

$\phi Y_{i,t} =$ year dummies for period 1997 to 2005 and;

$\epsilon_{i,j,t} =$ random error term.

Log transformation is used for all explanatory variables as well as for credit risk, idiosyncratic risk and total risk (Section 3.3, sub-section 3.3.1). The White (1980) consistent variance-covariance is used to adjust for heteroscedasticity.

An extended version of the base model (equation 5) is also used in the analysis (see equation 6 below). This includes the impact of operating leverage and dividend yield as well as various country specific factors that could explain cross-sectional variation in bank risk. The base model is expanded by introducing operating leverage and dividend yield as well as a number of dummy variables.

$$\begin{align*}
\text{RISK}_{i,j,t} &= \left[ \alpha_0 + \beta_1 OPL_{i,j,t} + \beta_2 DY_{i,j,t} + \beta_3 UD_{i,j,t} + \beta_4 CV_{i,j,t} + \beta_5 BC_{i,j,t} + \beta_6 BC_{i,j,t} + \beta_7 OBS_{i,j,t} + \\
&\quad + \beta_8 LTA_{i,j,t} + \beta_9 Size_{i,j,t} + \gamma_1 EFI_{j,t} + \delta_1 D_{i,j} + \delta_2 D_{j} + \delta_3 D_{3} + \delta_4 D_{4} + \delta_5 D_{5} + \sum \phi Y_{i,t} + \epsilon_{i,j,t} \right]
\end{align*}$$

(6)

where $OPL_{i,j,t} =$ natural logarithm of operating leverage for bank $i$, country $j$ at period $t$;

$DY_{i,j,t} =$ dividend yield for bank $i$, country $j$ at period $t$;

$D_{i,j} =$ bank specialization dummy where $D_{i,j} = 1$ if commercial banks or otherwise 0;
\( D_{z_j} \) = legal origin variable where \( D_{z_j} = 1 \) if common-law countries, 2 if French civil law countries, 3 if German civil-law countries and 4 if Scandinavian civil law countries;

\( D_{s_j} \) = geographical dummy where \( D_{s_j} = 1 \) if euro-zone countries or otherwise 0;

\( D_{c_j} \) = creditor rights index and;

\( D_{a_j} \) = anti-director rights index.

Analysis of research question 1 (RQ1A) using data from around the world also relies on the variables in equation (5) along with a series of dummy variables as well as country–level variables. The model is given below:

\[
\text{RISK}_w = \alpha_0 + \beta_1 D_{s_j} + \beta_2 CV_{t_j} + \beta_3 BC_{t_j} + \beta_4 OBS_{t_j} + \beta_5 LTA_{t_j} + \beta_6 \text{Size}_{t_j} + \\
\gamma_1 \text{EFI}_{t_j} + \delta_1 D_{c_j} + \delta_2 D_{s_j} + \gamma_2 \text{NIM}_{t_j} + \gamma_3 \text{BNC}_{t_j} + \gamma_4 \text{STurn}_{t_j} + \delta_3 \text{DIN}_{t_j} + \delta_4 \text{MB}_{t_j} + \delta_5 \text{HI}_{t_j} + \\
+ \sum \phi_i Y_{t_i} + \epsilon_{t_j} \tag{7}
\]

where,

\( D_{s_j} \) = bank specialization dummy where \( D_{s_j} = 1 \) if commercial banks or otherwise 0;

\( D_{z_j} \) = legal origin variable where \( D_{z_j} = 1 \) if common-law countries, 2 if French civil

\( \text{BNC}_{t_j} \) = Bank concentration for country \( j \) at period \( t \);

\( \text{NIM}_{t_j} \) = Net interest margin for country \( j \) at period \( t \);

\( \text{STurn}_{t_j} \) = Stock market turnover ratio for country \( j \) at period \( t \);

\( \text{DIN}_{t_j} \) = explicit deposit insurance dummy = 1, otherwise=0;
\( MB_{ij} \) = market based country dummy =1, otherwise=0;

\( HI_{ij} \) = High income country dummy =1, otherwise=0;

With regard to research question 1 (RQ1B) using both data sets (European and the world samples), it is important to test for the general fit of the model. Given the 10 year span of the analysis it is also important to test for the possibility of structural change, particularly given the formation of EMU. For this reason the sample is split into two, with 1999 being the year most associated with the formation of EMU chosen as the break point. This facilitates tests for structural change between the pre-EMU period (1996-1998) and the post-EMU period (1999-2005). Both pooled-OLS and panel techniques are used in testing for structural change using the following model:

\[
Y_{ijt} = X_{ijt} + \delta_{ij} + \beta_{ij} X_{ijt} D_t + \epsilon_{ijt} \tag{8}
\]

where,

\( X_{ij,t} \) = bank-specific characteristics for bank \( i \) in country \( j \) at period \( t \).

These variables are same as the explanatory variables identified in equation (5) and equation (6) for research question 1. \( D_t \) = time dummy, where \( D_t = 1 \) for post-euro period and \( D_t = 0 \) for pre-euro period;

\( D_t \times X_{i,j,t} \) = interaction term between each bank-specific variable \( X_{i,j,t} \) with the time dummy and;

\( Y_t \) is year dummy variable.

3.4.2 Empirical model related to research question 2 (RQ2)

Following Binder (1985) and Bundt Cosimano and Halloran (1992) the market model in equation (1) is extended by introducing a dummy variable to capture the possibility of a structural change in systematic risk. In the analysis the dummy variable
takes on a value of zero for the months of January 1995 to December 1998 and a value of one from January 1999 to April 2006.\(^{42}\) The model is written as:

\[
\tilde{R}_t = \alpha_{\text{pre}} + (\alpha_{\text{post}} - \alpha_{\text{pre}})D_t + \beta_{\text{pre}}\tilde{R}_m + (\beta_{\text{post}} - \beta_{\text{pre}})\tilde{R}_m D_t + \tilde{\epsilon}_t
\]  

(9)

where, \(D_t = 0\) pre-euro period January 1995 - December 1998 and \(D_t = 1\) post-euro January 1999 – April 2006. This model is estimated using individual bank returns as well as the returns from an equally weighted bank portfolio and a market-value weighted bank portfolio. The study also applies equation (9) to FTSE world bank indices for each country to measure the change in systematic risk with the EMU.

In addition, following Kane and Unal (1988) this study uses the unorthogonalized two index model.\(^{43}\) The model is as follows:

\[
\tilde{R}_t = \alpha_{\text{pre}} + \beta_1 D_t + \beta_2 \tilde{R}_m + \beta_3 \tilde{R}_m D_t + \beta_4 I_t + \tilde{\epsilon}_t
\]  

(10)

where, \(I_t = 10\) year benchmark bond for each euro zone country. \(\beta_2 = \) pre-euro beta, \(\beta_3 = \) changes in systematic risk, \(\beta_4 = \) interest rate risk, \(I_t = \) monthly change in the interest rate on the 10 year government bond and \(\tilde{\epsilon}_t = \) disturbance term on the individual and on the portfolio on month \(t\).

3.5 DESCRIPTIVE STATISTICS AND CORRELATION ANALYSIS

This section discusses the descriptive statistics and correlation coefficients for the

\[^{42}\]One exception is Greece where the analysis considers January 1995- December 2000 as the pre euro period and January 2001 – April 2006 as the post euro period.

\[^{43}\]Chane and Lane (1980) among others have orthogonalized the two index model but Kane and Unal (1988) show orthogonalization procedure provides bias t-statistics. In addition, following Kane and Unal (1988) the thesis uses the long term government bonds as a proxy for the interest rate.
variables used in the analysis. Sub-section 3.5.1 discusses descriptive statistics and correlation for data used in the test of research question 1 (RQ1). Sub-section 3.5.2 presents the descriptive statistics for data covering research question 2 (RQ2).

3.5.1 Descriptive statistics and correlation matrix related to research question 1 (RQ1)

With respect to research question 1 (RQ1A and RQ1B), the descriptive statistics for the sample used in this study are reported in Panels A and B of Table 3.7 for the European bank sample. The mean, standard deviation, minimum, maximum, skewness and kurtosis for each of the bank risk measures (credit risk, systematic risk, total risk, interest rate risk and idiosyncratic risk) are reported in Panel A of Table 3.7.

The average credit risk value (the ratio of loan loss provisions to total assets) is 1% with a standard deviation of 1%. The average equity market beta for the sample is 0.39, with standard deviation of 0.50 and the average interest rate risk parameter is 0.17, with a standard deviation of 0.20. The idiosyncratic risk and total risk measures are expressed in terms of natural logs though the underlying average standard deviation per annum is around 18% for total risk and 16% for idiosyncratic risk.44

Mean, standard deviation, minimum, maximum, skewness and kurtosis are also reported for the explanatory variables in Panel B of Table 3.7. There is some variation in the European bank off-balance sheet activities with average off-balance sheet activities

44Given a natural log of total risk of -7.35 per week then the variance is 0.000643 per week and the standard deviation per annum estimate is sqrt(0.000643)*sqrt(52) or 0.1828 per annum. Given a natural log of idiosyncratic risk of -7.62 per week then the variance is 0.000491 per week and the standard deviation per annum estimate is sqrt(0.000491)*sqrt(52) or 0.1597 per annum. These estimates appear reasonable, particularly given the use of a two factor model and the nature of the underlying distributions.
amounting to 52% of total assets. Financial leverage, or bank capital, ranges from 2% to 95% and charter value ranges from 0.87 to 1.79 with an average value of 1.02. Uninsured deposits measured as a proportion of total liabilities averages 0.16 with a minimum of zero and a maximum of 0.97.

The economic freedom index is obtained for each country for each of the years in the study period. The highest economic freedom index value is observed for Ireland and the lowest is for Greece. The creditor rights index ranges from 0 to 4, with a maximum for the United Kingdom and the minimum for France.
Table 3.7
Descriptive statistics for European bank sample (RQ1)

This table presents descriptive statistics for bank risks and explanatory variables. The study uses annual observations of bank specific variables and time invariant variables for listed bank shares in euro-zone and non-euro-zone countries. The total number of observations across the sample is 910, with 10 years of data for 91 banks. Panel A presents the descriptive statistics of bank equity risk, interest rate risk and credit risk. The total risk and idiosyncratic risk are expressed in terms of natural logs. Panel B presents the descriptive statistics of the bank specific and country specific variables. Skew presents skewness and kurt presents kurtosis. Natural log of risk measures are reported for all risk measures except for systematic risk.

Panel A Descriptive statistics of bank risk measures

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Std. dev</th>
<th>Min</th>
<th>Max</th>
<th>Skew</th>
<th>Kurt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credit risk</td>
<td>0.01</td>
<td>0.01</td>
<td>-0.02</td>
<td>0.06</td>
<td>3.57</td>
<td>27.63</td>
</tr>
<tr>
<td>Systematic risk</td>
<td>0.39</td>
<td>0.50</td>
<td>-1.27</td>
<td>3.32</td>
<td>0.99</td>
<td>1.35</td>
</tr>
<tr>
<td>Natural log of total risk</td>
<td>-7.35</td>
<td>1.23</td>
<td>-12.01</td>
<td>-3.37</td>
<td>-0.19</td>
<td>0.53</td>
</tr>
<tr>
<td>Interest rate risk</td>
<td>0.173</td>
<td>0.20</td>
<td>0.00</td>
<td>2.11</td>
<td>2.98</td>
<td>16.00</td>
</tr>
<tr>
<td>Natural log of idiosyncratic risk</td>
<td>-7.62</td>
<td>1.10</td>
<td>-12.05</td>
<td>-3.40</td>
<td>-0.18</td>
<td>1.38</td>
</tr>
</tbody>
</table>

Panel B Descriptive statistics of the explanatory variables

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Std. dev</th>
<th>Min</th>
<th>Max</th>
<th>Skew</th>
<th>Kurt</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bank level variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dividend yield (DY)</td>
<td>3.00</td>
<td>1.97</td>
<td>0</td>
<td>13.16</td>
<td>1.43</td>
<td>3.37</td>
</tr>
<tr>
<td>Operating leverage (OPL)</td>
<td>0.02</td>
<td>0.20</td>
<td>0.00</td>
<td>5.71</td>
<td>28.86</td>
<td>835.08</td>
</tr>
<tr>
<td>Uninsured deposits (UD)</td>
<td>0.16</td>
<td>0.14</td>
<td>0.00</td>
<td>0.97</td>
<td>2.55</td>
<td>10.56</td>
</tr>
<tr>
<td>Charter value (CV)</td>
<td>1.02</td>
<td>0.07</td>
<td>0.87</td>
<td>1.79</td>
<td>4.41</td>
<td>35.68</td>
</tr>
<tr>
<td>Bank capital (BC)</td>
<td>0.09</td>
<td>0.06</td>
<td>0.02</td>
<td>0.95</td>
<td>6.38</td>
<td>84.13</td>
</tr>
<tr>
<td>Bank capital squared (BC²)</td>
<td>0.01</td>
<td>0.04</td>
<td>0.00</td>
<td>0.90</td>
<td>20.40</td>
<td>447.46</td>
</tr>
<tr>
<td>Off balance sheet activities (OBS)</td>
<td>0.52</td>
<td>1.37</td>
<td>0.01</td>
<td>21.51</td>
<td>9.98</td>
<td>126.99</td>
</tr>
<tr>
<td>Loan to total assets (LTA)</td>
<td>0.60</td>
<td>0.15</td>
<td>0.01</td>
<td>0.92</td>
<td>-0.65</td>
<td>0.85</td>
</tr>
<tr>
<td>Size</td>
<td>5.77</td>
<td>2.50</td>
<td>1.17</td>
<td>11.33</td>
<td>0.36</td>
<td>-0.91</td>
</tr>
<tr>
<td><strong>Country level variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Economic freedom index (EFI)</td>
<td>68.65</td>
<td>5.77</td>
<td>55.60</td>
<td>82.40</td>
<td>0.00</td>
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</tr>
<tr>
<td>Bank specialization dummy (D₁)</td>
<td>0.77</td>
<td>0.42</td>
<td>0</td>
<td>1</td>
<td>-1.31</td>
<td>-0.28</td>
</tr>
<tr>
<td>Legal origin dummy (D₂)</td>
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<td>1</td>
<td>4</td>
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<td>-1.51</td>
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<tr>
<td>Euro-zone dummy(D₃)</td>
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<td>0.50</td>
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<td>0.14</td>
<td>-1.98</td>
</tr>
<tr>
<td>Creditor rights index(D₄)</td>
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<td>1.01</td>
<td>0</td>
<td>4</td>
<td>-0.59</td>
<td>-0.82</td>
</tr>
<tr>
<td>Anti-director rights index(D₅)</td>
<td>2.35</td>
<td>0.96</td>
<td>0</td>
<td>5</td>
<td>0.57</td>
<td>0.03</td>
</tr>
</tbody>
</table>

The anti-director rights index ranges from 0 to 5 with a maximum value of 5 for the United Kingdom and a minimum value of 0 for Belgium.

The pair-wise correlation coefficients are also calculated and reported in Table 3.8 for the independent variables with just two large correlation coefficients evident in this analysis though most are statistically significantly different from zero at 5% significance.
level.
Table 3.8

Correlation Analysis for European bank sample (RQ1)

The table represents the pairwise correlation analysis among the choice of variables. The correlation among the explanatory variables is as low as 0% between the operating leverage and economic freedom index and as high as -66% between size and bank capital squared. **Correlation is significant at the 0.01 level (2-tailed). *Correlation is significant at the 0.05 level (2-tailed).

<table>
<thead>
<tr>
<th></th>
<th>OPL</th>
<th>DY</th>
<th>UD</th>
<th>CV</th>
<th>BC</th>
<th>BC2</th>
<th>OBS</th>
<th>LTA</th>
<th>Size</th>
<th>EFI</th>
<th>D1</th>
<th>D2</th>
<th>D3</th>
<th>D4</th>
<th>D5</th>
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<tr>
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<td>-0.03</td>
<td>-0.04</td>
<td>0.06</td>
<td>0.06</td>
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<td>0.01</td>
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<td>-0.02</td>
<td>1</td>
<td>0.01</td>
<td>-0.14**</td>
<td>-0.09**</td>
<td>-0.10**</td>
<td>-0.13**</td>
<td>-0.12**</td>
<td>-0.03</td>
<td>-0.12**</td>
<td>-0.01</td>
<td>0.00</td>
<td>-0.16**</td>
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<td>0.01</td>
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<td>-0.32**</td>
<td>-0.13**</td>
<td>-0.42**</td>
<td>-0.07</td>
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<td>0.07**</td>
<td></td>
<td></td>
</tr>
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<td>CV</td>
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<td>-0.14**</td>
<td>0.14**</td>
<td>1</td>
<td>-0.04</td>
<td>-0.10**</td>
<td>-0.06</td>
<td>-0.03</td>
<td>0.45**</td>
<td>-0.12**</td>
<td>0.10**</td>
<td>-0.42**</td>
<td>0.32**</td>
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<td>0.25**</td>
</tr>
<tr>
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<td>-0.27**</td>
<td>-0.04</td>
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<td>0.88**</td>
<td>0.05</td>
<td>0.18**</td>
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<td>0.05</td>
<td>0.32**</td>
<td>0.31**</td>
<td>-0.33**</td>
<td>0.28**</td>
<td>0.02</td>
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<tr>
<td>BC2</td>
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<td>-0.32**</td>
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<td>0.13**</td>
<td>0.26**</td>
<td>0.45**</td>
<td>-0.48**</td>
<td>0.39**</td>
<td>-0.15**</td>
</tr>
<tr>
<td>OBS</td>
<td>0.01</td>
<td>-0.13**</td>
<td>0.18**</td>
<td>0.06</td>
<td>0.05</td>
<td>0.11**</td>
<td>1</td>
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<td>0.01</td>
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<td>0.19**</td>
<td>0.19**</td>
<td>-0.05</td>
<td>0.16**</td>
<td>-0.28**</td>
</tr>
<tr>
<td>LTA</td>
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<td>-0.12***</td>
<td>0.13**</td>
<td>0.03</td>
<td>0.18**</td>
<td>0.21**</td>
<td>-0.19**</td>
<td>1</td>
<td>-0.19**</td>
<td>0.20**</td>
<td>0.09**</td>
<td>0.17**</td>
<td>-0.27**</td>
<td>0.12**</td>
<td>-0.20**</td>
</tr>
<tr>
<td>Size</td>
<td>-0.04</td>
<td>-0.03</td>
<td>0.42**</td>
<td>0.45**</td>
<td>-0.53**</td>
<td>-0.66**</td>
<td>0.01</td>
<td>0.19**</td>
<td>1</td>
<td>-0.09**</td>
<td>-0.16**</td>
<td>-0.63**</td>
<td>0.56**</td>
<td>-0.35**</td>
<td>0.21**</td>
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<tr>
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<td>-0.07</td>
<td>-0.12**</td>
<td>0.05</td>
<td>0.13**</td>
<td>-0.22**</td>
<td>0.20**</td>
<td>-0.09**</td>
<td>1</td>
<td>0.02</td>
<td>0.36**</td>
<td>-0.55**</td>
<td>0.40**</td>
<td>0.02</td>
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<tr>
<td>D1</td>
<td>0.03</td>
<td>-0.12**</td>
<td>-0.05</td>
<td>0.10**</td>
<td>0.32**</td>
<td>0.26**</td>
<td>0.19**</td>
<td>-0.09**</td>
<td>-0.16**</td>
<td>0.02</td>
<td>1</td>
<td>0.24**</td>
<td>-0.18**</td>
<td>0.09**</td>
<td>0.25**</td>
</tr>
<tr>
<td>D2</td>
<td>0.04</td>
<td>-0.01</td>
<td>-0.23**</td>
<td>-0.42**</td>
<td>0.31</td>
<td>0.45**</td>
<td>0.19**</td>
<td>0.17**</td>
<td>-0.63**</td>
<td>0.36**</td>
<td>0.24**</td>
<td>1</td>
<td>-0.84**</td>
<td>0.66**</td>
<td>-0.29**</td>
</tr>
<tr>
<td>D3</td>
<td>-0.04</td>
<td>0.00</td>
<td>0.29**</td>
<td>0.32**</td>
<td>-0.33**</td>
<td>-0.48**</td>
<td>-0.05</td>
<td>-0.27**</td>
<td>0.56**</td>
<td>-0.55**</td>
<td>-0.18**</td>
<td>-0.84**</td>
<td>1</td>
<td>-0.68**</td>
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<td>D4</td>
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<td>-0.11**</td>
<td>-0.20**</td>
<td>0.28**</td>
<td>0.39**</td>
<td>0.16**</td>
<td>0.12**</td>
<td>-0.35**</td>
<td>0.40**</td>
<td>0.09**</td>
<td>0.66**</td>
<td>-0.68**</td>
<td>1</td>
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</tr>
<tr>
<td>D5</td>
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<td>0.27**</td>
<td>0.07*</td>
<td>0.25**</td>
<td>0.016</td>
<td>-0.15**</td>
<td>-0.28**</td>
<td>0.20**</td>
<td>0.21**</td>
<td>0.02</td>
<td>0.25**</td>
<td>-0.29**</td>
<td>0.14**</td>
<td>-0.27**</td>
<td>1</td>
</tr>
</tbody>
</table>
The two correlation coefficients are for bank capital and size (-53%) and squared bank capital and size (-66%). Given the magnitude of these coefficients the empirical analysis is repeated both with and without the size variable with little impact on the reported results.\footnote{No change was made to the base model, or the extended model, given that there is little evidence of multicollinearity problems in the data.}

The descriptive statistics in relation to research question 1 (RQ1) using banks from across the world are reported in Panel A and Panel B of Table 3.9. With the exception of systematic risk, all variables are converted into natural logarithms. Mean, standard deviation, minimum, maximum, skewness and kurtosis are reported for the explanatory variables in Panel B of Table 3.9. There is some variation in the off-balance sheet activities as a percentage of total liabilities with average off-balance sheet activities amounting to approximately 29%. Financial leverage, or bank capital, ranges from -1.21% to 98.6% and charter value ranges from 0.03 to 5.9 with a mean value of 1.05. Uninsured deposits measured as a proportion of total liabilities averages 0.07 with a minimum of -2.67 and a maximum of 22.80.

Bank concentration ratio ranges from 0.163 to 1 while net interest margin ranges from a minimum 0.006 to a maximum 0.235. USA has the lowest bank concentration while South Africa has the highest ratio. Net interest margin is the lowest for Ireland and the highest for Venezuela. The stock market turnover ratio shows an average of 1.05 with a minimum of 0 and a maximum of 4.95. The highest turnover ratio is observed in Pakistan.
Table 3.9
Descriptive statistics of the sample related to research question 1 (RQ1)
This table presents the descriptive statistics for the second set of data for all risk measures and explanatory variables used in relation to research question 1 (RQ1) for the world. Panel A describes the descriptive statistics of bank equity risk and credit risk measures. Panel B presents the descriptive statistics of the explanatory variables including bank level variables and country level variables. Skew presents skewness and kurt presents kurtosis. Natural log of risk measures are reported for all risk measures except for systematic risk.

### Panel A Descriptive statistics of bank risk measures-world analysis

<table>
<thead>
<tr>
<th>Risk Measure</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
<th>Skew</th>
<th>Kurt</th>
<th>Obs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural log of Credit risk (LLP/TA)</td>
<td>-2.499</td>
<td>0.482</td>
<td>-6.188</td>
<td>-0.111</td>
<td>-0.407</td>
<td>5.116</td>
<td>7222</td>
</tr>
<tr>
<td>Natural log of Credit risk (LLR/TA)</td>
<td>-1.901</td>
<td>0.365</td>
<td>-4.275</td>
<td>0.172</td>
<td>0.077</td>
<td>6.701</td>
<td>7125</td>
</tr>
<tr>
<td>Systematic risk</td>
<td>0.489</td>
<td>0.518</td>
<td>-3.168</td>
<td>4.070</td>
<td>0.472</td>
<td>4.918</td>
<td>6670</td>
</tr>
<tr>
<td>Natural log of Total risk</td>
<td>-2.856</td>
<td>0.560</td>
<td>-10.987</td>
<td>0.001</td>
<td>-1.941</td>
<td>26.033</td>
<td>6712</td>
</tr>
<tr>
<td>Natural log of Idiosyncratic risk</td>
<td>-2.959</td>
<td>0.550</td>
<td>-10.995</td>
<td>0.001</td>
<td>-1.537</td>
<td>23.654</td>
<td>6656</td>
</tr>
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</table>

### Panel B Descriptive statistics of the explanatory variables-world analysis

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
<th>Skew</th>
<th>Kurt</th>
<th>Obs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dividend yield (DY)</td>
<td>2.575</td>
<td>12.841</td>
<td>0</td>
<td>716.810</td>
<td>46.577</td>
<td>2412.786</td>
<td>6935</td>
</tr>
<tr>
<td>Operating leverage (OPL)</td>
<td>0.022</td>
<td>0.099</td>
<td>0</td>
<td>6.537</td>
<td>60.268</td>
<td>3754.085</td>
<td>7823</td>
</tr>
<tr>
<td>Uninsured deposits (UD)</td>
<td>0.068</td>
<td>0.405</td>
<td>-2.668</td>
<td>22.801</td>
<td>42.408</td>
<td>2094.865</td>
<td>7720</td>
</tr>
<tr>
<td>Charter value (CV)</td>
<td>1.046</td>
<td>0.161</td>
<td>0.031</td>
<td>5.904</td>
<td>19.380</td>
<td>717.321</td>
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<tr>
<td>Bank capital (BC)</td>
<td>0.082</td>
<td>0.053</td>
<td>-0.012</td>
<td>0.986</td>
<td>-0.242</td>
<td>111.097</td>
<td>7833</td>
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<tr>
<td>Off balance sheet activities (OBS)</td>
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<td>81.366</td>
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<tr>
<td>Loan to total assets (LTA)</td>
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<td>0.150</td>
<td>0</td>
<td>1.491</td>
<td>-0.811</td>
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<td>17.970</td>
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<tr>
<td>Bank concentration (BNC)</td>
<td>0.442</td>
<td>0.209</td>
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<td>0.812</td>
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<tr>
<td>Net interest margin (NIM)</td>
<td>0.038</td>
<td>0.022</td>
<td>0.006</td>
<td>0.235</td>
<td>3.403</td>
<td>20.629</td>
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</tr>
<tr>
<td>Stock market turnover (STurn)</td>
<td>1.054</td>
<td>0.745</td>
<td>0</td>
<td>4.948</td>
<td>1.324</td>
<td>5.909</td>
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<td>Deposit insurance Dummy (DIN)</td>
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<td>-2.737</td>
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<tr>
<td>Economic freedom Index (EFI)</td>
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<td>9.850</td>
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<td>Legal origin (D2)</td>
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<td>1</td>
<td>-0.339</td>
<td>1.115</td>
<td>7842</td>
</tr>
<tr>
<td>Creditor rights (D3)</td>
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<td>0</td>
<td>1</td>
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<td>1.052</td>
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</tr>
<tr>
<td>Anti-director rights (D5)</td>
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<td>0</td>
<td>4</td>
<td>0.680</td>
<td>2.325</td>
<td>7561</td>
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<td>Commercial bank=1, otherwise=0 (D1)</td>
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<td>0</td>
<td>5</td>
<td>-0.779</td>
<td>2.224</td>
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</tr>
</tbody>
</table>

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The economic freedom index is the highest in Hong Kong in 1996 at 90.5 while the lowest is observed for Bangladesh at 38.15 in 1995 followed by Venezuela at 45.04 in 2006. The creditor rights index ranges from 0 to 4, with a maximum for Egypt, Hong Kong, India, Indonesia, Israel, Malaysia, Pakistan, Singapore and the United Kingdom and the minimum for China, Colombia, France, Mexico, Philippines and Peru. The anti-director rights index ranges from 0 to 5 with a maximum value of 5 for Canada, Colombia, Hong Kong, India, Pakistan, South Africa, the United States of America and the United Kingdom and a minimum value of 0 for Belgium.

Commercial banks are dominated in Australia, Europe and Canada while banking holding companies are dominated in the USA. Explicit deposit insurance is present in all countries except for Australia, China, Cyprus, Egypt, Hong Kong, Mauritius, Morocco, Pakistan, Singapore and South Africa where it could be argued that implicit safety net exists.

The pair-wise correlation matrix reported in Table 3.10 on next page, shows no particularly high correlation among the independent variables such as bank capital, charter value, off-balance sheet activities, market discipline and loan to total assets though most coefficients are statistically significantly different from zero. Size and bank capital correlation is -39% while size and charter value is only 7%. The commercial bank dummy, legal origin dummy and market based dummy are highly correlated among each other. High income economy dummy and economic freedom index show a correlation of 65%. Similar results are also observed between market based dummy and economic freedom dummy.
freedom index.
Table 3.10
Correlation analysis for banks across the world (RQ1)

This table presents the correlation matrix for the second set of data for the explanatory variables used in relation to research question 1 (RQ1) for the world analysis. The table presents the pair-wise correlation matrix for the bank specific and country specific variables. *Correlation is significant at the 0.01 level (2-tailed). +Correlation is significant at the 0.05 level (2-tailed). DY=dividend yield; OPL=operating leverage, BC=bank capital; \( BC^2 \)=bank capital squared; CV=charter value; OBS=off-balance sheet activities; UD=uninsured deposits; LTA=loan to total assets; CONC=bank concentration; NIM=net interest margin; TURN=stock turnover ratio; DIN=deposit insurance; EFI=economic freedom index; MD=market based system; CL=common law country dummy; CB=commercial bank dummy; HI=high income country dummy.

<table>
<thead>
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<th>DY</th>
<th>OPL</th>
<th>BC</th>
<th>BC(^2)</th>
<th>CV</th>
<th>OBS</th>
<th>UD</th>
<th>Size</th>
<th>LTA</th>
<th>CONC</th>
<th>NIM</th>
<th>TURN</th>
<th>DIN</th>
<th>EFI</th>
<th>MD</th>
<th>CL</th>
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<td></td>
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<tr>
<td>BC</td>
<td>0.02+</td>
<td>0.21*</td>
<td>1.00</td>
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</tr>
<tr>
<td>( BC^2 )</td>
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<td>-0.97*</td>
<td>1.00</td>
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3.5.2 Descriptive statistics and correlation matrix related to research question 2 (RQ2)

The descriptive statistics for the individual European banks in euro-zone and non-euro-zone European countries are reported in Table 3.11. The mean return for banks in euro-zone countries ranges from 0.60% per month for German banks to 2.00% per month for Irish banks whereas the return variability ranges from 4.40% per month for Austrian banks to 17.00% per month for Finnish banks. The bank returns in euro-zone countries show positive kurtosis in all cases. Average excess kurtosis ranges from 1.33 for Irish banks to 19.45 for the Dutch banks. Both maximum and minimum average returns are generated by banks from Finland.

The cross-country correlation is reported in Table 3.12. Panel A to Panel C of Table 3.12, show the correlation among bank equity market returns in euro-zone countries over the period of January 1995 to April 2006. Panel A shows high correlation among banks in Austria, Belgium, France, Germany, Greece, Italy, the Netherlands, Portugal and Spain. The highest correlation is 95.80%, between Austria and Finland banks and between banks from France and Ireland. The lowest correlation is observed between Portugal and Spain banks at 14.00%.

The total sample period is also divided between the pre-euro period and the post-euro period. Panel B of Table 3.12, presents the correlation among the euro-zone bank index returns pre-euro period (January 1995 to December 1998). Relatively high correlation is found among the euro-zone bank returns. The highest correlation is reported at 90.90% between Italian and Portuguese banks.
Table 3.11
Descriptive statistics for European bank sample (RQ2)

This table presents the descriptive statistics of the sample in relation to research question 2 (RQ2). The table reports descriptive statistics for monthly returns for the equity markets used in the data analyses for the euro-zone countries Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom. All returns are in the local currency. The number of banks included in the sample from each country is reported. It should be noted that for the Finnish bank, Alandsbanken, both the A and the B shares are included in the sample. This leads to a total number of 96 banks with 97 listed shares that are subject to analysis.

NOB = number of banks.

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Non euro-zone

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Table 3.12  
Correlation analysis for European banks (RQ2)  
This table presents the correlation matrix of the sample in relation to research question 2 (RQ2). Panel A provides correlations of bank equity returns for the full period, January 1995 to April 2006. Panel B presents the correlations of bank equity market returns before the formation of Economic and Monetary Union (EMU) (January 1995 to December 1998). Panel C represents the correlations of bank equity market returns after the formation of EMU (January 1995 to April 2006). For Finland the DataStream bank index is used as no other bank indexes were available.  
** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).  

Panel A: Correlation of bank equity market returns, January 1995 to April 2006

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Panel B: Correlation of bank equity market return, January 1995 to December 1998

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<td>.778*</td>
<td>.834*</td>
</tr>
<tr>
<td>Ireland</td>
<td>.392**</td>
<td>.391**</td>
<td>.639**</td>
<td>.540**</td>
<td>.523**</td>
<td>.714</td>
<td>1</td>
<td>.421**</td>
<td>.539**</td>
<td>.270</td>
<td>.588**</td>
</tr>
<tr>
<td>Italy</td>
<td>.456**</td>
<td>.543**</td>
<td>.353*</td>
<td>.651**</td>
<td>.559**</td>
<td>.811*</td>
<td>.421**</td>
<td>1</td>
<td>.525**</td>
<td>.909**</td>
<td>.655**</td>
</tr>
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<td>.534**</td>
<td>.475**</td>
<td>.712**</td>
<td>.718**</td>
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<td>.539**</td>
<td>.525**</td>
<td>1</td>
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<td>.547**</td>
</tr>
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<td>.355</td>
<td>.467</td>
<td>.782*</td>
<td>.795*</td>
<td>.778*</td>
<td>.270</td>
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<td>.778*</td>
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<td>.787*</td>
</tr>
<tr>
<td>Spain</td>
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<td>.470**</td>
<td>.443**</td>
<td>.709**</td>
<td>.581**</td>
<td>.834*</td>
<td>.588**</td>
<td>.655**</td>
<td>.547**</td>
<td>.787*</td>
<td>1</td>
</tr>
</tbody>
</table>
## Panel C: Correlation of bank equity market return, January 1999 to April 2006

<table>
<thead>
<tr>
<th></th>
<th>Austria</th>
<th>Belgium</th>
<th>Finland</th>
<th>France</th>
<th>Germany</th>
<th>Greece</th>
<th>Ireland</th>
<th>Italy</th>
<th>Netherlands</th>
<th>Portugal</th>
<th>Spain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>1</td>
<td>.406**</td>
<td>.088</td>
<td>.294**</td>
<td>.416**</td>
<td>.229*</td>
<td>.247*</td>
<td>.198</td>
<td>.426**</td>
<td>.217*</td>
<td>.241*</td>
</tr>
<tr>
<td>Belgium</td>
<td>.406**</td>
<td>1</td>
<td>.288**</td>
<td>.683**</td>
<td>.689**</td>
<td>.421**</td>
<td>.445**</td>
<td>.517**</td>
<td>.824**</td>
<td>.585**</td>
<td>.631**</td>
</tr>
<tr>
<td>Finland</td>
<td>.088</td>
<td>.288**</td>
<td>1</td>
<td>.225*</td>
<td>.265*</td>
<td>.194</td>
<td>.197</td>
<td>.285**</td>
<td>.222*</td>
<td>.283**</td>
<td>.279**</td>
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<tr>
<td>France</td>
<td>.294**</td>
<td>.683**</td>
<td>.225*</td>
<td>1</td>
<td>.721**</td>
<td>.434**</td>
<td>.452**</td>
<td>.487**</td>
<td>.766**</td>
<td>.471**</td>
<td>.670**</td>
</tr>
<tr>
<td>Germany</td>
<td>.416**</td>
<td>.689**</td>
<td>.265*</td>
<td>.721**</td>
<td>1</td>
<td>.496**</td>
<td>.342**</td>
<td>.592**</td>
<td>.717**</td>
<td>.552**</td>
<td>.703**</td>
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<tr>
<td>Greece</td>
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<td>.421**</td>
<td>.194</td>
<td>.434**</td>
<td>.496**</td>
<td>1</td>
<td>.383**</td>
<td>.270*</td>
<td>.385**</td>
<td>.355**</td>
<td>.475**</td>
</tr>
<tr>
<td>Ireland</td>
<td>.247*</td>
<td>.445**</td>
<td>.197</td>
<td>.452**</td>
<td>.342**</td>
<td>.383**</td>
<td>1</td>
<td>.353**</td>
<td>.490**</td>
<td>.212*</td>
<td>.545**</td>
</tr>
<tr>
<td>Italy</td>
<td>.198</td>
<td>.517**</td>
<td>.285**</td>
<td>.487**</td>
<td>.592**</td>
<td>.270*</td>
<td>.353**</td>
<td>1</td>
<td>.592**</td>
<td>.276**</td>
<td>.733**</td>
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<tr>
<td>Netherlands</td>
<td>.426**</td>
<td>.824**</td>
<td>.222*</td>
<td>.766**</td>
<td>.717**</td>
<td>.385**</td>
<td>.490**</td>
<td>.592**</td>
<td>1</td>
<td>.512**</td>
<td>.744**</td>
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<tr>
<td>Portugal</td>
<td>.217*</td>
<td>.585**</td>
<td>.283**</td>
<td>.471**</td>
<td>.552**</td>
<td>.355**</td>
<td>.212*</td>
<td>.276**</td>
<td>.512**</td>
<td>1</td>
<td>.463**</td>
</tr>
<tr>
<td>Spain</td>
<td>.241*</td>
<td>.631**</td>
<td>.279**</td>
<td>.670**</td>
<td>.703**</td>
<td>.475**</td>
<td>.545**</td>
<td>.733**</td>
<td>.744**</td>
<td>.463**</td>
<td>1</td>
</tr>
</tbody>
</table>
Further, Panel C of Table 3.12 shows the correlations between bank index returns are generally lower during the post-euro period (January 1999 to April 2006). Austria, Finland and Ireland bank equity market indices exhibit lower correlations with the countries in the sample. For instance, Austria exhibits the lowest correlation at 9% with Finland. Lower correlations are also evident for Greek banks, perhaps consistent with its late entry to the EMU in 2001 (Ferreira and Ferreira 2006).

It is also found the bank returns correlation between Belgium and other major countries including France, Germany, Italy, the Netherlands, Portugal and Spain increased with the introduction of euro. For example, the correlation between Belgium and the Netherlands is 82.40%. Similarly, German bank returns show evidence of increased correlation with Spanish and Italian bank returns during the post-euro period. However, the correlation has decreased for French and Dutch banks after the introduction of euro but it remains high at 76.6%. The less than perfect positive correlation among the banks suggests that there is potential to reduce risk through diversification (Akhigbe and Whyte 2004). Thus, the decline in correlation among banks suggests that the benefits of portfolio diversification may have increased over the time for this group of banks.

3.6 SUMMARY

This chapter presented the data and methodology proposed to test the hypotheses developed in Chapter 2 to address the research questions identified in Chapter 1. Section 3.2 described the sample units, data sources, sampling procedure, sample composition and data coverage. The main source of bank specific data is extracted from BankScope database, with corresponding market return and market index obtained from DataStream International. All macroeconomic/country-level data are extracted from the Heritage
Foundation and World Bank IFC statistics.

Section 3.3 discussed the measure of the bank risk and its determinants in relation to the research questions 1 (RQ1A and RQ1B) and research question 2 (RQ2). Section 3.4 discussed the methodology and then extended it to define the multivariate regression equation models used to test the hypotheses discussed in Chapter 2. Finally, Section 3.5 provides the descriptive statistics for the variables used in the analysis.

The next three chapters will describe the results of testing the hypotheses laid out in Chapter 2 using the empirical methods proposed in this chapter. Specifically, Chapter 4 is devoted to the identifying determinants of European bank equity risk. Chapter 5 then discusses the structural changes in European bank equity risk and Finally, Chapter 6 focuses more broadly on the determinants of bank risk at the world banking system level.
CHAPTER 4
FACTORS DETERMINING EUROPEAN BANK RISKS:
EMPIRICAL RESULTS

4.1 INTRODUCTION

This chapter discusses the results in relation to research question 1 (RQ1) using the European bank sample. The remainder of this chapter is organized as follows. Section 4.2 represents the main results on effects of risk factors related to the base model (equation 5 as mentioned in Chapter 3, Section 3.4). Section 4.3 discusses the extended model (equation 6 as mentioned in Chapter 3, Section 3.4) where additional bank-specific variables and country-specific variables are included. Section 4.4 repeats the results from analyses of the impact of EMU on the risk factors. This also provides a check of the stability of the estimated models over the 10 year period of the study. Section 4.5 discusses the robustness tests and analysis. Section 4.6 concludes the chapter.

4.2 EFFECTS OF RISK FACTORS: BASE MODEL

Table 4.1 reports the empirical results for all five risk measures. The table represents the results under both pooled-OLS and two-stage least squares (2SLS) estimation methods. It seems that the results are not generally sensitive to the estimation methods. However, the Hausman chi-square test is statistically significant at the 1% significance level and hence 2SLS estimation is preferable to pooled-OLS.
Table 4.1
Determinants of European Bank Equity Risks and Credit Risk

This table represents the pooled-OLS and two-stage least squares regression results for bank characteristics. The following equation has been applied to generate the results.  

\[ RISK_{ij} = \alpha + \beta_1 UD_{ij} + \beta_2 CV_{ij} + \beta_3 BC_{ij} + \beta_4 LTA_{ij} + \beta_5 OBS_{ij} + \beta_6 Size_{ij} + \gamma EFI_{ij} + \varepsilon_{ij} \]  

(1)

\( RISK_{ij} \) presents the bank equity risks and credit risk. The bank equity risks include systematic risk, idiosyncratic risk, interest rate risk and total risk for individual bank \( i \) in country \( j \) at period \( t \). All bank equity risks are measured using the two index market model. The estimation techniques are provided in equation (3) and equation (4). Further, the credit risk includes the credit risk which is measured using \( CR_{ij} = \frac{LLP_{ij}}{TA_{ij}} \), where \( CR_{ij} \) is the credit risk measure for bank \( i \) in country \( j \) in period \( t \); or the ex-post realized risk. 

Table 4.1
Determinants of European Bank Equity Risks and Credit Risk

This table represents the pooled-OLS and two-stage least squares regression results for bank characteristics. The following equation has been applied to generate the results.

\[ RISK_{ij} = \alpha + \beta_1 UD_{ij} + \beta_2 CV_{ij} + \beta_3 BC_{ij} + \beta_4 LTA_{ij} + \beta_5 OBS_{ij} + \beta_6 Size_{ij} + \gamma EFI_{ij} + \varepsilon_{ij} \]  

(1)

\( RISK_{ij} \) presents the bank equity risks and credit risk. The bank equity risks include systematic risk, idiosyncratic risk, interest rate risk and total risk for individual bank \( i \) in country \( j \) at period \( t \). All bank equity risks are measured using the two index market model. The estimation techniques are provided in equation (3) and equation (4). Further, the credit risk includes the credit risk which is measured using \( CR_{ij} = \frac{LLP_{ij}}{TA_{ij}} \), where; \( CR_{ij} \) is the credit risk measure for bank \( i \) in country \( j \) in period \( t \); or the ex-post realized risk. 

**Pooled-OLS regression**

<table>
<thead>
<tr>
<th></th>
<th>Credit risk</th>
<th>Systematic risk</th>
<th>Total risk</th>
<th>Interest rate risk</th>
<th>Idiosyncratic risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0.019***</td>
<td>0.746***</td>
<td>-5.990***</td>
<td>0.370***</td>
<td>-6.314***</td>
</tr>
<tr>
<td>(0.004)</td>
<td>(0.206)</td>
<td>(0.615)</td>
<td>(0.117)</td>
<td>(0.614)</td>
<td></td>
</tr>
<tr>
<td>Uninsured deposits</td>
<td>0.001***</td>
<td>-0.050***</td>
<td>0.050***</td>
<td>0.008</td>
<td>0.070**</td>
</tr>
<tr>
<td>(0.018)**</td>
<td>(0.014)</td>
<td>(0.025)</td>
<td>(0.008)</td>
<td>(0.032)</td>
<td></td>
</tr>
<tr>
<td>Charter value</td>
<td>-0.007**</td>
<td>0.505**</td>
<td>3.691***</td>
<td>0.204</td>
<td>3.091***</td>
</tr>
<tr>
<td>(0.003)</td>
<td>(0.208)</td>
<td>(0.610)</td>
<td>(0.173)</td>
<td>(0.627)</td>
<td></td>
</tr>
<tr>
<td>Bank capital</td>
<td>-0.031***</td>
<td>-0.131**</td>
<td>-0.097</td>
<td>-0.002</td>
<td>-0.010</td>
</tr>
<tr>
<td>(0.015)**</td>
<td>(0.059)</td>
<td>(0.146)</td>
<td>(0.033)</td>
<td>(0.155)</td>
<td></td>
</tr>
<tr>
<td>Bank capital squared</td>
<td>0.146***†</td>
<td>0.086**</td>
<td>-0.166*</td>
<td>-0.033</td>
<td>-0.186**</td>
</tr>
<tr>
<td>(0.045)**</td>
<td>(0.036)</td>
<td>(0.092)</td>
<td>(0.020)</td>
<td>(0.096)</td>
<td></td>
</tr>
<tr>
<td>Off-balance sheet</td>
<td>0.033***†</td>
<td>0.050**</td>
<td>0.106***</td>
<td>0.001</td>
<td>0.067**</td>
</tr>
<tr>
<td>(0.013)**</td>
<td>(0.012)</td>
<td>(0.030)</td>
<td>(0.006)</td>
<td>(0.030)</td>
<td></td>
</tr>
</tbody>
</table>

**Two-Stage Least Square regression**

<table>
<thead>
<tr>
<th></th>
<th>Credit risk</th>
<th>Systematic risk</th>
<th>Total risk</th>
<th>Interest rate risk</th>
<th>Idiosyncratic risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0.006*</td>
<td>0.617***</td>
<td>-3.494***</td>
<td>-0.032</td>
<td>3.728***</td>
</tr>
<tr>
<td>(0.003)</td>
<td>(0.250)</td>
<td>(0.490)</td>
<td>(0.178)</td>
<td>(0.310)</td>
<td></td>
</tr>
<tr>
<td>Uninsured deposits</td>
<td>0.004†***</td>
<td>-0.042***</td>
<td>0.034**</td>
<td>0.003</td>
<td>0.056**</td>
</tr>
<tr>
<td>(0.002)**</td>
<td>(0.019)</td>
<td>(0.014)</td>
<td>(0.017)</td>
<td>(0.025)</td>
<td></td>
</tr>
<tr>
<td>Charter value</td>
<td>-0.005†***</td>
<td>0.603**</td>
<td>2.926***</td>
<td>-0.221</td>
<td>2.614***</td>
</tr>
<tr>
<td>(0.002)</td>
<td>(0.254)</td>
<td>(0.586)</td>
<td>(0.295)</td>
<td>(0.382)</td>
<td></td>
</tr>
<tr>
<td>Bank capital</td>
<td>-0.025**</td>
<td>-0.122***</td>
<td>-0.290*</td>
<td>-0.005</td>
<td>-0.203*</td>
</tr>
<tr>
<td>(0.012)</td>
<td>(0.045)</td>
<td>(0.167)</td>
<td>(0.067)</td>
<td>(0.119)</td>
<td></td>
</tr>
<tr>
<td>Bank capital squared</td>
<td>-0.012***†</td>
<td>0.075**</td>
<td>-0.115*</td>
<td>0.010</td>
<td>-0.098**</td>
</tr>
<tr>
<td>(0.006)**</td>
<td>(0.034)</td>
<td>(0.064)</td>
<td>(0.030)</td>
<td>(0.050)</td>
<td></td>
</tr>
<tr>
<td>Off-balance sheet</td>
<td>0.065***†</td>
<td>0.062***</td>
<td>0.084***</td>
<td>-0.017*</td>
<td>0.067***</td>
</tr>
<tr>
<td>(0.016)</td>
<td>(0.014)</td>
<td>(0.025)</td>
<td>(0.009)</td>
<td>(0.015)</td>
<td></td>
</tr>
<tr>
<td>activities</td>
<td>Loan to total assets</td>
<td>Size</td>
<td>Economic freedom index</td>
<td>Year dummy 1996-2005</td>
<td></td>
</tr>
<tr>
<td>-------------------</td>
<td>----------------------</td>
<td>------</td>
<td>------------------------</td>
<td>----------------------</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.003*** -0.218*** -0.588*** 0.025 -0.235</td>
<td>(0.001) (0.073) (0.246) (0.045) (0.242)</td>
<td>0.006*** -0.245*** -0.162 -0.012 0.032</td>
<td>(0.001) (0.079) (0.196) (0.062) (0.124)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.01)† 0.149*** 0.087*** -0.041† -0.026***</td>
<td>(0.008) (0.028) (0.006) (0.010)</td>
<td>(-0.040)<em><strong>† 0.148</strong></em> 0.065*** -0.006 -0.053***</td>
<td>(0.015)† (0.011) (0.022) (0.009) (0.014)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-0.007***† -0.013*** -0.041*** -0.034***</td>
<td>(0.004)† (0.003) (0.007) (0.002)</td>
<td>0.003† -0.010*** -0.025*** 0.038† -0.028***</td>
<td>(0.003)† (0.003) (0.010) (0.002) (0.003)</td>
<td></td>
</tr>
<tr>
<td>Adj R²</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td></td>
</tr>
<tr>
<td>Model test</td>
<td>F[17,1011]=14 558.70</td>
<td>0.22</td>
<td>F[17,1011]=69 257.32</td>
<td>0.59</td>
<td></td>
</tr>
<tr>
<td>Breusch Pagan χ²</td>
<td>F[17,1011]=23 103.87</td>
<td>0.35</td>
<td>F[17,1011]=5 356.60</td>
<td>0.10</td>
<td></td>
</tr>
<tr>
<td>Joint F-test for</td>
<td>F[17,1011]=5 100.44</td>
<td>0.20</td>
<td>F[17,1011]=23 103.87</td>
<td>0.57</td>
<td></td>
</tr>
<tr>
<td>year dummies</td>
<td>F[17,1014]=4 1015</td>
<td>0.20</td>
<td>F[17,1014]=10 16.65</td>
<td>0.57</td>
<td></td>
</tr>
<tr>
<td>Hansen chi-sq</td>
<td>F[17,1014]=5 1015</td>
<td>0.57</td>
<td>F[17,1014]=9 75.04</td>
<td>0.08</td>
<td></td>
</tr>
<tr>
<td>Number of obs.</td>
<td>1029</td>
<td>0.23</td>
<td>1029</td>
<td>0.22</td>
<td></td>
</tr>
</tbody>
</table>

116
The findings show a positive and statistically significant association between off-balance sheet items and bank risks. The result is consistent with hypothesis H3 (Chapter 2, Section 2.3.3). This supports the argument that off-balance sheet activities are contingent claims or contracts that generate fee income for banks but also create a balance sheet or portfolio risk. This is definitely a concern for bank regulators as the risk of off-balance sheet activities, if not managed properly, can squeeze liquidity and create sudden losses. However, Basel Accord I & II proposals have also considered off-balance sheet activities to be risky and have included them in the risk-weighted bank capital ratio.

There is mixed evidence with regard to the association between bank risk and charter value. A negative relationship is observed between bank charter value and credit risk. This result is consistent with the disciplining effect of charter value and hence supports hypothesis H1 (Chapter 2, Section 2.3.1). However, contentious findings are observed with regard to bank charter value and bank equity risk. A positive association is found between charter value and bank equity risk. This is inconsistent with hypothesis H1, though this result is in accordance with the theoretical considerations of prior studies (Park 1997; Hellman, Murdock and Stiglitz 2000; Saunders and Wilson 2001). One possible explanation for this relation is that charter value enhancing expansion took place over the study period and this may have resulted in increased European bank systematic risk, leading to greater losses during the business cycle contraction that occurred after 2000 (Demsetz and Strahan 1996; Hughes, Lang, Mester and Moon 1996; Saunders and Wilson 2001; Konishi and Yasuda 2004).

The other bank discipline variable is bank capital. The relationship between bank capital and both credit risk and systematic risk appears to be non-linear given the
statistically significant squared bank capital coefficients. Figure 4.1 and Figure 4.2 represent the estimated bank capital effect. The Y axis presents systematic risk (Figure 4.1) or credit risk (Figure 4.2) and X axis presents bank capital. This finding is in line with prior studies (e.g., Gennotte and Pyle 1991; Blum 1999; Calem and Rob 1999).

**Figure 4.1** Relationship between bank capital and systematic risk

**Figure 4.2** Relationship between bank capital and credit risk
It emerges that the higher the bank capital buffer the lower the bank risk consistent with the argument that careful management of bank capital can facilitate stability of the banking system (Furlong and Keeley 1987; Kim and Santomero 1988; Furlong and Keeley 1989; Keeley and Furlong 1990). However, with the build-up of bank capital banks tend to increase their level of risk (Calem and Rob 1999) Thus, the result supports hypothesis H2B as mentioned earlier in Chapter 2 (sub-section 2.3.2). Further, with respect to total risk and idiosyncratic risk, the coefficients on bank capital and bank capital squared are both negative and marginally statistically significant at the 10% significance level. The findings do not support hypothesis H2B.

The measure of market discipline, uninsured deposits, exhibits a negative and statistically significant association with systematic risk and a positive and significant association with credit risk, total risk and idiosyncratic risk. While the results for systematic risk support hypothesis H4, (Chapter 2; sub-section 2.3.4), the hypothesis is not supported for the other risk measures. This suggests that while market discipline may decrease risk relative to the market it could increase diversifiable bank-specific risks. The negative systematic risk coefficient could be interpreted as implying that an increase in bank liabilities and subordinated debt provides a superior market discipline strategy, reducing the effects of explicit or implicit deposit insurance. However, the positive relationship with credit risk and idiosyncratic risk suggests that increasing the level of longer maturity liabilities such as subordinated debt could also result in bank investments that carry greater levels of idiosyncratic, rather than systematic risk (Jensen and Meckling 1976). While idiosyncratic risk and individual bank credit risk might be diversified away by the investor, the bank still needs to manage these risks if it is to remain solvent.
Size is negatively related to credit risk and idiosyncratic risk. This finding is consistent with the work of Demsetz and Strahan (1997) and Demsetz, Saidenberg and Strahan (1996). This supports hypothesis H5B developed in earlier chapter (Chapter 2 sub-section 2.4.1). The relationship between systematic risk and size is positive and statistically significant at the 1% level. This result is consistent with previous studies particularly on US bank holding companies (Saunder, Strock and Travlos 1990; Demsetz, Saidenberg and Strahan 1996; Anderson and Fraser 2000) and also supports hypothesis H5A (Chapter 2 sub-section 2.4.1). Moreover, a positive association is observed for total risk and bank size. This finding is contrary to hypothesis H5B (Chapter 2 sub-section 2.4.1). This relationship suggests bank risk taking may be consistent with the “too-big – to-fail-policy”, where large banks have greater incentive to take higher risk as they enjoy a comprehensive safety net.

Another variable of interest is loans to total assets. The finding on credit risk is in the predicted direction, that is loans to total assets is positively associated with bank credit risk and thus, supports hypothesis H6 (Chapter 2 Section 2.4.2). However, loans to total assets is negatively related to systematic risk. This finding is contrary to hypothesis H6. This could come about where additional loans taken on by the banks are less risky than the existing pool of assets on bank balance sheets, resulting in decreased overall equity risk levels.\(^{46}\) There is some variation across the two estimation techniques. For example, with regard to total risk, a negative and statistically significant relationship is observed under pooled-OLS but a negative and insignificant coefficient is noted under

\(^{46}\) The study leaves further analysis of this question to future research.
2SLS estimation method. However, this negative coefficient is inconsistent with hypothesis H6.

In terms of macro-economic variables, the economic freedom index (EFI) is negatively associated with bank equity risk (systematic, total and idiosyncratic) measures and is statistically significant at the 1% level. This result implies that greater levels of economic freedom, particularly in terms of lower levels of regulation and government intervention, generate lower bank equity risk and credit risk. Hence, the result is consistent with predictions (Chapter 2, Section 2.4.3). Yet, there is some variation across the two methods. Although credit risk and interest rate risk exhibit a negative and statistically significant association with EFI under pooled-OLS, the relationship is not significant for 2SLS estimation technique. However, this negative association is consistent with the prediction (Chapter 2, Section 2.4.3). Table 4.2 below provides summary of the results as discussed above.

### Table 4.2
Summary of the Result
This table represents a summary of the result as discussed in Section 4.2. The results reported in column 3 under the term “Actual Sign” in the following table are statistically significant at the 5% significance level or better.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Predicted sign</th>
<th>Actual sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off-balance sheet activities</td>
<td>Positive (+)</td>
<td>Positive (+) with all risk measures except interest rate risk.</td>
</tr>
<tr>
<td>Charter value</td>
<td>Negative (-)</td>
<td>Negative (-) with credit risk only. Positive (+) with total, systematic and idiosyncratic risk.</td>
</tr>
<tr>
<td>Bank Capital</td>
<td>Non-linear</td>
<td>Non-linear with systematic risk and credit risk. No appreciable evidence of non-linearity with total and idiosyncratic risk.</td>
</tr>
<tr>
<td>Uninsured deposits</td>
<td>Negative (-)</td>
<td>Negative (-) with systematic risk. Positive (+) with credit, total and idiosyncratic risk.</td>
</tr>
<tr>
<td>Size</td>
<td>Positive (+) with systematic risk. Negative (-) with credit, total, interest rate and idiosyncratic risks</td>
<td>Negative (-) with credit and idiosyncratic risks. Positive (+) with systematic risk and total risk.</td>
</tr>
<tr>
<td>Loans to total assets</td>
<td>Positive (+)</td>
<td>Positive (+) with credit risk. Negative (-) with systematic risk.</td>
</tr>
<tr>
<td>Economic freedom index</td>
<td>Negative (-)</td>
<td>Negative (-) with all risk measures.</td>
</tr>
</tbody>
</table>
4.3 EFFECTS OF ADDITIONAL RISK FACTORS: EXTENDED MODEL

Table 4.3 on the following page reports on tests of hypotheses H7 and H8 (as developed in Chapter 2, Section 2.4.2) concerning bank risk determinants by estimating regression Equation 6 (mentioned in Chapter 3, Section 3.4) using pooled–OLS and two stage least squares (2SLS). This section discusses the results of the additional variables as the results for the base variables are little changed.

There is a negative relationship between dividend yield and bank equity risk. This result is in line with the predictions in the literature (Lee and Brewer 1987) and thus supports hypothesis H7 (developed in Chapter 2, in sub-section 2.4.2). Moreover, the findings exhibit a positive and statistically significant association between credit risk and dividend yield. This implies banks with high dividend yield do not necessarily exhibit lower credit risk. This is an unexpected outcome, though this study leaves further discussion of this result to future research.

Operating leverage has a positive (statistically significant at the 5% or higher) effect on bank equity risk (total risk, systematic risk and idiosyncratic risk) and credit risk. This is an expected outcome given the work of Mandelker and Rhee (1984); Saunders, Travlos and Strock (1990), Galloway, Lee and Roden (1997). It is argued that operating leverage acts in a similar manner to financial leverage, in increasing risk. This also lends support to hypothesis H8 (mentioned in Chapter 2 in sub-section 2.4.2). A negative association is observed between interest rate risk and operating leverage. This outcome is opposite to the predicted sign and this negative and statistically significant coefficient suggests that increasing income producing assets, all else held constant, could reduce financial leverage and thus reduce financial risk.
Table 4.3
Summary of the Result
This table represents a summary of the result of the additional variables as discussed in Section 4.3. The results reported in column 3 under the term “Actual Sign” in the following table are statistically significant at the 5% significance level or better.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Predicted sign</th>
<th>Actual sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dividend yield</td>
<td>Negative (-)</td>
<td>Negative with systematic, total and idiosyncratic risk and positive</td>
</tr>
<tr>
<td>Operating leverage</td>
<td>Positive (+)</td>
<td>Positive with all risk measures except for interest rate risk.</td>
</tr>
<tr>
<td>Ownership dummy (D₁)</td>
<td>Positive (+)</td>
<td>Positive with credit risk, systematic and total risk</td>
</tr>
<tr>
<td>Legal origin dummy (D₂)</td>
<td>Positive (+)</td>
<td>Negative with credit risk, total risk, systematic risk and interest</td>
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<tr>
<td>Geographical dummy (D₃)</td>
<td>Negative (-)</td>
<td>Negative with all risk measures</td>
</tr>
<tr>
<td>Creditor rights dummy (D₄)</td>
<td>Negative (-)</td>
<td>Positive with credit risk. Negative with total risk and idiosyncratic risk.</td>
</tr>
<tr>
<td>Anti-director rights (D₅)</td>
<td>Negative (-)</td>
<td>Negative with all risk measures except interest rate risk. Positive</td>
</tr>
</tbody>
</table>

There is evidence that commercial banks (D₁) exhibit greater credit risk, systematic risk and total risk than other bank classifications. The results are statistically significant at the 1% significance level or better. These findings are consistent with prediction (Chapter 2, Section 2.4.3).

Given the negative legal origin (D₂) coefficients, common-law country banks exhibit greater credit risk, systematic risk and total risk than the more heavily regulated civil-law country banks. The higher levels of common-law country bank risk may reflect the greater level of market discipline operating in civil-law countries which acts to constrain bank risk levels. This finding is consistent with the predictions (Chapter 2, Section 2.4.3).

The estimated coefficients for the geographical dummy (D₃) variable suggests that euro-zone country banks show lower levels of credit risk and bank equity risk. The results are statistically significant at the 5% level or better and are consistent with the predictions. However, with respect to interest rate risk, the findings show euro zone
banks have a higher level of interest rate risk. It can be argued that increased levels of financial market integration over the last decade may have affected interest rate processes. Financial market integration increases the speed with which interest rates change and associated volatility is transmitted among countries, making the control of interest rates by the authorities (central banks) more difficult and uncertain. Hence, increased globalization of financial market flows in recent years has made the measurement and management of interest rate risk a prominent concern (Saunders and Cornett 2006).

Enforcement of creditor rights (creditor rights variable) and anti-director rights (anti-director rights variable) seem to be important in explaining the variation in bank total risk and idiosyncratic risk. The results support the predictions (Chapter 2, Section 2.4.3). With regard to credit risk, the coefficient on anti-director rights and creditor rights is negative and positive respectively and statistically significant at the 1% level. The result is consistent with prediction for anti-director rights index, but is contrary to the predictions for creditor rights. Further, the coefficient for anti-director rights is negative and statistically significant with respect to systematic risk. This finding is in line with prediction (La Porta et al 1998).

Yet, anti-director rights index and interest rate risk is positively associated at the 5% or better significance level. This finding is however, contrary to that predicted (Chapter 2, Section 2.4.3).
Table 4.4

The Determinants of European Bank Equity Risks and Credit Risk

The tables presents the pooled-OLS regression and two stage least squares regression results to estimate the extended model of bank risk.

\[
RISK_{i,j,t} = \alpha_0 + \beta_1 \text{OPL}_{i,j,t} + \beta_2 \text{DY}_{i,j,t} + \beta_3 \text{UD}_{i,j,t} + \beta_4 \text{CV}_{i,j,t} + \beta_5 \text{BC}_{i,j,t} + \beta_6 \text{BC}^2_{i,j,t} + \beta_7 \text{OBS}_{i,j,t} + \beta_8 \text{LTA}_{i,j,t} + \beta_9 \text{Size}_{i,j,t} + \gamma_1 \text{EFI}_{j,t} + \delta_1 \text{D}_{1,j,t} + \delta_2 \text{D}_{2,j,t} + \delta_3 \text{D}_{3,j,t} + \sum \phi_i Y_{i,t} + \varepsilon_{i,j,t}
\]

(2)

**RISK**_{i,j,t} presents the bank equity risks and credit risk. The bank equity risks include systematic risk, idiosyncratic risk, interest rate risk and total risk for individual bank i in country j at period t. All bank equity risks are measured using the two index market model. The estimation techniques are provided in equation (3) and equation (4). Further, the credit risk includes the credit risk which is measured using \( CR_{i,j,t} = LLP_{i,j,t}/TA_{i,j,t} \), where: \( CR_{i,j,t} \) is the credit risk measure for bank i in country j in period t; \( LLP_{i,j,t} \) is the loan loss provision for bank i in country j in period t; \( TA_{i,j,t} \) is the total assets of bank i in country j in period t. The explanatory variables such as \( UD_{i,j,t} \) is the natural log of uninsured deposits for bank i in country j at period t; \( CV_{i,j,t} \) is the natural log of charter value for bank i, country j in period t; \( BC_{i,j,t} \) is the natural log of bank capital for bank i, in country j in period t; \( BC^2_{i,j,t} \) is the natural log of bank capital squared for bank i, in country j in period t; \( OBS_{i,j,t} \) is the natural log of off-balance sheet activities for bank i, in country j at period t; \( LTA_{i,j,t} \) is the loan to total assets for bank i, in country j at period t; \( Size_{i,j,t} \) is the natural log of market value of equity for bank i, in country j, in period t and \( EFI_{j,t} \) is the economic freedom index for country j at period t. \( OPL_{i,j,t} \) is the natural logarithm of operating leverage for bank i, country j at period t; \( DY_{i,j,t} \) is dividend yield for bank i, country j at period t; \( D_{1,j} \) is the specialization dummy where \( D_{1,j} = 1 \) if commercial banks or otherwise 0; \( D_{2,j} \) is legal origin variable where \( D_{2,j} = 1 \) if common-law countries, 2 if French civil law countries, 3 if German civil-law countries and 4 if Scandinavian civil law countries; \( D_{3,j} \) is a geographical dummy where \( D_{3,j} = 1 \) if euro-zone countries or otherwise 0; \( D_{4,j} \) is creditor rights index and; \( D_{5,j} \) is shareholder rights index. Finally, \( \varepsilon_{i,j,t} \) is the random error term. The joint F-test for the year dummies are statistically significant for all risk measures. All results are corrected for heteroscedasticity. The standard errors are reported in parenthesis. Superscripts *, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively. † indicates the coefficients of the explanatory variables and standard errors are scaled by 100.

<p>| | Pooled-OLS analysis | Two-stage least squares |
|---|---|---|---|---|---|---|---|---|---|---|
| Intercept | Credit risk | Systematic risk | Total risk | Interest rate risk | Idiosyncratic risk | Credit risk | Systematic risk | Total risk | Interest rate risk | Idiosyncratic risk |
| | 0.027*** | 1.13*** | -8.251*** | 0.105 | -8.665*** | -0.008 | 1.050** | -5.027*** | 0.154 | -6.507*** |
| | (0.004) | (0.266) | (0.781) | (0.162) | (0.762) | (0.016) | (0.538) | (0.624) | (0.352) | (0.749) |
| Operating leverage | Credit risk | Systematic risk | Total risk | Interest rate risk | Idiosyncratic risk | Credit risk | Systematic risk | Total risk | Interest rate risk | Idiosyncratic risk |
| | 0.001*** | 0.02*** | 0.016** | -0.009** | 0.003*** | 0.020†** | 0.022* | 0.020** | -0.004* | 0.004*** |
| | (0.040)† | (0.007) | (0.007) | (0.004) | (0.001) | (0.010) | (0.010) | (0.009) | (0.017) | (0.001) |</p>
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<th>Bank capital squared</th>
<th>Off balance sheet activities</th>
<th>Loan to total assets</th>
<th>Size</th>
<th>Economic freedom index</th>
<th>Ownership</th>
<th>dummy D1</th>
<th>Legal origin</th>
<th>dummy D2</th>
<th>Geographical dummy D3</th>
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<th>dummy D4</th>
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<td>(0.133)</td>
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<td>12***</td>
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<td>12***</td>
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<td>Breusch Pagan χ^2</td>
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<td>114.27</td>
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<td>8***</td>
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<td>6***</td>
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<td>6***</td>
<td>7***</td>
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</table>
4.4 IMPACT OF EMU ON RISK FACTORS: A TEST FOR STABILITY OF THE MODEL

The impact of EMU on variation in bank risk is also analyzed. Table 4.5 presents the result for this analysis. Both pooled-OLS and panel techniques are applied in this analysis but the Lagrange-multiplier test supports the pooled-OLS approach. A Wald F-test is employed to assess the possibility of structural change with EMU. The tests confirm the existence of structural change for all risk measures suggesting that the formation of EMU had an important impact on bank risks for the sample of banks used in this thesis. The year dummies are jointly significant for all risk measures.

The magnitude of the charter value coefficients fell dramatically with EMU for all risk measure models. This outcome is interpreted in terms of the decline in the importance of charter value with the formation of EMU and increasing levels of competition. The most statistically significant decline is observed for charter value relative to systematic risk with a change in the coefficient of -1.431. This finding is consistent with the hypothesis H11A as mentioned in Chapter 2.

The coefficient on bank capital is negative and statistically significant at the 1% level for systematic risk. This finding supports hypothesis H11B (See Chapter 2 Section 2.5). It is apparent that the non-linear relationship between bank capital and systematic risk may be driven by the post-EMU period. Further, evidence of non-linearity between bank capital and interest rate risk is also observed supporting hypothesis H11B, although the result is marginally significant. With regard to total risk and idiosyncratic risk, there is no evidence of non-linearity and thus the hypothesis H11B is rejected.
Further, the findings generally show a statistically significant (at the 1% level) increase in the effect of off-balance sheet activities on risk with the formation of EMU, consistent with hypothesis H11C. However, the importance of off-balance sheet activities with respect to credit risk has declined in the post-EMU period and the hypothesis H11C is rejected.

The importance of uninsured deposits has increased for bank systematic risk, total and idiosyncratic risk in the post-EMU period. This is consistent with hypothesis H11D (Chapter 2, Section 2.5 and Section 2.3.4). With respect to interest rate risk, the findings show a decline in importance of uninsured deposits in the post-EMU period, though the result is marginally significant.

The size variable has increased in importance following 1999 for all risk measures while being statistically significant for credit risk, total risk and idiosyncratic risk. The loan-to-total asset ratio coefficient also generally increases after 1999 with respect to bank equity risk though the change in the coefficient is not statistically significant.

Finally, the economic freedom index coefficient shows a statistically significant decline with respect to credit risk and interest rate risk after 1999.

In summary, the formation of the EMU has had an impact on the sensitivity of bank risk to some of the key variables included in the model. While some of the variation is due to changes in sensitivity to bank capital the remaining variation is associated more with changes in the magnitude of coefficients rather than their sign (See Section 4.2).
Table 4.5

Impact of Economic and Monetary Union (EMU) on bank equity risk, interest rate risk and credit risk

This table represents the impact of EMU on bank equity risk and credit risk. Pooled-OLS and random effects is used in estimation of these models as per Equation (8) discussed in Chapter 3. The sample is split into two, with 1999 being the year most associated with the formation of EMU chosen as the break point. This facilitates tests for structural change between the pre-EMU period (1996-1998) and the post-EMU period (1999-2005). The following model is used to test for structural changes with the formation of EMU:

\[
Y_{ijt} = \alpha + \beta X_{ijt} + \beta_{1} D_{j} X_{ijt} + \Sigma \delta_{t} Y_{t} + \epsilon_{ijt}
\]

where, \(X_{ijt}\) = bank-specific characteristics for bank \(i\) in country \(j\) at period \(t\). These variables are same as the explanatory variables identified in Equation (5) in Chapter 3.

\(D_{j}\) = time dummy, where \(D_{j} = 1\) for post-euro period and \(D_{j} = 0\) for pre-euro period;

\(X_{ijt} D_{j}\) = interaction term between each bank-specific variable \(X_{ijt}\) with the time dummy and;

\(Y_{t}\) is year dummy variable. All results are corrected for heteroscedasticity and the adjusted standard errors are reported in parenthesis. Superscripts *, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively. † indicates the coefficients of the explanatory variables and standard errors are scaled by 100.

<table>
<thead>
<tr>
<th>Credit risk</th>
<th>Systematic risk</th>
<th>Total risk</th>
<th>Interest rate risk</th>
<th>Idiosyncratic risk</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre EMU</td>
<td>Difference</td>
<td>Pre EMU</td>
<td>Difference</td>
</tr>
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<td>Intercept</td>
<td>0.004</td>
<td>-</td>
<td>0.409</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.372)</td>
<td>(1.292)</td>
<td>(0.170)</td>
</tr>
<tr>
<td>Uninsured deposits</td>
<td>0.044†</td>
<td>0.029†</td>
<td>-0.041***</td>
<td>0.017</td>
</tr>
<tr>
<td></td>
<td>(0.026)†</td>
<td>(0.036)†</td>
<td>(0.008)</td>
<td>(0.005)</td>
</tr>
<tr>
<td>Charter value</td>
<td>-0.005</td>
<td>-0.002</td>
<td>-1.711***</td>
<td>-1.431**</td>
</tr>
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<td></td>
<td>(0.005)</td>
<td>(0.006)</td>
<td>(0.611)</td>
<td>(1.735)</td>
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<td>0.001</td>
<td>0.101</td>
<td>-0.276**</td>
</tr>
<tr>
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<td>(0.001)</td>
<td>(0.001)</td>
<td>(0.136)</td>
<td>(0.317)</td>
</tr>
<tr>
<td>Bank capital squared</td>
<td>0.007†</td>
<td>0.002***</td>
<td>-0.064</td>
<td>0.182**</td>
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<td>(0.001)</td>
<td>(0.001)</td>
<td>(0.078)</td>
<td>(0.194)</td>
</tr>
<tr>
<td>Off balance sheet activities</td>
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<td>-0.001***</td>
<td>-0.046***</td>
<td>0.023***</td>
</tr>
<tr>
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<td>(0.014)†</td>
<td>(0.024)†</td>
<td>(0.017)</td>
<td>(0.008)</td>
</tr>
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<td>Loan to total assets</td>
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<td>-0.004</td>
<td>-0.394***</td>
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<td>(0.002)</td>
<td>(0.002)</td>
<td>(0.137)</td>
<td>(0.162)</td>
</tr>
<tr>
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<td>0.001**</td>
<td>0.130***</td>
<td>0.023***</td>
</tr>
<tr>
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<td>(0.025)†</td>
<td>(0.025)†</td>
<td>(0.019)</td>
<td>(0.007)</td>
</tr>
<tr>
<td>Economic freedom index</td>
<td>0.009**†</td>
<td>-0.02***</td>
<td>-0.002***</td>
<td>-0.006***</td>
</tr>
<tr>
<td></td>
<td>(0.005)†</td>
<td>(0.007)†</td>
<td>(0.003)</td>
<td>(0.002)</td>
</tr>
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<td>Year dummy 1996-2005</td>
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<td>yes</td>
<td>yes</td>
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Adj R\(^2\) 0.25  0.61  0.33  0.12  0.21
Breusch Pagan χ\(^2\) 648.57  278.65  145.194  454.54  134.186
Lagrange Multiplier test 58.66***  406.89***  384.89***  57.24***  320***
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<th>significance for differences</th>
<th>F-test for year dummies</th>
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<td>Joint significance</td>
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</tr>
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<td>2.54</td>
<td>2.71</td>
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<td>3.62</td>
<td>5.24</td>
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<td>2.15</td>
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4.5 ROBUSTNESS

In this section, the robustness of the findings from testing hypotheses H1 to H8 in Section 4.2 and Section 4.3 is checked using panel techniques (both random effects and fixed effects). The results under this method is discussed in Section 4.6.1 Section 4.6.2 reports the result excluding Danish and German commercial banks. Section 4.6.3 describes the result for alternative risk measures. Finally, Section 4.6.4 discusses the result in relation to an additional analysis in order to explain a more complex relationship that may affect bank risk measures.

4.5.1 Effect of risk factors controlling for heterogeneity

This section reports the results of the analysis of the risk measures under random effects and fixed effects models. These standard methods are chosen to capture unobservable heterogeneity in the data. Table 4.6 reports both Lagrange Multiplier (LM) test and Hausman test. The results show Hausman test is statistically significant at the 1% level and hence fixed effects is the preferred method. However, due to large number of dummy variables at individual bank level and country level, it may be unreasonable to expect a reliable result on only 117 banks under fixed effects estimation technique.

However, this study reports the result under both the estimation technique in Panel A and Panel B of Table 4.6. Table 4.6 Panel A presents the results with random effects. One important finding that is robust to the change in estimation method relates to off-balance sheet activities. The coefficients for this variable remain positive and statistically significant at the 5% significance level or better reflecting the relation between off-balance sheet activities and the various measures of bank riskiness.
Table 4.6
Comparison of bank risk measures using panel techniques

This table represents the results when panel techniques are applied to determine the relationship between bank risk and bank characteristics. The following equation has been applied to generate the results.

\[
Risk_{it} = \alpha + \beta UD_{i,t} + \beta_2 CV_{i,t} + \beta_3 BC_{i,t} + \beta_4 BC^2_{i,t} + \beta_5 OBS_{i,t} + \beta_6 LTA_{i,t} + \beta_7 Size_{i,t} + \gamma EFI_{t} + \epsilon_{i,t}
\]

\( RISK_{i,t} \) represents the bank equity risks and credit risk. The bank equity risks include systematic risk, idiosyncratic risk, interest rate risk and total risk for individual bank \( i \) in country \( j \) at period \( t \). All bank equity risks are measured using the two index market model. Credit risk is measured using \( CR_{i,t} = LLP_{i,t}/TA_{i,t} \), where \( CR_{i,t} \) is the credit risk measure for bank \( i \) in country \( j \) in period \( t \); \( LLP_{i,t} \) is the loan loss provision for bank \( i \) in country \( j \) in period \( t \); or the ex-post realized risk. \( TA_{i,t} \) is the total assets of bank \( i \) in country \( j \) in period \( t \). The explanatory variables such as \( UD_{i,t} \) is the natural log of uninsured deposits for bank \( i \), in country \( j \) at period \( t \), \( CV_{i,t} \) is the natural log of charter value for bank \( i \), country \( j \) in period \( t \); \( BC_{i,t} \) is the natural log of bank capital for bank \( i \), in country \( j \) in period \( t \); \( BC^2_{i,t} \) is the natural log of bank capital squared for bank \( i \), in country \( j \) in period \( t \); \( OBS_{i,t} \) is the natural log of off-balance sheet activities for bank \( i \), in country \( j \) at period \( t \); \( LTA_{i,t} \) is the loan to total assets for bank \( i \), in country \( j \) at period \( t \), \( Size_{i,t} \) is the natural log of market value of equity for bank \( i \), in country \( j \), in period \( t \) and \( EFI_{t} \) is the economic freedom index for country \( j \) at period \( t \). Finally, \( \epsilon_{i,t} \) is the random error term. Panel A and Panel B presents the results under the random effects and fixed effects respectively. The Hausman test and the Lagrange Multiplier test are reported. All results are corrected for heteroscedasticity. The standard errors are reported in parenthesis. Superscripts *, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively. † indicates the coefficients of the explanatory variables and standard errors are scaled by 100.

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<th>Panel A: Random effects analysis</th>
<th>Credit risk</th>
<th>Systematic risk</th>
<th>Total risk</th>
<th>Interest rate risk</th>
<th>Idiosyncratic risk</th>
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</thead>
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<td>Intercept</td>
<td>0.017***</td>
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<td>(0.688)</td>
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<td>0.075**</td>
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<td>(0.023)</td>
<td>(0.009)</td>
<td>(0.036)</td>
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<td>1.631**</td>
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<td>(0.105)</td>
<td>(0.670)</td>
<td>(0.167)</td>
<td>(0.656)</td>
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<td>(0.067)</td>
<td>(0.210)</td>
<td>(0.040)</td>
<td>(0.204)</td>
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<tr>
<td>Bank capital squared</td>
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<td>0.096**</td>
<td>0.078**</td>
<td>-0.022</td>
<td>0.028***</td>
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<td>(0.040)</td>
<td>(0.036)</td>
<td>(0.024)</td>
<td>(0.010)</td>
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<tr>
<td>Off balance sheet activities</td>
<td>0.003***†</td>
<td>0.045***</td>
<td>0.100**</td>
<td>-0.009</td>
<td>0.069**</td>
</tr>
<tr>
<td></td>
<td>(0.001)†</td>
<td>(0.014)</td>
<td>(0.043)</td>
<td>(0.008)</td>
<td>(0.032)</td>
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<tr>
<td>Loan to total assets</td>
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<td>-0.108***</td>
<td>-0.626**</td>
<td>0.031</td>
<td>-0.288</td>
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<td>(0.304)</td>
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<td>(0.329)</td>
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<td>-0.005</td>
<td>0.051***</td>
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<td>(0.010)</td>
<td>(0.033)</td>
<td>(0.006)</td>
<td>(0.021)</td>
</tr>
<tr>
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<td>-0.011***</td>
<td>-0.008***</td>
<td>-0.003***</td>
<td>-0.008***</td>
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<tr>
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<td>(0.003)</td>
<td>(0.003)</td>
<td>(0.001)</td>
<td>(0.002)</td>
</tr>
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<td>375.42</td>
<td>355.04</td>
<td>32.22</td>
<td>305.55</td>
</tr>
<tr>
<td></td>
<td>(prob.=0.00)</td>
<td>(prob.=0.00)</td>
<td>(prob.=0.00)</td>
<td>(prob.=0.00)</td>
<td>(prob.=0.00)</td>
</tr>
</tbody>
</table>
Further, the findings on bank charter value and uninsured deposits using random effects remain unchanged (as discussed in Section 4.2). With regard to the non-linear bank capital result some variation is observed under random effects. For instance, there is less evidence of a statistically significant non-linear relationship between bank risk (idiosyncratic risk and total risk) and bank capital though statistical significance remains for credit risk and systematic risk (as illustrated in Section 4.2).

The loans to total assets ratio results remain little changed when the model is estimated using random effects. Credit risk is positively related while total risk and systematic risk is negatively related to loans to total assets. Given the sample is

<table>
<thead>
<tr>
<th></th>
<th>Credit risk</th>
<th>Systematic risk</th>
<th>Total risk</th>
<th>Interest rate</th>
<th>Idiosyncratic risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uninsured deposits</td>
<td>-0.014**†</td>
<td>-0.049**</td>
<td>0.014</td>
<td>-0.008</td>
<td>0.067**</td>
</tr>
<tr>
<td>Charter value</td>
<td>-0.012***</td>
<td>-0.018</td>
<td>1.583**</td>
<td>-0.023</td>
<td>0.975**</td>
</tr>
<tr>
<td>Bank capital</td>
<td>-0.001†</td>
<td>-0.199*</td>
<td>-0.443*</td>
<td>-0.209***</td>
<td>-0.308</td>
</tr>
<tr>
<td>Bank capital squared</td>
<td>0.001</td>
<td>0.120**</td>
<td>0.292**</td>
<td>0.120***</td>
<td>0.225</td>
</tr>
<tr>
<td>Off balance activities</td>
<td>0.046***†</td>
<td>0.035**</td>
<td>0.062**</td>
<td>0.017*</td>
<td>0.050**</td>
</tr>
<tr>
<td>Loan to total assets</td>
<td>0.005***</td>
<td>-0.382**</td>
<td>-0.067</td>
<td>0.072</td>
<td>-0.421**</td>
</tr>
<tr>
<td>Size</td>
<td>-0.046*†</td>
<td>0.024***</td>
<td>0.065***</td>
<td>0.020</td>
<td>0.072***</td>
</tr>
<tr>
<td>Economic freedom index</td>
<td>-0.004†**</td>
<td>0.002</td>
<td>-0.038***</td>
<td>-0.003</td>
<td>-0.036***</td>
</tr>
<tr>
<td>Adj. R²</td>
<td>0.35</td>
<td>0.73</td>
<td>0.58</td>
<td>0.21</td>
<td>0.53</td>
</tr>
<tr>
<td>Hausman test</td>
<td>16.32</td>
<td>74.79</td>
<td>46.50</td>
<td>32.22</td>
<td>43.52</td>
</tr>
<tr>
<td>(prob=0.04)</td>
<td>(prob=0.00)</td>
<td>(prob=0.00)</td>
<td>(prob=0.00)</td>
<td>(prob=0.00)</td>
<td>(prob=0.00)</td>
</tr>
<tr>
<td>Lagrange Multiplier test</td>
<td>58.92</td>
<td>375.42</td>
<td>355.04</td>
<td>32.22</td>
<td>305.55</td>
</tr>
<tr>
<td>(prob=0.000)</td>
<td>(prob=0.00)</td>
<td>(prob=0.00)</td>
<td>(prob=0.00)</td>
<td>(prob=0.00)</td>
<td>(prob=0.00)</td>
</tr>
</tbody>
</table>
dominated by commercial banks this result suggests that deregulation and increased involvement in non-interest generating activity may have helped the banks in this sample to be less aggressive in the credit market, resulting in reduced total risk.

The study also finds that large banks have higher systematic risk, total risk and idiosyncratic risk (Stiroh 2006) and lower credit risk. This outcome is consistent with the results reported in Section 4.2 except for idiosyncratic risk. Finally, the economic freedom index (EFI) coefficient is negative for all bank risk measures and is statistically significant at the 5% significance level. This is consistent with the results reported earlier in Section 4.2.

Table 4.6 Panel B reports the results with fixed effects. Consistent with hypothesis H3 off-balance sheet activities is positively related with each of the bank risk measures consistent with the findings discussed in Section 4.2. With regards to charter value, the findings are consistent with that discussed in Section 4.2 for credit risk, total risk and idiosyncratic risk. The coefficient of uninsured deposits and size remain unchanged. One point of difference is the non-linear association between bank capital and interest rate risk.

4.5.2 Excluding Danish and German banks

The study re-runs the models excluding the 36 Danish commercial banks from the original sample, as this group of banks accounts for a substantial proportion of the bank sample. The findings are little changed with this additional analysis. Further, given the unusual nature of the German banking industry (Haq and Heaney 2009), the study constructs another unbalanced panel excluding German banks from the sample. The study
re-runs the base model and extended model after eliminating the three (3) German banks from the sample. The results remain unchanged both for the base model and the extended model though it is found that with exclusion of the three German banks there is evidence supporting a non-linear relationship between bank risk (total risk and idiosyncratic risk) and bank capital. The results are reported in Table A4.1 and Table A4.2 in Appendix.

4.5.3 Proportional risk measures

The analysis is repeated using proportional risk measures, where systematic risk, idiosyncratic risk and interest rate risk are measured as a proportion of total equity market risk rather than actual risk estimates. The proportional risk measures are calculated in the following manner.

\[
R_{ni} = \alpha + \beta_m R_m + \beta_t R_t + \epsilon_n : \quad (11)
\]

\[
\sigma_{ni}^2 = \beta_m^2 \sigma_m^2 + \beta_t^2 \sigma_t^2 + 2 \beta_m \beta_t \text{cov}(R_m, R_t) + \sigma_r^2 \quad (12)
\]

- systematic risk / total risk = \(\beta_m^2 \sigma_m^2 / \sigma_r^2\);
- Interest rate risk / total risk = \(\beta_t^2 \sigma_t^2 / \sigma_r^2\) and
- Idiosyncratic risk / total risk = \(\sigma_r^2 / \sigma_r^2\)

The original results, as discussed in Section 4.2 and Section 4.3, are robust to this alternative specification. The results are reported in Table A4.3 in Appendix.

4.5.4 Additional analysis- incorporating interaction terms

Finally, the study re-runs the analysis with the inclusion of various interaction terms to test for the possibility of more complex relationships explaining the various measures of bank risk. The following model applies the pooled-OLS estimation
technique.

\[
RISK_j = \alpha + \beta UD_{i,j} + \beta BC_{i,j} + \beta CV_{j-1} + \beta OBS_{i,j} + \beta LTA_{i,j} + \beta Siz_{i,j-1} + \gamma EFL + \delta UD_{i,j} * BC_{i,j-1} + \delta UD_{i,j} * CV_{j-1} + \delta OBS_{i,j} * CV_{j-1} + \delta OBS_{i,j} * BC_{i,j-1} + \delta CV_{j-1} * Siz_{i,j-1} + \epsilon_{i,j}
\]

(13)

where, \( UD_{i,j} * BC_{i,j-1} \) interaction between uninsured deposits and bank capital,

\( UD_{i,j} * CV_{j-1} \) interaction between uninsured deposits and charter value,

\( OBS_{i,j} * CV_{j-1} \) interaction between off-balance sheet activities and charter value,

\( OBS_{i,j} * BC_{i,j-1} \) interaction between off-balance sheet activities and bank capital,

\( CV_{j-1} * Siz_{i,j-1} \) interaction between charter value and bank size.

Table 4.7 reports the findings. The statistical significant negative coefficient (\( \delta_1 \)) for the interaction term indicates that the impact of charter value is decreasing in presence of uninsured deposits. However, uninsured deposits increase the influence of charter value on credit risk. Given the level of uninsured deposits, the interaction term between uninsured deposits and bank capital is positive and statistically significant for bank equity risk. This implies bank capital is unable to reduce bank risk in presence of market discipline. Perhaps this finding reinforces the argument that bank capital may not compliment market discipline.\(^{47}\) The impact of charter value increases on equity risk (with the exception of interest rate risk) and decreases in credit risk in off balance sheet activities. The coefficient (\( \delta_4 \)) for the interaction term between off-balance sheet activities and bank capital exhibits that the impact of bank capital on equity risk (except interest

\(^{47}\) It is beyond the scope of this thesis to further analyze this finding and thus is left for future research.
rate risk) decreases in off-balance sheet activities although it increases in credit risk.
Table 4.7  
Analysis of the interaction terms

This table represents the results when pooled-OLS is applied to determine the relationship between bank risk and bank characteristics with interaction terms. The following equation has been applied to generate the results.

\[
RISK_{ijt} = (\alpha_0 + \beta_{UD_{ij,t-1}} + \beta_{CV_{i,j,t-1}} + \beta_{BC_{i,j,t-1}} + \beta_{LTA_{i,j,t}} + \beta_{Size_{i,j,t}} + \gamma_{EFI_{t,j}} + \\
\delta_{UD_{ij,t}}*BC_{i,j,t-1} + \delta_{UD_{ij,t}}*CV_{i,j,t-1} + \delta_{OB_{i,j,t}}*CV_{i,j,t-1} + \delta_{OB_{i,j,t}}*BC_{i,j,t-1} + \delta_{CV_{i,j,t-1}}*\text{Size}_{i,j,t} + \epsilon_{i,j,t})
\]

(5)

\(RISK_{ijt}\) represents the bank equity risks and operational risk. The bank equity risks include systematic risk, idiosyncratic risk, interest rate risk and total risk for individual bank \(i\) in country \(j\) at period \(t\). All bank equity risks are measured using the two index market model. The estimation techniques are provided in equation (3) and equation (4). Further, the credit risk is measured using \(CR_{i,j,t} = LLP_{i,j,t}/TA_{i,j,t}\), where; \(CR_{i,j,t}\) is the credit risk measure for bank \(i\) in country \(j\) in period \(t\); or the ex-post realized risk; \(LLP_{i,j,t}\) is the loan loss provision for bank \(i\) in country \(j\) in period \(t\).

The explanatory variables such as \(UD_{i,j,t}\) is the natural log of uninsured deposits for bank \(i\), in country \(j\) at period \(t\), \(CV_{i,j,t}\) is the natural log of charter value for bank \(i\), country \(j\), lagged one period, \(BC_{i,j,t}\) is the natural log of bank capital for bank \(i\), in country \(j\) lagged one period, \(TA_{i,j,t}\) is the total assets of bank \(i\) in country \(j\) in period \(t\). The credit risk is measured using \(CR_{i,j,t} = LLP_{i,j,t}/TA_{i,j,t}\), where; \(CR_{i,j,t}\) is the credit risk measure for bank \(i\) in country \(j\) in period \(t\); or the ex-post realized risk; \(LLP_{i,j,t}\) is the loan loss provision for bank \(i\) in country \(j\) in period \(t\).

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The explanatory variables such as \(UD_{i,j,t}\) is the natural log of uninsured deposits for bank \(i\), in country \(j\) at period \(t\), \(CV_{i,j,t}\) is the natural log of charter value for bank \(i\), country \(j\), lagged one period, \(BC_{i,j,t}\) is the natural log of bank capital for bank \(i\), in country \(j\) lagged one period, \(TA_{i,j,t}\) is the total assets of bank \(i\) in country \(j\) in period \(t\). The credit risk is measured using \(CR_{i,j,t} = LLP_{i,j,t}/TA_{i,j,t}\), where; \(CR_{i,j,t}\) is the credit risk measure for bank \(i\) in country \(j\) in period \(t\); or the ex-post realized risk; \(LLP_{i,j,t}\) is the loan loss provision for bank \(i\) in country \(j\) in period \(t\).

The explanatory variables such as \(UD_{i,j,t}\) is the natural log of uninsured deposits for bank \(i\), in country \(j\) at period \(t\), \(CV_{i,j,t}\) is the natural log of charter value for bank \(i\), country \(j\), lagged one period, \(BC_{i,j,t}\) is the natural log of bank capital for bank \(i\), in country \(j\) lagged one period, \(TA_{i,j,t}\) is the total assets of bank \(i\) in country \(j\) in period \(t\). The credit risk is measured using \(CR_{i,j,t} = LLP_{i,j,t}/TA_{i,j,t}\), where; \(CR_{i,j,t}\) is the credit risk measure for bank \(i\) in country \(j\) in period \(t\); or the ex-post realized risk; \(LLP_{i,j,t}\) is the loan loss provision for bank \(i\) in country \(j\) in period \(t\). The explanatory variables such as \(UD_{i,j,t}\) is the natural log of uninsured deposits for bank \(i\), in country \(j\) at period \(t\), \(CV_{i,j,t}\) is the natural log of charter value for bank \(i\), country \(j\), lagged one period, \(BC_{i,j,t}\) is the natural log of bank capital for bank \(i\), in country \(j\) lagged one period, \(TA_{i,j,t}\) is the total assets of bank \(i\) in country \(j\) in period \(t\). The credit risk is measured using \(CR_{i,j,t} = LLP_{i,j,t}/TA_{i,j,t}\), where; \(CR_{i,j,t}\) is the credit risk measure for bank \(i\) in country \(j\) in period \(t\); or the ex-post realized risk; \(LLP_{i,j,t}\) is the loan loss provision for bank \(i\) in country \(j\) in period \(t\). The explanatory variables such as \(UD_{i,j,t}\) is the natural log of uninsured deposits for bank \(i\), in country \(j\) at period \(t\), \(CV_{i,j,t}\) is the natural log of charter value for bank \(i\), country \(j\), lagged one period, \(BC_{i,j,t}\) is the natural log of bank capital for bank \(i\), in country \(j\) lagged one period, \(TA_{i,j,t}\) is the total assets of bank \(i\) in country \(j\) in period \(t\). The credit risk is measured using \(CR_{i,j,t} = LLP_{i,j,t}/TA_{i,j,t}\), where; \(CR_{i,j,t}\) is the credit risk measure for bank \(i\) in country \(j\) in period \(t\); or the ex-post realized risk; \(LLP_{i,j,t}\) is the loan loss provision for bank \(i\) in country \(j\) in period \(t\). The explanatory variables such as \(UD_{i,j,t}\) is the natural log of uninsured deposits for bank \(i\), in country \(j\) at period \(t\), \(CV_{i,j,t}\) is the natural log of charter value for bank \(i\), country \(j\), lagged one period, \(BC_{i,j,t}\) is the natural log of bank capital for bank \(i\), in country \(j\) lagged one period, \(TA_{i,j,t}\) is the total assets of bank \(i\) in country \(j\) in period \(t\). The credit risk is measured using \(CR_{i,j,t} = LLP_{i,j,t}/TA_{i,j,t}\), where; \(CR_{i,j,t}\) is the credit risk measure for bank \(i\) in country \(j\) in period \(t\); or the ex-post realized risk; \(LLP_{i,j,t}\) is the loan loss provision for bank \(i\) in country \(j\) in period \(t\).

<table>
<thead>
<tr>
<th>Credit risk</th>
<th>Systematic risk</th>
<th>Total risk</th>
<th>Interest rate risk</th>
<th>Idiosyncratic risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0.021***</td>
<td>0.887***</td>
<td>-5.360***</td>
<td>0.571***</td>
</tr>
<tr>
<td></td>
<td>(0.005)</td>
<td>(0.315)</td>
<td>(0.823)</td>
<td>(0.204)</td>
</tr>
<tr>
<td>Uninsured deposits</td>
<td>0.002*</td>
<td>0.053</td>
<td>0.377</td>
<td>0.089</td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
<td>(0.109)</td>
<td>(0.236)</td>
<td>(0.064)</td>
</tr>
<tr>
<td>Charter value</td>
<td>-0.067***</td>
<td>1.112**</td>
<td>1.415***</td>
<td>-0.072</td>
</tr>
<tr>
<td></td>
<td>(0.017)</td>
<td>(0.562)</td>
<td>(0.556)</td>
<td>(0.548)</td>
</tr>
<tr>
<td>Bank capital</td>
<td>0.002</td>
<td>-0.036</td>
<td>0.307</td>
<td>0.093</td>
</tr>
<tr>
<td></td>
<td>(0.002)</td>
<td>(0.137)</td>
<td>(0.273)</td>
<td>(0.069)</td>
</tr>
<tr>
<td>Bank capital squared</td>
<td>0.001**</td>
<td>0.068*</td>
<td>-0.227**</td>
<td>-0.038*</td>
</tr>
<tr>
<td></td>
<td>(0.000)</td>
<td>(0.041)</td>
<td>(0.099)</td>
<td>(0.023)</td>
</tr>
<tr>
<td>Off balance sheet activities</td>
<td>0.010***</td>
<td>0.090**</td>
<td>0.555***</td>
<td>0.029</td>
</tr>
<tr>
<td></td>
<td>(0.004)</td>
<td>(0.046)</td>
<td>(0.222)</td>
<td>(0.044)</td>
</tr>
<tr>
<td>Loan to total assets</td>
<td>0.004***</td>
<td>-0.204***</td>
<td>-0.556***</td>
<td>0.007</td>
</tr>
</tbody>
</table>
Thus, this implies that given a fixed level of off balance sheet activities, bank capital is able to exhibit the disciplinary effect for equity risk but not for credit risk. The positive and significant estimates of $\delta_5$ suggest holding bank charter value fixed, larger banks exhibit greater credit risk, systematic risk, total risk and idiosyncratic risk. It seems that for a given level of bank charter value, larger banks are more sensitive to credit risk, systematic risk, total risk and idiosyncratic risk than smaller banks.

### 4.6 SUMMARY

This study analyzes the determinants of bank equity risk and credit risk measures. The sample consists of 117 listed financial institutions across 15 European countries from the period 1996-2005. The study focuses on five risk measures, total risk, systematic risk, interest rate risk, idiosyncratic risk and credit risk, on a number of bank-specific and country-specific variables. The study applies pooled-OLS and two-stage least square estimation techniques as well as panel analysis in robustness tests. With regard to bank

<table>
<thead>
<tr>
<th></th>
<th>(0.001)</th>
<th>(0.076)</th>
<th>(0.256)</th>
<th>(0.050)</th>
<th>(0.253)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>0.003***</td>
<td>0.145***</td>
<td>0.085***</td>
<td>-0.001</td>
<td>-0.033</td>
</tr>
<tr>
<td>Economic freedom index</td>
<td>0.000†</td>
<td>-0.013***</td>
<td>-0.040***</td>
<td>-0.006***</td>
<td>-0.035***</td>
</tr>
<tr>
<td>Uninsured deposits*bank capital ($\delta_1$)</td>
<td>0.004</td>
<td>0.200**</td>
<td>1.338***</td>
<td>0.080</td>
<td>1.375***</td>
</tr>
<tr>
<td>Uninsured deposits*charter value ($\delta_2$)</td>
<td>0.003***</td>
<td>-0.042***</td>
<td>-0.148**</td>
<td>0.041</td>
<td>-0.068***</td>
</tr>
<tr>
<td>Off-balance sheet activities*charter value ($\delta_3$)</td>
<td>-0.004**</td>
<td>0.173**</td>
<td>0.481**</td>
<td>-0.083</td>
<td>0.483*</td>
</tr>
<tr>
<td>Off-balance sheet activities*bank capital ($\delta_4$)</td>
<td>0.003***</td>
<td>-0.011**</td>
<td>-0.066**</td>
<td>0.008</td>
<td>0.069***</td>
</tr>
<tr>
<td>Charter value*size ($\delta_5$)</td>
<td>0.005***</td>
<td>0.211***</td>
<td>0.582***</td>
<td>0.037</td>
<td>0.465**</td>
</tr>
<tr>
<td>Adj $R^2$</td>
<td>0.27</td>
<td>0.57</td>
<td>0.35</td>
<td>0.10</td>
<td>0.25</td>
</tr>
<tr>
<td>Model test $F[22, 1011]$</td>
<td>20.22***</td>
<td>56.03***</td>
<td>27.22***</td>
<td>4.05***</td>
<td>12.12***</td>
</tr>
<tr>
<td>Breusch Pagan $\chi^2$</td>
<td>625</td>
<td>401</td>
<td>120</td>
<td>503</td>
<td>138</td>
</tr>
<tr>
<td>Joint F-test for year dummies</td>
<td>2.45***</td>
<td>4.25***</td>
<td>3.16***</td>
<td>1.72*</td>
<td>3.09***</td>
</tr>
<tr>
<td>NOBS</td>
<td>1012</td>
<td>1015</td>
<td>1015</td>
<td>1015</td>
<td>1015</td>
</tr>
</tbody>
</table>
capital, the findings show a non-linear relationship for credit risk and systematic risk. This result supports hypothesis H2B (Chapter 2). However, this non-linear relationship does not hold for other risk measures. Further, the results show that off-balance sheet activities are in general positively related to all risk measures. This result is consistent with the hypotheses H3 (reported in Chapter 2) and is robust to the various specifications reported in Section 4.6. This result has important policy implications.

Further, consistent with the hypothesis H4, the results show uninsured deposits are negatively related with bank systematic risk. This is consistent with the existence of a market discipline effect. This is an important result because it suggests that the level of uninsured deposits should have a direct impact on bank share price through its impact on systematic risk. The findings show a positive and statistically significant relation between uninsured deposits and credit risk, total risk and idiosyncratic risk. Perhaps, uninsured deposits are not a good market disciplinary tool for reduction of bank-specific risk.

The other important factor is bank charter value. Consistent with the hypothesis (H1) a negative and statistically significant relationship is observed between bank charter value and credit risk, which implies a charter value discipline effect with respect to bank credit risk. However, the findings also provide evidence of a positive and statistically significant relationship between charter value and bank equity risk (total risk, idiosyncratic risk and systematic risk). This relationship is contrary to hypothesis H1. One possible explanation is that this relationship reflects the growth opportunities implicit in charter value. Further, with respect to systematic risk (supports hypothesis H5A) and total risk (rejects hypothesis H5B) the coefficients of size are positive and statistically significant at the 1% level. However, a negative and statistically significant
(at the 1% level) association is observed for both idiosyncratic risk and credit risk. The results are robust to different specifications.

It is important to note variation in the various measures of bank risk between common-law country and civil-law country banks and between euro-zone and non-euro-zone banks. These findings are statistically significant at the 5% significance level or better.
CHAPTER 5
EUROPEAN BANK EQUITY RISK 1995-2006 - EMPIRICAL RESULTS

5.1 INTRODUCTION

This chapter focuses on research question 2 (RQ2) that is structural changes in European bank equity risks. Section 5.2 discusses the main results in relation to changes in bank equity risk. Section 5.3 focuses on the robust of the results and, finally, Section 5.4 provides a summary of this chapter.

5.2 RESULTS IN RELATION TO RESEARCH QUESTION 2 (RQ2)

It is important to first identify whether the changes in risk are economy wide movements or whether these shifts in risk are more localised. Total risk, idiosyncratic risk and systematic risk are estimated for the European non-financial sector and the European banking sector using equity market indices with the MSCI European and world indices being used to capture market effects. While changes in risk that occur with EMU are not generally statistically significant at the broad European economy level, analysis shows that banking sector risk generally falls while non-financial sector risk generally rises with EMU.

It is found that a majority of the country bank sectors exhibit decreased risk with

EMU, while increases and decreases are fairly evenly spread amongst the individual euro-zone country non-financial sectors (Table 5.1). For example, focusing on total risk, there are decreases (increases) in six (five) of the eleven country non-financial sectors with only three of these being statistically significant at the 10% level or better. Yet, it is important to note that for the bank sectors in these countries there are decreases (increases) in seven (four) of the eleven countries and in six of these seven cases the decline is statistically significant at the 10% level or better. The euro-zone country sector based results suggest that important changes have occurred in the banking sectors of these countries that are not closely reflected in non-financial sectors.
Table 5.1
European bank sector risk versus European non-financial sector risk

This table reports the results of total, idiosyncratic and systematic risk estimation based on DataStream indices for the European region. The study calculates changes in risk using the non-financial sector index and the banking sector index to provide an indication of the different effects observed with EMU for these two sectors. The total risk and idiosyncratic risk estimates are expressed as standard deviation. The systematic and idiosyncratic risk estimates are calculated using two MSCI indices, the MSCI Europe index and the MSCI World index. F-test Prob is the probability attached to the F-test for change in variance and t-stats refers to the t-test on the change in systematic risk across the period. To provide some indication of the change in risk exhibited across the euro-zone countries the analysis is repeated at the country level with a count of the number of countries reporting a decrease in risk (CN*) or an increase in risk (CN+) as well as the number of countries with a statistically significant decrease in risk (CN**) or a statistically significant increase in risk (CN++). These counts appear in the Difference columns of the table with the count of the statistically significant changes reported in parentheses.

*, + significant at 5% (10%) significance level.

| MSCI Indexes | Total risk | | | Idiosyncratic risk | | Systematic risk | | |
|--------------|------------|---|---|-------------------|---|----------------|---|
|              | Pre EMU    | Post EMU | Difference | F test Prob | Pre EMU | Post EMU | Difference | F test Prob | Changes in β | t-stats |
| Europe Index |            |          |            |             |          |            |             |             |             |         |
| Non Financial sector | 0.037 | 0.048 | 0.011 | 0.054+ | 0.019 | 0.022 | 0.003 | 0.261 | 0.205 | 2.66* |
| CN* (CN**) | 6 (3) |
| CN+ (CN++) | 5 (2) |
| Banking sector | 0.063 | 0.056 | -0.007 | 0.372 | 0.031 | 0.030 | -0.001 | 0.790 | -0.198 | -1.28 |
| CN* (CN**) | 7 (6) |
| CN+ (CN++) | 4 (1) |
| World Index |            |          |            |             |          |            |             |             |             |         |
| Non Financial sector | 0.037 | 0.048 | 0.011 | 0.054+ | 0.024 | 0.026 | 0.002 | 0.645 | 0.287 | 2.68* |
| Banking sector | 0.063 | 0.056 | -0.007 | 0.372 | 0.044 | 0.035 | -0.009 | 0.052* | -0.040 | -0.210 |
To gain a better idea of the impact of the EMU period on individual banks the study repeats the analysis using individual bank total risk, idiosyncratic risk and systematic risk and it is found that these individual risk measures have reduced substantially with EMU for a majority of the euro-zone banks in the sample. This finding supports the three hypotheses, H12, H13 and H14, as mentioned in Chapter 2 (See Section 2.6.3) and this support is evident at both the individual bank level and the bank sector level (proxied by equally weighted and value weighted portfolios of the banks in the sample) for decreased risk with EMU. The decrease in risk is particularly evident for French, Italian, Greek, Portuguese and Spanish banks (See Table 5.2 and Table 5.3). From Table 5.2, Panel A, 67 of the 96 euro zone banks (70% of the sample) exhibit a decline in total risk on average of 19% on average, with more than half of these declines being statistically significant. Further, bank idiosyncratic risk (Panel B, Table 5.2) declined 10%, on average, with 58 of the 96 banks (60% of the sample) exhibiting decreased risk.
Table 5.2
Estimates of total risk and idiosyncratic risk of European banks

This table reports results of tests for change in bank equity total and idiosyncratic risk. The average of individual bank total risk estimates for pre EMU and post EMU periods for each country are reported in Panel A along with counts of the number of statistically significant individual bank total risk estimate changes. F tests is used to estimate the change in variance. Similar results are reported in Panel B for individual bank idiosyncratic risk estimates. N is the total number of banks that are included in risk calculations for the country. N* is the number of banks with a decrease in total risk. N** is the total number of banks with a statistically significant decrease in risk. N+ is the number of banks with an increase in total risk and N++ is the number of banks with a statistically significant increase in total risk at the 5% level of significance. Note that N could exceed the sum of N* and N+ where the risk estimates (to four decimal places) are unchanged. In this regard, N0 shows the number of banks that exhibit no change in risk estimates to four decimal places. Total risk is defined: $\sigma_i^2 = \frac{1}{N} \sum_{t=1}^{N} (R_i - \bar{R})^2$ where $\sigma_i^2$ is the variance of the return for bank $i$, $\bar{R}$ return of bank $i$ and $\overline{R}$ average bank $i$ return. Idiosyncratic risk is defined as $\sigma^2_{\epsilon} = \sigma^2_i - \beta^2 \sigma^2_{\mu}$ where $\sigma^2_{\mu}$ is the total risk for bank $i$. $\sigma^2_{\epsilon}$ bank return idiosyncratic risk and $\beta^2 \sigma^2_{\mu}$ reflects the impact of systematic risk. Panel C presents the estimates of idiosyncratic risk and total risk for equally weighted (equal wgt.) and market value weighted (MV wgt.) portfolios.

+ Statistically significant at the 10% level of significance, * statistically significant at the 5% level of significance.

Panel A Estimates of total risk for individual banks using country index

<table>
<thead>
<tr>
<th>Country</th>
<th>Average Pre EMU</th>
<th>Average Post EMU</th>
<th>Average Change</th>
<th>N</th>
<th>N0</th>
<th>N*</th>
<th>N**</th>
<th>N+</th>
<th>N++</th>
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<td></td>
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<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Austria</td>
<td>0.063</td>
<td>0.045</td>
<td>-0.018</td>
<td>5</td>
<td>1</td>
<td>4</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Belgium</td>
<td>0.071</td>
<td>0.077</td>
<td>0.006</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
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<td>0.018</td>
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<td>0.006</td>
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<td>0</td>
<td>0</td>
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<td>0</td>
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### Panel B: Estimates of idiosyncratic risk for individual banks using country index

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<th>Average Change</th>
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<th>N**</th>
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<th>N++</th>
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<td>-0.016</td>
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<td>11</td>
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<td><strong>Total euro-zone</strong></td>
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<td>0.068</td>
<td>-0.008</td>
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<td>6</td>
<td>58</td>
<td>40</td>
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<td><strong>Non euro zone</strong></td>
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<td></td>
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<td></td>
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<td></td>
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</tr>
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<td>37</td>
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### Panel C: Estimates of idiosyncratic risk and total risk using equally weighted and market value weighted portfolios of the banks for each of the countries in the sample

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</tr>
<tr>
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<td>-0.032*</td>
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<td>0.032</td>
<td>0.000*</td>
<td>0.00</td>
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<td>0.055</td>
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<td>0.013+</td>
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<td>0.045</td>
<td>-0.010*</td>
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<td>0.071</td>
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</table>
Further, there was a 19% decrease in systematic risk (Table 5.3) on average with declines observed in 63 of the banks in the sample (64% of the sample). Regardless of risk measure, almost half of the declines are statistically significant. The sample includes both commercial banks and bank holding companies with the declines evident broadly across the sample. Regardless, there are a few banks, particularly the German banks that show an increase in total risk and idiosyncratic risk in particular. However, this finding on German banks is in contrary to the hypotheses H12 and H13 mentioned in Chapter 2 (See Section 2.6.3).

Given the important links that exist between the euro-zone countries and the neighboring non euro-zone countries an analysis of the change in risk for banks in the countries, Denmark, Sweden and United Kingdom is conducted. There is a general decrease in all bank equity risk in Sweden and United Kingdom but an increase in total risk and idiosyncratic risk in Denmark. One possible explanation for this result is that formation of EMU led to an increase in European financial market integration (Allen and

<table>
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<td>0.022</td>
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<td>0.066</td>
<td>0.062</td>
<td>-0.004</td>
<td>0.63</td>
</tr>
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</table>
Song 2005).
Table 5.3
Estimates of Systematic risk for European banks

Average individual bank systematic risk estimates ($\beta$) are reported by country for both the euro-zone and the non euro-zone countries. The $\beta$ estimates are reported for total sample period and pre-EMU period along with the change in systematic risk that occurred with EMU in Panel A. These estimates are calculated using country equity market indices for both individual banks and bank portfolios. N is the number of banking shares in the sample that are listed for the country. N* is the number of banks with a decrease in systematic risk and N** refers to the total number of banks with a statistically significant decrease in systematic risk at the 5% level of significance. N+ is the total number of banks that show an increase in systematic risk and N++ is the total number of banks that show a statistically significant increase in systematic risk at the 5% level of significance. Note that N could exceed the sum of N* and N+ where the risk estimates (to four decimal places) are unchanged. Bank portfolio results are reported in Panel B and these include both equally weighted (equal wgt.) and market value weighted (MV wgt.) portfolios. The standard market model is used to measure systematic risk: $R_i = \alpha_i + \beta_i R_m + \epsilon_i$ (see equation (4))

where, $R_i$ is the return on security $i$ at time period $t$, $R_m$ is the return on an equity market index at time period $t$. The systematic risk estimate for each bank or portfolio of banks is $\beta_i$ (systematic risk) and $\epsilon_i$ is a random shock term. The market model in equation (1) is extended by introducing a dummy variable to capture the structural changes in systematic risk. The dummy variable ($D$) takes on a value of zero (0) for the months of January 1995 to December 1998 and a value of one (1) from January 1999 to April 2006. $R_i = \alpha_i + (\alpha_{pou} - \alpha_{ru})D + \beta_{pou}R_m + (\beta_{pou} - \beta_{ru})R_mD + \epsilon_i$ (See equation (9)).

Note. + Statistically significant at the 10% level of significance, * statistically significant at the 5% level of significance.

Panel A: Estimates of systematic risk for individual banks

<table>
<thead>
<tr>
<th>Country</th>
<th>Average full period</th>
<th>Average pre-EMU</th>
<th>Average Change</th>
<th>N</th>
<th>N*</th>
<th>N**</th>
<th>N+</th>
<th>N++</th>
</tr>
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<td><strong>Euro zone</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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</tr>
<tr>
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<td>1</td>
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<tr>
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</tr>
<tr>
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<td>7</td>
<td>5</td>
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<td>7</td>
<td>3</td>
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<tr>
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<td>0.990</td>
<td>0.120</td>
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<td>3</td>
<td>1</td>
<td>6</td>
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<td>0</td>
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<tr>
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<td>0.620</td>
<td>-0.110</td>
<td>14</td>
<td>11</td>
<td>4</td>
<td>3</td>
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<td><strong>Total euro-zone</strong></td>
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<td>26</td>
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154
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<tr>
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Panel B Estimates of systematic risk for equally weighted and market value weighted portfolios

<table>
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<tr>
<th>Country</th>
<th>Portfolios</th>
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<th>t-stat</th>
<th>Pre-EMU</th>
<th>t-stat</th>
<th>change</th>
<th>t-stat</th>
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<td></td>
</tr>
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<td>Equal wgt</td>
<td>0.23*</td>
<td>6.19</td>
<td>0.28*</td>
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<td>MV wgt</td>
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<td>0.38*</td>
<td>5.09</td>
<td>0.19+</td>
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<td>-0.12</td>
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<td>MV wgt</td>
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<td>1.27*</td>
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</tr>
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<td>0.26*</td>
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<td>0.00</td>
<td>0.02</td>
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<td>Equal wgt</td>
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<td>0.99*</td>
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<td>1.30*</td>
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<td>0.94*</td>
<td>13.06</td>
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<td>1.15*</td>
<td>8.98</td>
<td>-0.23</td>
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</tr>
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<td>1.12*</td>
<td>17.73</td>
<td>0.00</td>
<td>-0.02</td>
</tr>
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<td>17.12</td>
<td>1.11*</td>
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<td>-0.18</td>
<td>-1.03</td>
</tr>
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<td>-0.49*</td>
<td>-3.73</td>
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<tr>
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<td>1.07*</td>
<td>10.67</td>
<td>-0.37*</td>
<td>-2.70</td>
</tr>
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<td>0.51*</td>
<td>13.24</td>
<td>0.62*</td>
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<td>MV wgt</td>
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<td>Equal wgt</td>
<td>0.12*</td>
<td>3.22</td>
<td>0.20*</td>
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<td>3.87</td>
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<td>0.88*</td>
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<td>12.10</td>
<td>0.52*</td>
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<td>1.69*</td>
<td>15.40</td>
<td>-0.38*</td>
<td>-2.50</td>
</tr>
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</table>

Furthermore, Europe is fairly unique in terms of the level of bank consolidation that occurred in its banking system during the period from 1999 to 2003, particularly when compared to other regions such as the USA and Asia (Allen and Song 2005). Regional integration between euro-zone and non euro-zone European countries may help
to explain this effect over the last ten years (Allen and Song 2005).

This study applies chi-square tests to test for statistical significance of the proportion of banks with decreases in risk relative to those with increases in risk. Under ordinary circumstances it would be expected that individual banks risk is as likely to rise as it is to fall over time (null hypothesis) and on the basis of this a chi-square tests of the proportion of banks that exhibited a change in risk with EMU was constructed. These tests show that a statistically significant proportion of the euro-zone bank sample exhibited a decrease in total risk (Prob. = 0.00), idiosyncratic risk (Prob. = 0.01) and systematic risk (Prob. = 0.00) with introduction of EMU. This provides further support for the hypotheses H12, H13 and H14 with respect to the euro-zone banks as mentioned in Chapter 2. This test was also performed using the neighboring non-euro-zone banks. Although the chi-square test for systematic risk was statistically significant (Prob. = 0.00), the null could not be rejected for either total risk (Prob. = 0.38) or idiosyncratic risk (Prob. = 0.23). There are a significant proportion of the euro-zone banks with decreased risk, though the decreases in risk are not so widespread in the neighboring non euro-zone country sample, particularly for total risk and idiosyncratic risk. The test supports only hypothesis H14 for the non euro-zone banks.

It is possible that the recent wave of bank mergers and acquisitions (Pricewaterhouse Coopers 2006) are unrelated to EMU and that the results observed in this study are due entirely to bank consolidations. This argument would certainly find support in the work of Amihud, DeLong and Saunders (2002), who find that cross-border mergers do not increase the risk of either the domestic bank or the host bank. Yet, it is difficult to see how the formation of the EMU and the recent merger and acquisition
activity in Europe can be separated. Indeed, Altunbas and Ibanez (2008) state that the mergers and acquisition growth “…increased in parallel with the introduction of the Monetary Union” (p. 7). Thus, there is no attempt in this study to disentangle the relationship that exists between EMU and the recent merger and acquisition activity.

5.3 ROBUSTNESS

There are number of further tests that have been conducted to assess the robustness of the results reported so far. First, a test for change in risk is conducted using sub-samples of the original bank sample, particularly commercial banks. Second, an analysis is performed to observe the changes in systematic risk, idiosyncratic risk and total risk using the MSCI world index and MSCI Europe index for both individual bank and bank portfolios using both the one-factor market model and two-factor market model. The Fama-French three factor model is also used to assess the impact on the market risk after adjustment for size and value characteristics of the bank equity returns. Third, systematic risk is examined using dummy variables to adjust for some of the critical events that have occurred during the study period such as the Asian Crisis 1997, the Russian rouble crisis 1998 and the internet bubble 2000. Fourth, all of the country wide results are re-estimated using individual country commercial bank indices. Fifth, an analysis is performed to compare the change in risk for banking and non-financial indices, Sixth, test is conducted to see whether this is a purely euro effect or whether similar changes in bank risk are observed for neighboring non euro-zone banks. Seventh, a test is also performed to assess the impact of excluding the Italian savings banks from the sample. Eighth, a test is conducted to see whether changes in the level of economic growth could explain the decrease in bank risk. Finally, CUSUM square graphs are
plotted to check the timing of structural breaks to see whether these are aligned with the
date when the EMU was put into place. In all care, the main results are little changed
Bank risk has tended to fall following EMU. These issues are discussed in greater detail
below.

5.3.1 Commercial banks

A sample of 51 commercial banks is used as the robustness check. These banks
are drawn from the original sample and divided into foreign exposure banks, regional
exposure banks and local exposure banks. The MSCI world index is used for the foreign
exposure banks, the MSCI Europe index is used for the regional banks and the MSCI
country index is used for the local exposure banks. The risk measures are then re
estimated using the alternate indices with both one factor market model and two-factor
market model. It is found that 84% of the banks show a decline in idiosyncratic risk and
total risk (statistically significant at the 1% significance level). It is also evident that 71%
of the commercial banks show a decline in systematic risk with 14 of these being
statistically significant at the 1% significance level. It should be noted that the decline in
bank equity risk is mainly observed in foreign and regional exposed banks. The results
are reported in Appendix Table A5.1.

5.3.2 Equity market index choice and equity pricing model

Systematic risk is re-estimated using the MSCI world index and the results are
consistent with the previous estimates. One exception is found with the world index
where a statistically significant risk reduction is observed for the Bank of Ireland. The
results for total risk and idiosyncratic risk for the individual banks and the portfolios of
banks also support previous results. Similar results are also obtained when the European market equity index is used as the market portfolio proxy. The majority of the euro-zone banks report a decrease in equity risk over the period and a large proportion of these banks show a statistically significant decrease in equity risk regardless of the index chosen to capture market risk.

In addition, a two-factor model, including interest rates and equity market index, and the Fama-French three factor model are fitted to the individual bank and bank portfolio returns to provide a further check. While there is little change in the results when using the two-factor model, the implementation of the Fama-French model needs a little more explanation. In order to construct the excess market return (Rm-Rf) and BE/ME (HML) French’s website. The size premium (SMB) is calculated using the MSCI small capital index and MSCI benchmark index. The French’s website data does not include Greece or Portugal and so the SMB and HML premiums and the excess market return were calculated separately for Greece and Portugal. The HML premium is calculated using the top and bottom 30% of the firms sorted by BE/ME (book value of equity to market value of equity) and the size premium is calculated using the top and bottom half of the sample sorted by ME (market value of equity). The market excess return is calculated using the 10 year bond benchmark as the risk-free rate and the MSCI benchmark index.

Even after adjusting for HML and SMB, there are 51 banks that exhibit a decline in systematic risk, with 22 of these banks showing a statistically significant decline in systematic risk.

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49 http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html
risk. Consistent with the previous analysis few of the banks showed a statistically significant increase in systematic risk. The results are reported in Appendix Table A5.2.

5.3.3 Controlling for different events

The impact of episodes such as Asian crisis 1997, Russian ruble crisis 1998 and internet bubble 2000 on bank systematic risk are also assessed using country wide market indices. It is important to note that the analysis excludes 6 banks from the sample due to data limitations.\(^{50}\) The results are little changed from the previous analysis. There is also a possibility that the true break in the data occurred at some time other than 1999. As a result the literature is searched for possible alternative break points and June 1998 is identified as the most natural alternative date. This is the date when the introduction of a single currency was announced. Analysis was repeated with this alternate break point though here is little support for a break in bank risk at this date. A further discussion on the issue of structural change is provided in Section 5.3.9. The results are reported in Appendix Table A5.3.

5.3.4 Commercial bank indices

Systematic risk is estimated for the banking industry for each country using commercially available bank industry indices extracted from DataStream International. Analysis includes results for single market model and two-factor market model. Support is again evident for the finding that bank equity risk for the banking industry in the euro-zone declined with EMU. The results are reported in Appendix Table A5.4.

\(^{50}\)The banks that have been excluded are: Erste bank in Austria, Mandatum bank in Finland, CIC ‘A’ in France, Banca Naz Lavoro and Banca Ppo di Verona Novara in Italy and Finibanco in Portugal.
5.3.5 Banking and Non-banking industry risk

The change in banking industry and non-banking industry risk is also analysed over the period. This comparison is made on an individual country basis as well as on a regional basis. While the individual country analysis shows that eight (8) out of eleven (11) country banking industries exhibit reduced total risk (seven countries show a statistically significant decline) around half of the country non-financial industry indices exhibit increased risk. These results are also apparent with idiosyncratic and systematic risk measures and are robust to index choice. While there is generally a decrease in bank risk over the period for euro-zone banks this is not evident for the remainder of the industries in Europe. Similar results are evident for European banking sector indices when compared with European non financial sector indices. For example, using the MSCI world index and MSCI Europe index, a decline in each of the three measures of risk is evident for the banking sector industry but this decline is not evident in the non-banking sector. Indeed, there is a statistically significant increase in equity risk for the non banking sector. The results are reported in Appendix Table A5.5 and Table A5.6.

5.3.6 Euro-zone and non-euro-zone banking industries

It is also of interest to determine whether the decrease in bank risk is focused solely on the banks trading within euro-zone countries or whether it is also evident in the neighboring non-euro-zone banks. The results are reported in Table 5.4.
Table 5.4
Estimates of Bank Equity Risk for Non-euro-zone European Banks

This table reports results of tests for change in bank equity risk: total, idiosyncratic and systematic risk. The average of individual bank total risk estimates for pre EMU and post EMU periods for each non euro zone European country are reported in Panel A along with counts of the number of statistically significant individual bank total risk estimate changes. Similar results are reported in Panel B for individual bank idiosyncratic risk estimates. Panel C presents the change in total and idiosyncratic risk for bank portfolios. Panel D and Panel E represent the change in individual bank systematic risk and change in systematic risk for bank (both equally weighted and market value weighted portfolios) respectively. N is the total number of banks that are included in risk calculations for the country. N* is the number of banks with a decrease in total risk. N** is the total number of banks with a statistically significant decrease in risk. N+ is the number of banks with an increase in risk and N++ is the number of banks with a statistically significant increase at the 5% level of significance. Total risk is defined:

\[ \sigma^2 = \frac{1}{N} \sum_{i=1}^{N} (R_i - \overline{R})^2 \]

Where \( \sigma^2 \) is the variance of the return for bank i, \( R_i \) return of bank i and \( \overline{R} \) average bank i return. Idiosyncratic risk is defined as

\[ \sigma_{\epsilon}^2 = \sigma^2 - \beta^2 \sigma_{\alpha}^2 \]

where \( \sigma_{\alpha}^2 \) is the total risk for bank i, \( \sigma_{\epsilon}^2 \) bank return idiosyncratic risk and \( \beta^2 \sigma_{\alpha}^2 \) reflects the impact of systematic risk.

***statistically significant at the 1% level of significance, **statistically significant at the 5% level of significance.

### Panel A Total risk measures for individual countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Pre EMU (avg.)</th>
<th>Post EMU (avg.)</th>
<th>N</th>
<th>N*</th>
<th>N**</th>
<th>N+</th>
<th>N++</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denmark</td>
<td>0.0024</td>
<td>0.0030</td>
<td>44</td>
<td>18</td>
<td>6</td>
<td>26</td>
<td>15</td>
</tr>
<tr>
<td>Norway</td>
<td>0.0059</td>
<td>0.0045</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Sweden</td>
<td>0.0084</td>
<td>0.0087</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Switzerland</td>
<td>0.0049</td>
<td>0.0036</td>
<td>26</td>
<td>16</td>
<td>11</td>
<td>9</td>
<td>4</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>0.0090</td>
<td>0.0062</td>
<td>8</td>
<td>6</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total number of bank shares</strong></td>
<td><strong>85</strong></td>
<td><strong>46</strong></td>
<td><strong>23</strong></td>
<td><strong>38</strong></td>
<td><strong>21</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Panel B Idiosyncratic risk measures for individual countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Pre EMU (avg.)</th>
<th>Post EMU (avg.)</th>
<th>N</th>
<th>N*</th>
<th>N**</th>
<th>N+</th>
<th>N++</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denmark</td>
<td>0.0022</td>
<td>0.0026</td>
<td>44</td>
<td>15</td>
<td>5</td>
<td>29</td>
<td>17</td>
</tr>
<tr>
<td>Norway</td>
<td>0.0035</td>
<td>0.0030</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Sweden</td>
<td>0.0050</td>
<td>0.0044</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Switzerland</td>
<td>0.0029</td>
<td>0.0027</td>
<td>26</td>
<td>13</td>
<td>9</td>
<td>13</td>
<td>6</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>0.0047</td>
<td>0.0039</td>
<td>8</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total number of bank shares</strong></td>
<td><strong>85</strong></td>
<td><strong>37</strong></td>
<td><strong>20</strong></td>
<td><strong>48</strong></td>
<td><strong>25</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Panel C Total risk and idiosyncratic risk for bank portfolios

<table>
<thead>
<tr>
<th>Portfolios</th>
<th>Total risk</th>
<th>Idiosyncratic risk</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre EMU</td>
<td>Post EMU</td>
</tr>
<tr>
<td>Denmark</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equally weighted</td>
<td>0.0005</td>
<td>0.0006</td>
</tr>
<tr>
<td>Market value weighted</td>
<td>0.0027</td>
<td>0.0013</td>
</tr>
<tr>
<td>Norway</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equally weighted</td>
<td>0.0043</td>
<td>0.0029</td>
</tr>
<tr>
<td>Market value weighted</td>
<td>0.0078</td>
<td>0.0057</td>
</tr>
</tbody>
</table>
### Panel D Systematic risk measures for individual countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Full period average $\beta$</th>
<th>Pre EMU average $\beta$</th>
<th>Average changes in $\beta$</th>
<th>$N$</th>
<th>$N^*$</th>
<th>$N^{**}$</th>
<th>$N^+$</th>
<th>$N^{++}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denmark</td>
<td>0.120</td>
<td>0.202</td>
<td>-0.123</td>
<td>44</td>
<td>33</td>
<td>9</td>
<td>11</td>
<td>-</td>
</tr>
<tr>
<td>Norway</td>
<td>0.622</td>
<td>0.702</td>
<td>-0.129</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Sweden</td>
<td>0.734</td>
<td>0.916</td>
<td>-0.232</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Switzerland</td>
<td>0.485</td>
<td>0.511</td>
<td>-0.040</td>
<td>26</td>
<td>14</td>
<td>4</td>
<td>11</td>
<td>1</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>1.322</td>
<td>1.603</td>
<td>-0.375</td>
<td>8</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total number of bank shares</strong></td>
<td></td>
<td></td>
<td></td>
<td>85</td>
<td>58</td>
<td>20</td>
<td>26</td>
<td>2</td>
</tr>
</tbody>
</table>

### Panel E Systematic risk measures for bank portfolios

<table>
<thead>
<tr>
<th>Portfolios</th>
<th>Full period $\beta$</th>
<th>$t$-stats</th>
<th>Pre EMU $\beta$</th>
<th>$t$-stats</th>
<th>Changes in $\beta$</th>
<th>$t$-stats</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Denmark</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equally weighted</td>
<td>0.120</td>
<td>3.22</td>
<td>0.202</td>
<td>3.04</td>
<td>-0.123</td>
<td>-1.60</td>
</tr>
<tr>
<td>Market value weighted</td>
<td>0.468</td>
<td>6.47</td>
<td>0.786</td>
<td>7.76</td>
<td>-0.508</td>
<td>-3.87***</td>
</tr>
<tr>
<td><strong>Norway</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equally weighted</td>
<td>0.622</td>
<td>7.73</td>
<td>0.702</td>
<td>5.18</td>
<td>-0.129</td>
<td>-0.81</td>
</tr>
<tr>
<td>Market value weighted</td>
<td>0.875</td>
<td>7.52</td>
<td>0.905</td>
<td>4.31</td>
<td>-0.045</td>
<td>-0.18</td>
</tr>
<tr>
<td><strong>Sweden</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equally weighted</td>
<td>0.739</td>
<td>10.21</td>
<td>0.899</td>
<td>6.13</td>
<td>-0.215</td>
<td>-1.28</td>
</tr>
<tr>
<td>Market value weighted</td>
<td>0.700</td>
<td>11.26</td>
<td>0.880</td>
<td>6.00</td>
<td>-0.240</td>
<td>-1.49</td>
</tr>
<tr>
<td><strong>Switzerland</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equally weighted</td>
<td>0.487</td>
<td>12.1</td>
<td>0.515</td>
<td>9.07</td>
<td>-0.044</td>
<td>-0.57</td>
</tr>
<tr>
<td>Market value weighted</td>
<td>1.430</td>
<td>9.41</td>
<td>1.535</td>
<td>5.35</td>
<td>-0.154</td>
<td>-0.52</td>
</tr>
<tr>
<td><strong>United Kingdom</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equally weighted</td>
<td>1.347</td>
<td>14.54</td>
<td>1.668</td>
<td>15.22</td>
<td>-0.449</td>
<td>-2.70***</td>
</tr>
<tr>
<td>Market value weighted</td>
<td>1.420</td>
<td>17.91</td>
<td>1.688</td>
<td>15.40</td>
<td>-0.3766</td>
<td>-2.49**</td>
</tr>
</tbody>
</table>

Analysis of the neighboring non-euro-zone countries shows that the banks in neighboring countries also exhibit a decline in risk, regardless of the measure chosen. For example, using both MSCI world index and MSCI Europe index, all three measures of
risk decline in the banking sector industry for both the euro-zone banks and the neighboring non euro-zone banks. This finding is consistent with the argument that EMU has facilitated regional integration to such an extent that there was some spill-over from euro-zone into neighboring non euro-zone countries.\footnote{Further, that approximately 83\% of the value of bank merger and acquisition deals in Europe involved the acquisition of stakes in western European banks (Pricewaterhouse Coopers 2006) and so it is expected that decreases in euro-zone equity risk will affect both the target bank and the acquirer bank. Regardless, given the size of the euro-zone banking sector relative to neighboring non euro-zone banking sectors it is unlikely that this decrease in risk is driven by non euro-zone banks.}

5.3.7 Excluding savings banks from the Italian sample

The study re-examines the Italian bank effect by excluding six (6) savings banks from the total bank sample. The results for the equally-weighted and market value weighted portfolio remains unchanged. Further, on an individual bank analysis, the average results also remain essentially unchanged. More than 70\% of the banks decrease their idiosyncratic and systematic risk while approximately 80\% of the banks reduce their total risk over the sample period. The results are reported in Appendix Table A5.7.

5.3.8 Bank risk and business cycle

The model is re-estimated in order to capture the impact of the recent economic downturn around 2001 and 2002. Theories of imperfect capital markets (Bernanke and Gertler 1989; Kiyotaki and Moore 1997) suggest that asymmetric information and agency costs are high during business cycle downturns and relatively low during booms. However, the pro-cyclical behaviour of banking business may be augmented by the tendency for the banks to lend more during economic upturns and to adopt more cautious lending standards during economic downturns (Altman, Brady, Resti and Sironi 2005).
Further, a positive correlation between risk and GDPs growth has been noted and this arises from the tendency for banks to increase their riskiness by lowering their lending standards during economic upturns (Vennet, Jonghe and Baele 2005).

The correlation between GDP and the change in risk with EMU is estimated and reported in Table 5.5 below. It is observed that while changes in total risk and idiosyncratic risk are negatively correlated with changes in GDP, changes in systematic risk are positively correlated with changes in GDP. The inconsistency in estimated correlation sign suggests that GDP growth does not provide a complete explanation for the decrease in risk across all three risk measures used in this study across the period.

Table 5.5
Correlation between Bank Equity Risk and Gross Domestic Product (GDP)
This table presents the correlation between the changes in bank equity risk and change in GDP. Using MSCI indices the change in equity risk is measured by taking the difference between pre-EMU and post EMU period.

<table>
<thead>
<tr>
<th>Country</th>
<th>Change in GDP</th>
<th>Change in total risk</th>
<th>Change in idiosyncratic risk</th>
<th>Change in systematic risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Euro-zone countries</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Austria</td>
<td>0.489</td>
<td>0.005</td>
<td>0.002</td>
<td>-0.561</td>
</tr>
<tr>
<td>Belgium</td>
<td>0.579</td>
<td>-0.001</td>
<td>0.000</td>
<td>0.318</td>
</tr>
<tr>
<td>Finland</td>
<td>1.654</td>
<td>0.008</td>
<td>0.005</td>
<td>-0.934</td>
</tr>
<tr>
<td>France</td>
<td>0.021</td>
<td>0.006</td>
<td>0.003</td>
<td>-0.575</td>
</tr>
<tr>
<td>Germany</td>
<td>0.468</td>
<td>-0.002</td>
<td>0.000</td>
<td>0.579</td>
</tr>
<tr>
<td>Greece</td>
<td>-1.354</td>
<td>0.028</td>
<td>0.009</td>
<td>-1.162</td>
</tr>
<tr>
<td>Ireland</td>
<td>2.904</td>
<td>-0.001</td>
<td>-0.002</td>
<td>-0.371</td>
</tr>
<tr>
<td>Italy</td>
<td>0.429</td>
<td>0.004</td>
<td>0.003</td>
<td>-0.428</td>
</tr>
<tr>
<td>Netherlands</td>
<td>1.368</td>
<td>0.001</td>
<td>0.002</td>
<td>0.218</td>
</tr>
<tr>
<td>Portugal</td>
<td>2.054</td>
<td>0.009</td>
<td>0.006</td>
<td>-0.239</td>
</tr>
<tr>
<td>Spain</td>
<td>0.054</td>
<td>0.003</td>
<td>0.001</td>
<td>-0.471</td>
</tr>
<tr>
<td>Non Euro-zone countries</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Denmark</td>
<td>0.982</td>
<td>0.001</td>
<td>-0.001</td>
<td>-0.338</td>
</tr>
<tr>
<td>Norway</td>
<td>2.007</td>
<td>0.002</td>
<td>0.001</td>
<td>-0.576</td>
</tr>
<tr>
<td>Sweden</td>
<td>-0.143</td>
<td>0.003</td>
<td>0.002</td>
<td>-0.483</td>
</tr>
<tr>
<td>Switzerland</td>
<td>-0.057</td>
<td>0.009</td>
<td>0.009</td>
<td>-0.288</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>-0.168</td>
<td>0.001</td>
<td>0.000</td>
<td>-0.257</td>
</tr>
<tr>
<td>Correlation between change in risk and</td>
<td>-</td>
<td>-0.479</td>
<td>-0.413</td>
<td>0.184</td>
</tr>
</tbody>
</table>
5.3.9 Structural Change

CUSUM square analysis allows further analysis of whether the structural breaks in the data do align with the starting date for EMU. 90% of the banks show a clear break around the time that EMU was introduced. For example, the graph for SAMPO ‘A’ in Finland shows a break just after the introduction of euro. The Belgium banks show evidence of structural change in period from 1999 to 2001. There is also support for a structural break around the introduction of the EMU for Ireland and Portugal. In Italy, both Banca Lombardo and Unicredito Italiano present a break point around the establishment of EMU. Moreover, risk measures for the Spanish banks such as Banco de Castilla, Banco Espanol de Credito, Banco Popular Espanol and Bankinter ‘R’ also appear to be directly affected by EMU around 1999.

Yet, there is no direct link for large German banks like the Bankgsellschaft Berlin, the Bayer Hypo-Und-Vbk, the Commerz bank with the EMU though Cusum-square graphs suggest that there is a structural break closer to the middle of 1996 and the impact of the Asian Crisis around 1997. It is important to note that some of the relatively smaller German banks like the Oldenburger LB and the BHW Holdings do exhibit a break-point with the introduction of EMU consistent with the majority of the banks in the sample. In short, the CUSUM square graphs support the assumption that there was a major structural change for the majority of the euro-zone banks with the introduction of EMU.
5.4 SUMMARY

The aim of this study is to assess the impact of EMU on euro-zone bank equity risk in relation to hypotheses H12, H13 and H14 as mentioned in Section 2.6.3 of Chapter 2. Over 70% of the banks reduced their total risk. More than 60% of the banks exhibit a reduction in idiosyncratic risk and 64% of the banks exhibit a decrease in systematic risk. The banks that exhibit a decrease in bank equity risk are clustered in countries like France, Greece, Italy, Portugal and Spain.

The results are robust to a number of different test specifications. For example, the use of the European index and world index as a proxy for the market index had little impact on the results and the use of the Fama-French three-factor model, which adjusts for the impact of size and value as well as market effects, also has little effect on the tests for change in market sensitivity of bank equity over the period. Further, financial crises appear to have little impact on the results. Tests are also conducted using banking industry index returns as a further check on the results. Finally, visual analysis of CUSUM square graphs provides evidence of a structural break around the time of the introduction of EMU for the majority of the banks in the sample. In summary, the majority of the banks in the sample exhibit a decrease in systematic risk with EMU.

Apparently, the euro-zone banking sector has been able to deal with the macroeconomic shocks arising from EMU. There has certainly been an increase in domestic and cross border merger activity since the formation of EMU and it has been argued that this has lead to an increase in financial integration among the euro-zone countries. Perhaps these mergers go some way toward explaining the reduction in bank equity risk in neighboring non-euro-zone European country banks with the formation of
The results are consistent with the contention that financial integration among the European banks may have resulted in reduced operating risk through decreased foreign exchange risk exposures, decreased differences in legislation and accounting and in simplification of European securities regulation. There has also been a rapid increase in bank merger and acquisition activity since 1999 with the beginning of EMU. These important changes could account for individual bank equity risk reduction that is noted in this study. Furthermore, the reduction in risk in non euro-zone European country banks suggests the possibility of spill-over effects from the EMU. However, the reduction in risk in non-euro-zone banking industry is not as pronounced as it is for EMU members.

While not all banks in all the countries in the study exhibit equity risk reduction, equity risk reduction is apparent in most countries in the sample. An important exception is the German banking industry, where many of the banks exhibit an increase in bank equity risk on an average.
CHAPTER 6

AN ANALYSIS OF BANK RISK AROUND THE WORLD -

EMPIRICAL RESULTS

6.1 INTRODUCTION

This chapter revisits the analysis conducted in Chapter 4 using a comprehensive cross-country data-set\(^{52}\) in analysis of how bank-specific characteristics and overall banking environment affect the bank equity risk and credit risk.

This chapter presents the results for the empirical testing of hypotheses H1, H2A H2B, H3, H4, H5A, H5B, H6, H7, H8, H9 and H10 related to research question 1 (RQ1): “Do bank regulation, off-balance sheet activities and market discipline explain bank risk, in particular equity risk and credit risk?” The remainder of the chapter is divided into the following sections. Section 6.2 discusses the regression results pertinent to research question 1 (RQ1). Section 6.3 presents regression results in relation to a regional analysis of bank equity risks and credit risk. Section 6.4 presents the results on the impact of the formation of EMU 1999. Section 6.5 presents tests of the robustness of the results reported for research question 1 (RQ1). Finally, Section 6.6 concludes the chapter, summarizing findings and relating the results with respect to the first research question (RQ1).

\(^{52}\)The data-set includes Western European banks as covered in Chapter 4. In addition, the sample in this study incorporates Turkey and Cyprus. The study period is extended by one year that is 1996-2006.
6.2 REGRESSION RESULTS FOR RQ1A: WORLD ANALYSIS

This section discusses the results of world analysis for all four risk measures (systematic risk, idiosyncratic risk, total risk and credit risk). Tests for endogeneity confirm that charter value and bank capital are endogenous variables and hence the preferred estimation method is two-stage least squares (2SLS) for all risk measures with the exception of idiosyncratic risk. However, the results are not particularly sensitive to estimation method. The Wald test statistics for the joint significance of time dummies is statistically significant at the 1% significance level and hence validates their inclusion in the model. Section 6.2.1 reports the results for systematic risk. Section 6.2.2 presents the results for idiosyncratic risk. Section 6.2.3 discusses the results for total risk and finally Section 6.2.4 reports the results for credit risk.

6.2.1 Determinants of systematic risk

Table 6.1 details the tests of the hypotheses H1, H2A, H2B, H3, H4 and H5A, H5B, H6, H7, H8, H9 and H10 for systematic risk determinants. The regression model is statistically significant with an adjusted R-square of 31% and significant F-statistic (F=70, prob >F 0.000).
Table 6.1
Cross-country analysis of the determinants of bank systematic risk

The table represents the cross-country results for the determinants of bank systematic risk. The standard market model is used to measure systematic risk: $R_i = \alpha_i + \beta_i R_m + \varepsilon_i$, where $R_i$ is the return on security $i$ at time period $t$, $R_m$ is the return on an equity market index at time period $t$. The systematic risk estimate for each bank is $\beta_i$ (systematic risk) and $\varepsilon_i$ is a random shock term. The table presents the pooled-OLS regression, pooled-OLS regression with lagged value of bank capital and lagged value of bank charter value and two-stage least squares (2SLS) regression results to estimate the model of bank risk.

\[
RISK_j = \gamma_{\text{EFI}} + \delta_{1}D_{1} + \delta_{2}D_{2} + \gamma_{2}\text{NIM}_{j} + \gamma_{3}\text{BNC}_{j} + \gamma_{4}\text{STurn}_{j} + \delta_{1}\text{DIN}_{j} + \delta_{2}\text{MB}_{j} + \delta_{3}\text{HI}_{j} + \sum\phi_{i}Y_{i,j} + \varepsilon_{i,j}
\] (1)

The explanatory variables such as $UD_{i,j}$ is the natural log of uninsured deposits for bank $i$, in country $j$ at period $t$, $CV_{i,j}$ is the natural log of charter value for bank $i$, country $j$ in period $t$, $BC_{i,j}$ is the natural log of bank capital squared for bank $i$, in country $j$ in period $t$, $OBS_{i,j}$ is the natural log of off-balance sheet activities for bank $i$, in country $j$ at period $t$, $LTA_{i,j}$ is the loan to total assets for bank $i$, in country $j$ at period $t$, $STurn_{i,j}$ is the natural log of market value of equity for bank $i$, in country $j$, in period $t$ and $EFI_{i,j}$ is the economic freedom index for country $j$ at period $t$. $D_{i,j}$ = bank specialization dummy where $D_{i,j} = 1$ if commercial banks or otherwise 0; $D_{2,j}$ = legal origin variable where $D_{2,j} = 1$ if common-law countries, 2 if French civil law countries, 3 if German civil-law countries and 4 if Scandinavian civil law countries; $BNC_{j} = $ Bank concentration for country $j$ at period $t$; $NIM_{j} = $ Net interest margin for country $j$ at period $t$; $STurn_{j} = $ Stock market turnover ratio for country $j$ at period $t$; $DIN_{j} = $ explicit deposit insurance dummy =1, otherwise=0; $MB_{j}$ = market based country dummy =1, otherwise=0; $HI_{j} = $ High income country dummy =1, otherwise=0; Finally, $\varepsilon_{i,j}$ is the random error term. The joint F-test for the year dummies are statistically significant for all risk measures. All results are corrected for heteroscedasticity. The standard errors are reported in parenthesis. Superscripts *, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively. † indicates the coefficients of the explanatory variables and standard errors are scaled by 100.

<table>
<thead>
<tr>
<th></th>
<th>Pooled-OLS</th>
<th>Pooled-OLS with lag</th>
<th>2SLS</th>
</tr>
</thead>
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<tr>
<td>Intercept</td>
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<td>0.177</td>
<td>0.252</td>
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<tr>
<td>(0.130)</td>
<td>(0.155)</td>
<td>(0.137)</td>
<td>(0.177)</td>
</tr>
<tr>
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<td>-0.144***</td>
<td>-0.259**</td>
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<tr>
<td>(0.040)</td>
<td>(0.075)</td>
<td>(0.043)</td>
<td>(0.131)</td>
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<tr>
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<td>-0.135**</td>
</tr>
<tr>
<td>- (0.051)</td>
<td>- (0.051)</td>
<td>- (0.058)</td>
<td>- (0.082)</td>
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<td>0.294</td>
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<td>(0.219)</td>
<td>(0.217)</td>
<td>(0.256)</td>
<td>(0.253)</td>
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<td>0.108***</td>
<td>0.100***</td>
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<tr>
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<td>(0.011)</td>
<td>(0.011)</td>
<td>(0.011)</td>
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<tr>
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<td>0.025**</td>
<td>0.023***</td>
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<td>(0.011)</td>
<td>(0.011)</td>
<td>(0.011)</td>
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<tr>
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<td>0.057***</td>
<td>0.055***</td>
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<td>(0.004)</td>
<td>(0.004)</td>
<td>(0.004)</td>
</tr>
<tr>
<td></td>
<td>Loan to total assets</td>
<td>Bank concentration</td>
<td>Net interest margin</td>
</tr>
<tr>
<td>------------------------------</td>
<td>----------------------</td>
<td>--------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td></td>
<td>-0.155***</td>
<td>-0.269***</td>
<td>-0.955**</td>
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<tr>
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<td>(0.036)</td>
<td>(0.046)</td>
<td>(0.045)</td>
</tr>
<tr>
<td></td>
<td>-0.152***</td>
<td>-0.267***</td>
<td>-1.056***</td>
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<td>(0.035)</td>
<td>(0.046)</td>
<td>(0.045)</td>
</tr>
<tr>
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<td>-0.164***</td>
<td>-0.279***</td>
<td>-1.402***</td>
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<td>(0.045)</td>
<td>(0.048)</td>
</tr>
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<td>-0.276***</td>
<td>-1.503***</td>
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<tr>
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<td>(0.045)</td>
<td>(0.049)</td>
</tr>
<tr>
<td></td>
<td>-0.161***</td>
<td>-0.272***</td>
<td>-1.253***</td>
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<tr>
<td></td>
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<td>(0.046)</td>
<td>(0.049)</td>
</tr>
<tr>
<td></td>
<td>-0.155***</td>
<td>-0.268***</td>
<td>-1.394***</td>
</tr>
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</table>

The existence of a positive and statistically significant (at the 1% level) coefficient for off-balance sheet items indicates that the higher the level of off-balance sheet items the higher the bank systematic risk. This is consistent with hypothesis H3 (Chapter 2, Section 2.3.3) and this result is similar to that reported for European banks (Chapter 4). This finding is broadly in line with earlier studies (e.g., Wagster 1996; Angbazo 1997; Fraser, Madura and Weigand 2002); supporting the moral-hazard hypothesis that off-balance sheet activities increase bank risk.

Further, the coefficient for bank capital is negative and statistically significant at the 1% level, indicating that the higher the level of bank capital the lower the level of systematic risk (Furlong and Keeley 1989; Keeley and Furlong 1990). This finding is
consistent with hypothesis H2A (See Chapter 2, Section 2.3.2). Yet, incorporating bank capital squared in the model suggests the possibility of a non-linear association between bank capital and systematic risk, supporting the theoretical work of Calem and Rob (1999). This finding is also in line with hypothesis H2B (See Chapter 2, Section 2.3.2) and comparable to the earlier finding reported for European banks in Chapter 4.

Figure 6.1 below provides a representation of the non-linear relationship, suggested by this model, between systematic risk (Y-axis) and capital requirement (X-axis).

The coefficient for market discipline is positive and statistically significant at the 1% level. This result leads to the rejection of hypothesis H4, indicating that an increase in market discipline increases bank systematic risk. This unexpected outcome raises concern about whether market discipline substitutes for bank capital (Blum 2002; Imai 2006; Niu 2008a; Niu 2008b). It is important to note that this result is also contrary to the previous
findings discussed in Chapter 4 for European banks. However, this result will be further explored in the regional analysis in Section 6.3 as there is some variation across different regions of the world.

Given the evidence in Table 6.1, the coefficient for size is positive and statistically significant at the 1% level. This result confirms that larger banks are more sensitive to overall market movements and hence larger banks exhibit higher systematic risk. This outcome is consistent with hypothesis H5A and also consistent with the finding discussed in Chapter 4 for European banks.

In contrast to hypothesis H6, the coefficient for loans to total assets is negative and statistically significant at the 1% level. This finding suggests that the magnitude of the bank loan portfolio (including risky loans) tends to reduce bank systematic risk.

Although the result in Chapter 4 for European banks suggests that systematic risk increases with charter value, there is no appreciable evidence to support either this finding or the disciplinary role of charter value in this broader data set.

In the case of country-level variables, the coefficient for deposit insurance is positive and statistically significant at the 1% level indicating that bank systematic risk is higher in countries that have deposit insurance. This finding is consistent with the existence of moral hazard associated with deposit insurance (Kareken and Wallace 1978; Buser, Chen and Kane 1981; Marcus and Shaked 1984; Ronn and Verma 1986). The result also supports hypothesis H10.

The results in Table 6.1 suggest that higher bank concentration is associated with lower levels of systematic risk. This finding also validates previous findings (e.g., Beck,
Demirguc-Kunt and Levine 2006; Beck, Demirguc-Kunt and Levine 2007; Schaeck, Cihak and Wolfe 2009). Consistent with predictions in Chapter 2, the coefficient for stock market turnover ratio is positive and statistically significant at the 1% level, suggesting that banks whose shares are more frequently traded are exposed to a higher level of systematic risk (Anderson and Fraser 2000; Konishi and Yasuda 2004). Also consistent with predictions as mentioned in Chapter 2, the coefficient for the common-law country dummy is positive and statistically significant at the 1% level, suggesting that legal-origin affects bank risk taking (Aghion and Bolton 1992; Hart and Moore 1994) and thus banks operating under common-law or British legal origin tend to exhibit higher systematic risk. However, it should be noted that this result is contrary to the finding for European banks reported previously in Chapter 4.

Furthermore, from Table 6.1, the coefficient for net interest margin is negative and statistically significant at the 1% level. This finding is broadly consistent with the work of Maudos and Fernández de Guevara (2004) though this is inconsistent with predictions in Chapter 2.

Finally, the coefficient for the high income country dummy is positive and statistically significant at the 1% level, suggesting developed economies exhibit greater systematic risk.

### 6.2.2 Determinants of idiosyncratic risk

Table 6.2 reports the results for idiosyncratic risk determinants. The regression model is statistically significant with an adjusted R-square of 25% and significant F-statistic (prob >F 0.000).
Consistent with hypothesis H2A, the coefficient of bank capital is negative and statistically significant at the 1% level, suggesting that increases in bank capital are associated with decreased risk. This finding supports the theoretical proposition that bank capital has a stabilizing effect (Furlong and Keeley 1990). In order to investigate the possibility of a non-linear relationship between bank capital and risk, bank capital squared is included in the model, though there is no appreciable evidence of non-linearity. This finding is inconsistent with hypothesis H2B.

Furthermore, the coefficient for off-balance sheet activities is negative and statistically significant at the 1% level. This indicates that higher off-balance sheet activities are associated with lower bank-specific risk, consistent with prior studies (e.g., Angbazo 1997; Esty 1998; Boot 2003; Yildirim and Philippatos 2007a). It appears that banks reduce risk with fee-based income, contrary to regulator suggestions (Basel Accord II) that off-balance sheet activities result in greater risk. The significance of off-balance sheet activities differs from the earlier analysis for European banks discussed in Chapter 4, where, it is found that off-balance sheet activities result in greater risk. This difference likely explains the growing importance of off-balance sheet activities in different regions as banks expand their operations. This result is further explored in the regional analysis reported in Section 6.3.
Table 6.2
Cross-country analysis of the determinants of bank idiosyncratic risk

The tables represent the cross-country results for the determinants of bank idiosyncratic risk. The standard market model is used to measure idiosyncratic risk: 

$$ R_i = \alpha + \beta R_m + \varepsilon_i $$

where, $ R_i $ is the return on security $ i $ at time period $ t $, $ R_m $ is the return on an equity market index at time period $ t $. Idiosyncratic risk is defined as the variance of the residual from the one factor market model. The tables represent the pooled-OLS regression, pooled-OLS regression with lagged value of bank capital and lagged value of bank charter value and two-stage least squares (2SLS) regression results to estimate the following model of bank risk.

$$ RISK_i = \gamma_{EFI} + \delta_{D1} + \delta_{D2} + \gamma_{NIM} + \gamma_{BNC} + \gamma_{STurn} + \delta_{DIN} + \delta_{MB} + \delta_{HI} + \sum \phi_i Y_{ij} + \varepsilon_{ij} $$

The explanatory variables such as $ UD_{ij} $ is the natural log of uninsured deposits for bank $ i $, in country $ j $ at period $ t $, $ CV_{ij} $ is the natural log of charter value for bank $ i $, country $ j $ in period $ t $, $ BC_{ij} $ is the natural log of bank capital for bank $ i $, in country $ j $ at period $ t $, $ OBC_{ij} $ is the natural log of bank capital squared for bank $ i $, in country $ j $ at period $ t $, $ OBS_{ij} $ is the loan to total assets for bank $ i $, in country $ j $ at period $ t $, $ Size_{ij} $ is the natural log of market value of equity for bank $ i $, in country $ j $, in period $ t $ and $ EFI_{ij} $ is the economic freedom index for country $ j $ at period $ t $.

$ D_{ij} = $ bank specialization dummy where $ D_{ij} = 1 $ if commercial banks or otherwise 0; $ D_{2j} = $ legal origin variable where $ D_{2j} = 1 $ if common-law countries, 2 if French civil law countries, 3 if German civil-law countries and 4 if Scandinavian civil law countries; $ BNC_{ij} = $ Bank concentration for country $ j $ at period $ t $; $ NIM_{ij} = $ Net interest margin for country $ j $ at period $ t $; $ STurn_{ij} = $ Stock market turnover ratio for country $ j $ at period $ t $; $ DIN_{ij} = $ explicit deposit insurance dummy =1, otherwise=0; $ MB_{ij} = $ market based country dummy =1, otherwise=0; $ HI_{ij} = $ High income country dummy =1, otherwise=0; Finally, $ \varepsilon_{ij} $ is the random error term. The joint F-test for the year dummies are statistically significant for all risk measures. All results are corrected for heteroscedasticity. The standard errors are reported in parenthesis. Superscripts *, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively. † indicates the coefficients of the explanatory variables and standard errors are scaled by 100.

<table>
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<th>Pooled-OLS</th>
<th>Pooled-OLS with lag</th>
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<tbody>
<tr>
<td>Intercept</td>
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<td>(0.224)</td>
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<td>(0.408)</td>
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<td>-0.027**</td>
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<tr>
<td>High income economy dummy</td>
<td>-0.440***</td>
<td>-0.442***</td>
<td>-0.434***</td>
<td>-0.436***</td>
<td>-0.432***</td>
<td>-0.434***</td>
</tr>
<tr>
<td></td>
<td>(0.031)</td>
<td>(0.031)</td>
<td>(0.032)</td>
<td>(0.032)</td>
<td>(0.034)</td>
<td>(0.034)</td>
</tr>
</tbody>
</table>

The coefficient for market discipline is negative and statistically significant at the 5% level. This suggests that the higher the market discipline the lower the idiosyncratic risk. This is consistent with the hypothesis H4 suggesting that market discipline dampens bank risk-taking incentives. The market disciplinary role of subordinated debt may convey information to investors and regulators regarding bank risk as subordinated debt-holders demand a higher interest rate from riskier banks. Perhaps, anticipation of higher

---

53 This finding differs from the earlier result for European banks reported in Chapter 4, where it is found that market discipline appear to be risk-enhancing.
funding costs motivates banks to reduce idiosyncratic risk.

The coefficient for loan to total assets is negative and statistically significant at the 1% level. This finding is inconsistent with hypothesis H6 (Chapter 2 Section 2.4.2). Possibly, this broader sample is dominated by US bank holding companies and so it is possible that increases in loans (commercial loans etc) may help these banks to diversify their idiosyncratic risk.

It is evident from the results reported in Table 6.2 that the coefficient for deposit insurance is positive and statistically significant at the 1% level. This finding suggests that explicit safety nets may have encouraged banks to undertake more risky investments and hence increase bank risk. Further, mis-priced deposit insurance could also provide banks with an incentive to engage in more risky lending strategies that increase the contingent payout from deposit insurance agencies. This finding is consistent with hypothesis H10.

The coefficient for the market-based dummy is negative and statistically significant at the 1% level, indicating that under a market-based system banks tend to demonstrate lower levels of idiosyncratic risk. Perhaps, market-based economies encourage banks to undertake more prudent risk levels (Rajan and Zingales 1998, 1999). This finding is inconsistent with hypothesis H9.

With respect to other country-level variables, the coefficient for stock market turnover ratio is positive and statistically significantly at the 1% level, indicating that the higher the frequency of share trading the higher the idiosyncratic risk (Anderson and Fraser 2000; Konishi and Yasuda 2004; Stiroh 2006). Further, there is evidence that
higher net interest margin leads to higher risk (Maudos and Fernández de Guevara 2004). These findings are consistent with predictions as explained earlier in Section 2.4.3 of Chapter 2.

There is also evidence that common-law country banks exhibit higher risk indicating that banks can extend risky loans due to the lower expected loss per loan in common-law countries because of the superior creditor protection in these countries. This is consistent with predictions mentioned in Section 2.4.3 of Chapter 2.

Banks in higher income economies also exhibit lower levels of idiosyncratic risk. Diversification opportunities and access to the capital markets enable high-income country investors to diversify their bank-specific risk. Thus, this is also in line with the predictions as discussed in Section 2.4.3 of Chapter 2.

Finally, contrary to the earlier prediction (Section 2.4.3 of Chapter 2) commercial banks exhibit lower levels of idiosyncratic risk than other financial institutions. This finding suggests that commercial banks in the sample may be able to reduce bank-specific risk through internal diversification opportunities.

6.2.3 Determinants of total risk

Estimation of the association between bank risk and bank-specific variables is reported in Table 6.3. The coefficient for bank capital is negative and statistically significant at the 5% level, indicating that bank capital imposes a disciplinary effect on total risk. This result supports hypothesis H2A. It seems that this finding is sensitive to the inclusion of bank capital square term and so fails to support hypothesis H2B, as well as the theoretical work of Calem and Rob (1999). However, the finding is consistent with
that observed for European banks as discussed in Chapter 4.

Consistent with hypothesis H3, the coefficient for off-balance sheet activities is positive and statistically significant at the 1% level, indicating that increases in off-balance sheet activities lead to increased bank total risk (Wagster 1996; Fraser, Madura and Weigand 2002). However, this finding is contrary to the prior studies, particularly those based on US data (e.g., Hassan, Karels and Peterson 1994, Lynge and Lee 1994, Avery and Berger 1991).

Market discipline is found to be associated with a reduction in total risk, suggesting that increases in market discipline decreases bank total risk. In other words, from the policy perspective, market discipline appears to promote disclosure and relevant information by banks to the market (Estrella 2004). Hence, banks that disclose more information are subject to greater market discipline and have greater incentive to reduce their total risk. This finding is also consistent with hypothesis H4 (See Chapter 2 Section 2.3.4). For the purpose of comparison, regional analysis is also conducted and the results are reported in Section 6.3.
Cross-country analysis of the determinants of bank total risk

The table represents the cross-country results for the determinants of bank total risk. The variance of bank equity returns is calculated each year for each bank using weekly return data available in that year and is defined as follows: 

$$
\sigma^2_{\text{R}_i} = \frac{1}{N} \sum_{t=1}^{T} (R_{i,t} - \overline{R})^2
$$

where $\sigma^2_{\text{R}_i}$ = the total risk or variance of bank returns for bank $i$; $R_{i,t}$ = bank $i$ return per week; $N$ = the number of observations. The table represent the pooled-OLS regression, pooled-OLS regression with lagged value of bank capital and lagged value of bank charter value and two-stage least squares (2SLS) regression results to estimate the following model of bank risk.

$$
\text{RISK}_{ij} = \alpha + \beta_1 UD_{ij,t} + \beta_2 CV_{ij,t} + \beta_3 BC_{ij,t} + \beta_4 OBS_{ij,t} + \beta_5 LTA_{ij,t} + \beta_6 Size_{ij,t} + \gamma_1 Y_{ij,t} + \gamma_2 EDI_{ij,t} + \gamma_3 NIM_{ij,t} + \gamma_4 BNC_{ij,t} + \gamma_5 STurn_{ij,t} + \delta_1 DIN_{ij,t} + \delta_2 MB_{ij,t} + \delta_3 HI_{ij,t} + \sum \phi_i + \epsilon_{ij,t}
$$

The explanatory variables such as $UD_{ij,t}$ is the natural log of uninsured deposits for bank $i$, in country $j$ at period $t$, $CV_{ij,t}$ is the natural log of charter value for bank $i$, country $j$ in period $t$, $BC_{ij,t}$ is the natural log of bank capital for bank $i$, in country $j$ in period $t$. $OBS_{ij,t}$ is the natural log of off-balance sheet activities for bank $i$, in country $j$ in period $t$. $LTA_{ij,t}$ is the loan to total assets for bank $i$, in country $j$ at period $t$, $Size_{ij,t}$ is the natural log of market value of equity for bank $i$, in country $j$, in period $t$ and $EDI_{ij,t}$ is the economic freedom index for country $j$ at period $t$. $D_{ij}$ = bank specialization dummy where $D_{ij}$ =1 if commercial banks or otherwise 0; $D_{2j}$ = legal origin variable where $D_{2j}$ =1 if common-law countries, 2 if French civil law countries, 3 if German civil-law countries and 4 if Scandinavian civil law countries; $BNC_{ij,t}$ = Bank concentration for country $j$ at period $t$; $NIM_{ij,t}$ = Net interest margin for country $j$ at period $t$; $STurn_{ij,t}$ = Stock market turnover ratio for country $j$ at period $t$; $DIN_{ij}$ = explicit deposit insurance dummy =1, otherwise=0; $MB_{ij,t}$ = market based country dummy =1, otherwise=0; $HI_{ij}$ = High income country dummy =1, otherwise=0; Finally, $\epsilon_{ij,t}$ is the random error term. The joint F-test for the year dummies are statistically significant for all risk measures. All results are corrected for heteroscedasticity. The standard errors are reported in parenthesis. Superscripts *, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively. † indicates the coefficients of the explanatory variables and standard errors are scaled by 100.

<table>
<thead>
<tr>
<th></th>
<th>Pooled-OLS</th>
<th>Pooled-OLS with lag</th>
<th>2SLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-3.512***</td>
<td>-3.500***</td>
<td>-3.537***</td>
</tr>
<tr>
<td></td>
<td>(0.202)</td>
<td>(0.228)</td>
<td>(0.206)</td>
</tr>
<tr>
<td>Bank capital</td>
<td>-0.224***</td>
<td>-0.205</td>
<td>-0.262***</td>
</tr>
<tr>
<td></td>
<td>(0.039)</td>
<td>(0.140)</td>
<td>(0.045)</td>
</tr>
<tr>
<td>Bank capital squared</td>
<td>-</td>
<td>0.007</td>
<td>0.044</td>
</tr>
<tr>
<td></td>
<td>(0)</td>
<td>(0.047)</td>
<td>(0.061)</td>
</tr>
<tr>
<td>Charter value</td>
<td>0.193</td>
<td>0.192</td>
<td>0.136</td>
</tr>
<tr>
<td></td>
<td>(0.049)</td>
<td>(0.040)</td>
<td>(0.039)</td>
</tr>
<tr>
<td>Off balance sheet items</td>
<td>-0.003</td>
<td>-0.003</td>
<td>0.003***</td>
</tr>
<tr>
<td></td>
<td>(0.012)</td>
<td>(0.012)</td>
<td>(0.001)</td>
</tr>
</tbody>
</table>

183
<table>
<thead>
<tr>
<th>Market discipline</th>
<th>-0.014**</th>
<th>-0.014**</th>
<th>-0.018**</th>
<th>-0.018**</th>
<th>-0.018**</th>
<th>-0.018**</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>(0.006)</td>
<td>(0.006)</td>
<td>(0.009)</td>
<td>(0.009)</td>
<td>(0.009)</td>
<td>(0.009)</td>
</tr>
<tr>
<td>Size</td>
<td>0.025***</td>
<td>0.025***</td>
<td>0.025***</td>
<td>0.025***</td>
<td>0.024***</td>
<td>0.024***</td>
</tr>
<tr>
<td></td>
<td>(0.004)</td>
<td>(0.004)</td>
<td>(0.004)</td>
<td>(0.004)</td>
<td>(0.005)</td>
<td>(0.005)</td>
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<tr>
<td>Loan to total assets</td>
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<td>-0.211***</td>
<td>-0.209***</td>
<td>-0.207***</td>
<td>-0.201***</td>
<td>-0.200***</td>
</tr>
<tr>
<td></td>
<td>(0.043)</td>
<td>(0.043)</td>
<td>(0.045)</td>
<td>(0.044)</td>
<td>(0.044)</td>
<td>(0.044)</td>
</tr>
<tr>
<td>Bank concentration</td>
<td>0.116**</td>
<td>0.116**</td>
<td>0.089*</td>
<td>0.090*</td>
<td>0.084</td>
<td>0.084</td>
</tr>
<tr>
<td></td>
<td>(0.058)</td>
<td>(0.058)</td>
<td>(0.053)</td>
<td>(0.053)</td>
<td>(0.054)</td>
<td>(0.054)</td>
</tr>
<tr>
<td>Net interest margin</td>
<td>2.787***</td>
<td>2.779***</td>
<td>2.871***</td>
<td>2.838***</td>
<td>2.831***</td>
<td>2.798***</td>
</tr>
<tr>
<td></td>
<td>(0.505)</td>
<td>(0.515)</td>
<td>(0.566)</td>
<td>(0.574)</td>
<td>(0.588)</td>
<td>(0.600)</td>
</tr>
<tr>
<td>Stock market turnover</td>
<td>0.110***</td>
<td>0.110***</td>
<td>0.099***</td>
<td>0.099***</td>
<td>0.101***</td>
<td>0.101***</td>
</tr>
<tr>
<td></td>
<td>(0.014)</td>
<td>(0.014)</td>
<td>(0.014)</td>
<td>(0.014)</td>
<td>(0.015)</td>
<td>(0.015)</td>
</tr>
<tr>
<td>Deposit insurance dummy</td>
<td>0.174***</td>
<td>0.175***</td>
<td>0.171***</td>
<td>0.172***</td>
<td>0.167***</td>
<td>0.168***</td>
</tr>
<tr>
<td></td>
<td>(0.037)</td>
<td>(0.037)</td>
<td>(0.038)</td>
<td>(0.038)</td>
<td>(0.037)</td>
<td>(0.037)</td>
</tr>
<tr>
<td>Economic freedom index</td>
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<td>-0.001</td>
<td>-0.002</td>
<td>-0.002</td>
<td>-0.002</td>
<td>-0.002</td>
</tr>
<tr>
<td></td>
<td>(0.002)</td>
<td>(0.002)</td>
<td>(0.002)</td>
<td>(0.002)</td>
<td>(0.002)</td>
<td>(0.002)</td>
</tr>
<tr>
<td>market based dummy</td>
<td>-0.183***</td>
<td>-0.184***</td>
<td>-0.178***</td>
<td>-0.180***</td>
<td>-0.174***</td>
<td>-0.176***</td>
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<tr>
<td></td>
<td>(0.021)</td>
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<td>(0.021)</td>
<td>(0.021)</td>
<td>(0.021)</td>
<td>(0.021)</td>
</tr>
<tr>
<td>Common law dummy</td>
<td>0.193***</td>
<td>0.194***</td>
<td>0.196***</td>
<td>0.198***</td>
<td>0.191***</td>
<td>0.193***</td>
</tr>
<tr>
<td></td>
<td>(0.020)</td>
<td>(0.020)</td>
<td>(0.020)</td>
<td>(0.020)</td>
<td>(0.022)</td>
<td>(0.022)</td>
</tr>
<tr>
<td>Commercial bank dummy</td>
<td>-0.058***</td>
<td>-0.058***</td>
<td>-0.049***</td>
<td>-0.048***</td>
<td>-0.051**</td>
<td>-0.051***</td>
</tr>
<tr>
<td></td>
<td>(0.022)</td>
<td>(0.022)</td>
<td>(0.022)</td>
<td>(0.022)</td>
<td>(0.024)</td>
<td>(0.024)</td>
</tr>
<tr>
<td>High income economy dummy</td>
<td>-0.431***</td>
<td>-0.431***</td>
<td>-0.427***</td>
<td>-0.426***</td>
<td>-0.426***</td>
<td>-0.425***</td>
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<tr>
<td></td>
<td>(0.032)</td>
<td>(0.032)</td>
<td>(0.032)</td>
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<td>(0.034)</td>
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<table>
<thead>
<tr>
<th>R-squared</th>
<th>0.25</th>
<th>0.25</th>
<th>0.27</th>
<th>0.27</th>
<th>0.30</th>
<th>0.30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model test</td>
<td>F(25,4654)=87.18</td>
<td>F(26,4653)=83.8</td>
<td>F(25,4446)=87</td>
<td>F(26,4445)=83.3</td>
<td>F(25,4433)=81.2</td>
<td>F(26,4432)=80.9</td>
</tr>
<tr>
<td>Joint F-test for year dummies</td>
<td>F(10,4654)=21.68</td>
<td>F(10,4653)=21.6</td>
<td>F(10,4446)=25.5</td>
<td>F(10,4445)=25.5</td>
<td>λ(10)=236***</td>
<td>λ(10)=236***</td>
</tr>
<tr>
<td>Wu-Hausman F test</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>4.73***</td>
<td>4.72***</td>
</tr>
<tr>
<td>Durbin-Wu-Hausman</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>9.10***</td>
<td>13.09***</td>
</tr>
<tr>
<td>chi-sq test</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>NOBS</td>
<td>4680</td>
<td>4680</td>
<td>4472</td>
<td>4472</td>
<td>4459</td>
<td>4459</td>
</tr>
</tbody>
</table>

Given the evidence in Table 6.3, the results suggest that size is an important determinant of total risk. Large banks tend to exhibit greater levels of total risk. This finding is inconsistent with hypothesis H5B (Chapter 2 Section 2.4.1), though this result does support the work of Acharya, Hasan and Saunders (2002). Further, the coefficient for loans to total assets is negative and statistically significant at the 1% level, indicating that a greater proportion of loan to total assets is associated with lower bank total risk. This is an unexpected outcome and thus fails to support hypothesis H6 (See Chapter 2
Section 2.4). One possible interpretation of this finding may be that regulation, structural reforms, and institutional changes may have prompted banks to improve their allocation of financial resources, favouring prudent investments in their loan portfolio and thereby promoting further development of the financial system and reducing risk (Pelozo 2008).

The coefficient for explicit deposit insurance is positive and statistically significant at the 1% level, suggesting that moral hazard associated with explicit deposit insurance creates incentive for excessive risk taking (Demirguc-Kunt and Detragiache 1998; Demirguc-Kunt and Detragiache 2002). This finding is consistent with hypothesis H10 (See Chapter 2 Section 2.4.2).

In addition, the coefficient for market-based economies is negative and is statistically significant at 1% significant level. This result leads to the rejection of hypothesis H9 though this finding supports prior studies (e.g., Rajan and Zingales 1998; Rajan and Zingales 1999).

Finally, with respect to other country-level variables, the coefficients for net interest margin (positive) and the common-law country dummy (positive) exhibit their predicted signs (See Chapter 2 Section 2.4.2). Further, contrary to predictions, the coefficient for the commercial bank dummy is negative and statistically significant at the 1% level, indicating that commercial banks demonstrate lower total risk. This finding seems to originate mostly from Canadian banks, as Canadian commercial banks are ranked among the world’s safest bank (World Economic Forum 2008). This proposition is further explored in the regional analysis in Section 6.3.
6.2.4 Determinants of credit risk

Table 6.4 reports the results for credit risk determinants. Panel A and Panel B presents the findings for two alternate credit risk measures, loan loss provisions and loan loss reserves. According to the findings observed in Panel A and Panel B of Table 6.4, the coefficient for charter value is negative and statistically significant at the 1% level indicating that increases in the charter value are associated with decreases in credit risk. Thus, charter value helps to reduce excessive risk taking, supporting hypothesis H1 (Chapter 2, Section 2.3.1). This finding is also consistent with prior theoretical (e.g., Merton 1977; Keeley 1990) and empirical (e.g. Konishi and Yasuda 2004; González 2005) studies. Given the evidence in Table 6.4, it can be confirmed that off-balance sheet items increase bank credit risk and hence this justifies the inclusion of these activities in the calculation of risk-weighted capital requirement (Wagster 1996; Fraser, Madura and Weigand 2002).

This finding is in line with hypothesis H3. Similar evidence is also observed for systematic risk and total risk. Further, consistent with hypothesis H4, the coefficient for market discipline is negative and statistically significant at the 1% level, suggesting that market discipline creates an incentive to monitor bank risk particularly on the loan side of the balance sheet (Morgan and Stiroh 2001; Blum 2002; Nier and Baumann 2006).

Panel A and Panel B confirm that larger banks exhibit lower credit risk as reflected by the negative coefficient on size due to diversification benefits (Demsetz and Strahan 1997). This result is consistent with hypothesis H5B (See Chapter 2, Section 2.4.1).
Cross-country analysis of the determinants of bank credit risk

The table represents the cross-country results for the determinants of bank credit risk. Panel A panel B represent the results of the determinants of credit risk. The panel represent the pooled-OLS regression, pooled-OLS regression with lagged value of bank capital and lagged value of bank charter value and two-stage least squares (2SLS) regression results to estimate the following model of bank risk.

\[ \text{RISK}_{it} = \alpha_i + \beta_1 \text{UD}_{ijt} + \beta_2 \text{CV}_{ijt} + \beta_3 \text{BC}_{ijt} + \beta_4 \text{BC}^2_{ijt} + \beta_5 \text{OBS}_{ijt} + \beta_6 \text{LTA}_{ijt} + \beta_7 \text{Size}_{ijt} + \gamma_1 \text{EFI}_{ijt} + \delta_1 \text{D}_{1j} + \delta_2 \text{D}_{2j} + \gamma_2 \text{NIM}_{ijt} + \gamma_3 \text{BNC}_{ijt} + \gamma_4 \text{STurn}_{ijt} + \delta_3 \text{DIN}_{ijt} + \delta_4 \text{MB}_{ijt} + \delta_5 \text{HI}_{ijt} + \sum \phi_i \text{Y}_{ijt} + \epsilon_{ijt}, \]

(5)

\( \text{RISK}_{it} \) measures credit risk. Credit risk is measured using \( \text{CR}_{ijt} = \frac{\text{LLP}_{ijt}}{\text{TA}_{ijt}} \), where; \( \text{CR}_{ijt} \) is the credit risk measure for bank \( i \) in country \( j \) in period \( t \); or the ex-post realized risk. \( \text{LLP}_{ijt} \) is the loan loss provision for bank \( i \) in country \( j \) in period \( t \); \( \text{TA}_{ijt} \) is the total assets of bank \( i \) in country \( j \) in period \( t \). The estimation techniques are provided in equation (3) Note that the second estimation method of credit risk eliminates a number of Danish banks due to lack of data availability. The explanatory variables such as \( \text{UD}_{ijt} \) is the natural log of uninsured deposits for bank \( i \) in country \( j \) in period \( t \); \( \text{BC}_{ijt} \) is the natural log of bank capital for bank \( i \) in country \( j \) in period \( t \); \( \text{CV}_{ijt} \) is the natural log of charter value for bank \( i \) in country \( j \) in period \( t \); \( \text{LTA}_{ijt} \) is the loan to total assets for bank \( i \) in country \( j \) in period \( t \); \( \text{NIM}_{ijt} \) = Net interest margin for country \( j \) at period \( t \); \( \text{BNC}_{ijt} \) = Bank concentration for country \( j \) at period \( t \); \( \text{STurn}_{ijt} \) = Stock market turnover ratio for country \( j \) at period \( t \); \( \text{DIN}_{ijt} \) = explicit deposit insurance dummy =1, otherwise=0; \( \text{MB}_{ijt} \) = market based country dummy =1, otherwise=0; \( \text{HI}_{ijt} \) =High income country dummy =1, otherwise=0; Finally, \( \epsilon_{ijt} \) is the random error term. The joint F-test for the year dummies are statistically significant for all risk measures. All results are corrected for heteroscedasticity. The standard errors are reported in parenthesis. Superscripts *, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively. † indicates the coefficients of the explanatory variables and standard errors are scaled by 100.

**Panel A Determinants of credit risk (measured by loan loss provision to total assets)**

<table>
<thead>
<tr>
<th></th>
<th>Pooled-OLS</th>
<th>Pooled-OLS with lag</th>
<th>2SLS</th>
</tr>
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<tr>
<td>Intercept</td>
<td>-1.671***</td>
<td>-1.374***</td>
<td>-1.697***</td>
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<tr>
<td></td>
<td>(0.130)</td>
<td>(0.165)</td>
<td>(0.144)</td>
</tr>
<tr>
<td>Bank capital</td>
<td>-0.120***</td>
<td>0.357**</td>
<td>-0.052</td>
</tr>
<tr>
<td></td>
<td>(0.042)</td>
<td>(0.161)</td>
<td>(0.042)</td>
</tr>
<tr>
<td>Bank capital squared</td>
<td>-</td>
<td>0.180***</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>- (0.057)</td>
<td>(0.048)</td>
<td>(0.048)</td>
</tr>
<tr>
<td>Charter value</td>
<td>-0.618***</td>
<td>-0.641***</td>
<td>-0.826***</td>
</tr>
<tr>
<td></td>
<td>(0.188)</td>
<td>(0.187)</td>
<td>(0.227)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------------------------</td>
<td>----------------</td>
<td>----------------</td>
<td>----------------</td>
</tr>
<tr>
<td>Off balance sheet items</td>
<td>0.043***</td>
<td>0.041***</td>
<td>0.045***</td>
</tr>
<tr>
<td></td>
<td>(0.010)</td>
<td>(0.010)</td>
<td>(0.010)</td>
</tr>
<tr>
<td>Market discipline</td>
<td>-0.023***</td>
<td>-0.022***</td>
<td>-0.032***</td>
</tr>
<tr>
<td></td>
<td>(0.011)</td>
<td>(0.011)</td>
<td>(0.011)</td>
</tr>
<tr>
<td>Size</td>
<td>-0.011***</td>
<td>-0.010***</td>
<td>-0.008***</td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.003)</td>
<td>(0.003)</td>
</tr>
<tr>
<td>Loan to total assets</td>
<td>0.509***</td>
<td>0.513***</td>
<td>0.492***</td>
</tr>
<tr>
<td></td>
<td>(0.064)</td>
<td>(0.066)</td>
<td>(0.065)</td>
</tr>
<tr>
<td>Bank concentration</td>
<td>-0.266***</td>
<td>-0.266***</td>
<td>-0.249***</td>
</tr>
<tr>
<td></td>
<td>(0.050)</td>
<td>(0.050)</td>
<td>(0.053)</td>
</tr>
<tr>
<td>Net interest margin</td>
<td>1.108**</td>
<td>0.925**</td>
<td>1.546***</td>
</tr>
<tr>
<td></td>
<td>(0.466)</td>
<td>(0.470)</td>
<td>(0.570)</td>
</tr>
<tr>
<td>Stock market turnover</td>
<td>-0.068***</td>
<td>-0.068***</td>
<td>-0.059***</td>
</tr>
<tr>
<td></td>
<td>(0.011)</td>
<td>(0.010)</td>
<td>(0.011)</td>
</tr>
<tr>
<td>Deposit insurance dummy</td>
<td>0.005</td>
<td>0.008</td>
<td>0.018</td>
</tr>
<tr>
<td></td>
<td>(0.024)</td>
<td>(0.024)</td>
<td>(0.025)</td>
</tr>
<tr>
<td>Economic freedom index</td>
<td>-0.007***</td>
<td>-0.007</td>
<td>-0.006***</td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
<td>(0.001)</td>
<td>(0.001)</td>
</tr>
<tr>
<td>market based dummy</td>
<td>0.075***</td>
<td>0.067***</td>
<td>0.061***</td>
</tr>
<tr>
<td></td>
<td>(0.021)</td>
<td>(0.021)</td>
<td>(0.022)</td>
</tr>
<tr>
<td>Common law dummy</td>
<td>-0.126***</td>
<td>-0.118***</td>
<td>-0.111***</td>
</tr>
<tr>
<td></td>
<td>(0.017)</td>
<td>(0.018)</td>
<td>(0.018)</td>
</tr>
<tr>
<td>Commercial bank dummy</td>
<td>0.079***</td>
<td>0.081***</td>
<td>0.086***</td>
</tr>
<tr>
<td></td>
<td>(0.024)</td>
<td>(0.024)</td>
<td>(0.025)</td>
</tr>
<tr>
<td>High income economy dummy</td>
<td>-0.221***</td>
<td>-0.217***</td>
<td>-0.237***</td>
</tr>
<tr>
<td></td>
<td>(0.022)</td>
<td>(0.022)</td>
<td>(0.023)</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.27</td>
<td>0.27</td>
<td>0.28</td>
</tr>
<tr>
<td>Model test</td>
<td>F(25,4605)=55</td>
<td>F(26,4604)=53</td>
<td>F(25,4220)=54</td>
</tr>
<tr>
<td>Joint F-test for year dummies</td>
<td>F(10,4605)=35</td>
<td>F(10,4604)=35</td>
<td>F(10,4220)=37</td>
</tr>
<tr>
<td>Wu-Hausman F test</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Durbin-Wu-Hausman Chi² test</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>NOBS</td>
<td>4631</td>
<td>4631</td>
<td>4246</td>
</tr>
</tbody>
</table>

Furthermore, the result reported in Panel B shows that the coefficient for bank capital is positive and statistically significant at the 1% level, indicating that enforced minimum capital levels can lead banks to take on higher risk. This finding is inconsistent with hypothesis H2A (Chapter 2) and should be of major concern to regulators and creditors.
Panel B: Determinants of credit risk (measured by loan loss reserves to total assets)

<table>
<thead>
<tr>
<th></th>
<th>Pooled-OLS</th>
<th>Pooled-OLS with lag</th>
<th>2SLS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>-0.858***</td>
<td>-0.290**</td>
<td>-0.827***</td>
</tr>
<tr>
<td></td>
<td>(0.117)</td>
<td>(0.143)</td>
<td>(0.131)</td>
</tr>
<tr>
<td></td>
<td>-0.571***</td>
<td>-0.517***</td>
<td>-0.224</td>
</tr>
<tr>
<td></td>
<td>(0.160)</td>
<td>(0.167)</td>
<td>(0.188)</td>
</tr>
<tr>
<td>Bank capital</td>
<td>0.127***</td>
<td>0.082**</td>
<td>0.119***</td>
</tr>
<tr>
<td></td>
<td>(0.036)</td>
<td>(0.037)</td>
<td>(0.117)</td>
</tr>
<tr>
<td></td>
<td>0.737***</td>
<td>0.802**</td>
<td>1.091***</td>
</tr>
<tr>
<td></td>
<td>(0.171)</td>
<td>(0.143)</td>
<td>(0.232)</td>
</tr>
<tr>
<td>Bank capital squared</td>
<td>-0.342***</td>
<td>-0.250***</td>
<td>-0.366***</td>
</tr>
<tr>
<td></td>
<td>(0.156)</td>
<td>(0.056)</td>
<td>(0.062)</td>
</tr>
<tr>
<td>Charter value</td>
<td>-0.410***</td>
<td>-0.175***</td>
<td>-1.325***</td>
</tr>
<tr>
<td></td>
<td>(0.194)</td>
<td>(0.059)</td>
<td>(0.067)</td>
</tr>
<tr>
<td></td>
<td>-0.173***</td>
<td>-1.315***</td>
<td>-0.099***</td>
</tr>
<tr>
<td></td>
<td>(0.056)</td>
<td>(0.062)</td>
<td>(0.056)</td>
</tr>
<tr>
<td>Off balance sheet items</td>
<td>0.009**</td>
<td>0.006**</td>
<td>0.009**</td>
</tr>
<tr>
<td></td>
<td>(0.004)</td>
<td>(0.003)</td>
<td>(0.004)</td>
</tr>
<tr>
<td>Market discipline</td>
<td>-0.029***</td>
<td>-0.032***</td>
<td>-0.028***</td>
</tr>
<tr>
<td></td>
<td>(0.008)</td>
<td>(0.009)</td>
<td>(0.009)</td>
</tr>
<tr>
<td></td>
<td>-0.032***</td>
<td>-0.028***</td>
<td>-0.028***</td>
</tr>
<tr>
<td></td>
<td>(0.009)</td>
<td>(0.009)</td>
<td>(0.009)</td>
</tr>
<tr>
<td>Size</td>
<td>-0.011***</td>
<td>-0.010***</td>
<td>-0.011***</td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.003)</td>
<td>(0.003)</td>
</tr>
<tr>
<td></td>
<td>-0.009***</td>
<td>-0.008***</td>
<td>-0.009***</td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.003)</td>
<td>(0.003)</td>
</tr>
<tr>
<td>Loan to total assets</td>
<td>0.499***</td>
<td>0.531***</td>
<td>0.553***</td>
</tr>
<tr>
<td></td>
<td>(0.066)</td>
<td>(0.071)</td>
<td>(0.070)</td>
</tr>
<tr>
<td></td>
<td>0.538***</td>
<td>0.565***</td>
<td>0.577***</td>
</tr>
<tr>
<td></td>
<td>(0.071)</td>
<td>(0.070)</td>
<td>(0.070)</td>
</tr>
<tr>
<td>Bank concentration</td>
<td>0.035</td>
<td>0.049</td>
<td>0.055</td>
</tr>
<tr>
<td></td>
<td>(0.042)</td>
<td>(0.044)</td>
<td>(0.044)</td>
</tr>
<tr>
<td></td>
<td>0.043</td>
<td>0.044</td>
<td>0.043</td>
</tr>
<tr>
<td>Net interest margin</td>
<td>0.055</td>
<td>-0.267</td>
<td>0.408</td>
</tr>
<tr>
<td></td>
<td>(0.342)</td>
<td>(0.145)</td>
<td>(0.375)</td>
</tr>
<tr>
<td></td>
<td>-0.870**</td>
<td>-0.687*</td>
<td>0.130</td>
</tr>
<tr>
<td>Stock market turnover</td>
<td>-0.089***</td>
<td>-0.091***</td>
<td>-0.094***</td>
</tr>
<tr>
<td></td>
<td>(0.010)</td>
<td>(0.011)</td>
<td>(0.011)</td>
</tr>
<tr>
<td></td>
<td>-0.088***</td>
<td>-0.090***</td>
<td>-0.092***</td>
</tr>
<tr>
<td></td>
<td>(0.010)</td>
<td>(0.011)</td>
<td>(0.011)</td>
</tr>
<tr>
<td>Deposit insurance dummy</td>
<td>0.016</td>
<td>0.024</td>
<td>0.016</td>
</tr>
<tr>
<td></td>
<td>(0.023)</td>
<td>(0.025)</td>
<td>(0.024)</td>
</tr>
<tr>
<td></td>
<td>0.023</td>
<td>0.024</td>
<td>0.023</td>
</tr>
<tr>
<td>Economic freedom index</td>
<td>-0.010***</td>
<td>-0.010***</td>
<td>-0.011***</td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
<td>(0.001)</td>
<td>(0.001)</td>
</tr>
<tr>
<td>Market based dummy</td>
<td>0.052***</td>
<td>0.056***</td>
<td>0.067***</td>
</tr>
<tr>
<td></td>
<td>(0.018)</td>
<td>(0.019)</td>
<td>(0.019)</td>
</tr>
<tr>
<td></td>
<td>0.042**</td>
<td>0.048***</td>
<td>0.054***</td>
</tr>
<tr>
<td>Common law dummy</td>
<td>-0.026</td>
<td>-0.019</td>
<td>-0.025</td>
</tr>
<tr>
<td></td>
<td>(0.016)</td>
<td>(0.017)</td>
<td>(0.018)</td>
</tr>
<tr>
<td></td>
<td>-0.012</td>
<td>-0.009</td>
<td>-0.011</td>
</tr>
<tr>
<td>Commercial bank dummy</td>
<td>0.059***</td>
<td>0.064***</td>
<td>0.062***</td>
</tr>
<tr>
<td></td>
<td>(0.018)</td>
<td>(0.018)</td>
<td>(0.019)</td>
</tr>
<tr>
<td></td>
<td>0.065***</td>
<td>0.069***</td>
<td>0.069***</td>
</tr>
<tr>
<td></td>
<td>(0.018)</td>
<td>(0.019)</td>
<td>(0.019)</td>
</tr>
<tr>
<td>High income dummy</td>
<td>-0.140***</td>
<td>-0.129***</td>
<td>-0.125***</td>
</tr>
<tr>
<td></td>
<td>(0.021)</td>
<td>(0.023)</td>
<td>(0.023)</td>
</tr>
<tr>
<td></td>
<td>-0.139***</td>
<td>-0.132***</td>
<td>-0.114***</td>
</tr>
<tr>
<td></td>
<td>(0.023)</td>
<td>(0.023)</td>
<td>(0.023)</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.24</td>
<td></td>
<td>0.26</td>
</tr>
<tr>
<td>Model test</td>
<td>F(25,4498)=65</td>
<td>F(10,4498)=19</td>
<td>F(10,4498)=19</td>
</tr>
<tr>
<td>Joint F-test for year dummies</td>
<td>0.25</td>
<td>F(26,4497)=65</td>
<td>F(10,4497)=18</td>
</tr>
<tr>
<td>Test of Endogeneity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wu-Hausman F test</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Durbin-Wu-Hausman Chi² test</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NOBS</td>
<td>4524</td>
<td></td>
<td>4411</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4411</td>
</tr>
</tbody>
</table>
With regards to the country-level variables, the coefficient for market-based dummy is positive and statistically significant at the 1% level. It would appear that a market-based system does not result in lower credit risk (Greenwood and Jovanovic 1990; Bencivenga and Smith 1991; de la Fuente and Marin 1996). This finding is consistent with hypothesis H9.

Further, consistent with predictions, the coefficient for the commercial bank dummy is positive and statistically significant at the 1% level, suggesting that commercial banks are more aggressive in the credit market. The negative and statistically significant coefficient for the economic freedom index, suggests that higher levels of freedom may have led to a reduction in credit risk through greater diversification.

Consistent with predictions in Chapter 2, it is observed from Panel A that higher credit risk is associated with higher interest margin (Maudos and Fernández de Guevara 2004). The negative and significant coefficient for stock market turnover ratio suggests that increasing frequency of trading is associated with decreased bank credit risk. This finding is inconsistent with predictions (Chapter 2). Further, common-law country banks exhibit lower credit risk. This finding is inconsistent with predictions and the previous studies (e.g., Aghion and Bolton 1992; Hart and Moore 1992; 1994). Finally, the findings in Table 6.4 confirm that banks in higher income groups exhibit lower credit risk. This may be due to diversification opportunities.

Overall, in answering research question 1 (RQ1A), the empirical findings suggest that in general off-balance sheet activities is associated with an increase in risk. Although
bank capital exhibit the disciplinary role with regard to equity risk but the finding is sensitive to the inclusion of bank capital squared. However, there is a non-linear association between bank capital and systematic risk. Moreover, while market discipline effect is present with regard to total risk, idiosyncratic risk and credit risk, the effect diminishes with regard to systematic risk. Size is an important determinant of bank risk. While large banks around the world show greater systematic risk and total risk, they also show lower credit risk.

6.3 REGRESSION RESULTS FOR RQ1A: REGIONAL ANALYSIS

This section discusses the results from regional analysis (Asia-Pacific, Eastern Europe, Middle East and Africa, North America, South America and Western Europe) to better understand the stability of the bank-level determinants across regions of the world. In this section, the results of the main variables are discussed at a regional level along with some of the important country-level variables. Section 6.3.1 presents the results for off-balance sheet activities. Section 6.3.2 represents the findings for charter value. Section 6.3.3 discusses the results for bank capital. Section 6.3.4 reports the finding for market discipline and finally Section 6.3.5 summarizes the results with respect to country-level variables.

Table 6.6 summarizes the findings for each region and draws a comparison between world analysis and regional analysis. The details of the empirical results are provided in the Appendix in Tables A6.1, A6.2, A6.3, A6.4, A6.5 and A6.6.

6.3.1 Off-balance sheet activities

Table 6.5 reports the comparison between world analysis and regional analysis.
The coefficient for off-balance sheet activity is positive and statistically significant at the 5% level or better for systematic risk in the Western Europe, Middle-East and Africa (MENA) and the North America regions. This finding is consistent with hypothesis H3, suggesting that reliance on non-interest generating income is an important risk factor. This finding is also consistent with the world analysis reported in Section 6.2.

**Table 6.5**

**Off-balance Sheet Activities and Risk - World Analysis versus Regional Analysis**

This table presents a summary of the results as discussed in Section 6.2 and Section 6.3. The results reported in columns under the term “Actual Sign” in the following table are statistically significant at 5% significance level or better. Asia Pacific=Asia Pacific region; EEC=Eastern European countries; MENA=Middle East and Africa region, NA=North America region; SA= South America and W. Europe=Western Europe region. Equity risk includes systematic risk, total risk and idiosyncratic risk. Credit risk is measured by loan loss provision and loan loss reserve. LLP=loan loss provision; LLR=loan loss reserve. The detailed results are reported in Appendix Table A6.1, Table A6.2, Table A6.3, Table A6.4, Table A6.5 and Table A6.6.

<table>
<thead>
<tr>
<th>Predicted sign</th>
<th>World</th>
<th>Asia Pacific</th>
<th>EEC</th>
<th>MENA</th>
<th>NA</th>
<th>SA</th>
<th>W. Europe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive (+)</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
</tr>
<tr>
<td>Positive (+)</td>
<td>Positive (+) with total, systematic and credit risk. Negative (-) with idiosyncratic risk.</td>
<td>Positive (+) with LLP under 2SLS</td>
<td>Positive (+) with equity risk.</td>
<td>Negative (-) with credit risk.</td>
<td>Positive (+) with equity risk and credit risk</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Positive (+) with idiosyncratic risk and LLP.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Consistent with hypothesis H3, and the world analysis conducted in Section 6.2, a positive and significant (at the 1% level) association is also evident with respect to total risk in the Western Europe, Middle-East and Africa (MENA), the North America and Asia-Pacific region. A similar result is also observed with respect to idiosyncratic risk in Western Europe, Middle-East and Africa (MENA), North America and Asia-Pacific regions. It is interesting to note that the aforementioned finding for idiosyncratic risk is contrary to that reported for world analysis in Section 6.2. Thus, the effect reported in the world analysis may reflect regional differences in sensitivity to idiosyncratic risk.
Off-balance sheet activities show statistically significant positive coefficient (at the 1\% level) for credit risk, in Western Europe, Eastern Europe and Asia-Pacific region.

This result supports hypothesis H3 and further supports the argument that off-balance sheet activities should be included in the calculation of capital as required by regulatory authorities.

Further, with regard to credit risk, a negative and statistically significant coefficient (at the 5\% level or better) is observed in the South America region. This finding rejects hypothesis H3, as discussed in Chapter 2.

One possible explanation could be that increased competition and foreign bank penetration in these developing economies has helped banks to achieve greater efficiency (Yildirim and Philippatos 2007b), and lower credit risk levels through greater focus on non-interest income generating activities. Indeed, this is an important finding because the rest of world banking system shows a positive association between off-balance sheet activities and risk. Overall, there is no considerable variation in the findings across the regional and world analysis. The detailed results are reported in Appendix in Tables A6.1, A6.2, A6.3, A6.4, A6.5 and A6.6.

6.3.2 Charter value

As reported in Table 6.6, the coefficient for charter value is negative and statistically significant at the 5\% level, or better, for systematic risk in Middle East and Africa region. This finding is in line with hypothesis H1, suggesting that charter value disciplines banks and thus reduces systematic risk (Demsetz, Saidenberg and Strahan 1996; Anderson and Fraser 2000; Konishi and Yasuda 2004). Contrary to the
the aforementioned finding in the Middle-East and Africa region, the results in Table 6.6 show that higher charter value is associated with higher systematic risk, particularly, in North America, South America and Western European region. This is an unexpected outcome and suggests that charter value may reflect growth opportunities which are associated with high risk projects. It is also evident with respect to total risk, that the coefficient for charter value is negative and statistically significant (at the 5% level or better) in Middle East and African region, suggesting that an increase in charter value is associated with a decrease in bank total risk. This outcome is in line with hypothesis H1. Yet, other regions including North America, South America and Western Europe exhibit a positive and statistically significant (at the 5% level or better) association between charter value and total risk. This finding fails to support hypothesis H1, though is broadly in line with the work of Saunders and Wilson 2001.

With regard to idiosyncratic risk, a negative and statistically significant (at the 5% level or better) coefficient for charter value is evident in Middle East and Africa region, consistent with hypothesis H1 and with the findings reported above for systematic risk and total risk.

This confirms the disciplinary role of charter value on bank equity risk (systematic risk, total risk and idiosyncratic) in Middle East and African region. The findings on world analysis reported in Section 6.2 exhibit no appreciable association between charter value and bank equity risk (systematic risk, idiosyncratic risk and total risk).
Table 6.6
Charter Value and Risk - World Analysis versus Regional Analysis
This table presents a summary of the results as discussed in Section 6.2 and Section 6.3. The results reported in columns under the term “Actual Sign” in the following table are statistically significant at 5% significance level or better. Asia Pacific=Asia Pacific region; EEC=Eastern European countries; MENA=Middle East and Africa region, NA=North America region; SA= South America and W. Europe=Western Europe region. Equity risk includes systematic risk, total risk and idiosyncratic risk. Credit risk is measured by loan loss provision and loan loss reserve. LLP=loan loss provision; LLR=loan loss reserve. The detailed results are reported in Appendix Table A6.1, Table A6.2, Table A6.3, Table A6.4, Table A6.5 and Table A6.6.

<table>
<thead>
<tr>
<th>Predicted sign</th>
<th>World</th>
<th>Asia Pacific</th>
<th>EEC</th>
<th>MENA</th>
<th>NA</th>
<th>SA</th>
<th>W. Europe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative (-)</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Positive (+) with LLP under 2SLS</td>
<td>Negative (-) with equity risk and credit risk.</td>
<td>Negative (-) with credit risk.</td>
<td>Positive (+) with systematic, total risk and LLR.</td>
<td>Negative (-) with credit risk. Positive (+) with equity risk.</td>
</tr>
</tbody>
</table>

Contrary to the Middle-East and the African region, a positive and statistically significant (at the 5% level or better) association is observed between charter value and idiosyncratic risk, particularly in the developed countries including the North American and the Western European regions. This finding supports existing literature (e.g., Marcus 1984; Keeley 1990; Hellmann, Murdock and Stiglitz 2000; Matutes and Vives 2000).

Furthermore, with respect to credit risk, evidence of the disciplinary role of charter value is observed in Asia-Pacific, Middle East and Africa, North America and Western European region with increases in charter value being associated with decreases in credit risk.

This result is consistent with hypothesis H1 and with the world analysis reported in Section 6.2. Yet, the developing economies in Eastern Europe and South America confirm a diminishing disciplinary effect for charter value, with increases in charter value associated with increases in credit risk. This finding is inconsistent with hypothesis H1.
In essence, there are some variations in the findings across the regions. However, the findings of the world analysis, is possibly influenced by majority of the regions including Asia-Pacific, Middle East and Africa, North America and Western Europe. The empirical results are provided in Appendix in Tables A6.1, A6.2, A6.3, A6.4, A6.5 and A6.6.

6.3.3 Bank capital

Table 6.7 reports the result for bank capital. A negative and statistically significant (at the 1% level) association between bank capital and systematic risk is observed in the Middle East and Africa and the Western European region. This finding is consistent with hypothesis H2A, indicating that increases in bank capital are associated with decreases in bank systematic risk (Furlong and Keeley 1989; Keeley and Furlong 1990). This result further supports the evidence reported for world analysis in Section 6.2.

There is evidence of non-linearity between bank capital and systematic risk in the Western European region\(^5\), though this result is not evident in the other regions. The coefficients for bank capital and bank capital squared are negative and positive respectively and statistically significant at the 1% level. This finding is consistent with hypothesis H2B and suggests that the systematic risk decreases initially with bank capital and then starts to increase after a certain level of bank capital (Calem and Rob 1999). It is important to note that this non-linear association between bank capital and systematic risk is also observed for the world analysis as reported in Section 6.2.

\(^5\) This finding is also consistent with that reported in Chapter 4.
Table 6.7

Bank Capital and Risk - World Analysis versus Regional Analysis

This table presents a summary of the results as discussed in Section 6.2 and Section 6.3. The results reported in columns under the term “Actual Sign” in the following table are statistically significant at 5% significance level or better. Asia Pacific=Asia Pacific region; EEC=Eastern European countries; MENA=Middle East and Africa region, NA=North America region; SA=South America and W. Europe=Western Europe region. Equity risk includes systematic risk, total risk and idiosyncratic risk. Credit risk is measured by loan loss provision and loan loss reserve. LLP=loan loss provision; LLR=loan loss reserve. The detailed results are reported in Appendix Table A6.1, Table A6.2, Table A6.3, Table A6.4, Table A6.5 and Table A6.6.

<table>
<thead>
<tr>
<th>Predicted Sign</th>
<th>World</th>
<th>Asia Pacific</th>
<th>EEC</th>
<th>MENA</th>
<th>NA</th>
<th>SA</th>
<th>W. Europe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual Sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
</tr>
<tr>
<td>Positive</td>
<td>Positive (+)</td>
<td>Positive (+)</td>
<td>Positive (+)</td>
<td>Positive (+)</td>
<td>Positive (+)</td>
<td>Positive (+)</td>
<td>Positive (+)</td>
</tr>
<tr>
<td>Negative</td>
<td>Negative (-)</td>
<td>Negative (-)</td>
<td>Negative (-)</td>
<td>Negative (-)</td>
<td>Negative (-)</td>
<td>Negative (-)</td>
<td>Negative (-)</td>
</tr>
</tbody>
</table>

With regard to total risk, the coefficient of bank capital is negative and statistically significant (at the 1% level) suggesting that increases in bank capital is associated with decreases in total risk as desired by the regulatory authorities. This finding is observed for the Asia-Pacific, the North American and the Western European regions. The result is consistent with hypothesis H2A and also consistent with the finding reported on the world analysis in Section 6.2. Further, similar to the world analysis (discussed in Section 6.2), there is no appreciable evidence of non-linear association between bank capital and total risk. Hence, there is little to support hypothesis H2B with respect to total risk.

With regard to idiosyncratic risk, a negative and statistically significant
coefficient is observed for bank capital for the Asia-Pacific, the North American and the Western European regions. This result is in line with hypothesis H2A, indicating that increases in bank capital are associated with decreases in bank-specific risk (Furlong and Keeley 1989; Keeley and Furlong 1990). This finding is consistent with that reported in Section 6.2 on world analysis.

Further, similar to the world analysis results there is no appreciable evidence of non-linearity between bank capital and idiosyncratic risk. This result fails to validate the theoretical work of Calem and Rob (1999) and does not support hypothesis H2B.

It is evident from Table 6.7, that increases in bank capital are associated with decreases in credit risk particularly in the Asia-Pacific, the North American and the Western European regions. This find is consistent with hypothesis H2A, indicating that increases in bank capital are associated with decreases in credit risk. This result is inconsistent with the world result reported in Section 6.2.

The coefficient of bank capital is positive and statistically significant at the 1% level for credit risk particularly, in the developing economies including the Middle East and African and the South American regions. This is an unexpected outcome suggesting that increases in bank capital are associated with increased credit risk and it is inconsistent with hypothesis H2A. Since increases in bank capital restrict the risk-return frontier of a bank, this forced reduction in leverage may induce banks to reconfigure the composition of its risky asset portfolio, leading to an increase in risk-taking behavior.

55 As there is little empirical evidence on bank capital and risk in developing countries, however, this finding is consistent with prior empirical work on Malaysian banks (Ahmed, Ariff and Skully 2008).
(Kohen and Santomero 1980; Kim and Santomero 1988). The other possible argument for this positive association between bank capital and credit risk in the Middle-East and Africa and the South America regions could be that the interests of government regulators and the private stakeholders (least-secured) in a government-owned bank may converge. Weakness in information and valuation technologies in the banks may constrain these banks from achieving better bank capital requirement (Kane 1995). This finding is also in line with the world analysis in Section 6.2 which reports a positive relationship between bank capital and credit risk.\footnote{Further discussion is explained at a higher level in the robustness section.}

Further, similar to the findings on world analysis (reported in Section 6.2) and in contrast to the European findings reported in Chapter 4, the results on regional analysis show no appreciable evidence of non-linearity between bank capital and credit risk. Thus, this finding fails to support hypothesis H2B. One possible interpretation of this finding may be that the Western European regional analysis discussed in this Chapter incorporates banks from Turkey and Cyprus and it could be possible the result may be driven by banks in these countries. The findings are presented in Appendix in Tables A6.1, A6.2, A6.3, A6.4, A6.5 and A6.6.

Overall, the empirical findings discussed above exhibit the disciplinary role of bank capital similar to the findings on world analysis. However, it is possible that the non-linearity between bank capital and systematic risk is a purely Western European feature though we leave further analysis of this question to future research.
6.3.4 Market discipline

Table 6.8 reported below summarizes the findings for market discipline variable in different regions. The coefficient for market discipline is negative and statistically significant (at the 1% level) for systematic risk in the Middle-East and Africa, North America and the Western European region. This finding suggests that increases in market discipline are associated with decreases in systematic risk. This result is consistent with hypothesis H4 and broadly in line with prior studies (e.g., Morgan and Stiroh 2000; Nier and Baumann 2006). An opposite finding is evident in the Asia-Pacific and the South American regions. The result shows that increases in market discipline are associated with increases in bank systematic risk. However, it should be interesting to note that this finding is consistent to that reported on world analysis in Section 6.2.

Table 6.8
Market Discipline and Risk - World Analysis versus Regional Analysis
This table presents a summary of the results as discussed in Section 6.2 and Section 6.3. The results reported in columns under the term “Actual Sign” in the following table are statistically significant at 5% significance level or better. Asia Pacific=Asia Pacific region; EEC=Eastern European countries; MENA=Middle East and Africa region, NA=North America region; SA= South America and W. Europe=Western Europe region. Equity risk includes systematic risk, total risk and idiosyncratic risk. Credit risk is measured by loan loss provision and loan loss reserve. LLP=loan loss provision; LLR=loan loss reserve. The detailed results are reported in Appendix Table A6.1, Table A6.2, Table A6.3, Table A6.4, Table A6.5 and Table A6.6.

<table>
<thead>
<tr>
<th>Predicted sign</th>
<th>World</th>
<th>Asia Pacific</th>
<th>EEC</th>
<th>MENA</th>
<th>NA</th>
<th>SA</th>
<th>W. Europe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative (-)</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
</tr>
<tr>
<td>Positive (+) with systematic risk, Negative (-) with total risk, idiosyncratic risk and credit risk.</td>
<td>Positive (+) with systematic risk</td>
<td>Not significant for any risk measure.</td>
<td>Negative (-) with equity risk, Positive (+) with LLR.</td>
<td>Negative (-) with systematic risk and LLP.</td>
<td>Positive (+) with idiosyncratic risk.</td>
<td>Positive (+) with systematic risk, total risk and LLR.</td>
<td>Negative (-) with systematic risk and LLR.</td>
</tr>
</tbody>
</table>
With regard to total risk there is some variation across the regions. Consistent with hypothesis H4, the coefficient for market discipline is negative and statistically significant (at the 5% level or better) for banks in the Middle East and African regions. This finding is also in line with the world analysis reported in Section 6.2. Nevertheless, a positive and statistically significant (at the 5% level or better) association is evident between market discipline and total risk in the South American and the Western European regions.

With regard to idiosyncratic risk, the coefficient for market discipline is negative and statistically significant (at the 5% level or better) for Middle East and African region. This finding is consistent with the hypothesis H4 and also consistent with the findings reported in Section 6.2 on a broader world analysis. Yet, there is some variation in the findings across the regions. A positive and statistically significant (at the 5% level or better) relationship is observed between market discipline and bank-specific risk in the developed regions including North American and Western European regions.

The credit risk results are similar to the world analysis (discussed in Section 6.2), with the North American and the Western European regions showing increases in market discipline with decreases in credit risk. This finding is consistent with hypothesis H4 and prior studies (e.g., Morgan and Stiroh 2000; Nier and Baumann 2006) discussed in Chapter 2.

Finally, a positive and statistically significant association between market discipline and credit risk is observed in the Middle-East and Africa and the South American regions. This finding casts some doubts on the regulatory role of uninsured deposits (subordinated-debt and inter-bank deposits) in these regions. This finding is
contradictory to hypothesis H4, though it is broadly in line with the theoretical and prior empirical studies (Blum 2002; Demirguc-Kunt and Huizinga 2004; Imai 2006).

The detailed results are reported in Appendix in Tables A6.1, A6.2, A6.3, A6.4, A6.5 and A6.6. In general, the findings discussed above suggest some variation across the regions. With regard to equity risk, it is possible that the world analysis may be driven by regions including Asia-Pacific, Middle-East and Africa and South America. However, with respect to credit risk, the world analysis may be influenced by North America and Western European regions.

6.3.5 Size

From Table 6.9, it is evident that size is an important determinant of bank risk. The coefficient for size is positive and statistically significant at the 1% level for banks in Asia-Pacific, the Middle-East and Africa, North America and the Western European regions, suggesting large banks exhibit greater sensitivity to the general market movements and hence have greater systematic risk (Saunders, Travlos and Strock 1990; Anderson and Fraser 2000). This finding is consistent with hypothesis H5A and also supports the result on world analysis (See Section 6.2).
Table 6.9
Size and Risk - World Analysis versus Regional Analysis

This table presents a summary of the results as discussed in Section 6.2 and Section 6.3. The results reported in columns under the term “Actual Sign” in the following table are statistically significant at 5% significance level or better. Asia Pacific=Asia Pacific region; EEC=Eastern European countries; MENA=Middle East and Africa region, NA=North America region; SA= South America and W. Europe=Western Europe region. Equity risk includes systematic risk, total risk and idiosyncratic risk. Credit risk is measured by loan loss provision and loan loss reserve. LLP=loan loss provision; LLR=loan loss reserve. The detailed results are reported in Appendix Table A6.1, Table A6.2, Table A6.3, Table A6.4, Table A6.5 and Table A6.6.

<table>
<thead>
<tr>
<th>Predicted sign</th>
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<th>Asia Pacific</th>
<th>EEC</th>
<th>MENA</th>
<th>NA</th>
<th>SA</th>
<th>W. Europe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive (+) with systematic risk.</td>
<td>Positive (+) with systematic risk and total risk.</td>
<td>Positive (+) with systematic risk</td>
<td>Negative (-) with idiosyncratic risk under OLS.</td>
<td>Positive (+) with systematic risk</td>
<td>Positive (+) with credit risk under OLS.</td>
<td>Positive (+) with credit risk and total risk.</td>
<td>Positive (+) with credit risk and total risk.</td>
</tr>
<tr>
<td>Negative (-) with credit risk, total risk, and idiosyncratic risk</td>
<td>Negative (-) with credit risk and total risk.</td>
<td>Negative (-) with credit risk</td>
<td>Negative (-) with idiosyncratic risk under OLS.</td>
<td>Positive (+) with credit risk</td>
<td>Negative (-) with credit risk and total risk.</td>
<td>Negative (-) with credit risk and total risk.</td>
<td>Negative (-) with credit risk and total risk.</td>
</tr>
</tbody>
</table>

With regard to total risk, there is mixed evidence across the regions. The coefficient for size is negative and statistically significant at the 1% level in the North America region suggesting that large banks are internally diversified and thus able to reduce total risk (Konishi and Yasuda 2004; Stiroh 2006). This finding is consistent with hypothesis H5B. However, a contradictory finding is observed in the Middle East and Africa and the Asia-Pacific regions indicating that large banks do not necessarily reduce total risk (Galloway, Lee and Roden 1997; Acharya, Hasan and Saunders 2002). It should be noted that, this positive association between size and total risk is also observed in world analysis discussed in Section 6.2.

With regard to idiosyncratic risk, the coefficient for size is negative and statistically significant (at the 5% level or better) in Eastern Europe, North America and the Western European regions. This finding is consistent with hypothesis H5B and
supports prior studies (Konishi and Yasuda 2004; Stiroh 2006). Yet, there is evidence of a positive association between size and idiosyncratic risk in the Middle-East and African region, suggesting that large banks may not be able to reduce idiosyncratic risk through internal diversification. Perhaps, banks in these emerging regions undertake riskier activities and tend to employ higher leverage (Demsetz and Strahan 1997).

Consistent with hypothesis H5B, evidence can be drawn from Table 6.9 that increases in size are associated with decreases in credit risk. This finding is observed in Asia-Pacific (particularly, for loan loss reserve), South America (particularly, for loan loss reserve) and the Western Europe (for both credit risk measures). The result reported for world analysis in the previous section (Section 6.2) also supports this finding.

With respect to credit risk, there are some contradictory findings evident across the regions with respect to the size effect. The coefficient for size is positive and statistically significant at the 5% level or better, suggesting that large banks do not seem to better diversify their credit risk in Eastern Europe, the Middle East and Africa and North America.

A possible interpretation of this contradictory finding in developing (Middle-East and Africa) and transition economies (Eastern Europe) may be that large banks in these regions are less flexible to cope with unexpected liquidity shortages because of insufficient access to capital markets.

In effect, the above findings indicate that with regard to systematic risk, there is no considerable variation between the world analysis and the regional analysis in particular, Asia-Pacific, Middle-East and Africa, North America and Western European
regions. With respect to total risk, it is possible that the world analysis may be driven by Asia-Pacific and Middle-East and Africa regions. Finally, the evidence confirms that large banks exhibit lower credit risk. This finding is observed in the world analysis as well as in separate regional analysis (Asia Pacific, North America, South America and Western Europe). The regression results are provided in Appendix in Tables A6.1, A6.2, A6.3, A6.4, A6.5 and A6.6.

6.3.6 Country-level variables

There is some variation in the country-level variables across the regions. It is evident from Table 6.10 that with respect to systematic risk, the coefficient for deposit insurance is positive and statistically significant at the 1% level, indicating that deposit insurance is associated with moral hazard and thus there is support for hypothesis H10. This result is evident in the Asia-Pacific and the Western European regions and it is consistent with that reported for world analysis in Section 6.2.

Consistent with hypothesis H10, the coefficient of deposit insurance is positive and statistically significant with respect to total risk for Asia-Pacific region. This further confirms the proposition that deposit insurance can encourage excessive bank risk (Demirguc-Kunt and Detragaiche 2002; Beck and Laeven 2006). Similar evidence is also observed in the Asia-Pacific region with regard to credit risk.
Table 6.10
Deposit Insurance and Risk - World Analysis versus Regional Analysis

This table presents a summary of the results as discussed in Section 6.2 and Section 6.3. The results reported in columns under the term “Actual Sign” in the following table are statistically significant at 5% significance level or better. Asia Pacific=Asia Pacific region; EEC=Eastern European countries; MENA=Middle East and Africa region, NA=North America region; SA= South America and W. Europe=Western Europe region. Equity risk includes systematic risk, total risk and idiosyncratic risk. Credit risk is measured by loan loss provision and loan loss reserve. LLP=loan loss provision; LLR=loan loss reserve. The detailed results are reported in Appendix Table A6.1, Table A6.2, Table A6.3, Table A6.4, Table A6.5 and Table A6.6.

<table>
<thead>
<tr>
<th>Predicted sign</th>
<th>World</th>
<th>Asia Pacific</th>
<th>EEC</th>
<th>MENA</th>
<th>NA</th>
<th>SA</th>
<th>W. Europe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive (+)</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
</tr>
<tr>
<td>Positive (+)</td>
<td>Positive (+) with systematic, idiosyncratic and total risk.</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Positive (+) with systematic risk.</td>
<td></td>
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</tr>
</tbody>
</table>

Further, the existence of a market-based system is an important country-level explanatory variable with respect to bank risk (Table 6.11). The coefficient for the market-based system is positive and statistically significant (at the 5% level or better) with credit risk in the Asia-Pacific and the Western European regions. This result is consistent with hypothesis H9. A market-based system appears to encourage banks to undertake higher levels of risk (Greenwood and Jovanovic 1990; Bencivenga and Smith 1991; de la Fuente and Marin 1996) and this finding is also observed in the world analysis (reported in Section 6.2). Similar results are also found for systematic risk (Demirguc-Kunt and Detragaiche 2002; Beck and Laeven 2006), particularly, in Asia-Pacific region.
Table 6.11

Market-Based System and Risk - World Analysis versus Regional Analysis

This table presents a summary of the results as discussed in Section 6.2 and Section 6.3. The results reported in columns under the term “Actual Sign” in the following table are statistically significant at 5% significance level or better. Asia Pacific=Asia Pacific region; EEC=Eastern European countries; MENA=Middle East and Africa region, NA=North America region; SA= South America and W. Europe=Western Europe region. Equity risk includes systematic risk, total risk and idiosyncratic risk. Credit risk is measured by loan loss provision and loan loss reserve. LLP=loan loss provision; LLR=loan loss reserve. The detailed results are reported in Appendix Table A6.1, Table A6.2, Table A6.3, Table A6.4, Table A6.5 and Table A6.6.

<table>
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<th>NA</th>
<th>SA</th>
<th>W. Europe</th>
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</thead>
<tbody>
<tr>
<td>Positive (+)</td>
<td>Positive (+) with credit risk.</td>
<td>Positive (+) with systematic risk and credit risk.</td>
<td>Insignificant for all risk measures.</td>
<td>Positive (+) and marginally significant for total and idiosyncratic risk.</td>
<td>Negative (-) with credit risk.</td>
<td>Negative (-) with credit risk.</td>
<td>Positive (+) with credit risk.</td>
</tr>
<tr>
<td>Negative (-)</td>
<td>with total risk and idiosyncratic risk.</td>
<td>Negative (-) with idiosyncratic risk.</td>
<td></td>
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</tbody>
</table>

A negative and statistically significant coefficient for market-based system is observed for equity risk (systematic risk, idiosyncratic risk and total risk) in the Western European region. Similar evidence is observed with respect to idiosyncratic risk in the Asia-Pacific region, supporting the argument that a market-based system conveys price signals which helps banks to make prudent investment decisions (Rajan and Zingales 1998, 1999). Further, the findings are consistent with that reported on world analysis with respect to total risk and idiosyncratic risk.

The economic freedom index (EFI) coefficient is negative and statistically significant (at the 1% level) with respect to credit risk in the Asia-Pacific, the Middle–East and Africa, the North America and the Western Europe regions (Table 6.12 reported below). This finding is consistent with predictions in Chapter 2 and with the world analysis (discussed in Section 6.2) suggesting that lower restrictions on bank activity result in lower credit risk. In contrast, results for transition (Eastern Europe) and
emerging economies (South America) show that greater freedom in banking activity can lead to increased credit risk. This is possibly due to weak supervision, low enforcement, reduced transparency, complicated ownership structure and control that are often found in these regions (Claessens and Laeven 2003).

**Table 6.12**

**Economic Freedom Index and Risk - World Analysis versus Regional Analysis**

This table presents a summary of the results as discussed in Section 6.2 and Section 6.3. The results reported in columns under the term “Actual Sign” in the following table are statistically significant at 5% significance level or better. Asia Pacific=Asia Pacific region; EEC=Eastern European countries; MENA=Middle East and Africa region, NA=North America region; SA= South America and W. Europe=Western Europe region. Equity risk includes systematic risk, total risk and idiosyncratic risk. Credit risk is measured by loan loss provision and loan loss reserve. LLP=loan loss provision; LLR=loan loss reserve. The detailed results are reported in Appendix A6.1, A6.2, A6.3, A6.4, A6.5 and A6.6. The detailed results are reported in Appendix Table A6.1, Table A6.2, Table A6.3, Table A6.4, Table A6.5 and Table A6.6.

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<th>SA</th>
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<tr>
<td>Negative (-)</td>
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<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
</tr>
<tr>
<td></td>
<td>Negative (-) with credit risk.</td>
<td>Negative (+) with credit risk.</td>
<td>Positive (+) with LLP.</td>
<td>Negative (-) with credit risk.</td>
<td>Positive (+) with LLR.</td>
<td>Negative (-) with systematic risk</td>
<td>Negative (-) with credit risk.</td>
</tr>
</tbody>
</table>

With respect to systematic risk, the coefficient for the economic freedom index is negative and statistically significant (at the 1% level), suggesting that higher levels of EFI, may result in lower levels of systematic risk and hence lead to greater stability in the banking system (González 2005). This finding is evident in the Western European region. However, this result does not hold for developing region, given the positive association between EFI and systematic risk found in the Middle East and Africa region indicating that greater freedom in activities may actually result in increase in bank risk in some regions (Claessens and Laeven 2004).
Table 6.13
Stock Market Turnover and Risk - World Analysis versus Regional Analysis
This table presents a summary of the results as discussed in Section 6.2 and Section 6.3. The results reported in columns under the term “Actual Sign” in the following table are statistically significant at 5% significance level or better. Asia Pacific=Asia Pacific region; EEC=Eastern European countries; MENA=Middle East and Africa region, NA=North America region; SA= South America and W. Europe=Western Europe region. Equity risk includes systematic risk, total risk and idiosyncratic risk. Credit risk is measured by loan loss provision and loan loss reserve. LLP=loan loss provision; LLR=loan loss reserve. The detailed results are reported in Appendix Table A6.1, Table A6.2, Table A6.3, Table A6.4, Table A6.5 and Table A6.6.

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<th>NA</th>
<th>SA</th>
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<tbody>
<tr>
<td>Positive (+)</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
</tr>
<tr>
<td>Positive (+) with equity risk.</td>
<td>Negative (-) with equity risk.</td>
<td>Positive (+) with total risk and idiosyncratic risk.</td>
<td>Negative (-) with LLP.</td>
<td>Positive (+) with credit risk and systematic risk (2SLS).</td>
<td>Negative (-) with LLP.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative with credit risk.</td>
<td>Negative with credit risk.</td>
<td>Positive (+) with total risk and idiosyncratic risk.</td>
<td>Negative (-) with LLP.</td>
<td>Positive (+) with credit risk and systematic risk (2SLS).</td>
<td>Negative (-) with LLP.</td>
<td></td>
<td></td>
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</table>

Table 6.13, reports the results for stock market turnover ratio variable. Consistent with the prediction in Chapter 2 and with the world analysis reported in Section 6.2, the coefficient for stock market turnover is positive and statistically significant at the 5% level or better, suggesting that higher frequency of trading is associated with higher systematic risk. This result is evident in Asia-Pacific, the Middle-East and Africa, South America and North American regions. With regard to total risk and idiosyncratic risk, the findings are similar to that reported above for systematic risk and this positive and statistically significant association is also observed in Asia-Pacific, the Middle-East and Africa and North America regions. These findings are consistent with predictions and with the world analysis. Also consistent with predictions and with world analysis (discussed in Section 6.2), there is a positive association with credit risk. This finding is particularly evident in the developing regions including Middle East and Africa and South America.
A negative and statistically significant association is observed between market turnover ratio and credit risk, suggesting that increases in frequency of trading, decreases bank credit risk. This result is evident in Eastern Europe, North America and Western Europe. This is an unexpected outcome and suggests that increases in stock market liquidity are associated with decreases bank credit risk and thus it is crucial for the economic growth (Levine and Zervos 1998). Similar evidence is also provided in the world analysis discussed in Section 6.2.

It is evident from Table 6.14 that developed regions including North America and Western Europe exhibit a positive association between systematic risk and bank concentration.

**Table 6.14**

**Bank Concentration and Risk - World Analysis versus Regional Analysis**

This table presents a summary of the results as discussed in Section 6.2 and Section 6.3. The results reported in columns under the term “Actual Sign” in the following table are statistically significant at 5% significance level or better. Asia Pacific=Asia Pacific region; EEC=Eastern European countries; MENA=Middle East and Africa region, NA=North America region; SA= South America and W. Europe=Western Europe region. Equity risk includes systematic risk, total risk and idiosyncratic risk. Credit risk is measured by loan loss provision and loan loss reserve. LLP=loan loss provision; LLR=loan loss reserve. The detailed results are reported in Appendix Table A6.1, Table A6.2, Table A6.3, Table A6.4, Table A6.5 and Table A6.6.

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<tbody>
<tr>
<td>Positive (+)</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
</tr>
<tr>
<td>Negative (-)</td>
<td>Negative (-) with systematic risk and LLP.</td>
<td>Negative (-) with LLP.</td>
<td>Positive (+) and marginally significant for total and idiosyncratic risk.</td>
<td>Negative (-) with equity risk.</td>
<td>Positive (+) with systematic risk.</td>
<td>Positive (+) with LLR.</td>
<td>Positive (+) with systematic risk and total risk.</td>
</tr>
</tbody>
</table>

This finding is consistent with prior studies (e.g., Boyd and Runkle 1993; Hughes, Lang, Mester and Moon 1999; Mishkin 1999). With regard to total risk, the coefficient for bank concentration is positive and statistically significant at the 1% level in the Western European region. This finding supports the classical “concentration fragility
theory”.

The Middle-East and Africa region provide a contrast from the above evidence. The coefficient for bank concentration is negative and statistically significant at the 1% level for systematic risk. This finding is broadly in line with prior empirical studies (e.g., Keeley 1990; Allen and Gale 2000; Kwast and De Nicoló 2002; Boyd, De Nicoló and Smith 2004; Demirguc-Kunt and Levine 2006, 2007) and also consistent with the world analysis (Section 6.2).

Further, Table 6.14 highlights similar evidence for both total risk and idiosyncratic risk in Middle-East and Africa region. There is mixed evidence across the regions with respect to credit risk. A negative and statistically significant association is observed between bank concentration and credit risk in the Western European region. This result is consistent with prior studies (e.g., Bergstresser 2001).

Similar evidence is also observed for the Asia-Pacific region (when loan loss provision is used to measure credit risk). Yet, there is evidence of a positive and statistically significant (at the 5% level or better) association between bank concentration and credit risk (measured by loan loss reserve) in Asia-Pacific and South American regions (Boyd and De Nicoló 2005).

It is evident from Table 6.15, with regard to total risk that the coefficient for net interest margin is positive and statistically significant (at the 1% level) in Asia-Pacific and South American regions, suggesting that increases in net interest margin are associated with increases in total risk. This result is consistent with predictions (Section 2.4.3 of Chapter 2) and with the world analysis (Section 6.2). In contrast, a negative
association is observed between net interest margin and total risk in Middle-East and Africa and North American regions. This finding is broadly in line with Maudos and Fernández de Guevara (2004). Further, with respect to idiosyncratic risk, the predicted sign is observed in the Asia Pacific and the South America regions. This finding is also observed in the world analysis. However, contradictory evidence is observed in the Middle-East and Africa region.

Table 6.15

Net Interest Margin and Risk - World Analysis versus Regional Analysis
This table presents a summary of the results as discussed in Section 6.2 and Section 6.3. The results reported in columns under the term “Actual Sign” in the following table are statistically significant at 5% significance level or better. Asia Pacific=Asia Pacific region; EEC=Eastern European countries; MENA=Middle East and Africa region, NA=North America region; SA= South America and W. Europe=Western Europe region. Equity risk includes systematic risk, total risk and idiosyncratic risk. Credit risk is measured by loan loss provision and loan loss reserve. LLP=loan loss provision; LLR=loan loss reserve. The detailed results are reported in Appendix Table A6.1, Table A6.2, Table A6.3, Table A6.4, Table A6.5 and Table A6.6.

<table>
<thead>
<tr>
<th>Predicted sign</th>
<th>World</th>
<th>Asia Pacific</th>
<th>EEC</th>
<th>MENA</th>
<th>NA</th>
<th>SA</th>
<th>W. Europe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive (+)</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
</tr>
<tr>
<td></td>
<td>Positive (+) with total risk, idiosyncratic risk and credit risk.</td>
<td>Insignificant for all risk measures.</td>
<td>Negative (-) with total risk and idiosyncratic risk.</td>
<td>Positive (+) with LLR.</td>
<td>Negative (-) with total risk and idiosyncratic risk.</td>
<td>Positive (+) with total risk, idiosyncratic risk and credit risk.</td>
<td>Positive (+) with LLP.</td>
</tr>
<tr>
<td></td>
<td>Negative (-) with systematic risk.</td>
<td>Positive (+) with total risk, idiosyncratic risk and credit risk.</td>
<td>Negative (-) with systematic risk.</td>
<td>Positive (+) with total risk, idiosyncratic risk and credit risk.</td>
<td>Positive (+) with total risk, idiosyncratic risk and credit risk.</td>
<td>Positive (+) with total risk, idiosyncratic risk and credit risk.</td>
<td>Positive (+) with LLP.</td>
</tr>
</tbody>
</table>

With regard to systematic risk, the coefficient for net interest margin is negative and statistically significant (at the 1% level) in the Asia-Pacific region. While this result is contrary to predictions as explained in Section 2.4.3 of Chapter 2, it is consistent with the world analysis (Section 6.2).

Finally, with respect to credit risk, the coefficient for net interest margin is positive and statistically significant at the 1% level, indicating that greater net interest
margin is associated with greater uncertainty on the loans granted (Maudos and Fernández de Guevara 2004). This finding is observed in Asia-Pacific, North America, South America and Western European regions. This result is consistent with predictions in Chapter 2 and also with the world analysis discussed in Section 6.2.

Legal origin is also an important determinant of bank risk (Table 6.16 below). With regard to systematic risk, the coefficient for legal origin is positive and statistically significant at the 1% level, indicating that common-law countries exhibit greater risk compared to their civil-law counterparts. This result is evident in Asia-Pacific region and is consistent with the finding observed in the world analysis. It is also found that common-law country banks exhibit higher total risk particularly in the Asia Pacific and the Western European regions. This finding is in line with predictions discussed in Section 2.4.2 of Chapter 2 and also with the world analysis (Section 6.2). Similar evidence is also observed with respect to idiosyncratic risk, particularly in the Western European region and it is also consistent with the world analysis. Finally, with regard to credit risk, Table 6.16 shows that common-law country banks exhibit higher credit risk particularly in the Western Europe region.

In the Asia-Pacific region, it is evident from the above Table 6.16 that consistent with prediction, the coefficient for common-law origin is positive and statistically significant at the 5% level or better with respect to loan loss reserves. Further, an opposite result is evident with the alternate measure of credit risk that is loan loss provision. This finding is consistent with the world analysis and inconsistent with prediction mentioned in Chapter 2.
Table 6.16

Legal Origin and Risk - World Analysis versus Regional Analysis

This table presents a summary of the results as discussed in Section 6.2 and Section 6.3. The results reported in columns under the term “Actual Sign” in the following table are statistically significant at 5% significance level or better. Asia Pacific=Asia Pacific region; EEC=Eastern European countries; MENA=Middle East and Africa region, NA=North America region; SA= South America and W. Europe=Western Europe region. Equity risk includes systematic risk, total risk and idiosyncratic risk. Credit risk is measured by loan loss provision and loan loss reserve. LLP=loan loss provision; LLR=loan loss reserve. The detailed results are reported in Appendix Table A6.1, Table A6.2, Table A6.3, Table A6.4, Table A6.5 and Table A6.6.

<table>
<thead>
<tr>
<th>Predicted sign</th>
<th>World</th>
<th>Asia Pacific</th>
<th>EEC</th>
<th>MENA</th>
<th>NA</th>
<th>SA</th>
<th>W. Europe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive (+)</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
</tr>
<tr>
<td>Positive (+)</td>
<td>Positive (+) with equity risk.</td>
<td>Positive (+) with systematic and total risk and LLR.</td>
<td>Not applicable</td>
<td>Negative (-) and marginally significant for equity risk.</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Positive (+) with idiosyncratic total risk and credit risk.</td>
</tr>
<tr>
<td>Negative (-)</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

The results reported in Table 6.17 below show that commercial banks in Western European region exhibit higher systematic risk. This finding is consistent with predictions discussed in Chapter 2.

Yet, commercial banks in Asia-Pacific and North American regions exhibit lower systematic risk while commercial banks in Asia-Pacific, Eastern Europe, North America and Western European regions exhibit lower total risk. One possible interpretation of this relationship could be that due to diversification benefits the commercial banks are able to diversify risk. This observation is also evident with respect to idiosyncratic risk in the Asia-Pacific, the Eastern Europe and the Western Europe regions.
Table 6.17
Commercial bank and Risk - World Analysis versus Regional Analysis

This table presents a summary of the results as discussed in Section 6.2 and Section 6.3. The results reported in columns under the term “Actual Sign” in the following table are statistically significant at 5% significance level or better. Asia Pacific=Asia Pacific region; EEC=Eastern European countries; MENA=Middle East and Africa region, NA=North America region; SA= South America and W. Europe=Western Europe region. Equity risk includes systematic risk, total risk and idiosyncratic risk. Credit risk is measured by loan loss provision and loan loss reserve. LLP=loan loss provision; LLR=loan loss reserve. The detailed results are reported in Appendix Table A6.1, Table A6.2, Table A6.3, Table A6.4, Table A6.5 and Table A6.6.

<table>
<thead>
<tr>
<th></th>
<th>World</th>
<th>Asia Pacific</th>
<th>EEC</th>
<th>MENA</th>
<th>NA</th>
<th>SA</th>
<th>W. Europe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Predicted sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
</tr>
<tr>
<td>Positive (+)</td>
<td>Positive (+) with credit risk.</td>
<td>Negative (-) with total risk and LLP.</td>
<td>Negative (-) with LLP and total risk and idiosyncratic risk.</td>
<td>Not applicable</td>
<td>Negative (-) with systematic risk, total risk.</td>
<td>Positive (+) with LLP.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Similar evidence is also observed in the world analysis. Finally, with regard to credit risk (loan loss provision), it is evident from Table 6.17, that North American commercial banks are more aggressive in the credit market (similar to the world analysis) compared to their counterparts in the Asia-Pacific, the Eastern Europe and the South America regions.

Overall, the empirical findings show that country-level variables are important determinants of bank risk. Deposit insurance exhibits moral hazard problem with regard to equity risk. This result is evident in world analysis as well as in Asia-Pacific and Western European regions. Further, with regard to market-based system, the findings show that there is no significant variation across the risk measures. The finding also exhibit that greater freedom in banking activities may lead to higher credit risk particularly in transition (Eastern Europe) and developing economies (South America) consistent with the world analysis. There is no considerable variation across the region

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with regard to bank concentration and net interest margin. The findings are reported in detail in Appendix in Tables A6.1, A6.2, A6.3, A6.4, A6.5 and A6.6.

6.4 IMPACT OF ECONOMIC AND MONETARY UNION (EMU) ON RISK FACTORS- RQ1B

The impact of EMU in 1999, on variation in bank risk is also analyzed. Table 6.18 presents the results for this analysis. Both pooled-OLS and 2SLS are applied in this analysis but the test of endogeniety supports the 2SLS approach. The year dummies are jointly significant for all risk measures. Panel A and Panel B of Table 6.18 report the findings for the impact of EMU on variation in bank equity risk and credit risk.

With regard to total risk, the coefficient on bank capital is positive and statistically significant (at the 1% level), suggesting that the importance of EMU increased in the post-EMU period for the world analysis. This finding fails to support hypothesis H11B (Chapter 2 Section 2.5). Similar evidence is also observed with regard to idiosyncratic risk.
Table 6.18
Determinants of bank risk with the formation of Economic and Monetary Union

This table presents the result of impact of the formation of EMU in 1999 on the determinants of bank risk. The table only presents the result for the differences. A dummy for EMU takes a value of 1 for post-EMU and 0 pre-EMU. All results are corrected for heteroscedasticity and the adjusted standard errors are reported in parenthesis.

The Wald test to test the joint significance for difference and joint test for year dummies under pooled -OLS is a F distribution while for 2SLS it is a chi square distribution. Superscripts *, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively. † indicates the coefficients of the explanatory variables and standard errors are scaled by 100.

Panel A Impact of Economic Monetary Union (EMU) - Equity risk

<table>
<thead>
<tr>
<th></th>
<th>Systematic risk</th>
<th></th>
<th>Idiosyncratic risk</th>
<th></th>
<th>Total risk</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pooled OLS</td>
<td>Pooled-OLS with lag</td>
<td>2SLS</td>
<td>Pooled OLS</td>
<td>Pooled-OLS with lag</td>
<td>2SLS</td>
</tr>
<tr>
<td>Intercept</td>
<td>-0.065</td>
<td>-0.040</td>
<td>-0.047</td>
<td>-3.125***</td>
<td>-3.268***</td>
<td>-3.249***</td>
</tr>
<tr>
<td></td>
<td>(0.155)</td>
<td>(0.157)</td>
<td>(0.172)</td>
<td>(0.194)</td>
<td>(0.208)</td>
<td>(0.211)</td>
</tr>
<tr>
<td>Bank capital</td>
<td>0.122</td>
<td>0.060</td>
<td>0.207</td>
<td>0.195*</td>
<td>0.243***</td>
<td>0.637***</td>
</tr>
<tr>
<td></td>
<td>(0.108)</td>
<td>(0.076)</td>
<td>(0.282)</td>
<td>(0.110)</td>
<td>(0.078)</td>
<td>(0.237)</td>
</tr>
<tr>
<td>Charter value</td>
<td>-1.894***</td>
<td>-0.992**</td>
<td>-7.665**</td>
<td>1.278*</td>
<td>1.030*</td>
<td>0.371</td>
</tr>
<tr>
<td></td>
<td>(0.653)</td>
<td>(0.521)</td>
<td>(3.428)</td>
<td>(0.759)</td>
<td>(0.607)</td>
<td>(5.416)</td>
</tr>
<tr>
<td>Off balance sheet activities</td>
<td>-0.049**</td>
<td>-0.051**</td>
<td>-0.013</td>
<td>0.005</td>
<td>0.016</td>
<td>-0.006</td>
</tr>
<tr>
<td></td>
<td>(0.026)</td>
<td>(0.025)</td>
<td>(0.031)</td>
<td>(0.024)</td>
<td>(0.024)</td>
<td>(0.036)</td>
</tr>
<tr>
<td>Market discipline</td>
<td>-0.090***</td>
<td>-0.104***</td>
<td>-0.109***</td>
<td>-0.023</td>
<td>-0.016</td>
<td>-0.016</td>
</tr>
<tr>
<td></td>
<td>(0.028)</td>
<td>(0.028)</td>
<td>(0.030)</td>
<td>(0.026)</td>
<td>(0.026)</td>
<td>(0.028)</td>
</tr>
<tr>
<td>Size</td>
<td>-0.004</td>
<td>-0.012</td>
<td>0.015</td>
<td>0.001</td>
<td>-0.003</td>
<td>0.012</td>
</tr>
<tr>
<td></td>
<td>(0.012)</td>
<td>(0.009)</td>
<td>(0.020)</td>
<td>(0.010)</td>
<td>(0.010)</td>
<td>(0.027)</td>
</tr>
<tr>
<td>Loan to total assets</td>
<td>0.020</td>
<td>0.011</td>
<td>0.026</td>
<td>-0.043</td>
<td>-0.049</td>
<td>-0.086</td>
</tr>
<tr>
<td></td>
<td>(0.080)</td>
<td>(0.080)</td>
<td>(0.083)</td>
<td>(0.074)</td>
<td>(0.073)</td>
<td>(0.071)</td>
</tr>
<tr>
<td>Bank concentration</td>
<td>0.068</td>
<td>0.061</td>
<td>0.068</td>
<td>0.018</td>
<td>0.001</td>
<td>0.081</td>
</tr>
<tr>
<td></td>
<td>(0.099)</td>
<td>(0.094)</td>
<td>(0.108)</td>
<td>(0.102)</td>
<td>(0.100)</td>
<td>(0.104)</td>
</tr>
<tr>
<td>Net interest margin</td>
<td>-1.380</td>
<td>-1.528</td>
<td>-0.601</td>
<td>1.283</td>
<td>0.142</td>
<td>0.856</td>
</tr>
<tr>
<td></td>
<td>(1.139)</td>
<td>(1.100)</td>
<td>(1.467)</td>
<td>(1.152)</td>
<td>(1.091)</td>
<td>(1.919)</td>
</tr>
<tr>
<td>Stock market turnover</td>
<td>0.093***</td>
<td>0.094***</td>
<td>0.179***</td>
<td>0.060**</td>
<td>0.055**</td>
<td>0.072</td>
</tr>
<tr>
<td></td>
<td>(0.029)</td>
<td>(0.030)</td>
<td>(0.052)</td>
<td>(0.028)</td>
<td>(0.027)</td>
<td>(0.076)</td>
</tr>
<tr>
<td>Deposit insurance dummy</td>
<td>-0.015</td>
<td>-0.009</td>
<td>-0.022</td>
<td>-0.018</td>
<td>-0.033</td>
<td>0.044</td>
</tr>
<tr>
<td></td>
<td>(0.059)</td>
<td>(0.057)</td>
<td>(0.072)</td>
<td>(0.067)</td>
<td>(0.069)</td>
<td>(0.075)</td>
</tr>
<tr>
<td>Economic freedom index</td>
<td>0.003</td>
<td>0.002</td>
<td>0.001</td>
<td>0.002</td>
<td>0.006*</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.003)</td>
<td>(0.003)</td>
<td>(0.003)</td>
<td>(0.003)</td>
<td>(0.003)</td>
</tr>
<tr>
<td>Market based dummy</td>
<td>0.008</td>
<td>0.022</td>
<td>-0.002</td>
<td>-0.024</td>
<td>-0.002</td>
<td>-0.100</td>
</tr>
<tr>
<td></td>
<td>(0.050)</td>
<td>(0.047)</td>
<td>(0.076)</td>
<td>(0.053)</td>
<td>(0.050)</td>
<td>(0.065)</td>
</tr>
<tr>
<td>Common law dummy</td>
<td>-0.219***</td>
<td>-0.225***</td>
<td>-0.097</td>
<td>-0.082</td>
<td>-0.106**</td>
<td>-0.022</td>
</tr>
<tr>
<td></td>
<td>(0.049)</td>
<td>(0.048)</td>
<td>(0.098)</td>
<td>(0.051)</td>
<td>(0.052)</td>
<td>(0.115)</td>
</tr>
<tr>
<td>Commercial dummy</td>
<td>-0.161***</td>
<td>-0.142***</td>
<td>-0.270***</td>
<td>0.027</td>
<td>0.002</td>
<td>0.059</td>
</tr>
<tr>
<td>------------------</td>
<td>-----------</td>
<td>-----------</td>
<td>-----------</td>
<td>-------</td>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td></td>
<td>(0.049)</td>
<td>(0.047)</td>
<td>(0.054)</td>
<td>(0.054)</td>
<td>(0.119)</td>
<td>0.055</td>
</tr>
<tr>
<td>High income dummy</td>
<td>-0.070</td>
<td>-0.105**</td>
<td>0.025</td>
<td>0.094</td>
<td>0.106*</td>
<td>0.104</td>
</tr>
<tr>
<td></td>
<td>(0.055)</td>
<td>(0.084)</td>
<td>(0.062)</td>
<td>(0.061)</td>
<td>(0.115)</td>
<td>(0.063)</td>
</tr>
<tr>
<td>Year dummy</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

| R²               | 0.27      | 0.28      | 0.26      | 0.25   | 0.25   | 0.25  | 0.26   | 0.27   | 0.26   |
| Model F-test     | 48***     | 52***     | 51***     | 52***  | 50***  | 46*** | 58***  | 58***  | 55***  |
| Wu-Hausman F test| -         | -         | 5.21***   | -      | -      | 2.53* | -      | -      | -      |
| Durbin-Wu-Hausman chi-sq test| - | - | - | - | 5.11* | - | - | - | 5.42* |
| Wald test-joint significance for differences| 6.80*** | 6.60*** | 93.3*** | 2.12*** | 2.27*** | 34.21*** | 3.57*** | 3.75*** | 56.77*** |
| Joint significance for year dummies| 29.60*** | 27.42*** | 287.***   | 21.96*** | 19.96*** | 218*** | 19.92*** | 20.15*** | 204.2*** |
| NOBS             | 4670      | 4468      | 4455      | 4662   | 4460   | 4477  | 4680   | 4472   | 4459   |

Panel B Impact of EMU- Credit risk

<table>
<thead>
<tr>
<th>Loan loss provision to total assets</th>
<th>Pooled OLS</th>
<th>Pooled-OLS with lag</th>
<th>2SLS</th>
<th>Pooled OLS</th>
<th>Pooled-OLS with lag</th>
<th>2SLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-1.647***</td>
<td>-1.630***</td>
<td>-1.529***</td>
<td>-0.803***</td>
<td>-0.927***</td>
<td>-0.764***</td>
</tr>
<tr>
<td>Bank capital</td>
<td>-0.049</td>
<td>-0.009</td>
<td>-0.485**</td>
<td>0.377***</td>
<td>0.272***</td>
<td>0.640***</td>
</tr>
<tr>
<td>Charter value</td>
<td>0.886**</td>
<td>0.956***</td>
<td>7.594***</td>
<td>0.857***</td>
<td>1.087***</td>
<td>3.304</td>
</tr>
<tr>
<td>Off balance sheet activities</td>
<td>0.039**</td>
<td>0.036*</td>
<td>0.010</td>
<td>-0.046***</td>
<td>-0.020</td>
<td>-0.060***</td>
</tr>
<tr>
<td>Market discipline</td>
<td>-0.054**</td>
<td>-0.035</td>
<td>-0.040</td>
<td>-0.072***</td>
<td>-0.058**</td>
<td>-0.063***</td>
</tr>
<tr>
<td>Size</td>
<td>-0.024***</td>
<td>-0.034***</td>
<td>-0.064***</td>
<td>-0.004</td>
<td>-0.019**</td>
<td>-0.011</td>
</tr>
<tr>
<td>Loan to total assets</td>
<td>0.222**</td>
<td>0.203**</td>
<td>0.236**</td>
<td>0.105</td>
<td>0.121</td>
<td>-0.018</td>
</tr>
<tr>
<td>Bank concentration</td>
<td>0.124</td>
<td>0.177**</td>
<td>0.150</td>
<td>0.168**</td>
<td>0.124</td>
<td>0.202**</td>
</tr>
<tr>
<td>Net interest margin</td>
<td>-2.555***</td>
<td>-3.413***</td>
<td>-3.801***</td>
<td>0.532</td>
<td>-1.058</td>
<td>-0.024</td>
</tr>
<tr>
<td>Stock market turnover</td>
<td>0.120***</td>
<td>0.125***</td>
<td>0.018</td>
<td>0.046**</td>
<td>0.039*</td>
<td>0.011</td>
</tr>
<tr>
<td>Deposit insurance dummy</td>
<td>-0.055</td>
<td>-0.039</td>
<td>-0.054</td>
<td>-0.022</td>
<td>-0.008</td>
<td>0.049</td>
</tr>
<tr>
<td>Economic freedom index</td>
<td>0.003</td>
<td>0.004*</td>
<td>0.002</td>
<td>0.002</td>
<td>0.003</td>
<td>0.006**</td>
</tr>
<tr>
<td>Market based dummy</td>
<td>-0.081***</td>
<td>-0.138**</td>
<td>-0.058</td>
<td>-0.048</td>
<td>-0.026</td>
<td>-0.103**</td>
</tr>
<tr>
<td>Stock market turnover</td>
<td>0.120***</td>
<td>0.125***</td>
<td>0.018</td>
<td>0.046**</td>
<td>0.039*</td>
<td>0.011</td>
</tr>
</tbody>
</table>

Panel B Impact of EMU- Credit risk

<table>
<thead>
<tr>
<th>Loan loss reserves to total assets</th>
<th>Pooled OLS</th>
<th>Pooled-OLS with lag</th>
<th>2SLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-1.647***</td>
<td>-1.630***</td>
<td>-1.529***</td>
</tr>
<tr>
<td>Bank capital</td>
<td>-0.049</td>
<td>-0.009</td>
<td>-0.485**</td>
</tr>
<tr>
<td>Charter value</td>
<td>0.886**</td>
<td>0.956***</td>
<td>7.594***</td>
</tr>
<tr>
<td>Off balance sheet activities</td>
<td>0.039**</td>
<td>0.036*</td>
<td>0.010</td>
</tr>
<tr>
<td>Market discipline</td>
<td>-0.054**</td>
<td>-0.035</td>
<td>-0.040</td>
</tr>
<tr>
<td>Size</td>
<td>-0.024***</td>
<td>-0.034***</td>
<td>-0.064***</td>
</tr>
<tr>
<td>Loan to total assets</td>
<td>0.222**</td>
<td>0.203**</td>
<td>0.236**</td>
</tr>
<tr>
<td>Bank concentration</td>
<td>0.124</td>
<td>0.177**</td>
<td>0.150</td>
</tr>
<tr>
<td>Net interest margin</td>
<td>-2.555***</td>
<td>-3.413***</td>
<td>-3.801***</td>
</tr>
<tr>
<td>Stock market turnover</td>
<td>0.120***</td>
<td>0.125***</td>
<td>0.018</td>
</tr>
<tr>
<td>Deposit insurance dummy</td>
<td>-0.055</td>
<td>-0.039</td>
<td>-0.054</td>
</tr>
<tr>
<td>Economic freedom index</td>
<td>0.003</td>
<td>0.004*</td>
<td>0.002</td>
</tr>
<tr>
<td>Market based dummy</td>
<td>-0.081***</td>
<td>-0.138**</td>
<td>-0.058</td>
</tr>
<tr>
<td>Common law dummy</td>
<td>0.076***</td>
<td>0.092***</td>
<td>-0.074</td>
</tr>
<tr>
<td>------------------</td>
<td>----------</td>
<td>----------</td>
<td>--------</td>
</tr>
<tr>
<td></td>
<td>(0.036)</td>
<td>(0.041)</td>
<td>(0.073)</td>
</tr>
<tr>
<td>Commercial dummy</td>
<td>-0.011</td>
<td>-0.014</td>
<td>0.078</td>
</tr>
<tr>
<td></td>
<td>(0.056)</td>
<td>(0.058)</td>
<td>(0.079)</td>
</tr>
<tr>
<td>High income dummy</td>
<td>-0.085*</td>
<td>-0.024</td>
<td>-0.202***</td>
</tr>
<tr>
<td></td>
<td>(0.049)</td>
<td>(0.055)</td>
<td>(0.070)</td>
</tr>
<tr>
<td>Year dummy</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>R²</td>
<td>0.28</td>
<td>0.29</td>
<td>0.26</td>
</tr>
<tr>
<td>Model F-test</td>
<td>43***</td>
<td>38***</td>
<td>37.88***</td>
</tr>
<tr>
<td>Tests of Endogeneity:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wu-Hausman F test</td>
<td>-</td>
<td>-</td>
<td>8.42***</td>
</tr>
<tr>
<td>Durbin-Wu-Hausman chi-sq test</td>
<td>-</td>
<td>-</td>
<td>16.95***</td>
</tr>
<tr>
<td>Wald test-joint significance for differences</td>
<td>6.47***</td>
<td>5.45***</td>
<td>76.03***</td>
</tr>
<tr>
<td>Joint significance for year dummies</td>
<td>37***</td>
<td>37***</td>
<td>355***</td>
</tr>
<tr>
<td>NOBS</td>
<td>4631</td>
<td>4246</td>
<td>4233</td>
</tr>
</tbody>
</table>
Further, it is apparent from Panel B of Table 6.18, with regard to credit risk (particularly measured by loan loss reserve to total assets), the coefficient of bank capital is positive and statistically significant at the 1% level suggesting that the magnitude of bank capital coefficient increased in the post-EMU period. This finding is similar to that reported above with respect to bank equity risk particularly total risk and idiosyncratic risk.

The magnitude of the charter value coefficients fell dramatically with EMU for systematic risk model. This outcome is interpreted in terms of the decline in the importance of charter value with the formation of EMU and increasing levels of competition.

The most statistically significant decline is observed for charter value relative to systematic risk with a change in the coefficient of -7.66 (under 2SLS estimation method). This finding is also evident for idiosyncratic risk. The result is consistent with hypothesis H11A (Chapter 2) and with the findings reported in Chapter 4 (Section 4.4) on European banks.

Yet, with regard to credit risk, the coefficient for charter value is positive and statistically significant at the 5% level or better, indicating that the importance of charter value increased for banks across the world with the formation of EMU. The most statistically significant increase is observed for charter value relative to loan loss provision with a change in the coefficient of 7.60. This finding fails to support hypothesis H11A (See Chapter 2 Section 2.5).

The coefficient for off-balance sheet activities is negative and statistically significant at the 5% level or better with regard to systematic risk. This finding indicates
that importance of off-balance sheet activities has declined in the post-EMU period for the world analysis. This result fails to support hypothesis H11C, though it is in line with the European analysis discussed in Chapter 4 (Section 4.4). Yet, there is some mixed evidence with respect to the two alternate credit risk measures. For example, there is a strong support for a decline in the importance of off-balance sheet activities in the post-EMU period with regard to loan loss reserves, though loan loss provision shows the magnitude of off-balance sheet activities increased in the post-EMU period.

With regard to systematic risk, the coefficient for market discipline is negative and statistically significant at the 5% level or better, indicating that importance of uninsured deposits has declined in the post-EMU period. This finding fails to support hypothesis H11D.

Further, inconsistent with hypothesis H11D, the magnitude of the market discipline coefficient fell with EMU for total risk. This is an unexpected outcome and suggests that subordinated debt and interbank deposits may not be an effective disciplinary tool during the post-EMU period for the bank across the world. Similar findings are also observed with regard to credit risk particularly loan loss reserve measure.

It is important to note that the aforementioned findings on market discipline with regard to systematic risk, total risk and credit risk are contrary to that reported for European banks in Chapter 4 (Section 4.4). Further, the size variable has decreased in importance following the formation of EMU in 1999 with respect to credit risk.

With regard to country-level variables, it is evident from Table 6.18 that the importance of stock market turnover has increased with the formation of EMU. Further,
countries under market-based system are able to reduce their credit risk during the post-EMU period.

6.5 ROBUSTNESS

This study performs a variety of sensitivity analyses. Section 6.5.1 presents the findings excluding the Japanese commercial banks. Section 6.5.2 reports the results for developed, developing and transition economies. Section 6.5.3 presents the findings when individual bank heterogeneity is controlled and hence the model is re-estimated using Generalized Least Square random effects. Finally, Section 6.5.4 discusses the results incorporating some additional bank-specific variables.

6.5.1 Excluding Japanese commercial banks

Japanese banks are among the world’s largest global financial intermediaries, with significant presence in many regions, particularly, the US, Europe and South East Asia. In addition, to being the among the world’s largest banks, they have some of the world’s largest banking problems. The Japanese banking system undoubtedly faced the most difficult period in 1990s. Due to bad loan problems, the Japanese banks reduced their lending. This shrinkage was concentrated in their overseas operation particularly in the US and Europe. This slower growth is not surprising. Several Japanese banks reported risk-based capital requirements below the regulatory (by the Bank for International Settlement) requirement (minimum 8%) which is a consequence of the decline in capital associated with the sharp decline in Japanese stock prices (Peek and Rosenberg 1998). Further, it is interesting to note that Japanese bank activity rapidly
grew in South East Asia\textsuperscript{57} despite the serious and mounting problems at Japanese parent banks.\textsuperscript{58}

In 2001, Japanese government announced plans for a government-backed purchase of USD 90 billion of shares of Japanese banks in order to avert a banking crisis. This was the third major attempt to bailout the banking system since 1998. In 2003, foreign financial institutions such as Goldman Sachs, Merrill Lynch and Deutsche bank were solicited in attempts to prevent a complete financial crisis in Japan. As a consequence, in late 2003, the eight biggest Japanese banking groups reported positive six month profits.

As Japan restructures their banking system, it is possible that the findings reported on the world analysis discussed in Section 6.2 may be affected by this weak banking system. Thus, this section reports the result of banks across the world excluding Japanese commercial banks. Although the main results reported in Section 6.2.1 are not sensitive to the exclusion of Japanese banks, there is some variation in the results. It is evident that the coefficient of charter value is positive and statistically significant at the 1\% level, suggesting that charter value increases bank systematic risk (Saunders and Wilson 2001). This finding is in consistent with hypothesis H1. Further, consistent with hypothesis H9, the coefficient for the market-based dummy is positive and statistically significant at the 5\% level, indicating that banks operating in market-based environment exhibit greater

\textsuperscript{57} This lending growth was related to the surge in foreign direct investment by Japanese companies in South East Asia during late 1980s and early 1990s (Goldberg and Klien 1998).

\textsuperscript{58} Peek and Rosenberg (1998) report that during 1993-1997 period, Japanese banks reduced the number of branches in the US by almost one third and in Europe by one eight while increasing the number in South East Asia by one fourth.
systematic risk.

With respect to idiosyncratic risk, the main result discussed in Section 6.2.2 is not sensitive to the exclusion of Japanese banks from the sample. Further, with respect to total risk, although the results discussed in Section 6.2.3 are essentially unchanged, there is evidence that off-balance sheet activity is sensitive to the exclusion of the Japanese banks from the broad sample.

The main findings discussed in Section 6.2.4 are reiterated with respect to credit risk (measured by loan loss provision). These results are not driven by Japanese commercial banks. However, with regard to the alternative credit risk measure (loan loss reserve), the findings remain little changed for the majority of the bank-specific variables with the exception of charter value. Charter value yields no appreciable evidence of bank disciplinary effect on loan loss reserves when Japanese banks are excluded.

The regression results are reported in Appendix Table A6.7, Panel A through to Panel E.

6.5.2 Comparison among developed, transition and developing economies

It is well-documented that banks may behave differently under different institutional settings (Berger, Klapper and Udell 2001; Berger and Udell 2002; Haselmann and Watchel 2006; Agoraki, Delis and Pasiouras 2009). To gain a better understanding of the relationship between bank-specific variables and bank risk, the sample in this study is divided into developed, transition and developing economies.59 It

59The sample is divided among developed, developing and transition economies based on The World Bank,
is evident from the literature that bank risk taking is well-documented for developed economies (e.g., Keeley 1990; Salas and Saurina 2003; Konishi and Yasuda 2004). However, none of the previous studies dealing with developed economies have focused on equity risk and credit risk as occurs in this study.

Most transition economies, particularly in Eastern Europe, have introduced reforms with the aim of increased competition, greater stability and more efficient intermediation in the banking industry (Bonin and Watchel 2003; De Haas and Van Lelyveld 2006). Berglof and Bolton (2002) argue that banking supervision in Eastern Europe has been tightened to reinstate confidence in the banking sector. Moreover, in order to reduce credit risk, company and bankruptcy law has been reformed to facilitate transparency and contract enforcement (Pistor, Raiser and Gelfer 2000). The capital requirement for banks has been tightened particularly in the wake of Russian Rouble crisis. Thus, it is important to examine the determinants of bank equity risk and credit risk for this region.

There is limited literature with particular focus on factors affecting bank equity risk and credit risk in transition economies. Haselmann and Watchel (2007) analyze the impact of the probability of default on a number of accounting measures of bank risk and conclude that banks in transition economies take on risk and also maintain a higher share of capital hence these banks are able to manage risk similar to banks in other developed economies. De Haas, Ferreira and Taci (2010) argue that bank-specific characteristics such as size and ownership (domestic versus foreign banks) are the major determinants of
credit risk in these economies. With regard to equity risk, Brown, Maurer, Pak and Tynaev (2009) focus on the Kyrgyzstan banking industry and conclude that structural reforms in the banking industry were able to lower their interest rate risk.

The banking sector of many developing economies has gradually transformed, particularly, driven by domestic deregulation, increased financial integration and globalization, increased importance of foreign banks and removal of entry barriers (Claessens, Van Horen, Gurcanlar and Mercado 2008).

Capital markets in emerging countries are still under-developed, and thus the banking system typically plays the central role of intermediation. The literature on bank equity risk and credit risk with regard to developing economies is limited. Prior studies either on developing economies (Demirguc-Kunt and Detragiache 1998; Levy-Yeyati, Peria, and Schmukler 2004) or on an international setting (Barth, Caprio and Levine 2004; Barth, Caprio and Levine 2008) have mainly focused on banking crisis. Further, on an international setting González (2005) concludes that regulatory restrictions increases bank risk by reducing charter value.

Table 6.19 summarizes the findings for developed, transition and developing economies. The detailed empirical findings are reported in Appendix in Table A6.8, Table A6.9 and Table A6.10. The results confirm the findings on world analysis discussed in Section 6.2 with very few variations. There are similarities in the findings between developed and developing economies particularly, with regard to bank capital and size. There is no appreciable evidence of association with respect to bank capital and off-balance sheet activities in transition economies.
Table 6.19
Determinants of bank risk: developed, transition and developing economies
This table presents a summary of the results. The results reported in columns under the term “Actual Sign” in the following table are statistically significant at 5% significance level or better. Equity risk includes systematic risk, total risk and idiosyncratic risk. Credit risk is measured by loan loss provision and loan loss reserve. LLP=loan loss provision; LLR=loan loss reserve. Detailed results are reported in Appendix A6.8, A6.9 and A6.10

<table>
<thead>
<tr>
<th>Bank Capital and Risk</th>
<th>World</th>
<th>Developed Economies</th>
<th>Transition Economies</th>
<th>Developing Economies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Predicted sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
</tr>
<tr>
<td>Negative (-)</td>
<td>Negative (-) with equity risk. Positive with LLR.</td>
<td>Negative (-) with total risk and idiosyncratic risk. Negative with LLP sensitive to estimation method.</td>
<td>No appreciable evidence.</td>
<td>Negative (-) with total risk and idiosyncratic risk. Positive with LLR.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Charter Value and Risk</th>
<th>World</th>
<th>Developed Economies</th>
<th>Transition Economies</th>
<th>Developing Economies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Predicted sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
</tr>
<tr>
<td>Negative (-)</td>
<td>Negative (-) with credit risk.</td>
<td>Positive with systematic risk and total risk. Positive with LLR.</td>
<td>Negative with systematic risk and credit risk. Positive with total risk but sensitive to estimation method.</td>
<td>Negative with LLP and sensitive to estimation method.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Off-balance sheet activities and Risk</th>
<th>World</th>
<th>Developed Economies</th>
<th>Transition Economies</th>
<th>Developing Economies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Predicted sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
</tr>
<tr>
<td>Positive (+)</td>
<td>Positive (+) with total, systematic and credit risk. Negative (-) with idiosyncratic risk.</td>
<td>Positive with systematic risk and total risk.</td>
<td>No appreciable evidence.</td>
<td>Positive with systematic risk.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Market discipline and Risk</th>
<th>World</th>
<th>Developed Economies</th>
<th>Transition Economies</th>
<th>Developing Economies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Predicted sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
</tr>
<tr>
<td>Negative (-)</td>
<td>Positive (+) with systematic risk. Negative (-) with total risk, idiosyncratic risk and credit risk.</td>
<td>Negative with LLR.</td>
<td>Negative with credit risk at the 10% significance level.</td>
<td>Positive with systematic risk. Negative with total risk, idiosyncratic risk and credit risk.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Size and Risk</th>
<th>World</th>
<th>Developed Economies</th>
<th>Transition Economies</th>
<th>Developing Economies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Predicted sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
</tr>
<tr>
<td>Positive (+) with systematic risk. Negative (-) with credit risk.</td>
<td>Positive (+) with systematic risk and total risk. Negative (-) with idiosyncratic risk and credit risk.</td>
<td>Positive with systematic and total risk. Negative with idiosyncratic risk and credit risk.</td>
<td>Negative with total risk LLP and sensitive to estimation method.</td>
<td>Positive with systematic risk and total risk, sensitive to estimation method. Negative with LLP.</td>
</tr>
<tr>
<td>Risk, Total Risk, and Idiosyncratic Risk</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------------------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Deposit Insurance and Risk

<table>
<thead>
<tr>
<th>Predicted sign</th>
<th>Developed Economies</th>
<th>Transition Economies</th>
<th>Developing Economies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive (+)</td>
<td>Positive (+) with equity risk.</td>
<td>Negative with systematic risk. Positive with idiosyncratic risk and credit risk.</td>
<td>NIL</td>
</tr>
</tbody>
</table>

### Market based System and Risk

<table>
<thead>
<tr>
<th>Predicted sign</th>
<th>Developed Economies</th>
<th>Transition Economies</th>
<th>Developing Economies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive (+)</td>
<td>Positive (+) with credit risk. Negative (-) with total risk and idiosyncratic risk.</td>
<td>Negative with systematic risk and total risk.</td>
<td>Positive with LLR.</td>
</tr>
</tbody>
</table>

### Stock Market Turnover and Risk

<table>
<thead>
<tr>
<th>Predicted sign</th>
<th>Developed Economies</th>
<th>Transition Economies</th>
<th>Developing Economies</th>
</tr>
</thead>
</table>

### Economic Freedom Index and Risk

<table>
<thead>
<tr>
<th>Predicted sign</th>
<th>Developed Economies</th>
<th>Transition Economies</th>
<th>Developing Economies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative (-)</td>
<td>Negative (-) with credit risk. Negative with systematic and total risk.</td>
<td>Positive with LLP.</td>
<td>Positive with systematic risk. Negative with credit risk.</td>
</tr>
</tbody>
</table>

### Legal Origin and Risk

<table>
<thead>
<tr>
<th>Predicted sign</th>
<th>Developed Economies</th>
<th>Transition Economies</th>
<th>Developing Economies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive (+)</td>
<td>Positive (+) with equity risk. Negative (-) with LLP.</td>
<td>Positive with equity risk. Negative with credit risk.</td>
<td>NIL</td>
</tr>
</tbody>
</table>

### Commercial Bank and Risk

<table>
<thead>
<tr>
<th>Predicted sign</th>
<th>Developed Economies</th>
<th>Transition Economies</th>
<th>Developing Economies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive (+)</td>
<td>Positive (+) with credit risk. Negative (-) with total risk and idiosyncratic risk.</td>
<td>Positive (+) with credit risk. Negative with credit risk.</td>
<td>Negative with LLP.</td>
</tr>
</tbody>
</table>

Finally, there is empirical support in transition and developed economies that increased charter value is associated with increase in bank risk.
6.5.3 Controlling for bank heterogeneity

This study controls for individual bank heterogeneity using generalized least squares (GLS) random effects with year dummies. The results from this sensitivity test are consistent with the primary results discussed in Section 6.2. The results are reported in Appendix in Table A6.11.

6.5.4 Extended model

This study incorporates some additional variables including dividend yield, operating leverage\(^{60}\) and governance variables including creditor rights index and anti-director right index\(^{61}\) in the original model. The results of the major bank-specific variables are consistent with the empirical findings discussed in Section 6.2. This section only reports the result of the additional variables. The detailed results are reported in Appendix in Table A6.12.

Creditor rights index seems to be important in explaining the variation in bank equity risk (systematic risk, total risk and idiosyncratic risk). The results are consistent with predictions (Chapter 2, Section 2.4.3) and also consistent with the findings reported in Chapter 4 (Section 4.3).

Further, with respect to total risk, the coefficient for anti-director rights index is negative and statistically significant at the 5% or better. This result suggests better

\(^{60}\) It is evident from the result that for bank equity risk both dividend yield and operating leverage remain insignificant. So the model excludes these two variables and re-runs the analysis and the results remain unchanged for the rest of the variables.

\(^{61}\) It is important to note that due to lack of governance index information for Bangladesh, Cyprus, Lithuania, Luxembourg and Romania the model is run for a sub-sample.
protection of the minority shareholders (anti-director rights index) reduces bank total risk. Thus, this outcome is consistent with predictions (Chapter 2, Section 2.4.3). Similar evidence is also observed for idiosyncratic risk. These findings are consistent with that reported in Chapter 4.

With regard to credit risk, contrary to prediction, the coefficient on creditor-rights index is positively associated with both credit risk measures (loan loss provision and loan loss reserves) indicating better creditor protection tend to increase credit risk. However, this result is consistent with result on European banks reported in Chapter 4. Further, the coefficient for operating leverage is positive and statistically significant at the 1% level. This finding is consistent with prediction and also with the findings reported in Chapter 4.

**6.5.5 Impact of Asian crisis (1997-1998) on bank risk**

The findings for the impact of Asian crisis 1997-1998 on variation in bank equity risk and credit risk are reported below in Panel A and Panel B of Table 6.20.

The magnitude of the charter value coefficients increased dramatically with Asian Crisis particularly for systematic risk measure model. This outcome is interpreted in terms of the increase in the importance of charter value with the Asian Crisis 1977-1998. The most statistically significant increase is observed for charter value relative to systematic risk with a change in the coefficient of 1.819. This finding is contrary to that reported in Section 6.4 Nevertheless, the importance of charter value with respect to credit risk, has declined in the post-Asian crisis period and the most significant decline is observed with loan loss reserve.
Table 6.20

This table presents the result of impact of Asian Crisis 1997 on the determinants of bank risk. The table only presents the result for the differences. A dummy for Asian crisis takes a value of 1 for 1997 and 1998 and otherwise 0. All results are corrected for heteroscedasticity and the adjusted standard errors are reported in parenthesis. The Wald test to test the joint significance for difference and joint test for year dummies under pooled-OLS is a F-distribution while for 2SLS it is a $\chi^2$-square distribution.

***significant at 1% significance level,
**significant at 5% significance level,
*significant at 10% significance level.
† the coefficients of the explanatory variables and standard errors are scaled by 100.

### Panel A Impact of Asian Crisis- Equity risk

<table>
<thead>
<tr>
<th></th>
<th>Systematic risk</th>
<th></th>
<th>Idiosyncratic risk</th>
<th></th>
<th>Total risk</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pooled OLS</td>
<td>Pooled-OLS with lag</td>
<td>Pooled OLS</td>
<td>Pooled-OLS with lag</td>
<td>Pooled OLS</td>
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<td>0.921**</td>
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<td>0.055**</td>
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<td>(0.062)</td>
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<td>0.223***</td>
<td>0.064</td>
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### Panel B Impact of Asian Crisis - Credit risk

#### Loan loss provision to total assets

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<th>Pooled OLS</th>
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<th>2SLS</th>
<th>Pooled OLS</th>
<th>Pooled-OLS with lag</th>
<th>2SLS</th>
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<td>Intercept</td>
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<td>-1.493***</td>
<td>-1.435***</td>
<td>-0.825***</td>
<td>-0.872***</td>
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<td>-0.927***</td>
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<td>0.041**</td>
<td>0.055**</td>
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<td>0.034***</td>
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<td>0.014**</td>
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<td>(0.006)</td>
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<td>(0.003)</td>
<td>(0.002)</td>
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<td>----------</td>
<td>----------</td>
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<td>0.141***</td>
<td>0.079</td>
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<tr>
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<td>Yes</td>
<td>Yes</td>
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<td>R²</td>
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<td>0.28</td>
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<td>Model F-test</td>
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<td>37***</td>
<td>37.88***</td>
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Tests of Endogeneity:

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<td>Wu-Hausman F test</td>
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<td>6.40***</td>
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<tr>
<td>Durbin-Wu-Hausman chi-sq test</td>
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<td>18.34***</td>
<td>-</td>
<td>-</td>
<td>12.90***</td>
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<td>Wald test-joint significance for differences</td>
<td>4.41***</td>
<td>5.66***</td>
<td>69.18***</td>
<td>3.67***</td>
<td>3.92***</td>
<td>44***</td>
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<tr>
<td>Joint significance for year dummies</td>
<td>32***</td>
<td>33.15***</td>
<td>307.5***</td>
<td>19.10***</td>
<td>13.72***</td>
<td>146***</td>
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<td>4246</td>
<td>4233</td>
<td>4524</td>
<td>4155</td>
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</table>
The findings generally show a statistically significant (at the 1% level) increase in the effect of off-balance sheet activities on systematic risk in the post-Asian crisis period, suggesting that banks expanded into off-balance sheet activities, and systematic risk became more highly linked to these non-interest generating activities. The importance of market discipline has increased for bank systematic risk, total risk and credit risk (loan loss reserve) in the post-Asian crisis period. This supports the growing belief in the ability of the market participants to monitor and discipline large and complex financial institutions (Stiroh 2006). Moreover, bank size has increased in importance following Asia Crisis 1997-1998 with regard to total risk and credit risk measures. Thus, large banks have experienced increased equity volatility over the period.

In essence, the findings discussed above supports the continued importance of charter value, off-balance sheet activities and market discipline as a determinant of bank risk in the post-Asian crisis period. On the contrary, the findings for EMU as discussed earlier in Section 6.4, imply that charter value, off-balance sheet activities and market discipline became less important determinants of bank equity risk following 1999.

6.6 SUMMARY

This chapter presents the results for the determinants of bank equity risk and credit risk measures using banks across the world. The sample consists of 758 listed financial institutions across six regions (Asia-Pacific, Eastern Europe, Middle East and Africa, North America, South America and Western Europe) from the period 1996-2006. The study conducts a world analysis and also a separate regional analysis. This study focuses on the effect of a number of bank-specific and country-specific variables on four risk measures, total risk, systematic risk, idiosyncratic risk and credit risk. The study
applies pooled-OLS, pooled-OLS with lagged charter value and bank capital and two-stage least squares (2SLS) estimation techniques. Some of the major findings are discussed below.

In general, off-balance sheet activities are linked with higher risk. This is evident in the world analysis as well as in the separate regional analysis. With regard to charter value, the results indicate that there are some variations across the risk measures. The charter value decreases bank credit risk but increases bank equity risk. This finding is evident both in the developed and developing economies.

The results show that bank risk is closely linked to bank capital. The finding suggests the disciplinary role of bank capital in the world analysis as well as in the separate regional analysis, particularly in Asia-Pacific, North America and Western Europe. Nevertheless, with regard to systematic risk, the non-linear association between bank risk and bank capital is evident in the world analysis. Indeed, this finding is driven by the Western European region.

In addition, as evident from the world analysis, market discipline decreases total risk, idiosyncratic risk and credit risk but it increases bank systematic risk. Similar finding is observed in North America and Western European regions. However, there are some variations across other regions. Moreover, some of the country-level variables are important determinant of bank equity risk and credit risk. For example, moral hazard problem associated with deposit insurance is observed in the world analysis particularly in Asia-Pacific and Western European regions. Further, market based system demonstrates greater credit risk and lower equity risk particularly in Western Europe. These results are robust to different specifications.
CHAPTER 7

CONCLUSION

7.1 INTRODUCTION

This concluding chapter summarizes the thesis. Specifically, Section 7.2 recapitulates the two broad research questions, their associated hypotheses, testing and results. Section 7.3 delineates the major contribution of this thesis to the literature. This is followed by a discussion on its policy implications in Section 7.4. Section 7.5 identifies some limitations while Section 7.6 concludes this chapter with some suggestions for future research.

7.2 REVIEW OF RESEARCH QUESTIONS, HYPOTHESES AND FINDINGS

The objective of this thesis has been to assess the dynamics of bank regulation (bank capital and charter value), off-balance sheet activities and market discipline and its relevance on bank risk. To achieve this, two broad research questions guided by the existing research gaps were considered: (RQ1A) Do bank regulation, off-balance sheet activities and market discipline, explain bank risk, in particular equity risk and credit risk? (RQ1B) Does bank risk sensitivity to bank regulation, off-balance sheet activities and market discipline change with the creation of the Economic and Monetary Union (EMU)?, and (RQ2) Is there a structural change in European bank equity risk with the formation of Economic and Monetary Union (EMU)? The following three sub-sections (7.2.1, 7.2.2, 7.2.3 and 7.2.4) summarize the hypotheses, methodology and major findings in relation to each of these research questions.
7.2.1 Summary of findings relates to RQ1A– An analysis of European banks (chapter 4)

RQ1A “Do bank regulation, off-balance sheet activities and market discipline explain bank risk, in particular equity risk and credit risk?”

This question was addressed by testing hypotheses (H1, H2A, H2B, H3 H4, H5A and H5B) in Equation 3 through to Equation 6 (as discussed in Chapter 3) focusing on the determinants of bank risk for European banks. The objective was to examine whether bank capital, charter value, off-balance sheet activities and market discipline explain bank equity risk (systematic risk, total risk, interest rate risk and idiosyncratic risk) and credit risk. The results for the base-line estimation method, pooled-OLS, along with two stage least squares (2SLS) and additional robustness tests were reported in Chapter 4. The following discussion focuses on the findings for European bank risk as discussed in Chapter 4.

Table 7.1 summarizes the findings on European bank risk analysis. It is well-documented that bank capital disciplines banks and reduce their risk taking incentives. However, securitization and other financial innovation encourage particularly, large banks to lower their effective capital requirements per dollar of risk which is popularly known as “regulatory capital arbitrage” (Jones 2000). This is a major concern to both regulators and investors. In this study, the findings for bank capital show a non-linear association between systematic risk and bank capital, which essentially implies that banks first reduce risk with the increase in bank capital and as the bank capital build-up, the
banks then start increasing their risk levels.
Table 7.1
Summary of the results

This table represents a summary of the result as discussed in Chapter 4 in Section 4.2. The results reported in column 3 under the term “Actual Sign” in the following table are statistically significant at 5% significance level or better.

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<th>Variables</th>
<th>Predicted sign</th>
<th>Actual sign</th>
</tr>
</thead>
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<td>Bank Capital</td>
<td>Non-linear (negative then positive)</td>
<td>Non-linear with systematic risk and credit risk. No appreciable evidence of non-linearity with total and idiosyncratic risk.</td>
</tr>
<tr>
<td>Off-balance sheet activities</td>
<td>Positive (+)</td>
<td>Positive (+) with all risk measures except interest rate risk.</td>
</tr>
<tr>
<td>Charter value</td>
<td>Negative (-)</td>
<td>Negative (-) with credit risk only. Positive (+) with total, systematic and idiosyncratic risk.</td>
</tr>
<tr>
<td>Uninsured deposits</td>
<td>Negative (-)</td>
<td>Negative (-) with systematic risk. Positive (+) with credit, total and idiosyncratic risk.</td>
</tr>
<tr>
<td>Size</td>
<td>Positive (+) with systematic risk. Negative (-) with credit, total, interest rate and idiosyncratic risks</td>
<td>Negative (-) with credit and idiosyncratic risks. Positive (+) with systematic risk and total risk.</td>
</tr>
<tr>
<td>Loans to total assets</td>
<td>Positive(+)</td>
<td>Positive (+) with credit risk. Negative (-) with systematic risk</td>
</tr>
<tr>
<td>Economic freedom index</td>
<td>Negative (-)</td>
<td>Negative (-) with all risk measures.</td>
</tr>
<tr>
<td>Dividend yield</td>
<td>Negative (-)</td>
<td>Negative (-) with systematic, total and idiosyncratic risk and positive with credit risk.</td>
</tr>
<tr>
<td>Operating leverage</td>
<td>Positive (+)</td>
<td>Positive (+) with all risk measures except for interest rate risk.</td>
</tr>
<tr>
<td>Ownership dummy (D₁)</td>
<td>Positive (+)</td>
<td>Positive (+) with credit risk, systematic and total risk</td>
</tr>
<tr>
<td>Legal origin dummy (D₂)</td>
<td>Positive (+)</td>
<td>Negative (-) with credit risk, total risk, systematic risk and interest rate risk. Positive with idiosyncratic risk.</td>
</tr>
<tr>
<td>Geographical dummy (D₃)</td>
<td>Negative (-)</td>
<td>Negative (-) with all risk measures</td>
</tr>
<tr>
<td>Creditor rights dummy (D₄)</td>
<td>Negative (-)</td>
<td>Positive (+) with credit risk. Negative (-) with total risk and idiosyncratic risk.</td>
</tr>
<tr>
<td>Anti-director rights (D₅)</td>
<td>Negative (-)</td>
<td>Negative (-) with all risk measures except interest rate risk. Positive (+) with interest rate risk.</td>
</tr>
</tbody>
</table>

Similar evidence is also observed with regard to credit risk. However, this non-linear relationship does not hold for other risk measures (total risk, idiosyncratic risk, interest rate risk). The growth in off-balance sheet activities and increase in the number of depository institutions failures have raised questions about the possible relationship between the two developments over the past decades. In this study the findings show that
off-balance sheet activities are in general positively related to various bank risk measures (equity risk and credit risk). Perhaps, this finding provides some comfort to the regulators to the extent that off-balance sheet activities is indeed risky business and must be included in the calculation of minimum risk capital.

The results for European banks show uninsured deposits are negatively associated with systematic risk, suggesting a market discipline effect. This finding indicates that the level of uninsured deposits has a direct impact on European bank share price through its impact on systematic risk. There is a positive and statistically significant relation between uninsured deposits and other bank risk measures (credit risk, total risk and idiosyncratic risk). Thus, while there is a positive pricing effects through systematic risk effects, uninsured deposits can lead to increasing levels of diversifiable risks. This result is important to undiversified investors and also to regulators concerned with bank failure.

The other important factor is bank charter value. A negative and statistically significant relationship is observed between bank charter value and credit risk, which implies charter value, acts as a bank disciplinary instrument with regard to credit risk. Yet, the evidence of a positive and statistically significant relationship between charter value and bank equity risk proxies (total risk, idiosyncratic risk and systematic risk) suggest the diminishing effect of charter value. This may be a major concern to bank regulators as well as investors. One possible explanation could be that the impact of financial liberalization and increased competition may have diminished the disciplinary effect of bank charter value. However, it is also possible that this positive association could simply reflect the growth opportunities implicit in bank charter value.

Furthermore, the finding for bank size confirms that large European banks exhibit
greater systematic risk and total risk. This suggests that large banks potentially suffer
greater moral hazard problem created by “too big to fail” policy. It is often argued that
the presence of larger institutions possess a threat to the safety and soundness of the
financial system (Mishkin 1999). This implies failure of a large institution exposes the
financial system to increased level of risk. Thus, regulators and governments are more
concerned about the contagion effect on the banking system and hence are reluctant to
allow large financial institutions to fail.

There is a negative association between dividend yield and bank equity risk. This
result is important for investors as dividend payments provide a signal concerning bank
expectations about future income.

The findings also provide evidence that any variability in business profile will
affect the equity risk and credit risk. This may be of some concern to regulators and
investors. Thus, it is evident from Table 7.1, that operating leverage has a positive effect
on European bank equity risk (total risk, systematic risk and idiosyncratic risk) and credit
risk. Yet, with regard to interest rate risk, the coefficient for operating leverage is
negative and statistically significant.

Finally, the finding shows that European commercial banks involve greater credit
risk, systematic risk and total risk compared to other bank classifications including
cooperatives, bank holding companies and savings banks. It is also important to note that
the banks in euro-zone area exhibit lower bank equity risk and credit risk. Policymakers
and regulators were doubtful whether formation of EMU will encourage banks in the
euro-zone area to reduce their risk levels through greater integration. Hence, the findings
from this thesis confirms European banks were able to reduce equity risk and credit risk
perhaps through increased bank merger and acquisitions. Moreover, the findings confirm that enforcement of creditor rights and anti-director rights are important in explaining the variation in bank total risk and idiosyncratic risk (La Porta et. al 1998).

7.2.2 Summary of findings related to RQ1A - An analysis of world banks (chapter 6)

RQ1A “Do bank regulation, off-balance sheet activities and market discipline explain bank risk in particular, equity risk and credit risk?”

This question was also addressed by testing hypotheses H1, H2A, H2B, H3, H4, H5A, H5B, H6, H7, H8, H9 and H10 in Equation 3, Equation 4 and Equation 7 (discussed in Chapter 3) on the determinants of equity risk and credit risk for banks across the world. The following discussion delineates the findings discussed earlier in Chapter 6 on the world analysis. Table 7.2 draws a comparison between the findings from the world analysis and the regional analysis. The findings are consistent with different robust estimation techniques. The following sub-sections discuss the findings with regard to risk for each of the important explanatory variables directly related to main hypotheses (H1, H2A, H2B, H3, H4, H5A, H5B, H6, H7, H8, H9 and H10).

7.2.2.1 Off-balance sheet activities

This study provides evidence that banks around the world generally show positive association between off-balance sheet activities and bank equity risk, with the exception of idiosyncratic risk. This finding is also observed in regional analysis particularly in Asia-Pacific, Western Europe, Middle-East and Africa (MENA) and the North America regions, suggesting that reliance on non-interest generating income is an important risk
factor for banks in developed as well as emerging economies.

With regard to credit risk, the result suggests that off-balance sheet activities do influence credit risk. This finding is evident both in the world analysis (Chapter 6 Section 6.2) and in the regional analysis (Chapter 6 Section 6.3) particularly in Western Europe, Eastern Europe and Asia-Pacific regions. This provides further support to the Basel Accord I and II, as it requires banks around the world to incorporate off-balance sheet activities in their bank capital calculation. There is one variation in the finding which is with regard to credit risk, a negative coefficient is observed in the South America region. Indeed, policy makers may be interested in this finding because the rest of the regions show a positive association between off-balance sheet activity and risk.
Table 7.2
Comparison of the results - world analysis and regional analysis

This table presents a summary of the results as discussed in Chapter 6 in Section 6.2 and Section 6.3. The results reported in columns under the term “Actual Sign” in the following table are statistically significant at 5% significance level or better. Asia Pacific=Asia Pacific region; EEC=Eastern European countries; MENA=Middle East and Africa region, NA=North America region; SA=South America and W. Europe=Western Europe region. Equity risk means systematic risk, total risk and idiosyncratic risk. Credit risk is measured by loan loss provision and loan loss reserve. LPL=loan loss provision; LLR=loan loss reserve.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Predicted sign</th>
<th>World Actual sign</th>
<th>Asia Pacific Actual sign</th>
<th>EEC Actual sign</th>
<th>MENA Actual sign</th>
<th>NA Actual sign</th>
<th>SA Actual sign</th>
<th>W. Europe Actual sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off-balance sheet activities</td>
<td>Positive with all risk measures except for idiosyncratic risk.</td>
<td>Positive with idiosyncratic risk and credit risk (measured by LLP).</td>
<td>Positive with credit risk (measured by LLP) under 2SLS</td>
<td>Positive with equity risk.</td>
<td>Positive with equity risk.</td>
<td>Negative with credit risk.</td>
<td>Positive with all risk measures.</td>
<td></td>
</tr>
<tr>
<td>Charter value</td>
<td>Negative</td>
<td>Negative with credit risk.</td>
<td>Negative with credit risk (measured by LLP).</td>
<td>Positive with all risk.</td>
<td>Negative with credit risk.</td>
<td>Positive with credit risk (measured by LLP)</td>
<td>Positive with equity risk.</td>
<td></td>
</tr>
<tr>
<td>Bank Capital</td>
<td>Negative</td>
<td>Negative with equity risk. Positive with credit risk (measured by LLR).</td>
<td>Negative with total risk, idiosyncratic risk and credit risk.</td>
<td>Negative with credit risk (measured by LLP) under 2SLS.</td>
<td>Negative with systematic risk.</td>
<td>Negative with total risk, idiosyncratic risk and credit risk.</td>
<td>Positive with credit risk (measured by LLR).</td>
<td></td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Variables</th>
<th>Predicted sign</th>
<th>World Actual sign</th>
<th>Asia Pacific Actual sign</th>
<th>EEC Actual sign</th>
<th>MENA Actual sign</th>
<th>NA Actual sign</th>
<th>SA Actual sign</th>
<th>W. Europe Actual sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market Discipline or uninsured deposits</td>
<td>Negative</td>
<td>Positive with systematic risk.</td>
<td>Positive with systematic risk.</td>
<td>Not significant for any risk measure.</td>
<td>Negative with systematic risk and credit risk (measured by LLR).</td>
<td>Positive with systematic risk and credit risk (measured by LLP).</td>
<td>Negative with credit risk.</td>
<td>Negative with systematics risk and credit risk (measured by LLR).</td>
</tr>
<tr>
<td>Loans to total assets</td>
<td>Positive</td>
<td>Negative with equity risk.</td>
<td>Positive with credit risk.</td>
<td>Positive with credit risk (measured by LLP).</td>
<td>Negative with total risk and systematic risk.</td>
<td>Negative with idiosyncratic risk and total risk.</td>
<td>Negative with credit risk.</td>
<td>Negative with equity risk and credit risk (measured by LLP).</td>
</tr>
<tr>
<td>Economic freedom index</td>
<td>Negative with credit risk.</td>
<td>Negative with credit risk.</td>
<td>Positive with credit risk (measured by LLP).</td>
<td>Negative with credit risk (measured by LLP).</td>
<td>Positive with credit risk (measured by LLP).</td>
<td>Positive with credit risk (measured by LLP).</td>
<td></td>
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<tr>
<th>Variables</th>
<th>Predicted sign</th>
<th>Actual sign</th>
<th>Actual sign</th>
<th>Actual sign</th>
<th>Actual sign</th>
<th>Actual sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bank concentration</td>
<td>Positive or negative</td>
<td>Negative with systematic risk and credit risk (measured by LLP).</td>
<td>Negative with loan loss provision and positive with credit risk (measured by LLP).</td>
<td>Positive and marginally significant for total and idiosyncratic risk.</td>
<td>Negative with equity risk.</td>
<td>Positive with credit risk (measured by LLR).</td>
</tr>
<tr>
<td>Net interest margin</td>
<td>Positive</td>
<td>Negative with systematic risk. Positive with idiosyncratic risk, total risk and credit risk (measured by LLP).</td>
<td>Positive with total risk and idiosyncratic risk.</td>
<td>Insignificant for all risk measures.</td>
<td>Negative with total risk and idiosyncratic risk.</td>
<td>Positive with credit risk (measured by LLR).</td>
</tr>
<tr>
<td>Deposit insurance</td>
<td>Positive</td>
<td>Positive with equity risk.</td>
<td>Positive with total risk, systematic risk and credit risk.</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>World</th>
<th>Asia Pacific</th>
<th>EEC</th>
<th>MENA</th>
<th>NA</th>
<th>SA</th>
<th>W. Europe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variables</td>
<td>Predicted sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
<td>Actual sign</td>
</tr>
<tr>
<td>Common-law dummy</td>
<td>Positive</td>
<td>Positive with credit risk (measured by LLP).</td>
<td>Negative and marginally significant for equity risk.</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Commercial bank dummy</td>
<td>Positive</td>
<td>Positive with credit risk. Negative with total risk and idiosyncratic risk.</td>
<td>Negative with credit risk (measured by LLP).</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
<tr>
<td>High-income dummy</td>
<td>Negative with equity risk and credit risk.</td>
<td>Negative with total risk, idiosyncratic risk and credit risk (measured by LLP).</td>
<td>Insignificant for all risk measures.</td>
<td>Negative with systematic risk.</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>
7.2.2.2 Charter value

It is observable from Table 7.2, that increases in charter value are associated with decreases in credit risk with respect to world analysis. Similar evidence of the disciplinary role of charter value although observed in Asia-Pacific, Middle East and Africa, North America and Western Europe regions but fails to confirm in the developing economies including Eastern Europe and South America. This diminishing effect of charter value may reflect the impact of financial liberalization and increased competition.

Further, there is evidence that charter value disciplines banks and thus reduces risk particularly systematic risk, idiosyncratic risk and total risk. This finding is observed in the Middle East and Africa region. Contrary to the aforementioned finding in the Middle-East and Africa region, it is evident that higher charter value is associated with higher risk (systematic risk, idiosyncratic risk and total risk) in North America, South America and Western European regions. Yet, the findings on world analysis exhibit no appreciable association between charter value and bank equity risk (systematic risk, idiosyncratic risk and total risk). Regulators and supervisors are about banking sector stability, hence the aforementioned findings may be of importance to them. These findings are equally important to managers, borrowers and customers as they are concerned particularly about idiosyncratic risk.

7.2.2.3 Bank capital

A number of regulatory reforms were addressed for banks around the world in order to discourage bank risk taking, prevent bank failures and ensure continued solvency. It has been argued that excessive risk-taking has been a major problem under
the deposit insurance contract.

However, bank capital shields the deposit insurance fund from liability by absorbing bank losses and preventing bank insolvency (Calem and Rob 1999). Thus, capital regulation has been a foundation of banking supervision.

With regard to systematic risk, the disciplinary effect of bank capital is observed in the world analysis and also in the regional analysis particularly, for the Middle East and Africa and Western Europe. This finding indicates that increases in bank capital are associated with decreases in bank systematic risk. However, the findings in this study on world analysis provide support that the build-up of bank capital may make banks less safe since the relationship is non-linear.

There is also support for this non-linearity in Western Europe\textsuperscript{62}, though this result is not evident in the other regions. This is of greater importance to policy makers and regulators because a potential social cost of bank risk-taking is the possibility that a major banks failure or series of failures could impose external cost on financial markets (Bhatacharya and Thakor 1993). This non-linear association between bank capital and systematic risk provides the regulators and the supervisors to assess the appropriateness of bank capital requirement addressed in the New Basel Capital Accord.

With regard to total risk, the finding reported on the world analysis shows bank capital is associated with decreases in total risk as desired by the regulatory authorities. Similar finding is observed in the regional analysis particularly for Asia-Pacific, North

\textsuperscript{62} This finding is also consistent with that reported in Chapter 4.
America and Western Europe. Similarly, with respect to idiosyncratic risk, the disciplinary role of bank capital is observed in the world analysis as well as in the regional analysis particularly in Asia-Pacific, North America and Western Europe, indicating that increases in bank capital are associated with decreases in bank-specific risk (Furlong and Keeley 1989; Keeley and Furlong 1990).

There is no appreciable evidence of non-linearity with regard to total risk and idiosyncratic risk both in the world analysis and the regional analysis. The findings further demonstrate that increase in bank capital is associated with decrease in credit risk particularly in Asia-Pacific, North America and Western Europe. Yet, the world analysis as well as the regional analysis particularly developing economies (Middle East and Africa and South America) suggests that bank capital does not necessarily reduce credit risk instead it may be stringent due to moral hazard problem associated with deposit insurance scheme.

7.2.2.4 Market discipline

Evidence from other variables also provides potentially important insights into bank risk taking. The findings suggest caution in evaluating the potential “market discipline” effects of subordinated debt and inter-bank deposits. This finding is evident both in world analysis and regional analysis particularly for Asia-Pacific and South American regions with regard to systematic risk. Similar evidence is also observed with regard to total risk particularly in South America and the Western Europe.

Developed economies including, North America and Western Europe, exhibit that uninsured deposits fail to account for reducing bank idiosyncratic risk. Similarly, with
regard to credit risk, the findings cast some doubts on the regulatory role of uninsured deposits (subordinated-debt and inter-bank deposits). This is evident particularly in the Middle-East and Africa and South American regions. The aforementioned results are important to regulators and policy makers as it suggests the erosion of market disciplinary effect of subordinated debt and inter-bank deposits. Yet, the analysis has implications for reducing bank risk through holding a riskier portfolio which will allow them to pay higher price for subordinated debt and this is evident with regard to systematic risk in Middle-East and Africa, North America and Western Europe. Similar evidence is also observed with regard to total risk and idiosyncratic risk particularly in Middle-East and Africa region. The credit risk results for both regional analysis (particularly in North America and Western Europe) and world analysis support the market disciplinary effect of subordinated debt and inter-bank deposits.

7.2.2.5 Size

The findings show that bank size has different and offsetting effects on bank equity risk and credit risk. With regard to systematic risk, the result confirms that large banks exhibit greater sensitivity to the general market movements and hence lead to higher level of systematic risk. This finding is evident in the world analysis and regional analysis particularly in Asia-Pacific, Middle-East and Africa, North America and Western European region.

With regard to total risk, it is also evident that large banks involve greater total risk. This finding is evident in the world analysis and particularly for Middle-East and Africa and Asia-Pacific regions. The findings also suggest that in the Middle-East and Africa region, large banks may not be able to reduce idiosyncratic risk through internal
diversification because these banks may tend to undertake riskier activities and likely to employ higher leverage (Demsetz and Strahan 1997). However, large banks in North America reflect lower total risk. Similar findings are observed with regard to idiosyncratic risk particularly, in Eastern Europe, North America and Western European regions. Further, with regard to credit risk, the world analysis supports that large banks are able to reduce their asset risk and hence reflect lower credit risk. This finding is also observed in the regional analysis particularly in Asia-Pacific, South America and Western Europe.

There are some contradictory findings suggesting that large banks have less flexibility to cope with unexpected liquidity shortages because of insufficient access to capital markets. This finding is evident in the transition (Eastern Europe) and developing (Middle East and Africa) economies.

7.2.2.6 Country-level variables

It is evident from Table 7.2 that some of the country level variables are important in explaining bank equity risk and credit risk. Deposit insurance exhibit moral hazard with regard to each risk measures in the world analysis as well as in the regional analysis particularly in Asia-Pacific and Western European regions.

It is evident in the world analysis that, market-based system increases credit risk. This finding is also observed in Asia-Pacific and Western European regions. Similar result is also found with regard to systematic risk particularly for Asia-Pacific region. Yet, it is evident from Table 7.2 that in Western Europe; market-based system reduces bank equity risk (systematic risk, total risk and idiosyncratic risk). Similar finding is also
observed in the world analysis with respect to total risk and idiosyncratic risk.

Further, greater freedom in banking activities can result in lower credit risk. This finding is observed in four out of six regions and is also evident in the world analysis. Yet, increased banking freedom can also lead to greater credit risk which is evident in the transition (Eastern Europe) and emerging economies (South America). The findings show no appreciable association between EFI and bank equity risk in the world analysis. However, with regard to systematic risk in Western European region, it is observed that higher level of EFI decreases systematic risk. A contradictory finding is observed in Middle East and Africa region.

It can be observed from Table 7.2 that stock market turnover ratio is an important country-level explanatory variable. There is evidence in the world analysis that high frequency of trading is associated with high bank equity risk. Yet, a negative association is observed with regard to credit risk. Further, there are some variations in the findings across the regions.

With regard to bank concentration variable, it is evident from the finding that there is support for “concentration fragility theory” particularly in Western European region. Yet, consistent with the world analysis, there is also evidence that higher bank concentration may result in decrease in equity risk. Further, net interest margin is associated with increases in total risk. This finding is evident in the world analysis as well as in the regional analysis particularly for Asia-Pacific and South American region. Similar finding is observed with regard to idiosyncratic risk and credit risk. However, contradictory evidence is also observed with regard to systematic risk.
The findings show that commercial banks exhibit lower total risk particularly in Eastern Europe, North America and Western European regions. This finding is also evident with regard to idiosyncratic risk in Asia-Pacific, Eastern Europe and Western European regions. Similar evidence is also observed with regard to total risk and idiosyncratic risk in the world analysis. Finally, North American commercial banks are more aggressive than their counterparts in Asia-Pacific, Eastern Europe and South American in the credit market. It is also evident from the empirical results that common-law country banks exhibit greater equity risk and credit risk.

7.2.3 Summary of findings related to RQ1B – Impact of EMU 1999

Although it is beyond the scope of this thesis to examine the detailed impact of EMU on bank risk taking, RQ1B: “Does bank risk sensitivity to bank regulation, off-balance sheet activities and market discipline change with the creation of the Economic and Monetary Union (EMU)?” was intended to produce a simple understanding of whether bank-specific variables experienced statistically significant change between pre-EMU period and post-EMU period. Such understanding is important in order to comprehend the importance of bank capital, charter value, off-balance sheet activities and market discipline before and after the formation of EMU. This research question was addressed by testing four hypothesis: (hypothesis H11A) bank charter value decreased in the post-EMU period, (hypothesis H11B) bank capital increased in the post-EMU period, (hypothesis H11C) bank off balance sheet activities increased in the post-EMU period, (hypothesis H11D) bank uninsured deposits increased in the post-EMU period.

The magnitude of the charter value coefficients fell dramatically with EMU for systematic risk model. This outcome is interpreted in terms of the decline in the
importance of charter value with the formation of EMU and increasing levels of competition. This finding is also evident for idiosyncratic risk. Further, with regard to systematic risk, findings indicate that importance of off-balance sheet activities has declined in the post-EMU period for the European analysis (discussed in Chapter 4) and world analysis (discussed in Chapter 6).

In general, the findings show that the formation of the EMU has had an impact on the sensitivity of bank risk to some of the key variables included in the model. While some of the variation is due to changes in sensitivity to bank capital the remaining variation is associated more with changes in the magnitude of coefficients rather than their sign (Chapter 4 and Chapter 6).

7.2.4 Summary of findings related to RQ2-Structural change in European bank risk (chapter 5)

RQ2 “Is there a structural change in European bank equity risk with the formation of Economic and Monetary Union (EMU)?”

This question was addressed by testing of the final three hypotheses: (hypothesis H12) total bank equity risk (increases) decreases with EMU, (hypothesis H13) idiosyncratic risk (increases) decreases with EMU and (hypothesis H14) systematic bank equity risk (increases) decreases with EMU. These were tested using regression Equation 9 (See Chapter 3). This finding supports the three hypotheses, H12, H13 and H14, as mentioned in Chapter 2 (See Section 2.6.3) and this support is evident at both the individual bank level and the bank sector level (proxied by equally weighted and value weighted portfolios of the banks in the sample) for decreased risk with EMU.
The decrease in risk is particularly evident for French, Italian, Greek, Portuguese and Spanish banks (See Table 5.2 and Table 5.3 in Chapter 5). It is evident (Table 5.2, Panel A) that 67 of the 96 euro zone banks (70% of the sample) show a decline in total risk on average of 19% on average, with more than half of these declines being statistically significant. Further, bank idiosyncratic risk (Panel B, Table 5.2) declined 10%, on average, with 58 of the 96 banks (60% of the sample) exhibiting decreased risk. While not all banks in all the countries in the study reveal equity risk reduction, equity risk reduction is apparent in most countries in the sample. An important exception is the German banking industry, where many of the banks exhibit an increase in bank equity risk on an average.

7.3 ACADEMIC CONTRIBUTION

This thesis contributes to the literature in several ways. As far as it could be ascertained, this is the first study to account for the structural changes in the European bank equity risk with the formation of EMU in 1999. The period is marked by increasing competition, changes in regulation, and increasing mergers and acquisition activity both in euro-zone and non-euro-zone countries. With regard to the determinants of bank equity risk and credit risk, as far as it could be ascertained, no prior study has examined the effect of bank regulation (bank capital and charter value), off-balance sheet activities and market discipline on bank equity risk and credit risk across the world.

This study attempts to bridge this gap by exploring the impact of endogenous variables such as bank capital and charter value, on bank risk. Moreover, few studies compare the factors that explain bank equity risk considering the pre-EMU period (before 1999) and post-EMU period (post 1999). Thus, this study provides an attempt to observe
whether there have been any changes in the importance of the factors affecting the bank equity risk with the formation of EMU.

In relation to the literature of bank risk, it is believed that this is the first study to use both equity and credit risk measures in a single study. The market based risk measures provide a clear view of the risk impact of various bank-specific factors such as bank capital, charter value, off balance sheet activities and market discipline.

In addition, this study considers credit risk, an accounting based risk measure. Although accounting based risk measures are considered to be backward-looking (Stiroh 2006), credit risk is an essential risk measure for the banking industry and it has become more important since Basel Accord I and Basel Accord II with the greater emphasis on the bank internal credit risk measures\textsuperscript{63}.

This study is perhaps the first to provide empirical evidence of a non-linear relationship between bank risk and bank capital from an international viewpoint. Based on the arguments of Calem and Rob (1999), this study hypothesize that with increasing bank capital, bank at first reduces risk with build-up of bank capital but with further build-up of bank capital banks may tend to take on greater level of risk, consistent with the “too big to fail” arguments.

\textbf{7.4 POLICY IMPLICATIONS}

The findings of this thesis should prove useful to policymakers, bank regulatory

\textsuperscript{63}Yet, in the revised version, of Basel Accord II as proposed in 2000, recognizes the role of the market, capable of forcing the banks to adopt capitalization level consistent with risk profile (Sironi and Zazzara 2003).
bodies and supervisory agencies which exercise regulatory authority over financial institutions, potential bank investors, creditors as well as academics. Regulators favour capital as a buffer against insolvency to promote the safety and soundness of the financial system. Basel Accord I and II focused on considering that banks across the world should be regulated by maintaining minimum 8% capital requirement. Perhaps, the increased attention on Basel capital requirement may help banks to reduce their risk. However, the findings in this study provide an insight that banks may reduce risk with bank capital but with the build-up of bank capital they tend to increase their risk level. Thus, it may not be possible to say that mandatory capital requirement have been effective tool in monitoring bank risk. It should be acknowledged that regulators should not consider “one size fits all” policy and thus should better design capital requirement which will help to mitigate bank runs and panics. Further, shareholders view the capital requirement different from the regulators. Shareholders seek an optimal mix of debt and equity in order to maximize the value of their common stock. Hence, given the regulatory requirement on capital adequacy and deposit insurance costs, bank shareholders need to consider the risk exposure of the bank.

In 1980s, rising losses on loans to less-developed and Eastern European economies, increased interest rate volatility and squeezed interest margins for on-balance sheet lending due to non-bank competition motivated large commercial banks particularly, in developed economies to involve in off-balance sheet activities. However, over the decades, increased financial innovation and securitization activities suggest that bank across the world can be termed as an “asset broker” rather than an “asset transformer”. This finding is observed for banks across the world and particularly in
Middle-East and Africa, North America and Western European regions. Thus, it is possible to state with hindsight that off-balance sheet activities increase risk and these activities are now an important source of fee income for many banks.

Earlier studies particularly based on US banks find that off-balance sheet activities reflect risk reducing attributes. However, this study provides evidence that banks across the regions show off-balance sheet activities increases bank risk exposure. This finding provides some comfort to the bank regulators. Indeed, expanded use of derivatives has resulted in an increase in the amount of regulation. For instance, the Basel requires incorporating off-balance sheet activities in the calculation of minimum capital requirement. Despite rules and regulations in place, huge losses have been observed over the past decade such as the Global Financial Crisis (2007-2008); collapse of the Long-term Capital Management in 1998 and Barings Bank in 1995.

Further, according to the Basel Accord II, under the market discipline criteria, the banks are required to increase their information disclosure particularly in relation to credit risk. Regulators encourage banks to issue long-term bonds which would improve the market discipline from the standpoint of creditor monitoring. The findings in this thesis shows that market discipline or uninsured deposits may not be justifiable to reduce risk. However, this result provides an understanding to the investors that subordinated debt may not be able to eliminate the agency problem and hence banks may engage in undertaking higher risk.

The empirical link between charter value and bank risk is examined in this study. This examination is partly motivated by changes in legislation and regulation in the banking industry and increase bank competition in the developed as well as emerging and
transition economies. Moreover, it is important for regulators and supervisors because greater supervisory requirement by the Basel Accord I and II may affect the impact of charter value on bank risk taking across the regions.

The findings identified in this study have implications for competition policy, moral hazard in banking, and bank safety and soundness. The results in this thesis have implications regarding the potential effect of deposit insurance on bank risk taking. It is apparent from the findings that the provision of insurance encourages banks to undertake excessive risk and thus lead to moral hazard problem. This is of importance to the regulators and policy makers as deposit insurance tends to be detrimental to overall bank stability.

Thus, an important policy implication is that regulators and supervisors may like to devote relatively more attention to bank equity risk compared to credit risk. This is important since the findings discussed in this thesis suggest that a number of factors identified by the equity market are risky.

Furthermore, policymakers should perhaps focus on gaining a better understanding of what European bank capabilities helped them to reduce equity market risk while adapting to a rapidly changing economic climate. From the point of view of EMU, the major policy implication of this analysis is perhaps one of unintended consequences. While there was little academic discussion concerning the impact of EMU on the banks, it appears that EMU has had a marked impact on European banks equity risk. Yet, the regulators/policymakers and investors can generate further evidence on German banking industry. Evidence suggests an increase in bank equity risk for the German banking industry. Germany is dominated by Sparkassen-Finanzgruppe which
includes savings and Landesbanken. This peculiarity of the German banking system is said to have limited bank consolidation, lowered market concentration, and facilitated continuing fragmentation in the market and may well explain the risk increases that is observed in this study.

7.5 LIMITATIONS

This study has several limitations. As discussed in Chapter 3, the sample selection may have been biased due to lack of information on merged or delisted banks during the sample period. Unfortunately, both Bureau Van Djik Bankscope and Datastream International remove such information after the banks have been acquired, failed or delisted. However, the survivorship bias may be of less importance for regulators as in the banking industry due to the special regulatory treatment afforded via recapitalization or reorganization when banks face difficulties (Boyd and Runkle 1993).

With regard to methodological issues, a more heuristic approach could have been undertaken in defining certain market discipline variables such as the subordinated debt yield spread. Bank risk could have been measured using the “Value at Risk”. Further, while a large set of factors have been incorporated in this thesis to account for bank equity risk and credit risk, some other bank specific and economic variables could still be excluded, such as individual bank efficiency, state bank versus other bank dummy and size measured using gross domestic product (GDP).

With respect to the world banking industry, the study could not incorporate some of the major banks from Middle East due to lack of market information in the Datastream International database. Nevertheless, study could not incorporate ownership variables
because of a lack of quantifiable ownership data. Moreover, due to lack of data, particularly in developing and transition economies, a finer measure of bank capital such as tier 1 or risk adjusted total capital requirement could not be used.

7.6 FUTURE RESEARCH DIRECTIONS

The results presented in this thesis suggest several avenues for future research on bank risk both in terms of sample and methodology. With respect to sample, the study can be extended to incorporate the unlisted banks around the world. For example, future research may seek to incorporate the difference in the factors affecting bank risk for listed and unlisted banks. Similarly, other financial companies such as insurance, thrift institutions and securities business could be included in the analysis. Moreover, as observed from the results reported in Chapter 5, based on the peculiarity in the German banking system, it would be interesting to tease out the reasons for the differences in bank equity risk particularly systematic risk for France and Germany. Further, given the GFC in 2007-2008, and the Western conventional banks (Barclays, Deutsche Bank, HSBC Plc, Lloyds TSB Plc and UBS among others) move into establishing a separate Islamic banking wing in their respective countries and overseas, it would be interesting compare the Western world banking system with the Islamic banking system.

The study could be extended to incorporate bank governance variables such as ownership variables including the percentage of insiders’ and outsiders’ ownership. Another avenue for future research is to further explore the possibility of non-linear relationship between bank capital and bank risk, and to delineate whether bank capital restrictions are essential for banks to avoid excessive risk. Scholars have argued that subordinated debt can substitute for bank capital (Herring 2004). Future research could
also provide new evidence on the market disciplinary effect of subordinated debt on bank risk. One extension to bank capital research could be to use a finer measure of bank capital such as risk-adjusted bank capital requirement (tier 1 or total capital) to delineate the impact of capital requirement on bank risk.

In terms of methodology, future research on the determinants of bank risk could be improved upon on several fronts. Future research could also be improved through the use of other measures of bank risk such as value at risk (VAR) and more detailed measures of off-balance sheet activities such as loan commitments, standby letters of credit and derivatives. Since a large fraction of variations in bank risk remains unexplained, future research may also seek to identify other factors that affect bank equity risk and credit risk. As mentioned in Section 7.5, the results for research question 1 (RQ1) in Chapter 4 and Chapter 6 may still be biased due to endogeneity. To that end, more sophisticated econometric methods such as dynamic panel techniques could be used to address in the future research.

One question for future research is whether the decline in bank equity risk (as discussed in Chapter 5) is due to bank portfolio diversification, increased equity holdings, changing income or the internationalization of the euro-zone banks as they take a more active part in the Eastern European markets. A further question is whether those banks with decreased risk weather the global financial crisis better than those banks with increased risk. In addition, it will be worthwhile to explore whether size and charter value is closely related to systematic risk.
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The Heritage Foundation. <http://heritage.org/index/>


Table A3.1
List of sample banks

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<td>Banco Santander Chile</td>
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<td>Fondo Comun CA Banco Universal</td>
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<td>USA</td>
<td>Banco Canarias de Venezuela CA</td>
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<td>Trustmark Corporation</td>
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<td>UCBH Holdings, Inc</td>
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<td>UMB Financial Corporation</td>
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<tr>
<td>Sterling Bancshares, Inc</td>
<td>USA</td>
<td></td>
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Table A4.1

Determinants of European bank equity risk and credit risk: excluding Danish banks

This table represents the pooled-OLS regression results for bank characteristics. Panel A represents the findings under the base model and Panel B reports the results under extended model. The following equations have been applied to generate the results.

\[
\text{RISK}_{i,j,t} = \alpha_t + \beta_1 \text{UD}_{i,j,t} + \beta_2 \text{CV}_{i,j,t} + \beta_3 \text{BC}_{i,j,t} + \beta_4 \text{OBS}_{i,j,t} + \beta_5 \text{LTA}_{i,j,t} + \beta_6 \text{Size}_{i,j,t} + \gamma \text{EFI}_{i,j,t} + \epsilon_{i,j,t}
\]

(1)

\[
\text{RISK}_{i,j,t} = \left[ \alpha_0 + \beta_1 \text{OPL}_{i,j,t} + \beta_2 \text{DY}_{i,j,t} + \beta_3 \text{UD}_{i,j,t} + \beta_4 \text{CV}_{i,j,t} + \beta_5 \text{BC}_{i,j,t} + \beta_6 \text{OBS}_{i,j,t} + \beta_7 \text{EFI}_{i,j,t} \right] + \delta_i \text{D}_{i,j} + \delta_s \text{D}_{s,j} + \sum \phi_i \text{Y}_{t,i,j} + \epsilon_{i,j,t}
\]

(2)

\text{EDI}_{i,j,t} presents the bank equity risks. The bank equity risks include systematic risk, idiosyncratic risk, interest rate risk and total risk for individual bank \(i\) in country \(j\) at period \(t\). All bank equity risks are measured using the two index market model. The estimation techniques are provided in equation (3) and equation (4) in chapter 3. The explanatory variables such as \(\text{UD}_{i,j,t}\) is the natural log of uninsured deposits for bank \(i\), in country \(j\) at period \(t\). \(\text{LTA}_{i,j,t}\) is the natural log of bank capital for bank \(i\), in country \(j\) in period \(t\). \(\text{BC}_{i,j,t}\) is the natural log of bank capital squared for bank \(i\), in country \(j\) in period \(t\). \(\text{OBS}_{i,j,t}\) is the natural log of charter value for bank \(i\), in country \(j\) in period \(t\). \(\text{EFI}_{i,j,t}\) is the economic freedom index for country \(j\) at period \(t\). \(\text{OPL}_{i,j,t}\) is the natural log of operating leverage for bank \(i\), in country \(j\) at period \(t\). \(\text{DY}_{i,j,t}\) = dividend yield for bank \(i\), in country \(j\) at period \(t\). \(\text{D}_{i,j}\) = bank specialization dummy where \(D_{i,j} = 1\) if commercial banks or otherwise 0; \(D_{s,j}\) = legal origin variable where \(D_{s,j} = 1\) if common-law countries, 2 if French civil law countries, 3 if German civil-law countries and 4 if Scandinavian civil law countries; \(D_{b,j}\) = shareholder rights index. Finally, \(\epsilon_{i,j,t}\) is the random error term. The joint F-test for the year dummies are statistically significant for all risk measures. All results are corrected for heteroscedasticity. The standard errors are reported in parenthesis. ***significant at 1% significance level, **significant at 5% significance level, *significant at 10% significance level. † the coefficients of the explanatory variables and standard errors are scaled by 100.

Panel A Determinants of bank risks (base model).

<table>
<thead>
<tr>
<th>Credit risk</th>
<th>Systematic risk</th>
<th>Total risk</th>
<th>Interest rate risk</th>
<th>Idiosyncratic risk</th>
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</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0.018***</td>
<td>0.648***</td>
<td>-4.992***</td>
<td>0.477***</td>
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<tr>
<td></td>
<td>(0.004)</td>
<td>(0.217)</td>
<td>(0.600)</td>
<td>(0.132)</td>
</tr>
<tr>
<td>Uninsured deposits</td>
<td>0.017†</td>
<td>-0.057**</td>
<td>0.052**</td>
<td>-0.023</td>
</tr>
<tr>
<td></td>
<td>(0.009)†</td>
<td>(0.029)</td>
<td>(0.026)</td>
<td>(0.020)</td>
</tr>
<tr>
<td>Charter Value</td>
<td>-0.005***</td>
<td>0.498**</td>
<td>2.121***</td>
<td>0.017</td>
</tr>
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<td></td>
<td>(0.002)</td>
<td>(0.255)</td>
<td>(0.585)</td>
<td>(0.206)</td>
</tr>
<tr>
<td>Bank capital</td>
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<td>-0.142**</td>
<td>-0.084</td>
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<tr>
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<td>(0.037)†</td>
<td>(0.060)</td>
<td>(0.139)</td>
<td>(0.034)</td>
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<tr>
<td>Bank capital²</td>
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<td>0.114***</td>
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<td>-0.024</td>
</tr>
<tr>
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<td>(0.006)†</td>
<td>(0.037)</td>
<td>(0.090)</td>
<td>(0.023)</td>
</tr>
<tr>
<td>Off-balance sheet items</td>
<td>0.015†***</td>
<td>0.055***</td>
<td>0.168***</td>
<td>0.004</td>
</tr>
<tr>
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<td>(0.006)†</td>
<td>(0.017)</td>
<td>(0.034)</td>
<td>(0.009)</td>
</tr>
<tr>
<td>Loan to total assets</td>
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<td>-0.781***</td>
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<td>(0.002)</td>
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<tr>
<td>Size</td>
<td>-0.011†***</td>
<td>0.162***</td>
<td>0.032**</td>
<td>-0.004</td>
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<tr>
<td></td>
<td>(0.005)†</td>
<td>(0.012)</td>
<td>(0.016)</td>
<td>(0.008)</td>
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<tr>
<td>Economic freedom index</td>
<td>0.009***</td>
<td>-0.011***</td>
<td>-0.041***</td>
<td>-0.006***</td>
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<td>(0.009)</td>
<td>(0.012)</td>
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### Panel B: Determinants of bank risk (extended model)

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<th>Credit risk</th>
<th>Systematic risk</th>
<th>Total risk</th>
<th>Interest rate risk</th>
<th>Idiosyncratic risk</th>
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</thead>
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<td>Intercept</td>
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<td>1.255***</td>
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<td>(0.353)</td>
<td>(0.745)</td>
<td>(0.179)</td>
<td>(0.722)</td>
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<td>Dividend Yield</td>
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<td>-0.020**</td>
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<tr>
<td>(0.051)†</td>
<td>(0.010)</td>
<td>(0.004)</td>
<td>(0.002)</td>
<td>(0.007)</td>
</tr>
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<td>Operating leverage</td>
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<td>0.022**</td>
<td>0.015**</td>
<td>-0.010**</td>
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<td>(0.011)</td>
<td>(0.007)</td>
<td>(0.005)</td>
<td>(0.002)</td>
</tr>
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<td>Uninsured deposits</td>
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<td>-0.035**</td>
<td>0.097**</td>
<td>-0.041**</td>
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<tr>
<td>(0.012)†</td>
<td>(0.016)</td>
<td>(0.045)</td>
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<td>(0.024)</td>
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<tr>
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<td>0.016**</td>
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<td>(0.008)</td>
<td>(0.035)</td>
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<td>(0.060)</td>
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<td>(0.073)</td>
<td>(0.015)</td>
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### Adj R²

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<td>0.20</td>
<td>F[24,630]=5</td>
<td>2.45</td>
<td>669</td>
</tr>
<tr>
<td>0.50</td>
<td>F[24,630]=22</td>
<td>10.45</td>
<td>669</td>
</tr>
<tr>
<td>0.40</td>
<td>F[24,630]=15</td>
<td>3.45</td>
<td>669</td>
</tr>
<tr>
<td>0.11</td>
<td>F[24,630]=5</td>
<td>2.20</td>
<td>669</td>
</tr>
<tr>
<td>0.35</td>
<td>F[24,630]=11</td>
<td>3.45</td>
<td>669</td>
</tr>
</tbody>
</table>

| Year dummy 1996-2005 | yes | yes | yes | yes | yes |
### Table A4.2
Determinants of European bank equity risk and credit risk: excluding German banks

This table represents the pooled-OLS regression results for bank characteristics. Panel A represents the findings under the base model and Panel B reports the results under extended model. The following equations have been applied to generate the results.

\[
RISK_{j,t} = \alpha_0 + \beta_1 UD_{i,j,t} + \beta_2 CV_{i,j,t} + \beta_3 BC_{i,j,t} + \beta_4 OBS_{i,j,t} + \beta_5 LTA_{i,j,t} + \beta_6 Size_{i,j,t} + \gamma EFI_{j,t} + \epsilon_{i,j,t}
\]

(1)

\[
RISK_{i,j,t} = \begin{bmatrix}
\alpha_0 + \beta_1 OPL_{i,j,t} + \beta_2 DY_{i,j,t} + \beta_3 UD_{i,j,t} + \beta_5 CV_{i,j,t} + \beta_6 BC_{i,j,t} + \beta_7 OBS_{i,j,t} + \\
\delta_1 D_{1,j} + \delta_2 D_{2,j} + \delta_3 D_{3,j} + \sum_{j} \phi_j Y_{j,i} + \epsilon_{i,j,t}
\end{bmatrix}
\]

(2)

\(RISK_{i,j,t}\) presents the bank equity risks. The bank equity risks include systematic risk, idiosyncratic risk, interest rate risk and total risk for individual bank \(i\) in country \(j\) at period \(t\). All bank equity risks are measured using the two index market model. The estimation techniques are provided in equation (3) and equation (4) in Chapter 3. The explanatory variables such as \(UD_{i,j,t}\) is the natural log of uninsured deposits for bank \(i\) in country \(j\) at period \(t\), \(CV_{i,j,t}\) is the natural log of charter value for bank \(i\), country \(j\) in period \(t\), \(BC_{i,j,t}\) is the natural log of bank capital for bank \(i\), in country \(j\) in period \(t\), \(OBS_{i,j,t}\) is the natural log of off-balance sheet activities for bank \(i\), in country \(j\) at period \(t\), \(LTA_{i,j,t}\) is the loan to total assets for bank \(i\), in country \(j\) at period \(t\), \(Size_{i,j,t}\) is the natural log of market value of equity for bank \(i\), in country \(j\), in period \(t\) and \(EFI_{j,t}\) is the economic freedom index for country \(j\) at period \(t\). \(OPL_{i,j,t}\) is the operating leverage for bank \(i\), country \(j\) at period \(t\). \(DY_{j,i} = \text{dividend yield for bank } i, \text{country } j \text{ at period } t; D_{1,j} = \text{bank specialization dummy where } D_{1,j} = 1 \text{ if commercial banks or otherwise } 0; D_{2,j} = \text{legal origin variable where } D_{2,j} = 1 \text{ if common-law countries, } 2 \text{ if French civil law countries, } 3 \text{ if German civil-law countries and } 4 \text{ if Scandinavian civil law countries; } D_{3,j} = \text{geographical dummy where } D_{3,j} = 1 \text{ if euro-zone countries or otherwise } 0; D_{4,j} = \text{creditor rights index and; } D_{5,j} = \text{shareholder rights index. Finally, } \epsilon_{i,j,t} \text{ is the random error term. The joint F-test for the year dummies are statistically significant for all risk measures. All results are corrected for heteroscedasticity. The standard errors are reported in parenthesis. ***significant at 1% significance level, **significant at 5% significance level, *significant at 10% significance level. † the coefficients of the explanatory variables and standard errors are scaled by 100.}

#### Panel A: Determinants of bank risks (base model)

<table>
<thead>
<tr>
<th>Credit risk</th>
<th>Systematic risk</th>
<th>Total risk</th>
<th>Interest rate risk</th>
<th>Idiosyncratic risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0.013***</td>
<td>0.714***</td>
<td>-5.002***</td>
<td>0.554***</td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.180)</td>
<td>(0.509)</td>
<td>(0.096)</td>
</tr>
<tr>
<td>Uninsured deposits</td>
<td>0.043***</td>
<td>-0.037***</td>
<td>0.032***</td>
<td>-0.001</td>
</tr>
<tr>
<td></td>
<td>(0.018)†</td>
<td>(0.011)</td>
<td>(0.016)</td>
<td>(0.008)</td>
</tr>
<tr>
<td>Charter value</td>
<td>-0.002**</td>
<td>0.111**</td>
<td>0.565***</td>
<td>0.060</td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
<td>(0.055)</td>
<td>(0.221)</td>
<td>(0.063)</td>
</tr>
<tr>
<td>Bank capital</td>
<td>-0.001**</td>
<td>-0.137**</td>
<td>-0.047</td>
<td>0.003</td>
</tr>
<tr>
<td></td>
<td>(0.045)†</td>
<td>(0.059)</td>
<td>(0.149)</td>
<td>(0.034)</td>
</tr>
<tr>
<td>Bank capital</td>
<td>0.025†**</td>
<td>0.070**</td>
<td>0.039</td>
<td>-0.002</td>
</tr>
<tr>
<td></td>
<td>(0.012)†</td>
<td>(0.029)</td>
<td>(0.072)</td>
<td>(0.016)</td>
</tr>
<tr>
<td>Off-balance sheet items</td>
<td>0.001***</td>
<td>0.036***</td>
<td>0.054***</td>
<td>-0.010*</td>
</tr>
<tr>
<td></td>
<td>(0.012)†</td>
<td>(0.011)</td>
<td>(0.027)</td>
<td>(0.006)</td>
</tr>
<tr>
<td>Loan to total assets</td>
<td>0.004***</td>
<td>-0.211***</td>
<td>-0.617***</td>
<td>-0.007</td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
<td>(0.063)</td>
<td>(0.189)</td>
<td>(0.038)</td>
</tr>
<tr>
<td>Size</td>
<td>-0.001***</td>
<td>0.137***</td>
<td>0.158***</td>
<td>0.007**</td>
</tr>
<tr>
<td></td>
<td>(0.000)†</td>
<td>(0.006)</td>
<td>(0.015)</td>
<td>(0.003)</td>
</tr>
<tr>
<td>Economic freedom index</td>
<td>0.007††</td>
<td>-0.014***</td>
<td>-0.043***</td>
<td>-0.006***</td>
</tr>
<tr>
<td></td>
<td>(0.003)†</td>
<td>(0.003)</td>
<td>(0.007)</td>
<td>(0.001)</td>
</tr>
</tbody>
</table>
### Panel B: Determinants of Bank Risks (Extended Model)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Credit Risk</th>
<th>Systematic Risk</th>
<th>Total Risk</th>
<th>Interest Rate Risk</th>
<th>Idiosyncratic Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0.024***</td>
<td>1.237***</td>
<td>-7.642***</td>
<td>0.275*</td>
<td>-7.877***</td>
</tr>
<tr>
<td>(0.003)</td>
<td>(0.243)</td>
<td>(0.692)</td>
<td>(0.143)</td>
<td>(0.678)</td>
<td></td>
</tr>
<tr>
<td>Operating leverage</td>
<td>0.001***</td>
<td>-0.040**</td>
<td>-0.075**</td>
<td>-0.008</td>
<td>-0.049*</td>
</tr>
<tr>
<td>(0.000)</td>
<td>(0.018)</td>
<td>(0.033)</td>
<td>(0.008)</td>
<td>(0.028)</td>
<td></td>
</tr>
<tr>
<td>Dividend yield</td>
<td>0.000**</td>
<td>0.018***</td>
<td>-0.009</td>
<td>-0.004</td>
<td>-0.019</td>
</tr>
<tr>
<td>(0.000)</td>
<td>(0.007)</td>
<td>(0.018)</td>
<td>(0.004)</td>
<td>(0.018)</td>
<td></td>
</tr>
<tr>
<td>Uninsured deposits</td>
<td>0.001***</td>
<td>-0.031***</td>
<td>-0.002</td>
<td>-0.004</td>
<td>0.042***</td>
</tr>
<tr>
<td>(0.000)</td>
<td>(0.011)</td>
<td>(0.036)</td>
<td>(0.007)</td>
<td>(0.021)</td>
<td></td>
</tr>
<tr>
<td>Charter Value</td>
<td>-0.002**</td>
<td>-0.088</td>
<td>-0.134</td>
<td>-0.004</td>
<td>-0.093</td>
</tr>
<tr>
<td>(0.001)</td>
<td>(0.096)</td>
<td>(0.247)</td>
<td>(0.068)</td>
<td>(0.226)</td>
<td></td>
</tr>
<tr>
<td>Bank capital</td>
<td>0.012†</td>
<td>-0.135**</td>
<td>-0.320***</td>
<td>-0.036</td>
<td>-0.325***</td>
</tr>
<tr>
<td>(0.042)</td>
<td>(0.067)</td>
<td>(0.160)</td>
<td>(0.035)</td>
<td>(0.169)</td>
<td></td>
</tr>
<tr>
<td>Bank capital²</td>
<td>0.017</td>
<td>0.066**</td>
<td>0.181***</td>
<td>0.019</td>
<td>0.193***</td>
</tr>
<tr>
<td>(0.021)</td>
<td>(0.033)</td>
<td>(0.079)</td>
<td>(0.017)</td>
<td>(0.083)</td>
<td></td>
</tr>
<tr>
<td>Off-balance sheet items</td>
<td>0.037***†</td>
<td>0.053***</td>
<td>0.178***</td>
<td>0.002</td>
<td>0.136***</td>
</tr>
<tr>
<td>(0.016)†</td>
<td>(0.012)</td>
<td>(0.033)</td>
<td>(0.006)</td>
<td>(0.032)</td>
<td></td>
</tr>
<tr>
<td>Loan to total assets</td>
<td>0.005***</td>
<td>-0.174***</td>
<td>-0.543***</td>
<td>-0.015</td>
<td>-0.367***</td>
</tr>
<tr>
<td>(0.001)</td>
<td>(0.066)</td>
<td>(0.203)</td>
<td>(0.039)</td>
<td>(0.194)</td>
<td></td>
</tr>
<tr>
<td>Size</td>
<td>-0.001***</td>
<td>0.116***</td>
<td>-0.079***</td>
<td>-0.001</td>
<td>-0.017**</td>
</tr>
<tr>
<td>(0.013)†</td>
<td>(0.007)</td>
<td>(0.017)</td>
<td>(0.004)</td>
<td>(0.008)</td>
<td></td>
</tr>
<tr>
<td>Economic Freedom index</td>
<td>0.014***</td>
<td>-0.012***</td>
<td>0.000</td>
<td>-0.002</td>
<td>0.004</td>
</tr>
<tr>
<td>(0.003)†</td>
<td>(0.003)</td>
<td>(0.008)</td>
<td>(0.002)</td>
<td>(0.008)</td>
<td></td>
</tr>
<tr>
<td>Ownership dummy (D₁)</td>
<td>0.001**</td>
<td>0.084***</td>
<td>0.022</td>
<td>-0.003</td>
<td>-0.053</td>
</tr>
<tr>
<td>(0.049)†</td>
<td>(0.034)</td>
<td>(0.086)</td>
<td>(0.017)</td>
<td>(0.082)</td>
<td></td>
</tr>
<tr>
<td>Legal Origin dummy(D₂)</td>
<td>-0.002**</td>
<td>-0.190***</td>
<td>-0.048</td>
<td>0.001</td>
<td>0.024</td>
</tr>
<tr>
<td>(0.022)†</td>
<td>(0.023)</td>
<td>(0.060)</td>
<td>(0.014)</td>
<td>(0.062)</td>
<td></td>
</tr>
<tr>
<td>Geographical dummy (D₃)</td>
<td>-0.003***</td>
<td>-0.192***</td>
<td>0.630***</td>
<td>0.079***</td>
<td>0.726***</td>
</tr>
<tr>
<td>(0.001)</td>
<td>(0.048)</td>
<td>(0.149)</td>
<td>(0.030)</td>
<td>(0.146)</td>
<td></td>
</tr>
<tr>
<td>Creditor rights index (D₄)</td>
<td>0.001***</td>
<td>0.027</td>
<td>-0.154***</td>
<td>-0.007</td>
<td>-0.141***</td>
</tr>
<tr>
<td>(0.019)†</td>
<td>(0.018)</td>
<td>(0.049)</td>
<td>(0.010)</td>
<td>(0.048)</td>
<td></td>
</tr>
<tr>
<td>Anti-director rights index (D₅)</td>
<td>-0.001***</td>
<td>-0.023</td>
<td>0.153***</td>
<td>0.027***</td>
<td>0.162***</td>
</tr>
<tr>
<td>(0.019)†</td>
<td>(0.015)</td>
<td>(0.039)</td>
<td>(0.008)</td>
<td>(0.037)</td>
<td></td>
</tr>
<tr>
<td>Year dummy 1996-2005</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
</tbody>
</table>

### Adj R² Model Test

<table>
<thead>
<tr>
<th>Year dummy 1996-2005</th>
<th>yes</th>
<th>yes</th>
<th>yes</th>
<th>yes</th>
<th>yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adj R²</td>
<td>0.24</td>
<td>0.55</td>
<td>0.35</td>
<td>0.11</td>
<td>0.30</td>
</tr>
<tr>
<td>Joint F-test for year dummies</td>
<td>2.21</td>
<td>12.12</td>
<td>4.96</td>
<td>2.00</td>
<td>4.21</td>
</tr>
<tr>
<td>Number of obs.</td>
<td>989</td>
<td>989</td>
<td>989</td>
<td>989</td>
<td>989</td>
</tr>
</tbody>
</table>
Table A4.3

Proportional risk measures

This table represents the pooled-OLS regression results for bank characteristics. Panel A represents the findings under the base model and Panel B reports the results under extended model. The following equations have been applied to generate the results.

\[
RISK_{ij,t} = \alpha_{ij} + \beta_1 UD_{i,j,t} + \beta_2 CV_{i,j,t} + \beta_3 BC_{i,j,t} + \beta_4 OPL_{i,j,t} + \beta_5 LTA_{i,j,t} + \beta_6 Size_{i,j,t} + \gamma_t EFi_{j,t} + \epsilon_{i,j,t}
\]

(1)

\[
RISK_{i,j,t} = \begin{bmatrix}
\alpha_{ij} + \beta_1 UD_{i,j,t} + \beta_2 CV_{i,j,t} + \beta_3 BC_{i,j,t} + \beta_4 OPL_{i,j,t} + \beta_5 LTA_{i,j,t} + \beta_6 Size_{i,j,t} + \gamma_t EFi_{j,t} + \delta_1 D_{1j} + \delta_2 D_{2j} + \delta_3 D_{3j} + \\
\delta_4 D_{4j} + \delta_5 D_{5j} + \sum \phi Y_{i,j,t} + \epsilon_{i,j,t}
\end{bmatrix}
\]

(2)

\( RISK_{i,j,t} \) presents the bank equity risks. The bank equity risks include systematic risk, idiosyncratic risk, interest rate risk and total risk for individual bank \( i \) in country \( j \) at period \( t \). All bank equity risks are measured using the two index market model. The estimation techniques are provided in equation (11) and equation (12) in Chapter 4. The explanatory variables such as \( UD_{i,j,t} \), \( CV_{i,j,t} \) is the natural log of uninsured deposits for bank \( i \), in country \( j \) at period \( t \). \( BC_{i,j,t} \) is the natural log of bank capital for bank \( i \), in country \( j \) in period \( t \). \( OBS_{i,j,t} \) is the natural log of bank capital squared for bank \( i \), in country \( j \) in period \( t \). \( OPL_{i,j,t} \) is the natural log of off-balance sheet activities for bank \( i \), in country \( j \) at period \( t \). \( LTA_{i,j,t} \) is the loan to total assets for bank \( i \), in country \( j \) at period \( t \). \( Size_{i,j,t} \) is the natural log of market value of equity for bank \( i \), in country \( j \) in period \( t \). \( EFi_{j,t} \) is the economic freedom index for country \( j \) at period \( t \). \( D_{1j} \) is bank specialization dummy where \( D_{1j} = 1 \) if commercial banks or otherwise 0; \( D_{2j} \) is legal origin variable where \( D_{2j} = 1 \) if common-law countries, 2 if French civil law countries, 3 if German civil-law countries and 4 if Scandinavian civil law countries; \( D_{3j} \) is geographical dummy where \( D_{3j} = 1 \) if euro-zone countries or otherwise 0; \( D_{4j} \) is creditor rights index and; \( D_{5j} \) is shareholder rights index. Finally, \( \epsilon_{i,j,t} \) is the random error term. The joint F-test for the year dummies are statistically significant for all risk measures. All results are corrected for heteroscedasticity. The standard errors are reported in parenthesis. ***significant at 1% significance level, **significant at 5% significance level, *significant at 10% significance level. † the coefficients of the explanatory variables and standard errors are scaled by 100.

Panel A Determinants of bank risks when systematic risk, idiosyncratic risk and interest rate risk is a proportion of total risk. (base model)

<table>
<thead>
<tr>
<th></th>
<th>Systematic risk</th>
<th>Idiosyncratic risk</th>
<th>Interest rate risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-0.129***</td>
<td>1.055***</td>
<td>-0.064***</td>
</tr>
<tr>
<td></td>
<td>(0.038)</td>
<td>(0.026)</td>
<td>(0.022)</td>
</tr>
<tr>
<td>Uninsured deposits</td>
<td>-0.009***</td>
<td>0.011***</td>
<td>0.003</td>
</tr>
<tr>
<td></td>
<td>(0.002)</td>
<td>(0.002)</td>
<td>(0.002)</td>
</tr>
<tr>
<td>Charter value</td>
<td>0.120***</td>
<td>0.127***</td>
<td>-0.053</td>
</tr>
<tr>
<td></td>
<td>(0.037)</td>
<td>(0.010)</td>
<td>(0.034)</td>
</tr>
<tr>
<td>Bank capital</td>
<td>-0.019**</td>
<td>0.001†</td>
<td>0.004</td>
</tr>
<tr>
<td></td>
<td>(0.009)</td>
<td>(0.005)</td>
<td>(0.006)</td>
</tr>
<tr>
<td>Bank capital squared</td>
<td>0.014**</td>
<td>0.003</td>
<td>0.006</td>
</tr>
<tr>
<td></td>
<td>(0.006)</td>
<td>(0.002)</td>
<td>(0.004)</td>
</tr>
<tr>
<td>Off-balance sheet activities</td>
<td>0.011***</td>
<td>0.008***</td>
<td>-0.020†</td>
</tr>
<tr>
<td></td>
<td>(0.002)</td>
<td>(0.010)</td>
<td>(0.001)</td>
</tr>
<tr>
<td>Loan to total assets</td>
<td>0.039***</td>
<td>-0.062***</td>
<td>0.020†</td>
</tr>
<tr>
<td></td>
<td>(0.013)</td>
<td>(0.001)</td>
<td>(0.008)</td>
</tr>
<tr>
<td>Size</td>
<td>0.024***</td>
<td>-0.018***</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>(0.002)</td>
<td>(0.000)</td>
<td>(0.001)</td>
</tr>
<tr>
<td>Economic freedom index</td>
<td>Systematic risk</td>
<td>Idiosyncratic risk</td>
<td>Interest rate risk</td>
</tr>
<tr>
<td>------------------------</td>
<td>----------------</td>
<td>-------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td></td>
<td>-0.002***</td>
<td>-0.001***</td>
<td>-0.001***</td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
<td>(0.020)†</td>
<td>(0.030)†</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Adj R²</th>
<th>Model test</th>
<th>NOBS</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.55</td>
<td>F[17,1017]=56.82</td>
<td>1029</td>
</tr>
<tr>
<td>0.53</td>
<td>F[17,1017]=56.42</td>
<td>1029</td>
</tr>
<tr>
<td>0.07</td>
<td>F[17,1017]=4.89</td>
<td>1029</td>
</tr>
</tbody>
</table>

Panel B Determinants of bank risks when systematic risk, idiosyncratic risk and interest rate risk is a proportion of total risk. (extended model)

<table>
<thead>
<tr>
<th></th>
<th>Systematic risk</th>
<th>Idiosyncratic risk</th>
<th>Interest rate risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-0.184***</td>
<td>1.065***</td>
<td>-0.023</td>
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<td>(0.010)†</td>
<td>(0.010)†</td>
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Table A5.1
Commercial banks in euro-zone countries
Average individual bank equity risk are reported for euro-zone countries. Pre-EMU period along with the change in systematic risk, idiosyncratic risk and total risk that occurred with EMU are reported in Panel A, Panel B and Panel C respectively. Total risk is defined: \( \sigma_{it}^2 = \frac{1}{N} \sum_{i=1}^{N} (R_{it} - \bar{R})^2 \) where \( \sigma_{it}^2 \) is the variance of the return for bank i, \( R_{it} \) return of bank i and \( \bar{R} \) average bank i return. Idiosyncratic risk is defined as \( \sigma_{it}^2 = \sigma_{it}^2 - \beta_{it}^2 \sigma_{it}^2 \) where \( \sigma_{it}^2 \) is the total risk for bank i. \( \sigma_{it}^2 \) bank return idiosyncratic risk and \( \beta_{it}^2 \sigma_{it}^2 \) reflects the impact of systematic risk. The standard market model is used to measure systematic risk: \( R_{it} = \alpha_{it} + \beta_{it} R_{mt} + \epsilon_{it} \) where, \( R_{it} \) is the return on security i at time period t, \( R_{mt} \) is the return on an equity market index at time period t. The systematic risk estimate for each bank or portfolio of banks is \( \beta_{it} \) (systematic risk) and \( \epsilon_{it} \) is a random shock term. The market model is extended by introducing a dummy variable to capture the structural changes in systematic risk. The dummy variable (D) takes on a value of zero (0) for the months of January 1995 to December 1998 and a value of one (1) from January 1999 to April 2006. \( R_{it} = \alpha_{it} + (\alpha_{it}-\alpha_{pre})D_{pre} + \beta_{it} R_{mt} + (\beta_{it}-\beta_{pre})R_{mt}D_{pre} + \epsilon_{it} \); *** significant at 1% significance level,** significant at 5% significance level,* significant at 10% significance level.

Panell A Estimation of systematic risk

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<th>Pre-EMU Average ( \beta )</th>
<th>Average changes in ( \beta )</th>
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<th>N**</th>
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Panel B Estimation of idiosyncratic risk

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Panel C Estimation of total risk

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<td>10</td>
<td>33</td>
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Table A5.2
Equity market index choice and equity pricing model

This table reports the findings using Fama-French three factor model. The alternative method to measure the risk is the Fama-French three factor model (1993) which is as follows:

\[ r_i = \alpha_i + \beta_i (R_m - R_f) + \gamma_i (SMB) - \epsilon_i \]

Where \( r_i \) is the return on the individual security; \( \alpha_i \) is the return on the individual security for size factor; \( \beta_i \) is the return on the individual security for book to market factor; \( \gamma_i \) is the return on security \( i \), return on market index and return on risk free asset respectively. N is the number of banks with a decrease in total risk. N* is the total number of banks with a statistically significant decrease in risk.

*** significant at 1% significance level. ** significant at 5% significance level.* significant at 10% significance level.

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<th>Changes in HML (avg.)</th>
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<th>Pre SMB (avg.)</th>
<th>Changes in SMB (avg.)</th>
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<th>N*</th>
<th>Pre-excess return (avg.)</th>
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<td>-</td>
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Table A5.3

Effects using different events
This table presents the impact of events such as: EMU January 1999, Asian Crisis July 1997-July 1998, Russian ruble crisis August 1998 and Internet bubble December 1999 to April 2000. The following model is used to estimate the impact of these events on bank risk.
\[ r_t = \alpha_0 + \alpha_1 D_{EU} + \alpha_2 D_{Asia} + \alpha_3 D_{Rub} + \alpha_4 D_{Int} + \beta_1 R_{AS} + \beta_2 R_{RU} D_{EU} + \epsilon \]

where \( D_{EU} = 0 \) pre Euro period January 1995 - December 1998 and \( D_{Europe} = 1 \) post Euro January 1999 –April 2006.,
\( D_{Asia} = 1 \) Asian Crisis period July 1997 to July 1998 and \( D_{Asia} = 0 \) otherwise, \( D_{Rub} = 1 \) Russian Ruble crisis August 1998 to September 1998 and \( D_{Rub} = 0 \) otherwise, \( D_{Int} = 1 \) internet bubble period December 1999 to April 2000 and \( D_{Int} = 0 \) otherwise. Panel A, Panel B and Panel C presents the effects of different events using country index, world index and Europe index respectively.*Significant at 10% significance level,** Significant at 5% significance level,***Significant at 1% significance level.

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Panel C: Impact of EMU, Asian crisis, Russian ruble crisis and internet bubble on bank equity return using Europe index

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<th>Russian crisis</th>
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<th>Internet bubble</th>
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<th>Avg. changes in systematic risk</th>
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*Significant at the 1% level.
**Significant at the 5% level.
***Significant at the 10% level.
### Table A5.4
#### Estimates of systematic risk and total risk of FTSE world bank indices

This table reports the average systematic risk ($\beta$) for the full sample period and the pre euro period and changes in systematic risk using the world index and the Europe index respectively after the introduction of euro. The standard market model is used to measure the systematic risk: $R_s = \alpha + \beta \cdot R_m + \varepsilon$, where, $R_s$ is the return of individual security at time period $t$, $R_m$ is the return on an index at time period $t$. The systematic risk estimate of each bank or portfolio of banks is captured by $\beta$ (systematic risk) and $\varepsilon$ is a random shock term. The market model in equation (1) is extended by introducing a dummy variable to capture the structural changes in systematic risk. The dummy variable takes on a value of zero (0) for the month of January 1995 to December 1998 and a value of one (1) from January 1999 to April 2006. $R_s = \alpha + \beta \cdot (R_m + D \cdot \varepsilon)$, where, $D = 0$ pre Euro period January 1995 - December 1998 and $D = 1$ post Euro January 1999 –April 2006. The following model is applied on individual bank return to estimate the total risk.

$$ \sigma_i^2 = \frac{1}{N} \sum_{t} (R_s - \bar{R})^2 $$

where, $\sigma_i^2$ is the variance of the return for bank i, $\bar{R}$ average return of bank i.*Significant at 10% significance level.** Significant at 5% significance level.***Significant at 1% significance level.

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<th>t-stat</th>
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<th>t-stat</th>
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Table A5.5

Banks versus non-bank risk individual country analysis using Europe index

The change in country bank equity risk and non-bank equity risk are reported for both the euro-zone and the non-euro-
zone countries. Pre-EMU period along with the change in total risk, idiosyncratic risk and systematic risk that occurred
with EMU are reported in Panel A, Panel B and Panel C respectively. Total risk is defined:
\[ \sigma^2_R = \frac{1}{N} \sum_{i=1}^{N} (R_i - \bar{R})^2 \]
where \( \sigma^2_R \) is the variance of the return for bank i, \( R_i \) return of bank i and \( \bar{R} \) is average bank i return. Idiosyncratic risk is
defined as \( \sigma^2_{\epsilon} = \sigma^2 - \beta^2 \sigma^2_{\sigma^{2}} \) where \( \sigma^2_{\epsilon} \) is the total risk for bank i, \( \sigma^2 \) bank return idiosyncratic risk and \( \beta^2 \sigma^2_{\sigma^{2}} \) reflects the impact of systematic risk. The standard market model is used to measure systematic
risk: \( R_i = \alpha + \beta \epsilon_i + \epsilon_i \) (see equation (4)) where, \( \epsilon_i \) is the return on security i at time period t, \( \epsilon_i \) the return on an equity market index at time period t. The systematic risk estimate for each bank or portfolio of banks is \( \beta \) (systematic risk) and \( \epsilon_i \) is a random shock term. The market model is extended by introducing a dummy variable to
capture the structural changes in systematic risk. The dummy variable (D) takes on a value of zero (0) for the months of
January 1995 to December 1998 and a value of one (1) from January 1999 to April 2006. \( R_i = \alpha + (\alpha_{pre} - \alpha_{post})D + \beta_{pre} \epsilon_i + (\beta_{pre} - \beta_{post}) \epsilon_i + \epsilon_i \) *** significant at 1% significance level, ** significant at 5% significance level.

Panel A: Estimation of total risk

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Panel B: Estimation of idiosyncratic risk

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Panel C: Estimation of systematic risk

Changes in $\beta$ and t-stats for both the non-banking and banking sectors for the Euro zone countries and the non-euro zone countries.
### Table A5.6
Banks versus non-financial sector risk – Europe wide analysis

The table presents the Europe wide analysis of the change in country bank equity risk and non-bank equity risk. Pre-EMU period along with the change in total risk, idiosyncratic risk and systematic risk that occurred with EMU are reported in Panel A, Panel B and Panel C respectively. Total risk is defined: \( \sigma^2_{it} = \frac{1}{N} \sum_{t=1}^{N} (R_i - \bar{R})^2 \) where \( \sigma^2_{it} \) is the variance of the return for bank i, \( R_i \) return of bank i and \( \bar{R} \) average bank i return. Idiosyncratic risk is defined as \( \sigma^2_{id} = \sigma^2_{i} - \beta^2 \sigma^2_{mt} \) where \( \sigma^2_{i} \) is the total risk for bank i, \( \sigma^2_{mt} \) bank return idiosyncratic risk and \( \beta^2 \sigma^2_{mt} \) reflects the impact of systematic risk. The standard market model is used to measure systematic risk: 

\[
R_i = \alpha_i + \beta_i R_m + \varepsilon_i
\]

(see equation (4)) where, \( R_i \) is the return on security i at time period t, \( R_m \) is the return on an equity market index at time period t. The systematic risk estimate for each bank or portfolio of banks is \( \beta_i \) (systematic risk) and \( \varepsilon_i \) is a random shock term. The market model is extended by introducing a dummy variable to capture the structural changes in systematic risk. The dummy variable (D) takes on a value of zero (0) for the months of January 1995 to December 1998 and a value of one (1) from January 1999 to April 2006. 

\[
R_i = \alpha_{pre} + (\alpha_{post} - \alpha_{pre})D + \beta_{pre} R_m + (\beta_{post} - \beta_{pre})R_m D + \varepsilon_i
\]

*** significant at 1% significance level, ** significant at 5% significance level.

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<th>Systematic risk</th>
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<td>0.0032</td>
<td>-0.007</td>
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Table A5.7

Bank equity risk excluding Italian savings banks

This table reports results of tests for change in bank equity total and idiosyncratic risk. The average of individual bank total risk estimates for pre EMU and post EMU periods for each country are reported in Panel A along with counts of the number of statistically significant individual bank total risk estimate changes. F tests is used to estimate the change in variance. Similar results are reported in Panel B for individual bank idiosyncratic risk estimates. N is the total number of banks that are included in risk calculations for the country. N* is the number of banks with a decrease in total risk. N** is the total number of banks with a statistically significant decrease in risk. N+ is the number of banks with an increase in total risk and N++ is the number of banks with a statistically significant increase in total risk at the 5% level of significance. Total risk is defined: 

\[ \sigma^2_t = \frac{1}{N} \sum_{n=1}^{N} (R_i - \bar{R})^2 \]

where \( \sigma^2_t \) is the variance of the return for bank i, \( R_i \) return of bank i and \( \bar{R} \) average bank i return. Idiosyncratic risk is defined as 

\[ \sigma^2_{id} = \sigma^2_t - \beta^2 \sigma^2_{sys} \]

where \( \sigma^2_{id} \) is the total risk for bank i, \( \sigma^2_t \) bank return idiosyncratic risk and \( \beta^2 \sigma^2_{sys} \) reflects the impact of systematic risk. Panel C presents the average individual bank systematic risk estimates (\( \beta \)) are reported by country for both the euro-zone and the non euro-zone countries. The \( \beta \) estimates are reported for total sample period and pre-EMU period along with the change in systematic risk that occurred with EMU in Panel A. These estimates are calculated using country equity market indices for individual banks. Panel D presents the estimates of equity risk for equally weighted (equal wgt.) and market value weighted (MV wgt.) portfolios. + Statistically significant at the 10% level of significance, * statistically significant at the 5% level of significance.

**Panel A  Estimates of total risk for individual banks using country index**

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<th>N*</th>
<th>N**</th>
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<td>Total</td>
<td></td>
<td></td>
<td>91</td>
<td>64</td>
<td>47</td>
<td>23</td>
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**Panel B  Estimates of idiosyncratic risk for individual banks using country index**

<table>
<thead>
<tr>
<th></th>
<th>Pre EMU (avg.)</th>
<th>Post EMU (avg.)</th>
<th>N</th>
<th>N*</th>
<th>N**</th>
<th>N+</th>
<th>N++</th>
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</thead>
<tbody>
<tr>
<td>Austria</td>
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<td>0.001</td>
<td>5</td>
<td>5</td>
<td>2</td>
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<td>0</td>
</tr>
<tr>
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<td>0.003</td>
<td>3</td>
<td>2</td>
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<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Finland</td>
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<td>0.032</td>
<td>6</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>0</td>
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<tr>
<td>France</td>
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<td>5</td>
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<td>9</td>
<td>7</td>
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<td>3</td>
<td>4</td>
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<td>2</td>
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<td>14</td>
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### Panel C Estimates of systematic risk for individual banks using country index

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<tr>
<th>Country</th>
<th>Full period Average $\beta$</th>
<th>Pre-EMU period Average $\beta$</th>
<th>Average changes in $\beta$</th>
<th>$N$</th>
<th>$N^*$</th>
<th>$N^{**}$</th>
<th>$N^+$</th>
<th>$N^{++}$</th>
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<td>0.94</td>
<td>1.01</td>
<td>-0.11</td>
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<td>1</td>
<td>2</td>
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<td>Greece</td>
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<td>0.99</td>
<td>0.22</td>
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<td>Italy</td>
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<td>Netherlands</td>
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<td>Spain</td>
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<tr>
<td><strong>Total listed bank shares</strong></td>
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<td><strong>60</strong></td>
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### Panel D Excluding Italian bank portfolios

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<th></th>
<th>Total risk</th>
<th>Idiosyncratic risk</th>
<th>Systematic risk</th>
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<tr>
<td></td>
<td>Pre EMU</td>
<td>Post EMU</td>
<td>Difference F test</td>
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<tr>
<td>EW wgt.</td>
<td>0.006</td>
<td>0.003</td>
<td>-0.003</td>
</tr>
<tr>
<td>MV wgt.</td>
<td>0.009</td>
<td>0.005</td>
<td>-0.004</td>
</tr>
</tbody>
</table>
Determinants of bank risk-Asia-Pacific region

The table represents the cross-country results for the determinants of bank equity risk and credit risk. Panel A through to Panel E reports the results. The standard market model is used to measure systematic risk: \( R_{ijt} = \alpha_i + \beta_t R_{mt} + \epsilon_{ijt} \), where \( R_{ijt} \) is the return on security \( i \) at time period \( t \), \( R_{mt} \) is the return on an equity market index at time period \( t \). The systematic risk estimate for each bank is \( \beta_t \) (systematic risk) and \( \epsilon_{ijt} \) is a random shock term. The table presents the pooled-OLS regression, pooled-OLS regression with lagged value of bank capital and lagged value of bank charter value and two-stage least squares (2SLS) regression results to estimate the model of bank risk.

\[
RISK_{ijt} = \left[ \alpha_0 + \beta_1 UD_{ij,t-1} + \beta_2 CV_{ij,t-1} + \beta_3 BC_{ij,t-1} + \beta_4 OBS_{ij,t-1} + \beta_5 LTA_{ij,t-1} + \beta_6 Size_{ij,t-1} + \right. \\
+ \sum_i \phi_i Y_{ij,t} + \epsilon_{ij,t-1}
\]

The explanatory variables such as \( UD_{ij,t} \) is the natural log of uninsured deposits for bank \( i \) in country \( j \) at period \( t \), \( CV_{ij,t} \) is the natural log of charter value for bank \( i \), country \( j \) in period \( t \), \( BC_{ij,t} \) is the natural log of bank capital squared for bank \( i \), in country \( j \) in period \( t \), \( OBS_{ij,t} \) is the natural log of off-balance sheet activities for bank \( i \), in country \( j \) at period \( t \), \( LTA_{ij,t} \) is the loan to total assets for bank \( i \), in country \( j \) at period \( t \), \( Size_{ij,t} \) is the natural log of market value of equity for bank \( i \), in country \( j \), in period \( t \) and \( \phi_i \) is the economic freedom index for country \( j \) at period \( t \). \( D_{ij} \) = bank specialization dummy where \( D_{ij}=1 \) if commercial banks or otherwise 0; \( D_{ij} \) = legal origin variable where \( D_{ij}=1 \) if common-law countries, 2 if French civil law countries, 3 if German civil-law countries and 4 if Scandinavian civil law countries; \( BNC_{ij} \) = Bank concentration for country \( j \) at period \( t \); \( NIM_{ij} \) = Net interest margin for country \( j \) at period \( t \); \( STurn_{ij} \) = Stock market turnover ratio for country \( j \) at period \( t \); \( DIN_{ij} \) = explicit deposit insurance dummy =1, otherwise=0; \( MB_{ij} \) = market based country dummy =1, otherwise=0; \( HI_{ij} \) = High income country dummy =1, otherwise=0; Finally, \( \epsilon_{ij,t} \) is the random error term. The joint F-test for the year dummies are statistically significant for all risk measures. All results are corrected for heteroscedasticity. The standard errors are reported in parenthesis. Superscripts *, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively. † indicates the coefficients of the explanatory variables and standard errors are scaled by 100.

### Table A6.1

### Determinants of Systematic Risk

The table represents the cross-country results for the determinants of bank equity risk and credit risk. Panel A through to Panel E reports the results. The standard market model is used to measure systematic risk: \( R_{ijt} = \alpha_i + \beta_t R_{mt} + \epsilon_{ijt} \), where \( R_{ijt} \) is the return on security \( i \) at time period \( t \), \( R_{mt} \) is the return on an equity market index at time period \( t \). The systematic risk estimate for each bank is \( \beta_t \) (systematic risk) and \( \epsilon_{ijt} \) is a random shock term. The table presents the pooled-OLS regression, pooled-OLS regression with lagged value of bank capital and lagged value of bank charter value and two-stage least squares (2SLS) regression results to estimate the model of bank risk.

\[
RISK_{ijt} = \left[ \alpha_0 + \beta_1 UD_{ij,t-1} + \beta_2 CV_{ij,t-1} + \beta_3 BC_{ij,t-1} + \beta_4 OBS_{ij,t-1} + \beta_5 LTA_{ij,t-1} + \beta_6 Size_{ij,t-1} + \right. \\
+ \sum_i \phi_i Y_{ij,t} + \epsilon_{ij,t-1}
\]

The explanatory variables such as \( UD_{ij,t} \) is the natural log of uninsured deposits for bank \( i \), country \( j \) at period \( t \), \( CV_{ij,t} \) is the natural log of charter value for bank \( i \), country \( j \) in period \( t \), \( BC_{ij,t} \) is the natural log of bank capital squared for bank \( i \), in country \( j \) in period \( t \), \( OBS_{ij,t} \) is the natural log of off-balance sheet activities for bank \( i \), in country \( j \) at period \( t \), \( LTA_{ij,t} \) is the loan to total assets for bank \( i \), in country \( j \) at period \( t \), \( Size_{ij,t} \) is the natural log of market value of equity for bank \( i \), in country \( j \), in period \( t \) and \( \phi_i \) is the economic freedom index for country \( j \) at period \( t \). \( D_{ij} \) = bank specialization dummy where \( D_{ij}=1 \) if commercial banks or otherwise 0; \( D_{ij} \) = legal origin variable where \( D_{ij}=1 \) if common-law countries, 2 if French civil law countries, 3 if German civil-law countries and 4 if Scandinavian civil law countries; \( BNC_{ij} \) = Bank concentration for country \( j \) at period \( t \); \( NIM_{ij} \) = Net interest margin for country \( j \) at period \( t \); \( STurn_{ij} \) = Stock market turnover ratio for country \( j \) at period \( t \); \( DIN_{ij} \) = explicit deposit insurance dummy =1, otherwise=0; \( MB_{ij} \) = market based country dummy =1, otherwise=0; \( HI_{ij} \) = High income country dummy =1, otherwise=0; Finally, \( \epsilon_{ij,t} \) is the random error term. The joint F-test for the year dummies are statistically significant for all risk measures. All results are corrected for heteroscedasticity. The standard errors are reported in parenthesis. Superscripts *, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively. † indicates the coefficients of the explanatory variables and standard errors are scaled by 100.

### Panel A Determinants of Systematic Risk

<table>
<thead>
<tr>
<th>Variable</th>
<th>Intercept (Pooled-OLS)</th>
<th>Intercept (Pooled with lag)</th>
<th>Intercept (2SLS)</th>
</tr>
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<tbody>
<tr>
<td>Loan to total assets</td>
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<td>-0.255***</td>
<td>-0.326***</td>
</tr>
<tr>
<td></td>
<td>(0.09)</td>
<td>(0.14)</td>
<td>(0.15)</td>
</tr>
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<td>Size</td>
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<td>0.053***</td>
<td>0.054***</td>
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<tr>
<td></td>
<td>(0.009)</td>
<td>(0.008)</td>
<td>(0.008)</td>
</tr>
<tr>
<td>Market discipline</td>
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<td>0.038***</td>
<td>0.037***</td>
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<td>(0.017)</td>
<td>(0.017)</td>
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<td>(0.474)</td>
<td>(1.763)</td>
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<td>-0.020</td>
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<td>(0.023)</td>
<td>(0.023)</td>
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<tr>
<td>Bank capital</td>
<td>-0.014</td>
<td>-0.036</td>
<td>-0.043</td>
</tr>
<tr>
<td></td>
<td>(0.064)</td>
<td>(0.257)</td>
<td>(0.244)</td>
</tr>
<tr>
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<td>-</td>
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</tr>
<tr>
<td></td>
<td>-0.009</td>
<td>-0.008</td>
<td>-</td>
</tr>
<tr>
<td>Bank capital squared</td>
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<td>-0.008</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>-0.009</td>
<td>-0.008</td>
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<tr>
<td>Interceptor</td>
<td>-1.161</td>
<td>-0.174</td>
<td>-0.043</td>
</tr>
<tr>
<td></td>
<td>(0.219)</td>
<td>(0.262)</td>
<td>(0.390)</td>
</tr>
<tr>
<td>Bank capital</td>
<td>-0.014</td>
<td>-0.036</td>
<td>-0.043</td>
</tr>
<tr>
<td></td>
<td>(0.064)</td>
<td>(0.257)</td>
<td>(0.244)</td>
</tr>
<tr>
<td>Bank capital squared</td>
<td>-</td>
<td>-0.008</td>
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<td>Bank capital squared</td>
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<td>-0.009</td>
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<tr>
<td>Interceptor</td>
<td>-1.161</td>
<td>-0.174</td>
<td>-0.043</td>
</tr>
<tr>
<td></td>
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<td>(0.390)</td>
</tr>
<tr>
<td>Bank capital</td>
<td>-0.014</td>
<td>-0.036</td>
<td>-0.043</td>
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<td>(0.064)</td>
<td>(0.257)</td>
<td>(0.244)</td>
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<tr>
<td>Bank capital squared</td>
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<td>-0.009</td>
<td>-0.008</td>
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<tr>
<td>Interceptor</td>
<td>-1.161</td>
<td>-0.174</td>
<td>-0.043</td>
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<tr>
<td></td>
<td>(0.219)</td>
<td>(0.262)</td>
<td>(0.390)</td>
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<td>0.123</td>
<td>0.128</td>
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<td>0.119***</td>
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<td>(0.020)</td>
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<td>0.004</td>
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<td>(0.003)</td>
<td>(0.003)</td>
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<td>0.142***</td>
<td>0.147***</td>
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<tr>
<td></td>
<td>(0.054)</td>
<td>(0.054)</td>
<td>(0.052)</td>
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<td>0.500***</td>
<td>0.506***</td>
</tr>
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<td>(0.035)</td>
<td>(0.034)</td>
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<td>-0.187***</td>
<td>-0.145***</td>
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<tr>
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<td>(0.062)</td>
<td>(0.064)</td>
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<td>0.029</td>
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<td>(0.072)</td>
<td>(0.067)</td>
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<td>F(25,183)=38</td>
<td>F(25,1740)=39</td>
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<td>-</td>
<td>-</td>
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<tr>
<td>Durbin-Wu-Hausman test</td>
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<td>-</td>
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</tr>
<tr>
<td>NOBS</td>
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<td>1857</td>
<td>1766</td>
</tr>
</tbody>
</table>

**Panel B Determinants of Idiosyncratic Risk**

|          | (0.227)  | (0.284)  | (0.225)  | (0.308)  | (0.256)  | (0.521)  |
| Bank capital | -0.248*** | 0.125  | -0.313*** | 0.314  | -0.411*** | 2.115*** |
| Bank capital squared | (0.063) | (0.286) | (0.063) | (0.391) | (0.083) | (0.837) |
| Charter value | -0.079 | -0.109 | 0.247 | 0.257 | 1.511 | 1.352 |
| Off balance sheet items | 0.042* | 0.043* | 0.040* | 0.040* | 0.048* | |
| Market discipline | -0.019 | -0.020 | -0.023 | -0.024 | -0.026 | -0.030* |
| Size | 0.012 | 0.013 | 0.006 | 0.008 | 0.000 | 0.009 |
| Loan to total assets | -0.226* | -0.208 | -0.239* | -0.211 | -0.286 | -0.136 |
| Bank concentration | 0.201* | 0.198 | 0.133 | 0.127 | 0.152 | 0.139 |
| Net interest margin | 7.704*** | 7.456*** | 8.536*** | 8.142*** | 9.129*** | 7.954*** |
| Stock market turnover | 0.090*** | 0.090*** | 0.074*** | 0.076*** | 0.083*** | 0.091*** |
| Deposit insurance dummy | 0.107** | 0.107*** | 0.099*** | 0.101* | 0.139 | 0.142 |

316
<table>
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<tr>
<th>Economic freedom index</th>
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Panel C Determinants of Total Risk

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| R-squared              | 0.32     | 0.33     | 0.34     | 0.34     | 0.32     | 0.30    |
| Model test             | F(25,1830)=52 | F(26,1829)=50 | F(25,1739)=56 | F(26,1738)=54 | F(25,1729)=50 | F(26,1728)=46 |
| Joint F-test for year dummies | - | - | - | 4*** | 9*** | 15*** |
| Wu-Hausman F test      | -        | -        | -        | -        | 3***     | 5***    |
| Durbin-Wu-Hausman Chi² test | -        | -        | -        | -        |          |         |
| NOBS                   | 1856     | 1856     | 1765     | 1765     | 1755     | 1755    |
Panel D Determinants of Credit Risk (LLP)

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### Panel E Credit Risk (LLR)

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**R-squared**
- Pooled-OLS: 0.27
- Pooled with lag: 0.29
- 2SLS: 0.27

**Model test**
- Joint F-test for year dummies:
  - F(25,1859)=28
  - F(26,1858)=28
  - F(25,1690)=25
  - F(26,1689)=25
  - F(25,1679)=23
  - F(26,1678)=23

**Test of Endogeneity**
- Wu-Hausman F test:
  - λ²(10)=112
  - λ²(10)=112
  - λ²(10)=112
  - λ²(10)=112
  - λ²(10)=112
  - λ²(10)=112

- Durbin-Wu-Hausman Chi² test:
  - 319
  - 319
  - 319
  - 319
  - 319
  - 319

- NOBS:
  - 1885
  - 1885
  - 1716
  - 1716
  - 1705
  - 1705

---

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Table A6.2
Determinants of bank risk-Eastern European countries

The table represents the cross-country results for the determinants of bank equity risk and credit risk. Panel A through to Panel E reports the results. The standard market model is used to measure systematic risk: \( R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it} \) where, \( R_i \) is the return on security \( i \) at time period \( t \), \( R_m \) is the return on an equity market index at time period \( t \). The systematic risk estimate for each bank is \( \beta_i \) (systematic risk) and \( \varepsilon_{it} \) is a random shock term. The table presents the pooled-OLS regression, pooled-OLS regression with lagged value of bank capital and lagged value of bank charter value and two-stage least squares (2SLS) regression results to estimate the model of bank risk.

\[
RISK_{it} = \left[ \alpha_i + \beta_i UD_{i,t} + \beta_i CV_{i,t} + \beta_i BC_{i,t} + \beta_i OBS_{i,t} + \beta_i LTA_{i,t} + \beta_i Size_{i,t} + \sum \phi_i Y_{t} + \varepsilon_{i,t} \right]
\]

(1)

The explanatory variables such as \( UD_{i,t} \) is the natural log of uninsured deposits for bank \( i \), in country \( j \) at period \( t \), \( CV_{i,t} \) is the natural log of charter value for bank \( i \), country \( j \) in period \( t \), \( BC_{i,t} \) is the natural log of bank capital for bank \( i \), in country \( j \) in period \( t \), \( OBS_{i,t} \) is the natural log of off-balance sheet activities for bank \( i \), in country \( j \) at period \( t \), \( LTA_{i,t} \) is the loan to total assets for bank \( i \), in country \( j \) at period \( t \), \( Size_{i,t} \) is the natural log of market value of equity for bank \( i \), in country \( j \), in period \( t \) and \( EFI_{i,t} \) is the economic freedom index for country \( j \) at period \( t \). \( D_{i,t} = \text{bank specialization dummy where} D_{i,t}=1 \text{ if commercial banks or otherwise} 0 \); \( D_{i,t} = \text{legal origin variable where} D_{i,t}=1 \text{ if common-law countries,} 2 \text{ if French civil law countries,} 3 \text{ if German civil-law countries and} 4 \text{ if Scandinavian civil law countries}; \( BNC_{i,t} = \) Bank concentration for country \( j \) at period \( t \); \( NIM_{i,t} = \text{Net interest margin for country} \ j \ at period \ t \); \( STurn_{i,t} = \text{Stock market turnover ratio for country} \ j \ at period \ t \); \( DIN_{i,t} = \text{explicit deposit insurance dummy =1, otherwise=0}; \( MB_{i,t} = \text{market based country dummy =1, otherwise=0}; \( HI_{i,t} = \text{High income country dummy =1, otherwise=0}; \text{Finally,} \varepsilon_{it} \text{ is the random error term. The joint F-test for the year dummies are statistically significant for all risk measures. All results are corrected for heteroscedasticity. The standard errors are reported in parenthesis. Superscripts *, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively. † indicates the coefficients of the explanatory variables and standard errors are scaled by 100.}

<table>
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<tr>
<th>Pooled-OLS</th>
<th>Pooled with lag</th>
<th>2SLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-0.698 (0.868)</td>
<td>-0.589 (1.492)</td>
</tr>
<tr>
<td>Bank capital</td>
<td>-0.079 (0.223)</td>
<td>0.178 (2.302)</td>
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</tr>
<tr>
<td>Charter value</td>
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<td>-0.077 (1.086)</td>
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<tr>
<td>Off balance sheet items</td>
<td>-0.035 (0.036)</td>
<td>-0.035 (0.036)</td>
</tr>
<tr>
<td>Market discipline</td>
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<td>-0.032 (0.099)</td>
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<td>0.018 (0.024)</td>
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<td>Loan to total assets</td>
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<td>-0.088 (0.010)</td>
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<td>Panel B Determinants of Idiosyncratic risk</td>
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<td>Pooled with lag</td>
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</tr>
<tr>
<td>Intercept</td>
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<td>(0.023)</td>
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<td>(2.801)</td>
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<td>(0.221)</td>
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<td>(0.008)</td>
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### Panel C: Determinants of Total Risk

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<td><strong>Intercept</strong></td>
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<td>-1.300*</td>
<td>-5.071**</td>
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<td>- (2.462)</td>
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<td><strong>Charter value</strong></td>
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<td>0.105</td>
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<td>(0.075)</td>
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<td>(0.025)</td>
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<td>(0.275)</td>
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<td>0.864*</td>
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<tr>
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<td>(0.237)</td>
<td>(0.247)</td>
<td>(0.279)</td>
</tr>
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<td>-0.005</td>
<td>-0.002</td>
<td>-0.009</td>
</tr>
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<td>(0.008)</td>
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<td>-0.060</td>
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<td>(0.192)</td>
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### Panel D: Determinants of Credit Risk – Loan Loss Provision

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</tr>
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<td>-3.357***</td>
<td>-4.660***</td>
</tr>
<tr>
<td></td>
<td>(0.963)</td>
<td>(1.003)</td>
<td>(1.105)</td>
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<tr>
<td><strong>Bank capital</strong></td>
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<td>-0.666**</td>
<td>-1.154***</td>
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<tr>
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<td>(0.388)</td>
<td>(0.312)</td>
<td>(0.384)</td>
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<td>Variable</td>
<td>Intercept</td>
<td>Pooled-OLS</td>
<td>Pooled with lag</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>-----------</td>
<td>------------</td>
<td>----------------</td>
</tr>
<tr>
<td><strong>Bank capital squared</strong></td>
<td>-2.113**</td>
<td>0.410</td>
<td>-3.382</td>
</tr>
<tr>
<td>Charter value</td>
<td>0.129</td>
<td>2.344**</td>
<td>2.255**</td>
</tr>
<tr>
<td>Off balance sheet items</td>
<td>0.037</td>
<td>0.045</td>
<td>0.036</td>
</tr>
<tr>
<td>Market discipline</td>
<td>-0.052</td>
<td>-0.003</td>
<td>-0.002</td>
</tr>
<tr>
<td>Size</td>
<td>0.059**</td>
<td>0.045</td>
<td>0.049</td>
</tr>
<tr>
<td>Loan to total assets</td>
<td>1.109***</td>
<td>1.260***</td>
<td>1.277***</td>
</tr>
<tr>
<td>Bank capital squared</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Charter value</td>
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<td>0.771</td>
<td>0.763</td>
</tr>
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<td>Off balance sheet items</td>
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<td>-2.137</td>
<td>-1.816</td>
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<td>Market based dummy</td>
<td>0.216</td>
<td>0.254</td>
<td>0.254</td>
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<tr>
<td>Commercial bank dummy</td>
<td>-0.596***</td>
<td>-0.691**</td>
<td>-0.712**</td>
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<tr>
<td>High income economy dummy</td>
<td>-0.311</td>
<td>-0.283</td>
<td>-0.308</td>
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<tr>
<td>R-squared</td>
<td>0.48</td>
<td>0.52</td>
<td>0.52</td>
</tr>
<tr>
<td>Model test</td>
<td>F(23,103)=5.66</td>
<td>F(24,102)=5.5</td>
<td>F(23,88)=6.5</td>
</tr>
<tr>
<td>Joint F-test for year dummies</td>
<td>F(10,103)=3.33</td>
<td>F(10,102)=3.32</td>
<td>F(10,88)=3.02</td>
</tr>
<tr>
<td>Wu-Hausman F test</td>
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<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Durbin-Wu-HausmanCh1 test</td>
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<td>-</td>
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</tr>
<tr>
<td>NOBS</td>
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<td>112</td>
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**Panel E Determinants of Credit risk-loan loss reserve**

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<tr>
<th>Variable</th>
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<th>Pooled-OLS</th>
<th>Pooled with lag</th>
<th>2SLS</th>
<th>2SLS with lag</th>
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<tbody>
<tr>
<td><strong>Bank capital squared</strong></td>
<td>-2.113**</td>
<td>0.410</td>
<td>-3.382</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Charter value</td>
<td>0.129</td>
<td>2.344**</td>
<td>2.255**</td>
<td>4.080**</td>
<td>4.457***</td>
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<td>0.028</td>
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<td>1.109***</td>
<td>1.260***</td>
<td>1.277***</td>
<td>1.258***</td>
<td>1.386***</td>
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<td></td>
</tr>
<tr>
<td>Charter value</td>
<td>0.586</td>
<td>0.771</td>
<td>0.763</td>
<td>1.024*</td>
<td>0.970*</td>
</tr>
<tr>
<td>Off balance sheet items</td>
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<td>-0.691**</td>
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<td>-0.641**</td>
<td>-0.733***</td>
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<td>R-squared</td>
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<td>0.52</td>
<td>0.52</td>
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<td>F(23,103)=5.66</td>
<td>F(24,102)=5.5</td>
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<td>Joint F-test for year dummies</td>
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<td>F(10,102)=3.32</td>
<td>F(10,88)=3.02</td>
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<td>11.723***</td>
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<td>Year 2</td>
<td>Year 3</td>
<td>Year 4</td>
<td>Year 5</td>
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<td>--------</td>
<td>--------</td>
<td>--------</td>
<td>--------</td>
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</tr>
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<td>Stock market turnover</td>
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<td>-1.160***</td>
<td>-1.091**</td>
<td>-0.998*</td>
<td>-1.253**</td>
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<td>-0.022</td>
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<td>-0.026</td>
<td>-0.033**</td>
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<td>-0.539</td>
<td>-0.374</td>
</tr>
<tr>
<td>Commercial bank dummy</td>
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<td>-0.078</td>
<td>0.222</td>
<td>0.116</td>
<td>0.236</td>
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<tr>
<td>High income economy dummy</td>
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<td>0.925*</td>
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<td>0.484</td>
<td>0.550</td>
<td>0.555</td>
<td>0.577</td>
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**Test of Endogeneity:**

- **Wu-Hausman F test**
  - F(23,94)=1.7
  - F(23,93)=5.9
- **Durbin-Wu-Hausman Chi² test**
  - λ²(10)=5.32
  - λ²(10)=6.48

**Model test**

- Joint F-test for year dummies
  - F(10,109)=0.65
  - F(10,108)=0.66
  - F(10,94)=0.50
  - F(10,93)=0.56
- NOBS                             | 133    | 133    | 118    | 118    | 118    | 118    |

**Note:** The values in the table represent the coefficients of various economic indicators over different years.
### Table A6.3

#### Determinants of bank risk-Middle-East and Africa

The table represents the cross-country results for the determinants of bank equity risk and credit risk. Panel A through Panel E reports the results. The standard market model is used to measure systematic risk: \( R_{it} = \alpha_{it} + \beta_{it} R_{mt} + \epsilon_{it} \)
where, \( R_{mt} \) is the return on security \( i \) at time period \( t \), \( R_{it} \) is the return on an equity market index at time period \( t \). The systematic risk estimate for each bank is \( \beta \) (systematic risk) and \( \epsilon_{it} \) is a random shock term. The table presents the pooled-OLS regression, pooled-OLS regression with lagged value of bank capital and lagged value of bank charter value and two-stage least squares (2SLS) regression results to estimate the model of bank risk.

\[
RISK_{it} = \alpha_{it} + \beta_{UD} D_{1jt} + \beta_{CV} CV_{1jt} + \beta_{BC} BC_{1jt} + \beta_{OBS} OBS_{1jt} + \beta_{LTA} LTA_{1jt} + \beta_{Size} Size_{1jt} + \gamma_{EFI} EFI_{1jt} + \delta_{D1} D_{1jt} + \delta_{D2} D_{2jt} + \gamma_{NIM} NIM_{1jt} + \gamma_{BNC} BNC_{1jt} + \gamma_{STurn} STurn_{1jt} + \delta_{IN} IN_{1jt} + \delta_{MB} MB_{1jt} + \delta_{LO} LO_{1jt} + \delta_{HI} HI_{1jt} + \sum \phi_{Y_{1jt}} + \epsilon_{i,j,t}
\]

The explanatory variables such as \( UD_{1jt} \) is the natural log of uninsured deposits for bank \( i \), in country \( j \) at period \( t \), \( CV_{1jt} \) is the natural log of charter value for bank \( i \), country \( j \) in period \( t \), \( B_{1jt} \) is the natural log of bank capital for bank \( i \), in country \( j \) in period \( t \), \( OBS_{1jt} \) is the natural log of bank capital squared for bank \( i \), in country \( j \) in period \( t \), \( D_{1jt} \) is the loan to total assets for bank \( i \), in country \( j \) at period \( t \), \( Size_{1jt} \) is the natural log of market value of equity for bank \( i \), in country \( j \), in period \( t \) and \( EFI_{1jt} \) is the economic freedom index for country \( j \) at period \( t \). \( D_{1jt} \) = bank specialization dummy where \( D_{1jt} = 1 \) if commercial banks or otherwise =0; \( D_{2jt} \) = legal origin variable where \( D_{2jt} = 1 \) if common-law countries, 2 if French civil law countries, 3 if German civil-law countries and 4 if Scandinavian civil law countries; \( BNC_{1jt} \) = Bank concentration for country \( j \) at period \( t \); \( NIM_{1jt} \) = Net interest margin for country \( j \) at period \( t \); \( STurn_{1jt} \) = Stock market turnover ratio for country \( j \) at period \( t \); \( LTA_{1jt} \) = explicit deposit insurance dummy =1, otherwise=0; \( MB_{1jt} \) = market based country dummy =1, otherwise=0; \( HI_{1jt} \) = High income country dummy =1, otherwise=0; Finally, \( \epsilon_{i,j,t} \) is the random error term. The joint F-test for the year dummies are statistically significant for all risk measures. All results are corrected for heteroscedasticity. The standard errors are reported in parenthesis. Superscripts *, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively. † indicates the coefficients of the explanatory variables and standard errors are scaled by 100.

#### Panel A Determinants of Systematic risk

<table>
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<td>Intercept</td>
<td>-0.105</td>
<td>-0.874</td>
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<tr>
<td>(0.635)</td>
<td>(1.013)</td>
<td>(0.634)</td>
<td>(1.082)</td>
</tr>
<tr>
<td>Bank capital</td>
<td>-0.317**</td>
<td>-1.730</td>
<td>-0.533***</td>
</tr>
<tr>
<td>(0.160)</td>
<td>(1.524)</td>
<td>(0.221)</td>
<td>(1.698)</td>
</tr>
<tr>
<td>Bank capital squared</td>
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<td>-0.118</td>
<td>-</td>
</tr>
<tr>
<td>(0.708)</td>
<td>(0.825)</td>
<td>-</td>
<td>(1.369)</td>
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<td>Charter value</td>
<td>-1.883**</td>
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<td>-1.975**</td>
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<td>(0.955)</td>
<td>(0.990)</td>
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<td>Off balance sheet items</td>
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<td>0.180**</td>
<td>0.197**</td>
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<tr>
<td>(0.091)</td>
<td>(0.090)</td>
<td>(0.093)</td>
<td>(0.093)</td>
</tr>
<tr>
<td>Market discipline</td>
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<td>-0.106**</td>
<td>-0.112**</td>
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<tr>
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<td>(0.049)</td>
<td>(0.056)</td>
<td>(0.055)</td>
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### Panel B: Determinants of Total Risk

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<td>(5.513)</td>
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<td>-5.138**</td>
<td>-2.492</td>
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<td>(2.314)</td>
<td>(2.489)</td>
<td>(3.056)</td>
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<td>(1.092)</td>
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<td>(0.255)</td>
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<td>(0.574)</td>
<td>(0.618)</td>
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<td>-1.714</td>
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<tr>
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<td>(1.316)</td>
<td>(1.285)</td>
<td>(1.309)</td>
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<td>Net interest margin</td>
<td>-9.973**</td>
<td>-8.008</td>
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<tr>
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<td>(4.451)</td>
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<td>(0.026)</td>
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**R-squared**

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<tr>
<td>Durbin-Wu-Hausman Chi² test</td>
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<td>222</td>
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<tr>
<td>NOBS</td>
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### Panel C Determinants of Idiosyncratic risk

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<td>2.862**</td>
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<td>(1.392)</td>
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<td>12.050***</td>
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<td>(0.550)</td>
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<td>-5.561***</td>
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<td>(2.289)</td>
<td>(2.482)</td>
<td>(2.992)</td>
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<td>-2.860***</td>
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<td>(0.936)</td>
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<td>(0.247)</td>
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<td>(0.090)</td>
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<td>(0.573)</td>
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<td>(1.318)</td>
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<td>(1.278)</td>
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<td>(4.407)</td>
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<td>1.536***</td>
<td>0.688</td>
</tr>
<tr>
<td></td>
<td>(0.561)</td>
<td>(0.548)</td>
<td>(0.689)</td>
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<td>(0.020)</td>
<td>(0.020)</td>
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<td>1.236*</td>
<td>1.141</td>
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<td></td>
<td>(0.731)</td>
<td>(0.723)</td>
<td>(0.823)</td>
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<td>-0.507</td>
<td>-0.489</td>
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<td></td>
<td>(0.334)</td>
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<td>(0.364)</td>
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<td>High income economy dummy</td>
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<td>-0.564</td>
<td>-0.261</td>
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<td>0.39</td>
<td>0.35</td>
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<td>(0.35)</td>
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<td>Joint F-test for year dummies</td>
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### Panel D Determinants of Credit risk (LLP)

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<td>(0.985)</td>
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<td>(1.557)</td>
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<td>0.289**</td>
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<td>(0.183)</td>
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<td>-0.028***</td>
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<td>R-squared</td>
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<td>Joint F-test for year dummies</td>
<td>F(23,162)=6</td>
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<td>F(10,162)=10</td>
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<td>Durbin-Wu-HausmanChi² test</td>
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### Panel E Determinants of Credit risk (LLR)

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<td>(0.665)</td>
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<td>(0.229)</td>
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<td>(1.010)</td>
<td>(1.091)</td>
<td>(1.651)</td>
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<td>Charter value</td>
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<td>(1.615)</td>
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<td>(0.080)</td>
<td>(0.083)</td>
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328
<table>
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<th>0.183**</th>
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<td>F(23,172)=12</td>
<td>F(24,171)=12</td>
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Table A6.4
Determinants of bank risk—North America

The table represents the cross-country results for the determinants of bank equity risk and credit risk. Panel A through to Panel E reports the results. The standard market model is used to measure systematic risk: \( R_{it} = \alpha + \beta R_{mt} + \varepsilon_{it} \), where, \( R_{it} \) is the return on security \( i \) at time period \( t \). \( R_{mt} \) is the return on an equity market index at time period \( t \). The systematic risk estimate for each bank is \( \beta \) (systematic risk) and \( \varepsilon_{it} \) is a random shock term. The table presents the pooled-OLS regression, pooled-OLS regression with lagged value of bank capital and lagged value of bank charter value and two-stage least squares (2SLS) regression results to estimate the model of bank risk.

\[
\text{RISK}_{it} = \left[ \alpha + \beta UD_{ij,t} + \beta CV_{ij,t} + \beta BC_{ij,t} + \beta OBS_{ij,t} + \beta LTA_{ij,t} + \beta \text{Size}_{ij,t} + \gamma \right. \\
\left. + \sum \phi \gamma_{ij,t} + \varepsilon_{ij,t} \right]
\]

(1)

The explanatory variables such as \( UD_{ij,t} \) is the natural log of uninsured deposits for bank \( i \), in country \( j \) at period \( t \), \( CV_{ij,t} \) is the natural log of charter value for bank \( i \), in country \( j \) in period \( t \), \( BC_{ij,t} \) is the natural log of bank capital for bank \( i \), in country \( j \) in period \( t \), \( OBS_{ij,t} \) is the natural log of off-balance sheet activities for bank \( i \), in country \( j \) at period \( t \), \( LTA_{ij,t} \) is the loan to total assets for bank \( i \), in country \( j \) at period \( t \), \( \text{Size}_{ij,t} \) is the natural log of market value of equity for bank \( i \), in country \( j \), in period \( t \) and \( EFI_{ij,t} \) is the economic freedom index for country \( j \) at period \( t \). \( D_{ij} = \) bank specialization dummy where \( D_{ij}=1 \) if commercial banks or otherwise 0; \( D_{ij} = \) legal origin variable where \( D_{ij}=2 \) if French civil law countries, 3 if German civil-law countries and 4 if Scandinavian civil law countries; \( BNC_{ij} = \) Bank concentration for country \( j \) at period \( t \); \( NIM_{ij} = \) Net interest margin for country \( j \) at period \( t \); \( STurn_{ij} = \) Stock market turnover ratio for country \( j \) at period \( t \); \( DIN_{ij} = \) explicit deposit insurance dummy =1, otherwise=0; \( MB_{ij} = \) market based country dummy =1, otherwise=0; \( HI_{ij} = \) High income country dummy =1, otherwise=0; Finally, \( \varepsilon_{ij,t} \) is the random error term. The joint F-test for the year dummies are statistically significant for all risk measures. All results are corrected for heteroscedasticity. The standard errors are reported in parenthesis. Superscripts *, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively. † indicates the coefficients of the explanatory variables and standard errors are scaled by 100.

**Panel A Determinants of Systematic risk**

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<td>-4.212</td>
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<td>(2.796)</td>
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<td>(1.924)</td>
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<td>-0.094</td>
<td>-</td>
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<td>(0.471)</td>
<td>(0.488)</td>
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<td>0.020***</td>
<td>0.019***</td>
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<td>-0.299*</td>
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<td>(0.009)</td>
<td>(0.009)</td>
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<td>Pooled-OLS</td>
<td>Pooled with lag</td>
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<td>------------</td>
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<td>------</td>
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<td>0.182</td>
<td>0.178</td>
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<td>(0.125)</td>
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<td>(0.036)</td>
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### Panel C: Determinants of Idiosyncratic Risk

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<td>-0.031</td>
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<td>0.021</td>
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<td>-0.065***</td>
<td>-0.067***</td>
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### Panel D: Determinants of Credit Risk (LLP)

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**Notes:**
- **F-values** for the Joint F-test for year dummies and the Wu-Hausman F test.
- **R-squared** values for the models.
- **NOBS** refers to the number of observations.
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Panel E Determinants of Credit risk (LLR)

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Table A6.5
Determinants of bank risk-South America

The table represents the cross-country results for the determinants of bank equity risk and credit risk. Panel A through to Panel E reports the results. The standard market model is used to measure systematic risk: \( R_{it} = \alpha_i + \beta_i R_{mt} + \epsilon_{it} \) where, \( R_{it} \) is the return on security \( i \) at time period \( t \), \( R_{mt} \) is the return on an equity market index at time period \( t \). The systematic risk estimate for each bank is \( \beta_i \) (systematic risk) and \( \epsilon_{it} \) is a random shock term. The table presents the pooled-OLS regression, pooled-OLS regression with lagged value of bank capital and lagged value of bank charter value and two-stage least squares (2SLS) regression results to estimate the model of bank risk.

\[
\text{RISK}_{it} = \left[ \alpha_i + \beta_i UD_{ij,t} + \beta_i CV_{ij,t} + \beta_i BC_{ij,t} + \beta_i OBS_{ij,t} + \beta_i LTA_{ij,t} + \beta_i Size_{ij,t} + \gamma_i EFI_{ij,t} + \delta_i D_{1,j} + \delta_i D_{2,j} + \gamma_i NIM_{ij,t} + \gamma_i BNC_{ij,t} + \gamma_i STurn_{ij,t} + \delta_i DIN_{ij,t} + \delta_i MB_{ij,t} + \delta_i HI_{ij,t} \right] + \sum \phi_i Y_{ij,t} + \epsilon_{ij,t}
\]

The explanatory variables such as \( UD_{ij,t} \) is the natural log of uninsured deposits for bank \( i \), in country \( j \) at period \( t \), \( CV_{ij,t} \) is the natural log of charter value for bank \( i \), country \( j \) in period \( t \), \( BC_{ij,t} \) is the natural log of bank capital for bank \( i \), in country \( j \) in period \( t \), \( OBS_{ij,t} \) is the natural log of off-balance sheet activities for bank \( i \), in country \( j \) at period \( t \), \( LTA_{ij,t} \) is the loan to total assets for bank \( i \), in country \( j \) at period \( t \), \( Size_{ij,t} \) is the natural log of market value of equity for bank \( i \), in country \( j \), in period \( t \) and \( EFI_{ij,t} \) is the economic freedom index for country \( j \) at period \( t \). \( D_{1,j} = \) bank specialization dummy where \( D_{1,j} = 1 \) if commercial banks or otherwise 0; \( D_{2,j} = \) legal origin variable where \( D_{2,j} = 1 \) if common-law countries, 2 if French civil law countries, 3 if German civil-law countries and 4 if Scandinavian civil law countries; \( BNC_{ij,t} = \) Bank concentration for country \( j \) at period \( t \); \( NIM_{ij,t} = \) Net interest margin for country \( j \) at period \( t \); \( STurn_{ij,t} = \) Stock market turnover ratio for country \( j \) at period \( t \); \( DIN_{ij,t} = \) explicit deposit insurance dummy =1, otherwise=0; \( MB_{ij,t} = \) market based country dummy =1, otherwise=0; \( HI_{ij,t} = \) High income country dummy =1, otherwise=0; Finally, \( \epsilon_{ij,t} \) is the random error term. The joint F-test for the year dummies are statistically significant for all risk measures. All results are corrected for heteroscedasticity. The standard errors are reported in parenthesis. Superscripts *, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively. † indicates the coefficients of the explanatory variables and standard errors are scaled by 100.

### Panel A Determinants of Systematic risk

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### Panel C Determinants of Total risk

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<td>(0.595)</td>
<td>(0.599)</td>
<td>(0.575)</td>
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<td>5.392**</td>
<td>3.580**</td>
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<tr>
<td></td>
<td>(2.220)</td>
<td>(2.339)</td>
<td>(1.790)</td>
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<td>0.913</td>
<td>0.931</td>
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<tr>
<td></td>
<td>(0.614)</td>
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<td>0.031+</td>
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<td>(0.253)</td>
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### Panel D Determinants of Credit risk (LLP)

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<tr>
<td></td>
<td>(0.258)</td>
<td>(1.197)</td>
<td>(0.238)</td>
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<tr>
<td>Bank capital squared</td>
<td>-</td>
<td>-0.151</td>
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<td></td>
<td>-</td>
<td>(0.599)</td>
<td>-</td>
</tr>
<tr>
<td>Charter value</td>
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<td>1.137</td>
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**Note:** NOBS refers to the number of observations.
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<td>(0.590)</td>
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<td>(0.670)</td>
<td>(0.613)</td>
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<td>-0.131***</td>
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<td>(0.169)</td>
<td>(0.176)</td>
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<td>(0.182)</td>
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<td></td>
<td>(0.180)</td>
<td>(0.224)</td>
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<td>Net interest margin</td>
<td>2.201***</td>
<td>2.167***</td>
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<td>(0.739)</td>
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<td>(0.665)</td>
<td>(0.679)</td>
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<td>Stock market turnover</td>
<td>0.596***</td>
<td>0.591**</td>
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<tr>
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<td>(0.137)</td>
<td>(0.140)</td>
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<tr>
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<td>(0.159)</td>
<td>(0.164)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.172)</td>
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<td>0.006***</td>
<td>0.006***</td>
<td>0.004</td>
</tr>
<tr>
<td>------------------------</td>
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<td>(0.003)</td>
<td>(0.003)</td>
<td>(0.003)</td>
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<td>-0.176***</td>
<td>-0.204***</td>
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<td>(0.055)</td>
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<td>Commercial bank dummy</td>
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<td>(0.057)</td>
<td>(0.056)</td>
<td>(0.071)</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.53</td>
<td>0.53</td>
<td>0.49</td>
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<td>F(22,220)=14</td>
<td>F(23,219)=14</td>
<td>F(22,187)=10</td>
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<td>Joint F-test for year dummies</td>
<td>F(10,220)=7.69</td>
<td>F(10,219)=7.29</td>
<td>F(10,187)=6.68</td>
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<td>Test of Endogeneity</td>
<td>Wu-Hausman F test</td>
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<td>Durbin-Wu-HausmanChi(^2) test</td>
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<td>NOBS</td>
<td>243</td>
<td>243</td>
<td>210</td>
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**Determinants of bank risk–Western Europe**

The table represents the cross-country results for the determinants of bank equity risk and credit risk. Panel A through Panel E reports the results. The standard market model is used to measure systematic risk: \( R_{it} = \alpha_y + \beta_y R_{om} + \varepsilon_y \) where, \( R_{it} \) is the return on security \( i \) at time period \( t \), \( R_{om} \) is the return on an equity market index at time period \( t \). The systematic risk estimate for each bank is \( \beta_y \) (systematic risk) and \( \varepsilon_y \) is a random shock term. The table presents the pooled-OLS regression, pooled-OLS regression with lagged value of bank capital and lagged value of bank charter value and two-stage least squares (2SLS) regression results to estimate the model of bank risk.

\[
\text{RISK}_{ijt} = \alpha_0 + \beta_1 UD_{ij,t} + \beta_2 CV_{ij,t} + \beta_3 BC_{ij,t} + \beta_4 OBS_{ij,t} + \beta_5 LTA_{ij,t} + \beta_6 SIC_{ij,t} + \beta_7 H1_{ij,t} + \gamma_1 EFI_{ij,t} + \delta_1 D1_{ij,t} + \delta_2 D2_{ij,t} + \gamma_2 NIM_{ij,t} + \gamma_3 BNC_{ij,t} + \gamma_4 STurn_{ij,t} + \delta_3 DIN_{ij,t} + \delta_4 MB_{ij,t} + \delta_5 HI_{ij,t} + \sum \phi Y_{ij,t} + \varepsilon_{ij,t}\]

(1)

The explanatory variables such as \( UD_{ij,t} \) is the natural log of uninsured deposits for bank \( i \), in country \( j \) at period \( t \), \( CV_{ij,t} \) is the natural log of charter value for bank \( i \), country \( j \) in period \( t \), \( BC_{ij,t} \) is the natural log of bank capital for bank \( i \), in country \( j \) in period \( t \), \( OBS_{ij,t} \) is the natural log of off-balance sheet activities for bank \( i \), in country \( j \) in period \( t \), \( LTA_{ij,t} \) is the loan to total assets for bank \( i \), in country \( j \) in period \( t \), \( SIC_{ij,t} \) is the natural log of market value of equity for bank \( i \), in country \( j \) in period \( t \), \( EFI_{ij,t} \) is the economic freedom index for country \( j \) at period \( t \); \( D1_{ij,t} = 1 \) if commercial banks or otherwise 0; \( D2_{ij,t} = \) legal origin variable where \( D2_{ij,t} = 1 \) if common-law countries, 2 if French civil law countries, 3 if German civil-law countries and 4 if Scandinavian civil law countries; \( BNC_{ij} = \) Bank concentration for country \( j \) at period \( t \); \( NIM_{ij,t} = \) Net interest margin for country \( j \) at period \( t \); \( STurn_{ij} = \) Stock market turnover ratio for country \( j \) at period \( t \); \( DIN_{ij,t} = \) explicit deposit insurance dummy =1, otherwise=0; \( MB_{ij} = \) market based country dummy =1, otherwise=0; \( HI_{ij,t} = \) High income country dummy =1, otherwise=0; Finally, \( \varepsilon_{ij,t} \) is the random error term. The joint F-test for the year dummies are statistically significant for all risk measures. All results are corrected for heteroscedasticity. Superscripts *, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively. † indicates the coefficients of the explanatory variables and standard errors are scaled by 100.

### Panel A Determinants of Systematic Risk

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<td>0.835***</td>
<td>1.013***</td>
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<tr>
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<td>(0.244)</td>
<td>(0.265)</td>
<td>(0.272)</td>
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<td>-0.225</td>
<td>-0.045</td>
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<tr>
<td></td>
<td>(0.054)</td>
<td>(0.207)</td>
<td>(0.054)</td>
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<tr>
<td>Bank capital squared</td>
<td>-0.061</td>
<td>-0.043</td>
<td>-0.045</td>
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<tr>
<td></td>
<td>(0.056)</td>
<td>(0.043)</td>
<td>(0.043)</td>
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<td>Charter value</td>
<td>0.269*</td>
<td>0.297*</td>
<td>0.472***</td>
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<td>(0.154)</td>
<td>(0.175)</td>
<td>(0.169)</td>
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<td>Off balance sheet items</td>
<td>0.127***</td>
<td>0.129***</td>
<td>0.127***</td>
</tr>
<tr>
<td></td>
<td>(0.026)</td>
<td>(0.026)</td>
<td>(0.025)</td>
</tr>
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<td>Market discipline</td>
<td>-0.104***</td>
<td>-0.104***</td>
<td>-0.109***</td>
</tr>
<tr>
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<td>(0.023)</td>
<td>(0.024)</td>
<td>(0.023)</td>
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<td>Size</td>
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<td>0.106***</td>
<td>0.108***</td>
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<td>(0.007)</td>
<td>(0.008)</td>
<td>(0.007)</td>
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<td>Loan to total assets</td>
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<td>-0.044***</td>
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<td>(0.015)</td>
<td>(0.015)</td>
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<td>Bank concentration</td>
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<td>0.181*</td>
<td>0.177*</td>
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<td>Pooled with lag</td>
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<td>-----------------</td>
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<tr>
<td>Net interest margin</td>
<td>(0.098)</td>
<td>(0.099)</td>
<td>(0.099)</td>
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<tr>
<td>Stock market turnover</td>
<td>-0.480</td>
<td>-0.394</td>
<td>-0.594</td>
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<td>Deposit insurance dummy</td>
<td>0.250**</td>
<td>0.255**</td>
<td>0.203*</td>
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<td>-0.019***</td>
<td>-0.019***</td>
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<td>Commercial bank dummy</td>
<td>0.179***</td>
<td>0.180***</td>
<td>0.173**</td>
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<td>High income economy dummy</td>
<td>-0.523***</td>
<td>-0.528***</td>
<td>-0.547**</td>
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<td>-0.166**</td>
<td>-0.148**</td>
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<td>Bank capital squared</td>
<td>-0.405***</td>
<td>-0.244***</td>
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<td>Charter value</td>
<td>1.297***</td>
<td>1.484***</td>
<td>0.632**</td>
</tr>
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<td>Off balance sheet items</td>
<td>0.127***</td>
<td>0.142***</td>
<td>0.146**</td>
</tr>
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<td>Market discipline</td>
<td>0.096***</td>
<td>0.094***</td>
<td>0.086**</td>
</tr>
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<td>Size</td>
<td>-0.049***</td>
<td>-0.039***</td>
<td>-0.043**</td>
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<td>Loan to total assets</td>
<td>-0.088***</td>
<td>-0.092***</td>
<td>-0.093**</td>
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<td>Bank concentration</td>
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<td>Net interest margin</td>
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<td>Deposit insurance dummy</td>
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**Panel B Determinants of Idiosyncratic Risk**

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<th>F(26,1172)=66</th>
<th>F(25,1131)=64</th>
<th>F(26,1133)=64</th>
<th>F(25,1133)=63</th>
<th>F(26,1133)=65</th>
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<tr>
<td>Wu-Hausman F test</td>
<td>4.93***</td>
<td>3.42**</td>
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<tr>
<td>Durbin-Wu-Hausman Chi^2 test</td>
<td>-</td>
<td>-</td>
<td>10.02***</td>
<td>10.44***</td>
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<th>F(2,10)=128</th>
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<th>(0.117)</th>
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<tr>
<td>Bank capital</td>
<td>-0.166**</td>
<td>-1.378***</td>
<td>-0.148**</td>
<td>-0.838**</td>
<td>-0.208**</td>
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<td>Bank capital squared</td>
<td>-0.405***</td>
<td>-0.244***</td>
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<td>-0.091</td>
<td>-0.091</td>
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<td>Charter value</td>
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<td>1.484***</td>
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<td>-0.052</td>
<td>-0.053</td>
<td>-0.037</td>
</tr>
<tr>
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<td>(0.112)</td>
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<td>(0.111)</td>
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<td>High income economy dummy</td>
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<td>1.599***</td>
</tr>
<tr>
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<td>(0.289)</td>
<td>(0.289)</td>
<td>(0.311)</td>
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<td>R-squared</td>
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<td>0.289</td>
<td>0.311</td>
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<td>F(10,921)=1.8</td>
<td>F(25,860)=23</td>
</tr>
<tr>
<td>Joint F test for year dummies</td>
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<td>F(10,921)=1.8</td>
<td>F(10,921)=1.8</td>
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<td>Wu-Hausman F test</td>
<td>4.418**</td>
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<td>8.657**</td>
</tr>
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<td>Durbin-Wu-Hausman Chi² test</td>
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<td>2.813**</td>
<td>2.813**</td>
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<tr>
<td>NOBS</td>
<td>948</td>
<td>886</td>
<td>886</td>
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</tbody>
</table>
Determinants of bank risk: excluding Japanese banks

The table represents the cross-country results for the determinants of bank equity risk and credit risk. Panel A through to Panel E reports the results. The standard market model is used to measure systematic risk: \( R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it} \), where, \( R_{it} \) is the return on security \( i \) at time period \( t \), \( R_{mt} \) is the return on an equity market index at time period \( t \). The systematic risk estimate for each bank is \( \beta_i \) (systematic risk) and \( \varepsilon_{it} \) is a random shock term. The table presents the pooled-OLS regression, pooled-OLS regression with lagged value of bank capital and lagged value of bank charter value and two-stage least squares (2SLS) regression results to estimate the model of bank risk.

\[
RISK_{it} = \left( \alpha_0 + \beta_{UD_{ij}} + \beta_{CV_{ij}} + \beta_{BC_{ij}^2} + \beta_{OBS_{ij}} + \beta_{LTA_{ij}} + \beta_{Size_{ij}} + \gamma_1EFI_{ij} + \delta_1D_{1j} + \delta_2D_{2j} + \gamma_2NIM_{ij} + \gamma_3BNC_{ij} + \gamma_4STurn_{ij} + \delta_3DIN_{ij} + \delta_4MB_{ij} + \delta_5HI_{ij} \right) + \sum \phi_i^T_{ij} + \varepsilon_{ij}
\]

The explanatory variables such as \( UD_{ij} \) is the natural log of uninsured deposits for bank \( i \), in country \( j \) at period \( t \), \( CV_{ij} \) is the natural log of charter value for bank \( i \), country \( j \) in period \( t \), \( BC_{ij}^2 \) is the natural log of bank capital squared for bank \( i \), in country \( j \) in period \( t \), \( OBS_{ij} \) is the natural log of off-balance sheet activities for bank \( i \), in country \( j \) at period \( t \); \( LTA_{ij} \) is the loan to total assets for bank \( i \), in country \( j \) at period \( t \), \( Size_{ij} \) is the natural log of market value of equity for bank \( i \), in country \( j \) in period \( t \) and \( EFI_{ij} \) is the economic freedom index for country \( j \) at period \( t \). \( D_{1j} \) = bank specialization dummy where \( D_{1j} = 1 \) if commercial banks or otherwise 0; \( D_{2j} \) = legal origin variable where \( D_{2j} = 1 \) if common-law countries, 2 if French civil law countries, 3 if German civil-law countries and 4 if Scandinavian civil law countries; \( BNC_{ij} \) = Bank concentration for country \( j \) at period \( t \); \( NIM_{ij} \) = Net interest margin for country \( j \) at period \( t \); \( STurn_{ij} \) = Stock market turnover ratio for country \( j \) at period \( t \); \( DIN_{ij} \) = explicit deposit insurance dummy =1, otherwise=0; \( MB_{ij} \) = market based country dummy =1, otherwise=0; \( HI_{ij} \) = High income country dummy =1, otherwise=0; Finally, \( \varepsilon_{ij} \) is the random error term. The joint F-test for the year dummies are statistically significant for all risk measures. All results are corrected for heteroscedasticity. The standard errors are reported in parenthesis. Superscripts *, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively. † indicates the coefficients of the explanatory variables and standard errors are scaled by 100.

<table>
<thead>
<tr>
<th>Panel A Determinants of systematic risk</th>
<th>Pooled OLS</th>
<th>Pooled-OLS with lag</th>
<th>2SLS</th>
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<td>0.090</td>
<td>-0.019</td>
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<td>0.153</td>
<td>-0.109***</td>
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<td>Bank Capital Squared</td>
<td>-0.116***</td>
<td>0.116***</td>
<td>-0.152***</td>
</tr>
<tr>
<td>Charter Value</td>
<td>0.234</td>
<td>0.214</td>
<td>0.585**</td>
</tr>
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<td>Off balance Sheet Activities</td>
<td>0.126***</td>
<td>0.125***</td>
<td>0.117***</td>
</tr>
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<td>Market Discipline</td>
<td>0.041***</td>
<td>0.041***</td>
<td>0.042***</td>
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<tr>
<td></td>
<td>Pooled OLS</td>
<td>Pooled-OLS with lag</td>
<td>2SLS</td>
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<tr>
<td>--------------------------------</td>
<td>------------</td>
<td>---------------------</td>
<td>------</td>
</tr>
<tr>
<td><strong>Panel B Determinants of Idiosyncratic risk</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>-3.264***</td>
<td>-3.503***</td>
<td>-3.353***</td>
</tr>
<tr>
<td></td>
<td>(0.197)</td>
<td>(0.224)</td>
<td>(0.212)</td>
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<td>-0.604***</td>
<td>-0.240***</td>
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<td>(0.153)</td>
<td>(0.056)</td>
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<td>-0.091</td>
<td>-0.157**</td>
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<td>(-0.073)</td>
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<td>0.072</td>
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<td>(0.491)</td>
<td>(0.490)</td>
<td>(0.435)</td>
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<td>-0.046***</td>
<td>-0.047***</td>
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<td>(0.011)</td>
<td>(0.011)</td>
<td>(0.011)</td>
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<td>Market Discipline</td>
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<td>-0.060***</td>
<td>-0.064***</td>
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<tr>
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<td>(0.013)</td>
<td>(0.013)</td>
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<td>(0.013)</td>
<td>(0.013)</td>
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<td>(0.013)</td>
<td>(0.013)</td>
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<td>(0.014)</td>
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<td></td>
<td>(0.014)</td>
<td>(0.014)</td>
<td>(0.014)</td>
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<td>(0.014)</td>
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<td>(0.014)</td>
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<tr>
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<td>(0.014)</td>
<td>(0.014)</td>
</tr>
<tr>
<td></td>
<td>Pooled OLS</td>
<td>Pooled-OLS with Lag</td>
<td>2SLS</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>------------</td>
<td>---------------------</td>
<td>------</td>
</tr>
<tr>
<td><strong>Intercept</strong></td>
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</tr>
<tr>
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<td>(0.231)</td>
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</tr>
<tr>
<td></td>
<td>-0.262***</td>
<td>-0.272*</td>
<td>-0.293***</td>
</tr>
<tr>
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<td>(0.042)</td>
<td>(0.145)</td>
<td>(0.050)</td>
</tr>
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</tr>
<tr>
<td></td>
<td>-0.004</td>
<td>0.041</td>
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<tr>
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<td>(0.048)</td>
<td>(0.065)</td>
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</tr>
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<td>0.222</td>
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<td>(0.444)</td>
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<td>-0.049***</td>
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<td>2SLS</td>
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<tr>
<td>--------------------------</td>
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<tr>
<td><strong>Test of Endogeneity</strong></td>
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<tr>
<td><strong>Wu-Hausman F test</strong></td>
<td></td>
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<td></td>
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<tr>
<td><strong>Durbin-Wu-Hausman Chi² test</strong></td>
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<td><strong>NOBS</strong></td>
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### Panel D Determinants of Credit risk (LLP)

<table>
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<td>-1.276***</td>
<td>-1.553***</td>
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<td>(0.162)</td>
<td>(0.152)</td>
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<td><strong>Bank Capital</strong></td>
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<td>0.340**</td>
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<tr>
<td></td>
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<td>(0.144)</td>
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<td><strong>Bank Capital Squared</strong></td>
<td>-</td>
<td>0.116**</td>
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<tr>
<td></td>
<td>-</td>
<td>(0.047)</td>
<td>-</td>
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<td>(0.189)</td>
<td>(0.233)</td>
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<td>0.041***</td>
<td>0.043***</td>
</tr>
<tr>
<td></td>
<td>(0.011)</td>
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<td>(0.012)</td>
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<td>-0.025**</td>
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<td>(0.012)</td>
<td>(0.015)</td>
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<td>Variable</td>
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<td>2SLS</td>
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<td><strong>Panel E: Determinants of Credit Risk (LLR)</strong></td>
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</tr>
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<td>(0.136)</td>
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<td>Bank Capital</td>
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<td>1.045***</td>
<td>0.156***</td>
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<tr>
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<td>Bank Capital Squared</td>
<td></td>
<td>-0.315***</td>
<td>0.223***</td>
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<td></td>
<td></td>
<td>-0.047</td>
<td>0.059</td>
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<tr>
<td>Charter Value</td>
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<td>0.471**</td>
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<td>0.176</td>
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<td>Off balance Sheet Activities</td>
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<td>0.017**</td>
<td>0.014*</td>
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<td>Size</td>
<td>-0.016***</td>
<td>-0.014***</td>
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</table>

**Note:** The table above shows the estimated coefficients and standard errors for the credit risk determinants using three different models: Pooled OLS, Pooled-OLS with lag, and 2SLS. The coefficients are presented with their respective significance levels (*** for p < 0.01, ** for p < 0.05, * for p < 0.1).
<table>
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</thead>
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<td>0.449***</td>
<td>0.477***</td>
<td>0.431***</td>
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<td>Bank Concentration</td>
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<td>0.120***</td>
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<td>0.115**</td>
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<td>Net Interest Margin</td>
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<td>Stock market turnover</td>
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<td>-0.076***</td>
<td>-0.081***</td>
<td>-0.081***</td>
<td>-0.081***</td>
<td>-0.081***</td>
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<td>Deposit insurance</td>
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<td>0.037</td>
<td>0.040*</td>
<td>0.033</td>
<td>0.038</td>
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<td>-0.011***</td>
<td>-0.011***</td>
<td>-0.011***</td>
<td>-0.012***</td>
<td>-0.012***</td>
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<tr>
<td>Market based dummy</td>
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<td>0.073***</td>
<td>0.065***</td>
<td>0.092***</td>
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<td>Common law country</td>
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<td>0.005</td>
<td>0.012</td>
<td>0.007</td>
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<tr>
<td>Commercial bank dummy</td>
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<td>0.018</td>
<td>0.019</td>
<td>0.019</td>
<td>0.018</td>
<td>0.018</td>
</tr>
<tr>
<td>High income country dummy</td>
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<td>-0.145***</td>
<td>-0.146***</td>
<td>-0.140***</td>
<td>-0.136***</td>
<td>-0.127***</td>
</tr>
<tr>
<td>R-squared</td>
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<td>0.24</td>
<td>0.24</td>
<td>0.25</td>
<td>0.25</td>
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<tr>
<td>Model test</td>
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<td>F(26,3601)=63</td>
<td>F(25,3321)=62.07</td>
<td>F(26,3320)=61</td>
<td>F(25,3307)=63</td>
<td>F(26,3306)=62</td>
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<tr>
<td>Joint F-test for year dummies</td>
<td>F(10,3602)=11</td>
<td>F(10,3601)=11</td>
<td>F(10,3321)=10</td>
<td>F(10,3320)=10</td>
<td>F(10,3307)=10</td>
<td>F(10,3306)=10</td>
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<td>Test of Endogeneity</td>
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<td>3.16**</td>
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<td>11.59***</td>
<td>9.53**</td>
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<td>Wu-Hausman F test</td>
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<td>3628</td>
<td>3347</td>
<td>3347</td>
<td>3347</td>
<td>3347</td>
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</table>
Table A6.8
Analysis of risk for developed economies

The table represents the cross-country results for the determinants of bank equity risk and credit risk. Panel A through to Panel E reports the results. The standard market model is used to measure systematic risk: \( R_{it} = \alpha + \beta R_{mt} + \epsilon_{it} \) where, \( R_{it} \) is the return on security \( i \) at time period \( t \), \( R_{mt} \) is the return on an equity market index at time period \( t \). The systematic risk estimate for each bank is \( \beta_i \) (systematic risk) and \( \epsilon_{it} \) is a random shock term. The table presents the pooled-OLS regression, pooled-OLS regression with lagged value of bank capital, and lagged value of bank charter value and two-stage least squares (2SLS) regression results to estimate the model of bank risk.

\[
\text{RISK}_{it} = \left[ \alpha + \beta_1 UD_{ij,t} + \beta_2 CV_{ij,t} + \beta_3 BC_{ij,t} + \beta_4 OBS_{ij,t} + \beta_5 LTA_{ij,t} + \beta_6 Size_{ij,t} + \right.
\]
\[
\left. + \phi_Y Y_{ij,t} + \epsilon_{ij,t} \right]
\]

The explanatory variables such as \( UD_{ij,t} \) is the natural log of uninsured deposits for bank \( i \), in country \( j \) at period \( t \), \( CV_{ij,t} \) is the natural log of charter value for bank \( i \), in country \( j \) in period \( t \), \( BC_{ij,t} \) is the natural log of bank capital for bank \( i \), in country \( j \) in period \( t \), \( OBS_{ij,t} \) is the natural log of off-balance sheet activities for bank \( i \), in country \( j \) at period \( t \), \( LTA_{ij,t} \) is the loan to total assets for bank \( i \), in country \( j \) at period \( t \), \( Size_{ij,t} \) is the natural log of market value of equity for bank \( i \), in country \( j \), in period \( t \) and \( \epsilon_{ij,t} \) is the economic freedom index for country \( j \) at period \( t \). \( D_{ij} \) = bank specialization dummy where \( D_{ij} = 1 \) if commercial banks or otherwise 0; \( D_{ij} \) = legal origin variable where \( D_{ij} = 1 \) if common-law countries, 2 if French civil law countries, 3 if German civil-law countries and 4 if Scandinavian civil law countries; \( BNC_{ij,t} \) = Bank concentration for country \( j \) at period \( t \); \( NIM_{ij,t} \) = Net interest margin for country \( j \) at period \( t \); \( STurn_{ij,t} \) = Stock market turnover ratio for country \( j \) at period \( t \); \( DIN_{ij,t} \) = explicit deposit insurance dummy =1, otherwise=0; \( MB_{ij,t} \) = market based country dummy =1, otherwise=0; \( HI_{ij} \) = High income country dummy =1, otherwise=0; Finally, \( \epsilon_{ij,t} \) is the random error term. The joint F-test for the year dummies are statistically significant for all risk measures. All results are corrected for heteroscedasticity. The standard errors are reported in parenthesis. Superscripts *, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively. † indicates the coefficients of the explanatory variables and standard errors are scaled by 1000.

Panel A Determinants of systematic risk:

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Panel B: Determinants of idiosyncratic risk
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<td>(0.243)</td>
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**Panel C Determinants of total risk**

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<td>-1.695***</td>
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<td>(0.243)</td>
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<td><strong>R-squared</strong></td>
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<td>0.18</td>
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<td>31.79***</td>
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### Panel D: Determinants of credit risk – loan loss provision

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### Panel E: Determinants of credit risk – loan loss reserves

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<tr>
<td>Charter value</td>
<td>-0.003</td>
<td>-0.016</td>
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<tr>
<td>Off balance sheet items</td>
<td>0.045***</td>
<td>0.045***</td>
<td>0.044***</td>
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<td>0.045***</td>
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<tr>
<td></td>
<td>-0.016*</td>
<td>-0.015*</td>
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</tr>
<tr>
<td>Size</td>
<td>-0.017</td>
<td>-0.014**</td>
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<tr>
<td></td>
<td>-0.017***</td>
<td>-0.014***</td>
<td>-0.010**</td>
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<td>-0.017***</td>
<td>-0.014***</td>
<td>-0.010**</td>
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</tr>
<tr>
<td>--------------------------</td>
<td>----------</td>
<td>----------</td>
<td>----------</td>
</tr>
<tr>
<td>Loan to total assets</td>
<td>0.893***</td>
<td>0.897***</td>
<td>0.973***</td>
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<td></td>
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<td>(0.095)</td>
<td>(0.083)</td>
</tr>
<tr>
<td>Bank concentration</td>
<td>-0.076</td>
<td>-0.063</td>
<td>-0.091</td>
</tr>
<tr>
<td></td>
<td>(0.060)</td>
<td>(0.060)</td>
<td>(0.061)</td>
</tr>
<tr>
<td>Net interest margin</td>
<td>3.406***</td>
<td>2.964***</td>
<td>5.377***</td>
</tr>
<tr>
<td></td>
<td>(0.988)</td>
<td>(0.991)</td>
<td>(1.118)</td>
</tr>
<tr>
<td>Stock market turnover</td>
<td>-0.105***</td>
<td>-0.105***</td>
<td>-0.108***</td>
</tr>
<tr>
<td></td>
<td>(0.017)</td>
<td>(0.017)</td>
<td>(0.018)</td>
</tr>
<tr>
<td>Deposit insurance</td>
<td>0.089**</td>
<td>0.099**</td>
<td>0.080</td>
</tr>
<tr>
<td>Economic freedom index</td>
<td>-0.003</td>
<td>-0.003</td>
<td>0.005+</td>
</tr>
<tr>
<td></td>
<td>(0.048)</td>
<td>(0.047)</td>
<td>(0.050)</td>
</tr>
<tr>
<td>Market based dummy</td>
<td>0.065**</td>
<td>0.046</td>
<td>0.040</td>
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<tr>
<td></td>
<td>(0.033)</td>
<td>(0.033)</td>
<td>(0.032)</td>
</tr>
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<td>Common law dummy</td>
<td>-0.201***</td>
<td>-0.182***</td>
<td>-0.216***</td>
</tr>
<tr>
<td></td>
<td>(0.034)</td>
<td>(0.034)</td>
<td>(0.034)</td>
</tr>
<tr>
<td>Commercial bank dummy</td>
<td>0.056**</td>
<td>0.055**</td>
<td>0.069***</td>
</tr>
<tr>
<td></td>
<td>(0.026)</td>
<td>(0.025)</td>
<td>(0.026)</td>
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<tr>
<td>High income dummy</td>
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<td>0.286***</td>
<td>0.271***</td>
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<tr>
<td></td>
<td>(0.094)</td>
<td>(0.094)</td>
<td>(0.093)</td>
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<tr>
<td>R-squared</td>
<td>0.26</td>
<td>0.27</td>
<td>0.29</td>
</tr>
<tr>
<td>Test of Endogeneity</td>
<td>41***</td>
<td>46***</td>
<td>46***</td>
</tr>
<tr>
<td>Wu-Hausman F test</td>
<td>9.21***</td>
<td>8.64***</td>
<td>6.76***</td>
</tr>
<tr>
<td>NOBS</td>
<td>3060</td>
<td>3206</td>
<td>2830</td>
</tr>
</tbody>
</table>

**Note:** Stochastic variable (High income dummy) is not endogenous.
### Table A6.9

#### Analysis of risk for developing economies

The table represents the cross-country results for the determinants of bank equity risk and credit risk. Panel A through to Panel E reports the results. The standard market model is used to measure systematic risk: $R_{it} = \alpha_i + \beta_i R_{mt} + \epsilon_{it}$ where, $R_{it}$ is the return on security $i$ at time period $t$, $R_{mt}$ is the return on an equity market index at time period $t$. The systematic risk estimate for each bank is $\beta_i$ (systematic risk) and $\epsilon_{it}$ is a random shock term. The table presents the pooled-OLS regression, pooled-OLS regression with lagged value of bank capital and lagged value of bank charter value and two-stage least squares (2SLS) regression results to estimate the model of bank risk.

\[
RISK_{it} = \alpha_i + \beta_i UD_{ij,t} + \beta_i CV_{ij,t} + \beta_i BC_{ij,t}^2 + \beta_i OBS_{ij,t} + \beta_i LTA_{ij,t} + \beta_i SICE_{ij,t} + \\
\gamma_i EFI_{ij,t} + \delta_i D_{ij} + \gamma_i NIM_{ij,t} + \gamma_i BNC_{ij,t} + \gamma_i STurn_{ij,t} + \delta_i DIN_{ij,t} + \delta_i MB_{ij,t} + \delta_i HI_{ij,t} + \\
\sum \phi_i Y^2_{ij,t} + \epsilon_{ij,t}
\]

The explanatory variables such as $UD_{ij,t}$ is the natural log of uninsured deposits for bank $i$, in country $j$ at period $t$, $CV_{ij,t}$ is the natural log of charter value for bank $i$, in country $j$ in period $t$, $BC_{ij,t}^2$ is the natural log of bank capital squared for bank $i$, in country $j$ in period $t$, $OBS_{ij,t}$ is the natural log of off-balance sheet activities for bank $i$, in country $j$ at period $t$, $LTA_{ij,t}$ is the loan to total assets for bank $i$, in country $j$ at period $t$, $SICE_{ij,t}$ is the natural log of market value of equity for bank $i$, in country $j$, in period $t$ and $EFI_{ij,t}$ is the economic freedom index for country $j$ at period $t$. $D_{ij} =$ bank specialization dummy where $D_{ij} = 1$ if commercial banks or otherwise 0; $D_{ij} =$ legal origin variable where $D_{ij} = 1$ if common-law countries, 2 if German civil-law countries, 3 if Scandinavian civil law countries; $BNC_{ij,t} =$ Bank concentration for country $j$ at period $t$; $NIM_{ij} =$ Net interest margin for country $j$ at period $t$; $STurn_{ij,t} =$ Stock market turnover ratio for country $j$ at period $t$; $DIN_{ij,t} =$ explicit deposit insurance dummy =1, otherwise=0; $MB_{ij} =$ market based country dummy =1, otherwise=0; $HI_{ij} =$ High income country dummy =1, otherwise=0; Finally, $\epsilon_{ij,t}$ is the random error term. The joint F-test for the year dummies are statistically significant for all risk measures. All results are corrected for heteroscedasticity. The standard errors are reported in parenthesis. Superscripts *, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively. † indicates the coefficients of the explanatory variables and standard errors are scaled by 100.

#### Panel A Determinants of systematic risk

<table>
<thead>
<tr>
<th></th>
<th>Pooled OLS</th>
<th>Pooled-OLS with lag</th>
<th>2SLS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intercept</strong></td>
<td>0.154</td>
<td>0.116</td>
<td>0.197</td>
</tr>
<tr>
<td></td>
<td>(0.233)</td>
<td>(0.314)</td>
<td>(0.258)</td>
</tr>
<tr>
<td><strong>Bank capital</strong></td>
<td>-0.015</td>
<td>-0.083</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>(0.070)</td>
<td>(0.397)</td>
<td>(0.079)</td>
</tr>
<tr>
<td><strong>Bank capital squared</strong></td>
<td>-0.028</td>
<td>-0.061</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>(0.167)</td>
<td>(0.268)</td>
<td>-</td>
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<tr>
<td><strong>Charter value</strong></td>
<td>-0.723**</td>
<td>-0.718**</td>
<td>-0.237</td>
</tr>
<tr>
<td></td>
<td>(0.363)</td>
<td>(0.363)</td>
<td>(0.489)</td>
</tr>
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<td><strong>Off balance sheet items</strong></td>
<td>0.113**</td>
<td>0.112***</td>
<td>0.104***</td>
</tr>
<tr>
<td></td>
<td>(0.029)</td>
<td>(0.030)</td>
<td>(0.030)</td>
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<td><strong>Market discipline</strong></td>
<td>0.050**</td>
<td>0.050**</td>
<td>0.061***</td>
</tr>
<tr>
<td></td>
<td>(0.022)</td>
<td>(0.022)</td>
<td>(0.022)</td>
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<tr>
<td><strong>Size</strong></td>
<td>0.010</td>
<td>0.010</td>
<td>0.015**</td>
</tr>
<tr>
<td></td>
<td>(0.009)</td>
<td>(0.009)</td>
<td>(0.007)</td>
</tr>
<tr>
<td><strong>Loan to total assets</strong></td>
<td>-0.233**</td>
<td>-0.236**</td>
<td>-0.292***</td>
</tr>
<tr>
<td></td>
<td>(0.101)</td>
<td>(0.102)</td>
<td>(0.109)</td>
</tr>
<tr>
<td><strong>Bank concentration</strong></td>
<td>-1.049***</td>
<td>-1.049***</td>
<td>-1.006***</td>
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<tr>
<td></td>
<td>(0.131)</td>
<td>(0.131)</td>
<td>(0.124)</td>
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<td>Variable</td>
<td>Pooled OLS</td>
<td>Pooled-OLS with lag</td>
<td>2SLS</td>
</tr>
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<td>------------------------------</td>
<td>------------</td>
<td>---------------------</td>
<td>-------</td>
</tr>
<tr>
<td>Intercept</td>
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<td>1.604</td>
<td>1.371</td>
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<td>0.167</td>
<td>0.167</td>
<td>0.167</td>
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<tr>
<td>Deposit insurance</td>
<td>-0.086*</td>
<td>-0.086*</td>
<td>-0.081</td>
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<td>Economic freedom index</td>
<td>0.007***</td>
<td>0.007***</td>
<td>0.007***</td>
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<td>0.252**</td>
<td>0.253**</td>
<td>0.230***</td>
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<td>0.044**</td>
<td>0.409***</td>
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<td>0.154***</td>
<td>0.153***</td>
<td>0.183***</td>
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<tr>
<td>High income dummy</td>
<td>-0.222***</td>
<td>-0.222***</td>
<td>-0.222***</td>
</tr>
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<td>R-squared</td>
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<td>0.34</td>
<td>0.37</td>
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<td>0.32***</td>
<td>0.31***</td>
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<td>Joint F-test for year dummies</td>
<td>2.40***</td>
<td>2.40***</td>
<td>15</td>
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<td>Test of Endogeneity</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Wu-Hausman F test</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Durbin-Wu-HausmanChi² test</td>
<td></td>
<td></td>
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<tr>
<td>NOBS</td>
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<td>1061</td>
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### Panel B Determinants of idiosyncratic risk

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<th>Pooled-OLS with lag</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-3.418***</td>
<td>-3.219***</td>
<td>-3.181***</td>
</tr>
<tr>
<td>Bank capital</td>
<td>-0.298***</td>
<td>0.063</td>
<td>-0.441***</td>
</tr>
<tr>
<td>Bank capital squared</td>
<td>(0.089)</td>
<td>(0.103)</td>
<td>(0.128)</td>
</tr>
<tr>
<td>Charter value</td>
<td>-2.033</td>
<td>-2.057</td>
<td>-1.191</td>
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<tr>
<td>Off balance sheet items</td>
<td>-0.031</td>
<td>-0.028</td>
<td>-0.039</td>
</tr>
<tr>
<td>Market discipline</td>
<td>-0.095***</td>
<td>-0.095***</td>
<td>-0.103***</td>
</tr>
<tr>
<td>Size</td>
<td>0.012</td>
<td>0.013</td>
<td>0.003</td>
</tr>
<tr>
<td>Loan to total assets</td>
<td>-0.244**</td>
<td>-0.225</td>
<td>-0.299*</td>
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<td>0.334*</td>
<td>0.333*</td>
<td>0.259</td>
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<tr>
<td>Net interest margin</td>
<td>1.318</td>
<td>1.333</td>
<td>1.921</td>
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<td>0.115***</td>
<td>0.103***</td>
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<td>0.349***</td>
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<td>-0.003</td>
<td>-0.003</td>
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<td>-0.191***</td>
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<td>-0.045</td>
<td>-0.066</td>
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<tr>
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<td>-0.029</td>
<td>-0.028</td>
<td>0.021</td>
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</table>

**Note:** The table above shows the coefficients for various determinants of idiosyncratic risk across different models and specifications. The significance levels are indicated by asterisks (*, **, ***), with ***, indicating statistical significance at the 0.01 level.
### Panel C Determinants of total risk

<table>
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<th>2SLS</th>
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<tbody>
<tr>
<td></td>
<td>(0.353)</td>
<td>(0.410)</td>
<td>(0.384)</td>
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<td>-0.240***</td>
<td>0.128</td>
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<tr>
<td></td>
<td>(0.086)</td>
<td>(0.388)</td>
<td>(0.101)</td>
</tr>
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<td>-0.010</td>
<td>-0.007</td>
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</tr>
<tr>
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<td>(0.040)</td>
<td>(0.040)</td>
<td>(0.040)</td>
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<td>Charter value</td>
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<td>Off balance sheet items</td>
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<td>(1.243)</td>
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<tr>
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<td>(0.024)</td>
<td>(0.024)</td>
<td>(0.023)</td>
</tr>
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<td>Size</td>
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<td>0.033***</td>
<td>0.016</td>
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<td>(0.013)</td>
<td>(0.013)</td>
<td>(0.015)</td>
</tr>
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<td>Loan to total assets</td>
<td>-0.281**</td>
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<td>-0.374***</td>
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<td>0.077</td>
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<tr>
<td></td>
<td>(0.186)</td>
<td>(0.186)</td>
<td>(0.203)</td>
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</tr>
<tr>
<td></td>
<td>(1.717)</td>
<td>(1.714)</td>
<td>(1.688)</td>
</tr>
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<td>Stock market turnover</td>
<td>0.111***</td>
<td>0.112***</td>
<td>0.105***</td>
</tr>
<tr>
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<td>(0.025)</td>
<td>(0.030)</td>
</tr>
<tr>
<td>Deposit insurance</td>
<td>0.256***</td>
<td>0.255***</td>
<td>0.299***</td>
</tr>
<tr>
<td></td>
<td>(0.074)</td>
<td>(0.074)</td>
<td>(0.098)</td>
</tr>
<tr>
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<td>0.002+</td>
<td>0.002+</td>
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<td>(0.003)</td>
<td>(0.003)</td>
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<td>-0.063</td>
<td>-0.041</td>
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<td>(0.054)</td>
<td>(0.043)</td>
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<td>Common law dummy</td>
<td>0.144***</td>
<td>0.147***</td>
<td>0.120***</td>
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<tr>
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<td>(0.044)</td>
<td>(0.045)</td>
<td>(0.049)</td>
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<td>Commercial bank dummy</td>
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<td>-0.060</td>
<td>-0.054</td>
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<td>(0.055)</td>
<td>(0.055)</td>
<td>(0.056)</td>
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<tr>
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<td>-0.047</td>
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<tr>
<td></td>
<td>(0.072)</td>
<td>(0.072)</td>
<td>(0.076)</td>
</tr>
<tr>
<td>R-squared</td>
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<td>0.18</td>
<td>0.19</td>
</tr>
<tr>
<td>Model test</td>
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<td>17***</td>
<td>20***</td>
</tr>
<tr>
<td>Joint F-test for year dummies</td>
<td>6.24***</td>
<td>6.20***</td>
<td>7.52***</td>
</tr>
<tr>
<td>Wu-Hausman F test</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Durbin-Wu-HausmanChi² test</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td>NOBS</td>
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<td>1147</td>
<td>1068</td>
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</table>

**Test of Endogeneity:**

- R-squared
- Joint test for year dummies
- Wu-Hausman F test
- Durbin-Wu-Hausman Chi² test
- NOBS
### Panel D Determinants of credit risk-loan loss provision

<table>
<thead>
<tr>
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<th>Pooled OLS</th>
<th>Pooled-OLS with lag</th>
<th>2SLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-1.032***</td>
<td>-0.733*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.294)</td>
<td>(0.412)</td>
<td>(0.310)</td>
</tr>
<tr>
<td></td>
<td>(0.096)</td>
<td>(0.573)</td>
<td>(0.099)</td>
</tr>
<tr>
<td>Bank capital</td>
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<td>0.543</td>
<td>0.008</td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.036)</td>
<td>(0.040)</td>
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<td>0.044</td>
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<td>-0.012***</td>
<td>-0.012***</td>
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### Panel E Determinants of credit risk-loan loss reserves

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<td>-0.087</td>
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<td>0.097</td>
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<td>(0.106)</td>
<td>(0.125)</td>
<td>(0.126)</td>
<td>(0.109)</td>
<td>(0.109)</td>
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<tr>
<td><strong>Net interest margin</strong></td>
<td>-2.085*</td>
<td>-2.007*</td>
<td>1.915</td>
<td>1.801</td>
<td>-1.935</td>
<td>-1.485</td>
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<td></td>
<td>(1.259)</td>
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<td>(1.780)</td>
<td>(1.829)</td>
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<td><strong>Stock market turnover</strong></td>
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<tr>
<td></td>
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<td>(0.014)</td>
<td>(0.017)</td>
<td>(0.016)</td>
<td>(0.017)</td>
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<tr>
<td><strong>Deposit insurance</strong></td>
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<td>(0.043)</td>
<td>(0.043)</td>
<td>(0.098)</td>
<td>(0.101)</td>
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<tr>
<td><strong>Economic freedom index</strong></td>
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<tr>
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<td>(0.002)</td>
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<td>(0.002)</td>
<td>(0.002)</td>
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<td>(0.002)</td>
</tr>
<tr>
<td><strong>Market based dummy</strong></td>
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<td>(0.037)</td>
<td>(0.037)</td>
<td>(0.051)</td>
<td>(0.049)</td>
</tr>
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<td><strong>Common law dummy</strong></td>
<td>0.126<em><strong>0.147</strong></em>0.131<em><strong>0.148</strong></em>0.109<em><strong>0.135</strong></em></td>
<td></td>
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<td></td>
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<tr>
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<td>(0.032)</td>
<td>(0.032)</td>
<td>(0.034)</td>
<td>(0.033)</td>
<td>(0.037)</td>
<td>(0.040)</td>
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<td><strong>Commercial bank dummy</strong></td>
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<td>(0.045)</td>
<td>(0.045)</td>
<td>(0.066)</td>
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<tr>
<td><strong>High income dummy</strong></td>
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<td>-0.071</td>
<td>-0.070</td>
<td>-0.044</td>
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<td>(0.058)</td>
<td>(0.059)</td>
<td>(0.058)</td>
<td>(0.075)</td>
<td>(0.076)</td>
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<tr>
<td><strong>R-squared</strong></td>
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<td>0.27</td>
<td>0.23</td>
<td>0.25</td>
<td>0.25</td>
<td>0.27</td>
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<tr>
<td><strong>Model test</strong></td>
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<td>20***</td>
<td>16***</td>
<td>18***</td>
<td>16***</td>
<td>17***</td>
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<tr>
<td><strong>Joint F-test for year dummies</strong></td>
<td>8.18***</td>
<td>8.21***</td>
<td>7.01***</td>
<td>6.71***</td>
<td>60.19***</td>
<td>56.31***</td>
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</table>

**Test of Endogeneity:**

- **Wu-Hausman F test**
  - 0.096 2.13*
- **Durbin-Wu-Hausman Chi^2 test**
  - 0.197 6.55*
- **NOBS**
  - 1090 999 999 988 988
Table A6.10
Analysis of risk for transition economies

The table represents the cross-country results for the determinants of bank equity risk and credit risk. Panel A through to Panel E reports the results. The standard market model is used to measure systematic risk: 

\[ R_{t} = \alpha_{j} + \beta_{j} R_{m,t} + \varepsilon_{i,t} \]

where, \( R_{t} \) is the return on the stock index at time period \( t \) and \( R_{m,t} \) is the return on an equity market index at time period \( t \). The systematic risk estimate for each bank is \( \beta_{j} \) (systematic risk) and \( \varepsilon_{i,t} \) is a random shock term. The table presents the pooled-OLS regression, pooled-OLS regression with lagged value of bank capital and lagged value of bank charter value, and two-stage least squares (2SLS) regression results to estimate the model of bank risk.

\[
RISK_{i,t} = \alpha_{i} + \beta_{i} UD_{i,t-1} + \beta_{j} CV_{i,t-1} + \beta_{k} BC_{i,t-1} + \beta_{l} OBS_{i,t-1} + \beta_{m} LTA_{i,t-1} + \beta_{n} Size_{i,t-1} + \gamma_{1}EFI_{i,t} + \delta_{1}DIN_{i,t} + \gamma_{2}NIM_{i,t} + \gamma_{3}BNC_{i,t} + \gamma_{4}STurn_{i,t} + \delta_{2}OBST_{i,t} + \delta_{3}MB_{i,t} + \delta_{4}HI_{i,t} + \sum \phi_{j} Y_{i,t} + \varepsilon_{i,t} \]  

(1)

The explanatory variables such as \( UD_{i,j} \), is the natural log of uninsured deposits for bank \( i \), in country \( j \) at period \( t \); \( CV_{i,j} \), is the natural log of charter value for bank \( i \), in country \( j \) in period \( t \); \( BC_{i,j} \), is the natural log of bank capital for bank \( i \), in country \( j \) in period \( t \); \( OBS_{i,j} \), is the natural log of off-balance sheet activities for bank \( i \), in country \( j \) at period \( t \); \( LTA_{i,j} \), is the loan to total assets for bank \( i \), in country \( j \) at period \( t \); \( Size_{i,j} \), is the natural log of market value of equity for bank \( i \), in country \( j \), in period \( t \) and \( EFI_{i,j} \), is the economic freedom index for country \( j \) at period \( t \). \( D_{i,j} \) = bank specialization dummy where \( D_{i,j} =1 \) if commercial banks or otherwise 0; \( D_{2,j} \) = legal origin variable where \( D_{2,j} =1 \) if common-law countries, 2 if French civil law countries, 3 if German civil-law countries and 4 if Scandinavian civil law countries; \( BNC_{i,j} \) = Bank concentration for country \( j \) at period \( t \); \( NIM_{j} \) = Net interest margin for country \( j \) at period \( t \); \( STurn_{i,j} \) = Stock market turnover ratio for country \( j \) at period \( t \); \( DIN_{j} \) = explicit deposit insurance dummy =1, otherwise=0; \( MB_{i,j} \) = market based country dummy =1, otherwise=0; \( HI_{i,j} \) = High income country dummy =1, otherwise=0; Finally, \( \varepsilon_{i,j} \) is the random error term. The joint F-test for the year dummies are statistically significant for all risk measures. All results are corrected for heteroscedasticity. The standard errors are reported in parenthesis. Superscripts *, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively. † indicates the coefficients of the explanatory variables and standard errors are scaled by 100.

**Panel A Determinants of systematic risk**

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<td>(0.130)</td>
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<td>Bank capital squared</td>
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<td>(0.341)</td>
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<td>Charter value</td>
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<td>(1.445)</td>
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<td>0.041</td>
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<td>(0.159)</td>
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<td>(0.152)</td>
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<td>-0.456**</td>
<td>-0.640***</td>
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<td>(0.202)</td>
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<td>(0.860)</td>
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<td>F(10,316)=2</td>
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<tr>
<td>Wu-Hausman F test</td>
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Panel B Determinants of idiosyncratic risk

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<td>-1.985***</td>
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<td>-2.341***</td>
<td>-2.341***</td>
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<td>(0.518)</td>
<td>(0.515)</td>
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<td>(0.794)</td>
<td>(0.988)</td>
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<td>Durbin-Wu-Hausman Chi² test</td>
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### Panel C: Determinants of Total Risk

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### Panel D: Determinants of Credit Risk-LLP

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**Panel E: Determinants of credit risk - LLR**

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<td>376</td>
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Table A6.11
Determinants of bank risk-world analysis: base model

The table represents the cross-country results for the determinants of bank equity risk and credit risk. Panel A and Panel B report the results under random effects panel technique for equity risk and credit risk respectively. The standard market model is used to measure systematic risk: $R_i = x_i + \beta R_m + \epsilon_i$, where, $R_i$ is the return on security $i$ at time period $t$, $R_m$ is the return on an equity market index at time period $t$. The systematic risk estimate for each bank is $\beta$ (systematic risk) and $\epsilon_i$ is a random shock term.

$$\text{RISK}_{ijt} = \alpha_i + \beta_1 \text{UD}_{ijt} + \beta_2 \text{CV}_{ijt} + \beta_3 \text{BC}_{ijt} + \beta_4 \text{BC}_{ijt}^2 + \beta_5 \text{OBS}_{ijt} + \beta_6 \text{LTA}_{ijt} + \beta_7 \text{Size}_{ijt} + \sum \phi_t \text{Y}_{ijt} + \epsilon_{ijt}$$

The explanatory variables such as $\text{UD}_{ijt}$ is the natural log of uninsured deposits for bank $i$, in country $j$ at period $t$; $\text{CV}_{ijt}$ is the natural log of charter value for bank $i$, country $j$ in period $t$; $\text{BC}_{ijt}$ is the natural log of bank capital for bank $i$, in country $j$ in period $t$; $\text{BC}_{ijt}^2$ is the natural log of bank capital squared for bank $i$; $\text{LTA}_{ijt}$ is the natural log of off-balance sheet activities for bank $i$, in country $j$ at period $t$; $\text{OBS}_{ijt}$ is the loan to total assets for bank $i$, in country $j$ at period $t$, $\text{Size}_{ijt}$ is the natural log of market value of equity for bank $i$, in country $j$, in period $t$; $\text{EFI}_{ijt}$ is the economic freedom index for country $j$ at period $t$. $\text{D}_{ijt}$ is bank specialization dummy where $\text{D}_{ijt} = 1$ if commercial banks or otherwise 0; $\text{D}_{ijt}$ is legal origin variable where $\text{D}_{ijt} = 1$ if common-law countries, 2 if French civil law countries, 3 if German civil-law countries and 4 if Scandinavian civil law countries; $\text{BNC}_{ijt}$ is Bank concentration for country $j$ at period $t$: $\text{NIM}_{ijt}$ is net interest margin for country $j$ at period $t$; $\text{STurn}_{ijt}$ is Stock market turnover ratio for country $j$ at period $t$; $\text{DIN}_{ijt}$ is explicit deposit insurance dummy =1, otherwise=0; $\text{MB}_{ijt}$ is market based country dummy =1, otherwise=0; $\text{HI}_{ijt}$ is High income country dummy =1, otherwise=0; Finally, $\epsilon_{ijt}$ is the random error term. The joint F-test for the year dummies are statistically significant for all risk measures. All results are corrected for heteroscedasticity. The standard errors are reported in parenthesis. Superscripts *, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively. † indicates the coefficients of the explanatory variables and standard errors are scaled by 100.

Panel A  Determinants of equity risk—world analysis

<table>
<thead>
<tr>
<th></th>
<th>Systematic risk</th>
<th>Idiosyncratic risk</th>
<th>Total risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-2.156***</td>
<td>-2.754***</td>
<td>-2.929***</td>
</tr>
<tr>
<td></td>
<td>(0.191)</td>
<td>(0.238)</td>
<td>(0.233)</td>
</tr>
<tr>
<td>Bank capital</td>
<td>-0.011**</td>
<td>-0.035</td>
<td>-0.122**</td>
</tr>
<tr>
<td></td>
<td>(0.005)</td>
<td>(0.254)</td>
<td>(0.059)</td>
</tr>
<tr>
<td>Bank capital squared</td>
<td>-0.009</td>
<td>-0.068</td>
<td>-0.015</td>
</tr>
<tr>
<td></td>
<td>(0.103)</td>
<td>(0.082)</td>
<td>(0.057)</td>
</tr>
<tr>
<td>Charter value</td>
<td>-0.622**</td>
<td>-0.621**</td>
<td>0.421</td>
</tr>
<tr>
<td></td>
<td>(0.252)</td>
<td>(0.252)</td>
<td>(0.998)</td>
</tr>
<tr>
<td>Off-balance sheet items</td>
<td>0.021**</td>
<td>0.022**</td>
<td>-0.017**</td>
</tr>
<tr>
<td></td>
<td>(0.006)</td>
<td>(0.006)</td>
<td>(0.008)</td>
</tr>
<tr>
<td>Market discipline</td>
<td>0.016**</td>
<td>0.016**</td>
<td>-0.033**</td>
</tr>
<tr>
<td></td>
<td>(0.008)</td>
<td>(0.008)</td>
<td>(0.016)</td>
</tr>
<tr>
<td>Size</td>
<td>0.056***</td>
<td>0.056***</td>
<td>0.004</td>
</tr>
<tr>
<td></td>
<td>(0.007)</td>
<td>(0.007)</td>
<td>(0.008)</td>
</tr>
<tr>
<td>Loan to total assets</td>
<td>-0.049</td>
<td>-0.049</td>
<td>-0.149**</td>
</tr>
<tr>
<td></td>
<td>(0.043)</td>
<td>(0.043)</td>
<td>(0.061)</td>
</tr>
</tbody>
</table>

367
| Variable                          | Panel A | Panel B 
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Determinants of credit risk-world analysis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Credit risk LLP</td>
</tr>
<tr>
<td>Bank concentration</td>
<td>-0.166**</td>
<td>-0.166**</td>
</tr>
<tr>
<td></td>
<td>(0.079)</td>
<td>(0.079)</td>
</tr>
<tr>
<td>Net interest margin</td>
<td>-0.584**</td>
<td>-0.581**</td>
</tr>
<tr>
<td></td>
<td>(0.278)</td>
<td>(0.278)</td>
</tr>
<tr>
<td>Stock market turnover</td>
<td>0.078***</td>
<td>0.078***</td>
</tr>
<tr>
<td></td>
<td>(0.013)</td>
<td>(0.013)</td>
</tr>
<tr>
<td>Deposit insurance</td>
<td>0.145***</td>
<td>0.145***</td>
</tr>
<tr>
<td></td>
<td>(0.047)</td>
<td>(0.047)</td>
</tr>
<tr>
<td>Economic freedom Index</td>
<td>-0.004*</td>
<td>-0.004*</td>
</tr>
<tr>
<td></td>
<td>(0.002)</td>
<td>(0.002)</td>
</tr>
<tr>
<td>Market based dummy</td>
<td>0.005</td>
<td>0.006</td>
</tr>
<tr>
<td></td>
<td>(0.040)</td>
<td>(0.040)</td>
</tr>
<tr>
<td>Common law country</td>
<td>0.314**</td>
<td>0.314***</td>
</tr>
<tr>
<td></td>
<td>(0.041)</td>
<td>(0.041)</td>
</tr>
<tr>
<td>Commercial bank dummy</td>
<td>-0.062</td>
<td>-0.062</td>
</tr>
<tr>
<td></td>
<td>(0.051)</td>
<td>(0.051)</td>
</tr>
<tr>
<td>High income country dummy</td>
<td>0.106**</td>
<td>0.105**</td>
</tr>
<tr>
<td></td>
<td>(0.049)</td>
<td>(0.049)</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.45</td>
<td>0.45</td>
</tr>
<tr>
<td>Breusch and Pagan Lagrangian multiplier</td>
<td>(\lambda^2(10)=292)</td>
<td>(\lambda^2(10)=292)</td>
</tr>
<tr>
<td>NOBS</td>
<td>4670</td>
<td>4670</td>
</tr>
</tbody>
</table>

**Note:** The table above represents the determinants of credit risk in the world analysis. The credit risk is assessed using LLP and LLR models. The variables include bank capital, bank capital squared, charter value, off-balance sheet items, market discipline, size, loan to total assets, bank concentration, and net interest margin. The table also includes R-squared values and joint F-tests for year dummies.
<table>
<thead>
<tr>
<th>Model</th>
<th>Coefficient 1</th>
<th>Coefficient 2</th>
<th>Coefficient 3</th>
<th>Coefficient 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock market turnover</td>
<td>-0.056***</td>
<td>-0.056***</td>
<td>-0.044***</td>
<td>-0.045***</td>
</tr>
<tr>
<td>Deposit insurance</td>
<td>0.032</td>
<td>0.033</td>
<td>0.015</td>
<td>0.017</td>
</tr>
<tr>
<td>Economic freedom Index</td>
<td>-0.003</td>
<td>-0.003</td>
<td>-0.007***</td>
<td>-0.006***</td>
</tr>
<tr>
<td>Market based dummy</td>
<td>0.062*</td>
<td>0.056</td>
<td>0.057</td>
<td>0.044</td>
</tr>
<tr>
<td>Common law country</td>
<td>-0.114***</td>
<td>-0.108***</td>
<td>-0.066*</td>
<td>-0.053</td>
</tr>
<tr>
<td>Commercial bank dummy</td>
<td>0.113**</td>
<td>0.116**</td>
<td>0.077*</td>
<td>0.083**</td>
</tr>
<tr>
<td>High income country dummy</td>
<td>-0.276***</td>
<td>-0.271***</td>
<td>-0.193***</td>
<td>-0.183***</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.32</td>
<td>0.32</td>
<td>0.27</td>
<td>0.27</td>
</tr>
<tr>
<td>Joint F-test for year Dummies</td>
<td>$\chi^2(10) = 287$</td>
<td>$\chi^2(10) = 286$</td>
<td>$\chi^2(10) = 160$</td>
<td>$\chi^2(10) = 159$</td>
</tr>
<tr>
<td>Breusch and Pagan Lagrangian multiplier</td>
<td>$\chi^2(1) = 1804$</td>
<td>$\chi^2(1) = 1778$</td>
<td>$\chi^2(1) = 4734$</td>
<td>$\chi^2(1) = 4713$</td>
</tr>
<tr>
<td>NOBS</td>
<td>4631</td>
<td>4631</td>
<td>4524</td>
<td>4524</td>
</tr>
</tbody>
</table>
Determinta of bank risk–world analysis: extended model

The table represents the cross-country results for the determinants of bank equity risk and credit risk. Panel A, Panel B, Panel C, Panel D and Panel E reports the cross results for equity risk and credit risk. The standard market model is used to measure systematic risk:  

\[ R_u = \alpha_t + \beta_t R_m + \epsilon_u \]

where, \( R_u \) is the return on security i at time period t, \( R_m \) is the return on an equity market index at time period t. The systematic risk estimate for each bank is \( \beta_t \) (systematic risk) and \( \epsilon_u \) is a random shock term. The table presents the pooled-OLS regression, pooled-OLS regression with lagged value of bank capital and lagged value of bank charter value and two-stage least squares (2SLS) regression results to estimate the model of bank risk.

\[ RISK_{jt} = \gamma_t E_{jt} + \delta_t D_{jt} + \gamma_j B_{nj} + \gamma_t S_{jt} + \delta_t S_{jt} + \delta_t S_{jt} + \delta_t D_{jt} + \delta_t H_{jt} + \sum \phi Y_{jt} + \epsilon_{jt} \]

The explanatory variables such as \( UD_{jt} \) is the natural log of uninsured deposits for bank \( i \), in country \( j \) at period \( t \), \( CV_{jt} \) is the natural log of charter value for bank \( i \), country \( j \) in period \( t \), \( BC_{jt} \) is the natural log of bank capital for bank \( i \), in country \( j \) in period \( t \), \( BC^2_{jt} \) is the natural log of bank capital squared for bank \( i \), country \( j \) in period \( t \), \( OBS_{jt} \) is the natural log of off-balance sheet activities for bank \( i \), in country \( j \) at period \( t \), \( LTA_{jt} \) is the loan to total assets for bank \( i \), in country \( j \) at period \( t \), \( Size_{jt} \) is the natural log of market value of equity for bank \( i \), in country \( j \) in period \( t \) and \( E_{jt} \) is the economic freedom index for country \( j \) at period \( t \). \( D_{jt} \) = bank specialization dummy where \( D_{jt} = 1 \) if commercial banks or otherwise 0; \( D_{jt} \) = legal origin variable where \( D_{jt} = 1 \) if common-law countries, 2 if French civil law countries, 3 if German civil-law countries and 4 if Scandinavian civil law countries; \( B_{nj} \) = Bank concentration for country \( j \) at period \( t \); \( NIM_{jt} \) = Net interest margin for country \( j \) at period \( t \); \( S_{jt} = Stock market turnover ratio for country \( j \) at period \( t \); \( SRI_{jt} = Stock market turnover ratio for country \( j \) at period \( t \); \( CRI_{jt} = creditor rights index for country \( j \); \( SRI_{jt} = shareholder rights index for country \( j \); \( D_{jt} \) = Bank capital for country \( j \) at period \( t \); \( D_{jt} \) = Bank capital squared for country \( j \) at period \( t \); \( H_{jt} = High income country dummy = 1, otherwise=0; \( MB_{jt} = market based country dummy = 1, otherwise=0; \( HI_{jt} = High income country dummy = 1, otherwise=0; \( E_{jt} \) is the random error term. The joint F-test for the year dummies are statistically significant for all risk measures. All results are corrected for heteroscedasticity. The standard errors are reported in parenthesis. Superscripts *, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively. † indicates the coefficients of the explanatory variables and standard errors are scaled by 100.

**Panel A: Determinants of systematic risk–world analysis**

<table>
<thead>
<tr>
<th></th>
<th>Pooled-OLS</th>
<th>lagged Pooled-OLS</th>
<th>2SLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0.171</td>
<td>0.375**</td>
<td>0.192</td>
</tr>
<tr>
<td></td>
<td>(0.152)</td>
<td>(0.172)</td>
<td>(0.158)</td>
</tr>
<tr>
<td>Dividend Yield</td>
<td>0.002</td>
<td>0.002</td>
<td>0.003</td>
</tr>
<tr>
<td></td>
<td>(0.002)</td>
<td>(0.002)</td>
<td>(0.002)</td>
</tr>
<tr>
<td>Operating leverage</td>
<td>0.038</td>
<td>0.038</td>
<td>0.031</td>
</tr>
<tr>
<td></td>
<td>(0.026)</td>
<td>(0.027)</td>
<td>(0.027)</td>
</tr>
<tr>
<td>Bank capital</td>
<td>-0.104***</td>
<td>0.249</td>
<td>-0.082**</td>
</tr>
<tr>
<td></td>
<td>(0.043)</td>
<td>(0.156)</td>
<td>(0.041)</td>
</tr>
<tr>
<td>Bank capital squared</td>
<td>-</td>
<td>0.133***</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>- (0.054)</td>
<td>-</td>
<td>(0.062)</td>
</tr>
<tr>
<td>Charter value</td>
<td>0.547***</td>
<td>0.578***</td>
<td>0.278**</td>
</tr>
<tr>
<td></td>
<td>(0.233)</td>
<td>(0.230)</td>
<td>(0.130)</td>
</tr>
<tr>
<td>Off-balance sheet items</td>
<td>0.113***</td>
<td>0.111***</td>
<td>0.104***</td>
</tr>
<tr>
<td></td>
<td>(0.012)</td>
<td>(0.012)</td>
<td>(0.012)</td>
</tr>
<tr>
<td>Market discipline</td>
<td>0.022**</td>
<td>0.022**</td>
<td>0.019***</td>
</tr>
<tr>
<td></td>
<td>(0.010)</td>
<td>(0.010)</td>
<td>(0.009)</td>
</tr>
<tr>
<td></td>
<td>Pooled-OLS</td>
<td>lagged Pooled-OLS</td>
<td>2SLS</td>
</tr>
<tr>
<td>------------------</td>
<td>------------</td>
<td>--------------------</td>
<td>-------</td>
</tr>
<tr>
<td><strong>Intercept</strong></td>
<td>-3.275***</td>
<td>-3.278***</td>
<td>-3.277***</td>
</tr>
<tr>
<td></td>
<td>(0.246)</td>
<td>(0.263)</td>
<td>(0.240)</td>
</tr>
<tr>
<td>Dividend Yield</td>
<td>-0.002</td>
<td>-0.002</td>
<td>-0.001</td>
</tr>
<tr>
<td></td>
<td>(0.004)</td>
<td>(0.004)</td>
<td>(0.004)</td>
</tr>
<tr>
<td>Operating leverage</td>
<td>0.023</td>
<td>0.024</td>
<td>0.025</td>
</tr>
<tr>
<td></td>
<td>(0.028)</td>
<td>(0.028)</td>
<td>(0.027)</td>
</tr>
<tr>
<td>Bank capital</td>
<td>-0.201***</td>
<td>-0.205</td>
<td>-0.225***</td>
</tr>
<tr>
<td></td>
<td>(0.040)</td>
<td>(0.140)</td>
<td>(0.044)</td>
</tr>
<tr>
<td>Bank capital squared</td>
<td>-</td>
<td>-0.001</td>
<td>0.044</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>(0.047)</td>
<td>(0.060)</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.27</td>
<td>0.27</td>
<td>0.28</td>
</tr>
<tr>
<td>Joint F-test for year dummy</td>
<td>33</td>
<td>33</td>
<td>32</td>
</tr>
<tr>
<td>Wu-Hausman F-test</td>
<td>-</td>
<td>-</td>
<td>0.052**</td>
</tr>
<tr>
<td>Durbin-Wu-Hausman $\lambda^2$ test</td>
<td>-</td>
<td>-</td>
<td>0.053**</td>
</tr>
<tr>
<td>NOBS</td>
<td>4429</td>
<td>4429</td>
<td>4245</td>
</tr>
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</table>

**Panel B Determinants of total risk—world analysis**
<table>
<thead>
<tr>
<th>Charter value</th>
<th>0.085</th>
<th>0.086</th>
<th>0.141</th>
<th>0.141</th>
<th>0.384</th>
<th>0.372</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(0.547)</td>
<td>(0.546)</td>
<td>(0.466)</td>
<td>(0.465)</td>
<td>(1.046)</td>
<td>(1.047)</td>
</tr>
<tr>
<td>Off-balance sheet items</td>
<td>0.013**</td>
<td>0.013**</td>
<td>0.011**</td>
<td>0.011**</td>
<td>0.012**</td>
<td>0.012**</td>
</tr>
<tr>
<td></td>
<td>(0.006)</td>
<td>(0.006)</td>
<td>(0.005)</td>
<td>(0.005)</td>
<td>(0.006)</td>
<td>(0.006)</td>
</tr>
<tr>
<td>Market discipline</td>
<td>-0.012**</td>
<td>-0.012**</td>
<td>-0.014**</td>
<td>-0.014**</td>
<td>-0.014**</td>
<td>-0.014**</td>
</tr>
<tr>
<td></td>
<td>(0.006)</td>
<td>(0.006)</td>
<td>(0.007)</td>
<td>(0.007)</td>
<td>(0.007)</td>
<td>(0.007)</td>
</tr>
<tr>
<td>Size</td>
<td>0.033***</td>
<td>0.033***</td>
<td>0.033***</td>
<td>0.033***</td>
<td>0.031***</td>
<td>0.031***</td>
</tr>
<tr>
<td></td>
<td>(0.005)</td>
<td>(0.005)</td>
<td>(0.005)</td>
<td>(0.005)</td>
<td>(0.007)</td>
<td>(0.007)</td>
</tr>
<tr>
<td>Loan to total assets</td>
<td>-0.207***</td>
<td>-0.207***</td>
<td>-0.198***</td>
<td>-0.196***</td>
<td>-0.192***</td>
<td>-0.191***</td>
</tr>
<tr>
<td></td>
<td>(0.042)</td>
<td>(0.042)</td>
<td>(0.042)</td>
<td>(0.042)</td>
<td>(0.041)</td>
<td>(0.041)</td>
</tr>
<tr>
<td>Bank concentration</td>
<td>0.035</td>
<td>0.035</td>
<td>0.015</td>
<td>0.017</td>
<td>0.012</td>
<td>0.014</td>
</tr>
<tr>
<td></td>
<td>(0.070)</td>
<td>(0.070)</td>
<td>(0.064)</td>
<td>(0.063)</td>
<td>(0.068)</td>
<td>(0.068)</td>
</tr>
<tr>
<td>Net interest margin</td>
<td>2.782***</td>
<td>2.784***</td>
<td>2.918***</td>
<td>2.884***</td>
<td>2.852***</td>
<td>2.818***</td>
</tr>
<tr>
<td></td>
<td>(0.543)</td>
<td>(0.549)</td>
<td>(0.607)</td>
<td>(0.613)</td>
<td>(0.625)</td>
<td>(0.634)</td>
</tr>
<tr>
<td>Stock market turnover</td>
<td>0.117***</td>
<td>0.117***</td>
<td>0.106***</td>
<td>0.106***</td>
<td>0.105***</td>
<td>0.106***</td>
</tr>
<tr>
<td></td>
<td>(0.017)</td>
<td>(0.017)</td>
<td>(0.017)</td>
<td>(0.017)</td>
<td>(0.018)</td>
<td>(0.018)</td>
</tr>
<tr>
<td>Deposit insurance</td>
<td>0.089**</td>
<td>0.089**</td>
<td>0.087**</td>
<td>0.088**</td>
<td>0.081**</td>
<td>0.082**</td>
</tr>
<tr>
<td></td>
<td>(0.044)</td>
<td>(0.044)</td>
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**Panel C Determinants of Idiosyncratic risk – world analysis**

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### Panel D Determinants of credit risk-loan loss provision – world analysis

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## Panel E Determinants of credit risk-loan loss reserve –world analysis

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<tr>
<th>Variable</th>
<th>Coefficient</th>
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<tr>
<td>Intercept</td>
<td>-0.462***</td>
<td>0.027</td>
<td>-0.597***</td>
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<td>Dividend Yield</td>
<td>(0.127)</td>
<td>(0.014)</td>
<td>(1.765)</td>
<td>(0.009)</td>
<td>(1.143)</td>
<td>(0.011)</td>
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<tr>
<td>Operating leverage</td>
<td>0.214***</td>
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<td>0.214***</td>
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<tr>
<td>Bank capital</td>
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<td>0.006</td>
<td>-0.096***</td>
<td>0.006</td>
<td>0.096***</td>
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<tr>
<td>Bank capital squared</td>
<td>0.303***</td>
<td>(0.063)</td>
<td>0.204***</td>
<td>(0.066)</td>
<td>0.204***</td>
<td>(0.066)</td>
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<td>Charter value</td>
<td>0.153</td>
<td>0.207</td>
<td>0.197</td>
<td>0.427***</td>
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<td>Off-balance sheet items</td>
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<td>0.007**</td>
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<td>0.007**</td>
<td>0.008</td>
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<td>Market discipline</td>
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<td>Loan to total assets</td>
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<td>0.066</td>
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<td>Bank concentration</td>
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<td>-0.090**</td>
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<td>Net interest margin</td>
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<td>0.464</td>
<td>0.455</td>
<td>0.471</td>
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<td>Stock market turnover</td>
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<td>0.053***</td>
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<td></td>
<td>(0.007)</td>
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<td>(0.008)</td>
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<td>Shareholder rights index</td>
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<td>-0.025***</td>
<td>-0.039***</td>
<td>-0.038***</td>
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<td>-0.032***</td>
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<td>(0.008)</td>
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<td>Commercial bank dummy</td>
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<td>0.025</td>
<td>0.033**</td>
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<tr>
<td></td>
<td>(0.017)</td>
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<td>High income country dummy</td>
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<td>-0.074***</td>
<td>-0.069***</td>
<td>-0.068***</td>
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<td>-0.061***</td>
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<td></td>
<td>(0.024)</td>
<td>(0.023)</td>
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<td>12</td>
<td>12</td>
<td>λ²(10)=112</td>
<td>λ²(10)=112</td>
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