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Intermediation Patterns in Banks: Three Empirical Essays

by

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To my dear husband

ABSTRACT

This thesis focuses on the stability, strategic investment decisions and intermediation patterns of banks using different samples that cover many key regions of the world. To this end, three distinct lines of research are pursued. First, an empirical analysis of the relationship between revenue diversification, bank performance and stability in emerging economies is conducted. Second, the initial analysis is extended to the European region and specifically examines how the ownership structure in banks influence the benefits derived from revenue diversification. Finally, using banks in the Mercosur (Argentina, Brazil, Paraguay and Uruguay), the impact of systemic crisis on intermediation patterns is analysed to better understand, the factors that condition the recovery of major bank fundamentals after a crisis.

Using different estimation methodologies, different samples, and an innovative approach to the various lines of research, the following robust evidence is provided: first, diversification *within* and *across* business lines decreases insolvency risk in emerging economies. Second, in the European region, revenue diversification is beneficial in banks that have a majority shareholder. This is because a large shareholder protects its own wealth by positively influencing strategic investment decisions. In other words, the presence of a majority shareholder will be consistently associated with risk efficient levels of diversification. Third, there is *prima facie* evidence of a certain level of "abnormal" behaviour in banks in the Mercosur. This manifest in protracted recovery of private sector intermediation, high levels of excess liquidity on banks' balance sheet and high intermediation spread that persists well after the crisis.

The major contributions of the thesis are as follows: all three chapters uses estimation methodologies new to the literature in each area as well an original research approach in order to obtain new insights. For example, the link identified between ownership concentration and revenue diversification is a novel way of analyzing the impact of the latter on insolvency risk, which illuminates the debate on the benefits of revenue diversification that currently exists in the literature. Also this thesis is the first to provide multiple benchmarks for which post-crisis bank behaviour is compared, thus anchoring current debate on the issue.

Finally, the empirical results give rise to important public policy considerations. First, the robust positive association between diversification and bank soundness suggests there is no negative trade-off between the diversification strategy and bank performance. As a consequence, there is no compelling reason to restrict banks activity. Regulatory initiatives should therefore focus on ensuring risk efficient diversification strategies are supported in banks. In addition, the role of ownership structure in ensuring market discipline should also not be undermined by immoderate restrictions on ownership of bank shares. The final recommendation is quite simple in concept and very timely for countries designing a path for post-crisis recovery: it is important to implement policies that bring about a sustained increase of confidence in the banking system, as a starting point, a stable macroeconomic environment alongside improved prudential institutional frameworks.

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DECLARATION OF AUTHORSHIP

I, **Sarah Oludamilola Sanya** declare that the thesis entitled

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and the work presented in the thesis are both my own, and have been generated by me as the result of my own original research. I confirm that:

- this work was done wholly or mainly while in candidature for a research degree at this University;
- where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated;
- where I have consulted the published work of others, this is always clearly attributed;
- where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work;
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Southampton, 15th December 2009

Sarah O. Sanya

Chapter I

INTRODUCTION

1.1 AIMS

This thesis aims to offer new insights into intermediation patterns and bank stability. To this end, this research provides two distinctive analyses of the relationship between revenue diversification, performance and stability in banks across a wide range of countries. Furthermore, a unique analysis into post-systemic crisis recovery of bank fundamentals particularly private sector credit in the Mercosur (Argentina, Brazil, Paraguay and Uruguay) concludes this work.

1.2 OVERVIEW

Financial crises in the past few decades have resulted in sizeable losses both in developed and emerging economies. The losses in emerging economies have been significantly more detrimental to subsequent economic growth. This is because of the protracted decline in capital flows necessary for economic growth, poverty alleviation and financial development after crises. The severity and spread of the recent 2007 global financial crisis has generated a renewed interest in financial stability in both developed and emerging economies. The crisis has also highlighted the importance of a coordinated policy response across countries to prevent the spread of financial stress.

Motivated by this interest in financial stability, the need to ensure soundness of individual institutions in order to prevent and/or curtail the spread of financial stress, and the need to hasten post-crises recovery of bank fundamentals across countries, this empirical research aims to unveil the linkages between banks portfolio composition, performance and stability as well as identifying factors that wedge post-crisis recovery in bank activities. This work thus makes the following specific contributions.

First, this work enhances and deepens understanding of the relationship between intermediation patterns, performance and stability in banks employing a variety of econometric techniques and a number of different samples. Second, this thesis -for the first time in the literature- looks at the benefits of revenue diversification for

banks in emerging economies. This represents a valuable extension to the scope of prior research, which had previously been on industrialized economies. In addition, ensuring the stability of banks in emerging economies will be particularly important in coping with the global crisis and its aftermath. Second, this thesis extends previous research, and thereby adds a new dimension to the literature by disentangling the influence of the ownership structure in banks on the benefits of revenue diversification. The fact that a large shareholder may exert controlling influence on banks portfolio composition has previously not been considered. The finding that the benefits of diversification will be related to the ownership structure in banks, gives regulators and supervisor new insights about bank activities and their relationship with performance and stability. In addition, the discovery of this vital link is in no doubt valuable to investors. Third, using an innovative methodical approach, this thesis investigates the behaviour of bank fundamentals after systemic crisis. This analysis is particularly valuable, as prior interest on systemic crisis has been on its determinants with very little work on post-crisis recovery. The finding, that the long and protracted recovery of private sector intermediation in Latin America could be hastened by institutional and macroeconomic factors is highly beneficial given the depth and spread of the current 2007 crisis.

The idea that revenue diversification can lower bank risk, enhance performance and increase the volume of intermediation is intellectually appealing to researchers, bank managers and owners of equity capital. More importantly, regulatory initiatives will respond favourably to these findings because of the need to safeguard the financial system especially during a crisis. In addition, concerns for further economic contraction after systemic crisis will focus domestic public policy discussions on expediting post crisis recovery of credit supply and also feature prominently in supranational policy initiatives especially for emerging markets, dependent on external financing from industrialized economies.

1.3 STRUCTURE OF THIS THESIS

This thesis is structured along two distinctive public policy concerns in banking, whereby one problem is further decomposed into two separate analyses. As a result, one chapter is devoted to each one of the three different lines of research. What is common to these three distinct lines of research is their focus on patterns of intermediation in banks. While the first two looks at how intermediation patterns can improve bank stability, the third analysis is on how to regularize intermediation patterns after episodes of financial distress.

Chapter II is a deep literature review of the relationship between revenue diversification and bank performance. It is the starting point for the analysis of the relationship of interest in chapter III and IV.

Chapter III analyses the relationship between revenue diversification, bank performance and stability using a dataset of 11 leading emerging economies. Following a detailed review of the vast body of literature on revenue diversification, this chapter empirically tests whether greater diversification of banks revenue sources in emerging economies increases 1) profitability per unit of risk and 2) stability. This chapter presents robust evidence of a positive link between revenue diversification, bank performance and risk in emerging economies.

Chapter IV builds upon the initial findings of the preceding chapter and extends the analysis to developed economies proxy by nine European countries. To this end, this chapter contains an empirical validation of the hypothesis that the level of revenue diversification in banks with a large shareholder is risk mitigating. Other studies using similar datasets have not considered the role played by the ownership structure of banks in determining its portfolio composition. The results confirm the previous finding of a beneficial effect of diversification on bank performance by showing robust evidence for this positive association when controlling for the ownership structure in banks. This is a previously unidentified link.

Chapter V takes a different approach to stabilizing intermediation patterns in banks and focuses on post crisis recovery of essential bank fundamentals. This chapter introduces an innovative econometric technique -convergence analysis- to determine whether or not post-crisis recovery exists and what factors drive the return to normality in bank behaviour. Whilst the literature is silent about these issues, presumably because credit recovery is certain, this thesis shows evidence to the contrary. Specifically, credit recovery is protracted due to macroeconomic volatilities, institutional and regulatory inadequacies in these economies. In addition, this chapter offers a first way of assessing "normal" post crisis behaviour by analyzing the level of bank fundamentals against a pre-specified benchmark. Indeed, the results of this exercise offer evidence of the need to ensure rapid post crisis recovery especially since crisis tends to have destabilizing spill over effects to emerging economies.

Chapter VI provides an overall summary to this thesis and identifies important policy implications that can be drawn from it. It also acknowledges the limitations of the presented work and highlights fruitful avenues for future research. The subsequent section presents a brief summary of the three main chapters.

Chapter II Literature Review

This chapter is an in depth review of the literature on the benefits revenue diversification fully describing the methods and results of several other studies and explains the contribution of the thesis relative to the existing literature. The chapter also highlights the novelty of the results and explores reasons why the impact of revenue diversification on bank risk may differ in emerging economies.

Chapter III Can Banks in Emerging Economies Benefit From Revenue Diversification?

This chapter is an empirical investigation of the impact of revenue diversification on bank performance and risk, explicitly identifying and controlling for the

endogeneity of the diversification decision. While prior research in this area has been on developed economies, the analysis in this chapter shifts the focus to emerging economies - in recognition of the possibility that rapid economic and financial development will provide banks with more profitable diversification opportunities. Using a panel dataset of 226 listed banks across 11 countries and a new methodological approach (Systems Generalized Method of Moments estimator), chapter III provides the first empirical evidence of the impact of (i) the observed shift towards non-interest income and (ii) diversification within interest and non-interest generating activities on insolvency risk and bank performance. The core finding is that diversification *across* and *within* both interest and non-interest income-generating activities decrease insolvency risk and enhance performance. The results show that these benefits are largest for banks with moderate risk exposure. This finding is robust to a broad array of sensitivity checks including controls for bank structure and the regulatory environment. These results not only provide evidence that revenue diversification can indeed be beneficial, they also cast some doubt on prior research that assume otherwise. By implicitly assuming banks are limited in their ability to make ex-ante risk efficient portfolio choices, the negative externalities from bad portfolio choices, is incorrectly attributed to revenue diversification - a major flaw in prior literature of revenue diversification.

Chapter IV Ownership Structure, Revenue Diversification and Insolvency Risk in European Banks.

Chapter IV makes a further important contribution to the literature on revenue diversification. This chapter introduces a new dimension to the nexus between revenue diversification and bank performance by introducing one of many factors (ownership structure) that may make diversification value enhancing. More specifically, it tests the hypothesis that the level of revenue diversification in banks with concentrated ownership structure will be risk efficient. The analysis in this chapter uses a panel dataset of 153 listed European banks over the period 2000-2007, and also employs a different estimation technique - the three Stage Least Squares (3SLS) to address the issue of endogeneity. The following results are

presented: First, this chapter finds revenue diversification reduces insolvency risk in banks that have a large shareholder. This is because, the need for this shareholder to protect its wealth is often accomplished through its ability to influence strategic investment decisions positively. Hence the presence of a majority shareholder is consistently associated with risk efficient levels of diversification. The results presented in this chapter are robust to an array of controls including alternative estimation, sample and variable specifications. The link identified between ownership concentration and revenue diversification is a novel way of analyzing the impact of the latter on insolvency risk in banks. This previously undiscovered link confirms the hypothesis that the problems with inefficient diversification decisions originates from within the banks management or ownership structure, which may favour myopic investment decisions in order to increase short-term profitability. This chapter reiterate that it is unlikely that revenue diversification is not beneficial for banks. In terms of policy implications, these findings highlight that prior research that finds revenue diversification to be value destroying is missing an important link as it does account for the influence of internal factors. In sum, the results suggest that there is still no compelling evidence to justify bank regulations that restricts banking activities.

Chapter V Bank Behavior after Crises in Mercosur

Chapter V importantly contributes to prior research and public policy discussions in two ways. First this chapter uses convergence analysis, which to the best of my knowledge has not previously been used in the rather limited literature on post-systemic crisis recovery, to identify whether or not the volume of private sector intermediation recovers in the Mercosur after crisis. Second, it also determines the hierarchy in which macroeconomic, institutional, and bank specific characteristics wedge post-crisis recovery using nested regression estimation techniques. Using a panel dataset of commercial banks during the period 1990-2006, the research presented in this chapter analyzes the impact of crises on four sets of financial indicators of bank behavior—profitability, maturity preference, credit supply, and risk. The result show that most indicators of bank behavior, such as profitability, in fact revert to previous or more normal levels, however, a key finding of the chapter

is that private sector intermediation is significantly reduced for prolonged periods of time and that a high level of excess liquidity persist well after the crisis. The inter-linkages between global economies implies lessons learnt from this analysis can no longer be viewed as region-specific, but instead are highly valuable tools that can shape public policy design and regulatory initiatives across countries. The finding that systemic crisis is followed by a collapse in private sector intermediation is particularly important as real activity in sectors more dependent on external finance is impeded when banks cut back on lending. Therefore, the results in this chapter urgently call for a coordinated policy response by advanced and emerging economies during times of financial stress. Such responses needs to ensure 1) access to external funding for emerging economies is not blocked during and after crisis 2) continued support for advanced economy banks with large presence in emerging economies especially where credit from these banks cannot be easily replaced by other sources of finance (Danninger et al. 2009).

Chapter VI Summary, Conclusions and Future Research

To end this thesis, a global summary and concluding remarks is presented in Chapter 6. This outlines the limitations of this work, and identifies a number of fruitful avenues for future research.

Chapter II

LITERATURE REVIEW ON REVENUE DIVERSIFICATION

2.1 OVERVIEW

This review is motivated by the ongoing tension in the literature about the benefits of diversification to banks. While it remains theoretically intuitive that the diversification of a bank's revenue base will be beneficial, there is no shortage of empirical evidence to suggest that this may not necessarily be the case. Each piece of research is however individually unique. The difference in methodology, analytical approach and dataset used in these studies to a certain extent becomes instrumental in driving the different conclusions. Prior studies have so far been limited in bringing the current literature together in a consistent manner in order to identify the drivers of beneficial revenue diversification.

This review itself is thus an innovation that contributes to the existing literature. This is because it not only details the methods and findings of key studies in the literature as prior studies have done, but also identifies to what extent the difference in analytical approach drive the results reported. For example, it is established in the literature that the benefits of diversification for medium to large banks are greater than for small banks that are less able to capitalize on diversification opportunities. Therefore, an inconsideration for the peculiarities of the dataset may lead to erroneous conclusions regarding diversification benefits.

The rest of this chapter is organized as follows; section (2.2) briefly reviews geographic diversification. Section (2.3) introduces revenue diversification as well as the different analytical approaches used in this strand of the literature. Section (2.4), (2.5), and (2.6) respectively investigates whether the choice of analytical approach, data and econometric methodology, and measures of revenue diversification employed in the literature explain the differences in conclusions. Finally section (2.7) recaps the contribution of the thesis to the diversification literature.

2.2 GEOGRAPHIC DIVERSIFICATION

There is a reported increased shift towards non-interest income in recent years aided by technological progress and deregulation Goddard et al. (2008). Banks look to non-interest income to increase revenue as well as lower bank risk especially when net-interest income and non-interest income are only weakly correlated. Possible benefits of this diversification include greater operating efficiency, greater debt capacity, and lower taxes. The potential costs of diversification include the misuse of resources to undertake value-decreasing investments, the tendency for poor segments to drain resources from better-performing segments, and agency costs imposed by the misalignment of incentives between various segment managers (Berger and Ofek 1995). Geographic and revenue diversification are the two main aspects of diversification that has been examined in prior literature even though there is still no clear prediction about their overall effect on firm value. Geographic diversification is when a bank operates outside the state it is headquartered or outside its country of incorporation, whereas revenue diversification occurs when banks generate income outside their traditional lending activities.

Geographic diversification reduces the risk that a geographically focused idiosyncratic shock will affect a bank severely enough to cause it to fail, thus enhancing the banks stability (Winton 1999). Recent work by Grossman (1995) is suggestive of the fact that countries with extensive branch networks were less likely to experience a banking crisis in the 1930's while Wheelock (1995) found that in the United States, states that had more branch banks (within state) had lower failure rates during the Depression. Most studies on geographic diversification are on the US where until the Riegle-Neal Interstate Banking and Branching Efficiency Act in 1994, there were legal barriers preventing banks from accepting deposits outside their home state.

Even though this thesis mainly focuses on revenue diversification I briefly review prior work on geographic diversification particularly studies whose analytical

methods and variables of interest have deeply influenced the ongoing debate on the benefits of diversification[1].

Grossman (1994) investigated bank stability during the Great depression in 25 countries around the world. The study demonstrates that geographic diversification is not solely responsible for enhanced stability as banking systems in countries such as France and Belgium that did not have extensively branched banks were also stable during the Great Depression.

Hughes et al. (1996), investigates the role of geographic diversification on bank performance and safety using 443 US bank holding companies data that are heterogeneous with respect to size. They find that the estimated effects of geographic diversification on return and risk depend on the efficiency of the BHC. For inefficient BHC's an increase in the number of branches is beneficial (lowers insolvency risk and increases efficiency), while an increase in the number of states in which BHC's operates is not. For efficient BHCs, neither an increase in the number of states nor the number of bank branches is beneficial.

Carlson (2004), also tests the role of geographic diversification on bank stability during the Great Depression. The results show geographically diversified banks are less likely to survive and the duration of survival is also relatively much shorter. However, further investigation showed banks failed not because they were geographically diversified but because they systematically held riskier portfolios than unit banks. More specifically, branched banks in the sample held fewer reserves and made more loans. The effect is an increased exposure to systematic shocks even though idiosyncratic shocks declined. The conclusion is therefore that branching per se is not detrimental. Conversely it is the choice made by individual

[1] Winton (1999) highlights the following three ways in which geographic diversification can reduce bank risk. First, geographic diversification expands investment opportunities in banks by increasing the types of industries and/or sectors banks lend to. Second, branching diversifies a bank's portfolio with respect to region specific shocks. While this two mechanisms influence the asset side of the balance sheet, geographic diversification also offers opportunities for diversification on the liability side of the balance sheet as diversifying the depositor base reduces the effect that economic shocks, deposit withdrawal and bank panic may have on bank stability.

banks about how to use their diversification opportunities that subsequently influences risk.

The results of studies that have used more recent datasets remain mixed; Morgan and Salmolyk (2003) find that geographic diversification does not increase profitability or reduce overall portfolio risk among Bank Holding Companies (BHC's) in the US since 1994-2001. However, increased diversification improves the lending capacity of banks.

Deng et al. (2007) investigates the relationship between geographic, asset and revenue diversification and the cost of debt during 1994-1998. They find diversification lowers the cost of debt particularly when the endogeneity of the diversification decision is controlled for. They attribute this to the fact that riskier BHC's tend to choose to diversify, thus standard Ordinary Least Squares (OLS) regression procedures will incorrectly attribute the poor performance of diversifying banks to the diversification decision. Hyland and Diltz (2002) also confirm the endogeneity problem in studies of diversification as diversified firms in their sample are poorly performing even before they diversify.

2.3 REVENUE DIVERSIFICATION AND THE THREE DISTINCT ANALYTICAL APPROACHES

2.3.1 Overview

Regarding revenue diversification prior work has taken three distinct approaches to understanding the impact of diversification on bank profitability and risk. The first approach uses risk return analysis that result from merger simulations among existing individual banks and firms. This approach was popular before the passage of the Graham Leach Bliley Act (GLBA) in 1994, which permitted revenue diversification in banks. However, simulating hypothetical mergers have some major shortcomings. First, it does not take into account the economies of scale and scope that arises in real life mergers. Second, randomly assigning firms that merge

calls into question the relevance of the results since in reality acquisitions are strategic investments and hardly ever randomly decided. Third, the relevance of the predictions of simulation studies particularly before the GLBA depends on how similar the bank eligible-activities before the enforcement of the GLBA closely mirrors the range of permissible activities after this period. Nevertheless, these studies give insight into the potential risk effects of diversification strategies before they are fully exploited.

The second approach is an analysis of actual data of functionally diversified banks involved in non-interest generating activities using cross sectional and/or panel regressions which may or may not have dynamic properties. This is the most popular of the three and is the approach taken in this study.

The third and final approach exclusively focuses on stock market reaction to the diversification decision.

This thesis builds on the second approach and uses actual data for diversified banks to quantify the relationship between diversification and risk in Emerging and European Economies although the following important features differentiate it from earlier work.

First, this thesis is the first to analyze diversification benefits for banks in emerging economies. This is a clear extension in scope to the current literature. The positive link identified between non-interest income and risk-adjusted profitability for all banks provides *prima facie* evidence on the benefits of a diversified earning stream on the total risk of a bank.

Second, the analysis in this thesis improves on both the methodological and data segmentation problem endemic in balance sheet data. The System Generalized method of moment's estimators is a new econometric methodology in this strand of literature that addresses the endogeneity of the diversification decision with rigor. The use of this methodology is particularly relevant in addressing the peculiarities of the panel dataset assembled.

Furthermore, the fact that the dataset cuts across a number of leading emerging economies also increases the applicability of the results.

The three analytical approaches do not always give a consistent picture of the impact of revenue diversification. However this chapter categorizes the existing literature based on each approach. It also compares and contrasts, methods, data, and variable definitions used in prior literature with the objective of bringing together the vast but nevertheless growing literature on revenue diversification, for the first time in a clear and consistent manner.

2.3.2 First approach: Synthetic bank simulations

Beginning with simulation exercises. Boyd and Graham (1988), Rose (1989) and Boyd et al. (1993) analyze the effect of BHC expansion by simulating mergers between bank holding companies and non-bank firms. The studies jointly covered the period between 1971-1987. The results from these synthesized mergers show the most beneficial mergers were between BHC's and life insurance companies. In other words, mergers between these two types of institution reduce the risk of failure. The merger simulations based on accounting data further suggest that BHC's combination with securities or real estate development firms increases the risk of failure. Overall, maximizing diversification benefits will depend on which industry the bank enters into.

Saunders and Walter (1994), replicate the work of Boyd and Graham (1988) using a similar dataset and also find that the greatest risk-reductions from diversification arises when banks expand into insurance as opposed to securities activities. To see if the results in Boyd and Graham (1988) hold across time specifically after the GLBA Lown et al. (2000) undertake a similar analysis for the period 1984-1998. Their results suggest in accord with Boyd and Graham (1988) that, mergers between BHCs and life insurance firms will produce firms that are less risky (and no less profitable) than those in either of the two individual industries. However in contrast to Boyd and Graham (1988), they do not find Mergers between BHCs and securities firms to raise BHCs' risk measures significantly as previously stated.

Drawing heavily on the characteristics of the life insurance market, Lown et al. (2000) stated the following as key features of a successful diversification strategy:

First, the new activities the firm proposes to undertake must have a long-term growth potential. For example between 1986 and 1991, life insurance premiums growth exceeded 12 percent per year on average across all countries in the then European Community (EC). The long-term sustainability of these activities is also assured since they are linked to long-run phenomena like rising income, average life expectancy, and technological innovations. Possible tax deductibility of life insurance contributions implemented increases the long-term attractiveness of life insurance cover to customers. Second, the new activities should impose minimal increases in operating costs to the diversifying firm. Third; there should be synergies due to the scale and scope of operations of the acquiring firm. In the case of bank mergers with insurance companies, these synergies further lowers cost, and improves effectiveness of selling life insurance product. In addition, banks can use valuable customer information and administrative systems to tailor their sales approach and products to their customers needs.

2.3.3 Second approach: Accounting analysis

The second approach to studying the benefits of diversification examines actual income statement and balance sheet data of bank activities. This approach to the study remains the most popular. This is because it requires less restrictive assumptions on the data generating process compared to simulation studies. In addition, large datasets can easily be collected and analyzed compared to stock market data analysis making this approach versatile and appealing to the researcher.

Using a sample of 23 domestic U.S bank holding companies with Section 20 subsidiaries over the period 1990 to 1997, Kwan (1998) show diversification into securities activities increased bank risk. [2] This result is echoed in DeYoung and

[2] A bank holding company or a foreign bank may be granted permission to engage to a limited extent through a so-called section 20 subsidiary in underwriting and dealing in securities that a

Roland (2001) who use data from 472 large U.S. commercial banks between 1988 and 1995. They provide three explanations into why diversification may not be beneficial. First, the high switching and information costs makes it more costly for banks and customers to walk away from lending relationships thus increasing the likelihood that revenues from lending activities are more stable over time. Second, given an ongoing lending relationship is established, the ongoing production cost is mostly variable (interest) costs, compared to the fixed or semi fixed labor cost of expanding into non-interest income, which increases operating leverage. Third, fee-based activities gives banks an opportunity to increase leverage since they attract lower regulatory capital requirements compared to lending activities as banks are required to hold equity capital against outstanding loan balances.

Some studies rely on the principles of portfolio theory to gauge potential benefits of diversification. Standard portfolio theory suggests that the overall variance of net- operating revenue will rise as the non-interest income component increases if non-interest income is more volatile than net-interest income. A negative covariance between non and net-interest income growth will directly lower the overall variance. As long as the covariance between both types of activities is not exactly one, the variance of net operating revenue can still be reduced. In using this principle, Stiroh (2004a) uses data during the period 1978 to 2001 to examine how non-interest income affects variations in bank profits and risk. Results from both aggregate and bank data provide little evidence that diversification benefits exist. He attributes this to the fact that potential diversification benefits are receding as the correlation between net and non-interest income growth increase for the average bank in their sample. This result is also corroborated when Stiroh (2006a), use the same portfolio framework on equity market data for U.S. BHC's during the period 1997 to 2004.

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member bank may not underwrite or deal in directly (bank-ineligible securities). Section 20 subsidiaries are subject to limitations and/or standards designed to address certain safety and soundness concerns. One of the more prominent constraints is that it can derive no more than 25 percent of its gross revenue from underwriting or dealing in other bank-ineligible securities.

Furthermore, Stiroh and Rumble (2006) comprehensively analyze balance sheet data for US financial holding companies (FHC's) during the period 1997 to 2002 using both panel and cross sectional analysis. The study uses risk-adjusted measures of profitability as well as the Z-score to measure total risk, while using the Herfindahl type approach to construct measures of diversification. This study also innovatively measures the "net effect" of diversification as the sum of the direct exposure effect to non-interest income plus the indirect diversification effect through changes in the institutions own degree of diversification. This analysis show the "double-edged" nature of this phenomenon as revenue diversification does bring benefits, however there are greater offsetting effects from a greater reliance on non-interest income, which are more volatile and not necessarily more profitable than interest generating activities. Goddard et al. (2008) also use the "net effect" approach in their study of diversification for small US credit unions during the period 1993-2004 and find that the negative indirect effect outweighs the positive direct exposure effect for all but the largest credit unions. These results are similar to those obtained in other studies such as Lang and Stultz (1994), Morgan and Samolyk (2003), and Acharya et al. (2006) that use similar methods to construct measures of diversification and risk.

2.3.3.1 Is Endogeneity of the diversification decision driving the results?

A number of studies using this balance sheet data have highlighted the need to correct for the endogeneity of the diversification decision since they find that high-risk banks in their sample were more likely to diversify. For example, Acharya et al. (2006) study the effect of diversification of the *loan portfolio* on the return and risk of 105 Italian Banks over the period 1993-1999. After controlling for endogeneity the findings show that *loan portfolio* diversification in their sample of predominantly small banks is not necessarily beneficial for banks. Lang and Stultz (1994) find that diversification does not guarantee higher performance for the firms in their sample even though diversifying firms in their sample had previously been poor performers. It therefore appears that firms that have exhausted growth opportunities in their existing line of business seek growth through diversification. On the other hand, Templeton and Severiens (1992), find diversification to be beneficial for high-risk banks after identifying and controlling for the endogeneity of the diversification decision.

The influence of endogeneity on the relationship between diversification and firm value is also evident in the strand of this literature that measures diversification as the number of industries the firm operates in. Using the Compustat Industry Segment (CIS) database, it is also possible to separately analyze the effects of related and unrelated diversification (conglomeration) to find out if banks are better off operating as a single entity or merged with other financial or non-financial firms. More specifically diversification is measured as the number of segments a particular firm operates in. A firm's value is estimated by valuing the diversified firm's segments as if they were operated as separate firms. The ratio of the firm's actual value to its imputed value measures excess value, or the gain or loss in value from diversification [3]. Positive excess value indicates that

[3] Excess value is defined as the log of the ratio of firm value to its imputed value. Each segment of a diversified firm (multi-segment firm) is valued using median sales and asset multipliers of single-segment firms in that industry. The imputed value of the firm is the sum of the segment values. Negative excess value implies that the firm trades at a discount, while positive excess values are indicative of a premium.

diversification enhances the value of segments beyond that of their stand-alone counterparts. Negative excess value indicates that diversification destroys value.

Using this analysis, Berger and Ofek (1995) without controlling for endogeneity find that diversification reduces value especially when the diversification is within unrelated industries. However, a number of studies using similar methods and datasets but controlling for the endogeneity of the diversification decision have refuted this conclusion. For example, when Campa and Kedia (2002) and Villalonga (2004a) replicate the work of Berger and Ofek (1995) and control for the fact that diversified firms in their sample actually traded at a discount prior to diversifying(endogeneity) they find the opposite.

Campa and Kedia (2002) uses three different econometric techniques to control for the endogeneity of the diversification decision and all three consistently reverse the diversification discount. Furthermore, Villalonga (2004a) use a similar dataset and methodology as Berger and Ofek (1995) and Campa and Kedia (2002) in order to eliminate the possibility that differences in sample are driving the results. On the sample of 8,937 firms during 1978-1997 used in the study, the results show that diversification does not destroy value even though the diversified firms trade at a discount relative to their single segment counterparts prior to diversification. In other words, characteristics, which cause firms to diversify, also cause them to be discounted, but diversification does not further destroy value.More specifically, when systematic differences in diversified and non-diversified firms are controlled for the diversification discount disappears or even turns into a premium.

Also, using a similar sample to Berger and Ofek (1995), Hyland and Diltz (2002) find that diversifying firms traded at a discount even before diversification, and no further loss in value occurred after diversification.

While some studies have concluded that the lack of adequate control for the endogeneity of the diversification decision is one important reason for the disparity of results presented in the diversification literature, Villalonga (2004b) tests

whether the problem originates from multi-segment operations reported in the COMPUSTAT database of US firms. The study uses a similar sample of firms and methodology as prior studies of excess value (Berger and Ofek 1995, Campa and Kedia (2002) and Villalonga (2004a)). However, the sample of firms is drawn from both the Business Information Tracking Series (BITS) and COMPUSTAT. The value estimates obtained on BITS is compared with those obtained on COMPUSTAT. Consistent with earlier studies, there is a diversification discount when firms' activities are broken down into COMPUSTAT segments. However, when the same firms' activities are broken down into BITS business units, the discount changes into a significantly large premium. The author argues that the disparity in results is because the COMPUSTAT data is better at measuring diversification of "unrelated" firms, a so called conglomeration and if only segments of related business lines are considered using COMPUSTAT data then there is a diversification premium. Hence, according to this explanation, the findings in Villalonga (2004b) would indicate that there is a "conglomerate discount", to unrelated mergers and at the same time a premium to related diversification. Because related diversification is relatively more prevalent in banks than purely unrelated diversification the net effect of diversification on bank value should be positive.

2.3.4 Third approach: Stock price impact

The third approach uses market data to evaluate potential diversification benefits. Santomero and Chung (1992) use option pricing techniques to simulate the volatility of asset returns from diversification. Their study presents full support for diversification. They find diversification into similar lines of activity- the so-called "related mergers"- to be beneficial. They also find BHC mergers with securities firms does not increase the riskiness of BHC's whilst BHC mergers with real estate increase risk but the returns from this combination is sufficiently high to compensate banks and not increase the risk of failure.

Saunders and Walter (1994), replicate the work of Boyd and Graham (1988) using equity market data. The results show that there are risk-reduction benefits of diversification.

DeLong (2001), undertakes an event study methodology on US firms to measure the Cumulative Abnormal Returns (CAR) in Mergers during the period 1988 to 1995 the results show that bank mergers into similar lines of business did not destroy value.

Stiroh (2006a), uses a portfolio framework to evaluate the impact of diversification on the return and risk of U.S. BHC's from 1997 to 2004. The results indicate that the banks most reliant on activities that generate non-interest income do not earn higher average equity returns, but are much more risky.

Baele et al. (2007) use stock market data to quantify the effect of diversification on bank risk and return in a cross country panel data study of 143 listed European banks over the period 1989-2004. The measure of performance used is the modified Tobin's Q, and both the systematic and idiosyncratic components of bank risk is modeled. Their results show diversification increases firm value ad decreases idiosyncratic risk. Furthermore, they argue succinctly that results from the European banking sector can differ from the US in that banks have been functionally diversified for longer and with fewer restrictions on the scope of activities they engage in compared to US banks.

To summarize, the fact that there is evidence that diversification can enhance bank performance does not necessarily mean that that these benefits exist for all banks. Given that the lack of consistency in data, methodology and measures of diversification used in prior literature will affect the results; conclusions will have to be made carefully. By sheer weight of evidence it would appear that diversification is beneficial for banks when the endogeneity of the diversification decision is accounted for. Yet there are strong opposing views.

The following section aims to review the evidence in order to determine if there are potential explanations for the different conclusions that have been reached in the literature. It will also highlight whether or not the differences in the literature can be rationalized and to what extent the results remain unexplainable.

2.4 DOES THE CHOICE OF ANALYTICAL APPROACH EXPLAIN DIFFERENCES IN THE RESULTS?

The results from studies using simulation analysis are unanimous about the benefits of diversification particularly with regards to mergers between banking and insurance firms.

Regarding the use of balance sheet data, Most of the disparity in results in the literature on revenue diversification stems from studies that have analyzed balance sheet data. These studies are often plagued with inconsistencies in the dataset and econometric methodology. For example, the segmented structure of the U.S banking system and the relative shorter history of diversification make it more likely that diversification benefits in U.S banks are lower compared to their European counterparts. Regarding the structure of the banking system, a number of studies particularly in the U.S have found benefits of diversification for medium to large banks. According to Goddard et al. (2008), this is due to their expertise and technological advancement in effectively diversify away from their core product of loan provision, the benefits of diversification for small banks are virtually non-existent for the same reasons even in European banks (Merciecia et al. 2007, Goddard et al. 2008). Hence irrespective of the geographic location of banks, there are differences in diversification benefits across asset classes. There is also sufficient evidence to show that the endogeneity of the diversification decision bias the relationship between diversification and bank performance. According to Santomero and Chung (1992), a deeper look at the shortcomings of balance sheet data analysis suggest that the existence of diversification benefits as suggested by portfolio theory cannot be discredited.

With the exception of studies such as (Stiroh 2006a) based on U.S banks, most studies on the third approach, using stock market data, have addressed the data segmentation problem endemic in analysis of the U.S banking sector .Thus, whilst the volatility of stock market data is relatively higher than balance sheet data, there appears to be a consensus on the fact that the benefits of diversification exist. This result may be due to the fact that the listed banks are larger banks with less financing constraints, and generally more homogenous in characteristics compared to if the banks had been randomly sampled. Therefore introducing this sample selection increases the consistency of results.

To summarize, regarding the three different analytical approaches the main tension seems to be with studies that use actual balance sheet data. Studies using simulation analysis and stock market data are unified on the fact that diversification benefits exists for banks. However, the fact that both analytical approaches require a more homogenous dataset than studies that use accounting data may be driving the results. The results remains mixed with studies that only use accounting data. However, due to the weight of evidence showing that the endogeneity of the diversification decision biases the results, a compulsory requirement for further work in this area is to recognize and explicitly control for this endogeneity.

2.5 CAN DIFFERENCES IN ECONOMETRIC METHODOLOGY OR DATA EXPLAIN THE RESULTS?

Regarding the geographic distribution of banks, there is less unison in studies based on BHC's in the U.S, whereas the results regarding diversification benefits are more positive from other countries around the world. For example, Landskroner et al. (2005) in their study of Israeli banks find diversification benefits exist. Likewise Baele et al. (2007) in a cross-country analysis of European banks also find evidence in support of diversification.

Regarding econometric methodologies, studies that use methodologies such as simple OLS or fixed effects estimators that do not control for endogeneity have

found diversification to be value destroying especially for banks in the U.S. For example, DeYoung and Roland (2001) and Morgan and Samolyk (2003) do not find that diversification increases performance in U.S BHC's. Deng et al. (2007) on the other hand, find that diversification lowers the cost of debt for U.S BHC's when endoeneity is controlled for. Templeton and Severiens (1992) show high risk BHC's tend to be more diversified.

Lang and Stultz (1994), Hyland and Diltz (2002) use an event study analysis to compare the performance of diversified firms to the performance of non-diversified firms that share the same characteristics. Their results show that the value of firms that diversify had been discounted even before they ventured into new markets and therefore diversification did not cause additional value destruction. Campa and Kedia (2002) use data similar to Lang and Stultz (1994) and Hyland and Diltz (2002), however their study uses the following three econometric techniques to control for the endogeneity of the diversification decision. First, they explicitly control for unobserved firm characteristics that affect the diversification decision by introducing fixed-firm effects in a panel regression. Second, they obtain the probability of diversifying using probit regressions and use it as an instrument in simultaneous equation model that links multi segment operations to firm value. Finally, their study uses Heckman's correction to control for the self-selection bias induced when firms choose to diversify. The evidence in all three methods indicates that the discount reported on diversified firms is linked to endogeneity. In other words, firm characteristics, which cause firms to diversify, also cause them to be discounted.Without controlling for endogeneity they find a strong negative correlation between diversification and firm value, however this negative relationship disappears and sometimes even become positive when a correction for endogeneity is made.

Villalonga (2004a) also replicate cross sectional regressions in Campa and Kedia (2002) to establish whether or not diversification destroys value. After similar rigorous controls for endogeneity and when systematic differences in diversified

and non-diversified firms are controlled for the diversification discount disappears or even turns into a premium[4].

2.5.1 A note on cross sectional regressions

Empirical studies on diversification either exploit the panel or cross-sectional characteristics of the dataset or in some cases do both. While both approaches are insightful there are some limitations. Meaningful cross-sectional analysis requires large datasets, a limitation that can be mitigated by performing panel data analysis. Information from panel data is also very useful in that it reflects both cross-sectional differences between firms that are constant over time, as well as the time series information, which reflects changes within firms over time. Pure cross-sectional analysis disregards this time series information and may be a biased representation of the diversification benefits that accrue to a bank.

Stiroh (2006a) uses a portfolio framework and pooled cross sectional regressions to evaluate the impact of increased diversification on bank value and risk. They find that highly diversified firms do not earn higher average equity returns and they are much more risky. They however note that about 70 percent of banks in their dataset have levels of non-interest income below the risk-minimizing threshold and may still benefit from diversification. Stiroh and Rumble (2006) also use cross-sectional regressions to examine whether diversification improves the performance of US financial holding companies (FHCs) during the period 1997 to 2002. The evidence on the net effect of diversification shows that while some diversification benefits exist between FHCs, the gains are offset by the increased exposure to non-interest activities, which are much more volatile but not necessarily more profitable than interest-generating activities. Whilst the study uses both cross

[4] Acharya et al. (2006) analyze the effect of loan portfolio diversification in a sample of 105 Italian banks in the 1990's. Even though their study controls for endogeneity they find that diversification does not improve bottom line performance. The dataset used in their study however has some peculiarities that may naturally lead to these results. First, the sample is dominated by small provincial banks (71%), similar diversification restrictions were in place on Italian banks until 1990 as they were in the United States before the Graham Leach Bliley Act of 1995. and about 59% of banks in their sample are state-owned.

sectional and panel data, the evidence against diversification is strongest when cross sectional data is used.

However, according to Villalonga (2004a), cross sectional effects are not per se evidence that diversification destroys value. For, this strong statement to be made the longitudinal aspects of the dataset has to be exploited. In other words, diversified firms must have destroyed value by engaging in diversification or at least be destroying value by staying diversified". This is particularly important especially if poor performing banks are more likely to diversify. Pure cross-sectional effects will attribute the poor firm value to diversification while analysis of the panel data will be able to measure the incremental effect of diversification on firm value.

2.6 CAN DIFFERENCES IN MEASURES OF DIVERSIFICATION AND RISK EXPLAIN THE RESULTS?

The results in the literature show differences in measures of diversification are less likely to explain the disparity of results in the diversification literature in comparison to the difference in methods and data used.

A number of studies construct their measure of diversification in a similar manner to the Herfindahl-Hirschman Index or HHI, which is typically a measure of concentration or competition among firms in an industry. The general guideline to constructing these indices is to take the sum of the squared share of each banks investment in a certain income generating category (interest income or non interest income) relative to its total operating income. The HHI can also be measured specifically for the loan portfolio based on the share of each banks investment in commercial and industrial loans, real estate loans, home mortgage loans, consumer loans, and agricultural loans and for the non interest income portfolio. The higher the value of the HHI the less diversified the bank is. These measures have gained popularity as preferred measures of diversification (Morgan and Samolyk (2003), Acharya et al. (2006) and Merciecia et al. (2007)). Morgan and Samolyk (2003) in

studying the relationship between diversification risk and performance among Bank Holding Companies (BHC's) in the U.S during the period 1994 to 2001 use a loan product diversification measure which is based on the Herfindahl-Hirschman Index or HHI. They find that diversification does not increase profitability or reduce overall portfolio risk. However this does not seem to be driving the results as Deng et al. (2007) use the same measure of diversification and find that diversification is beneficial and reduces risk.

Stiroh and Rumble (2006) more recently Goddard et al. (2008) use the HHI measures of revenue diversification for U.S FHC's and small credit unions respectively. They analyze the concept of the "net effect" of diversification to illuminate the relationship between diversification and performance. The net effect is the sum of the banks direct exposure effect to non-interest income plus the indirect diversification effect through changes in the composition of net operating revenue of the bank. They show that the increase in the non-interest income share of net-operating revenue produces a beneficial diversification effect for banks; however, these gains are offset by the direct increased exposure to non-interest income activities, which are volatile but not necessarily more profitable than traditional interest generating activities.

Regarding, measures of performance, researchers can use either accounting or stock market data to construct the measures of risk and return. Popular measures of profitability are the Return on Assets (ROA), or the Return on Equity (ROE), both the ROA and ROE can also be risk adjusted to measure profit per unit of risk. The other measure of risk often used is the Z-score, which can be derived from both balance sheet and stock market data. The Z-score is an indicator of the probability of bankruptcy. The Z-score begins with the idea that bankruptcy arises when profits are sufficiently negative to eliminate equity. The Z-score (or *Z*), then, is the number of standard deviations below the mean by which profits must fall to bankrupt the firm (Lown et al.(2000)). Hence, higher values of *Z* are associated with lower probabilities of failure. The formulas for the *Z-score* and risk adjusted returns on equity and assets are shown below:

$$Z - score = \frac{ROA + E/A}{\sigma_{ROA}}$$

$$RAROE = \frac{ROE}{\sigma_{ROE}}\ ,\ RAROA = \frac{ROA}{\sigma_{ROA}}$$

Where the return on assets *(ROA)* is the ratio of profit before tax to total assets, return on equity *(ROE)* is the ratio of profit after tax to total equity and *E/A* is the ratio of equity to assets. A higher ratio indicates higher risk-adjusted profits. The risk adjusted returns on equity and asset is calculated by dividing the Return on Equity *(ROE)* and Return on *Assets (ROA)* by their standard deviations respectively.

Stiroh and Rumble (2006) in their study to examine whether or not diversification improves the performance of US financial holding companies (FHCs), use the risk adjusted profit measures as well as the Z-score to measure total risk. Their results show diversification benefits to be offset by the increased exposure to non-interest activities. Their result is also inline with studies that use similar measures such as (Morgan and Samolyk (2003) and Stiroh (2004a)). However, the lack of evidence on diversification benefits cannot be explicitly linked to the use of these measures as Boyd et al. (1993), Boyd and Graham (1998) and other simulation analysis that use both the ROE/ROA and Z-score, find diversification to be beneficial to banks.

Other measures of diversification and performance exist in the literature. Berger and Ofek (1995) and Villalonga (2004a, 2004b) measure diversification as the number of segment/industries the firm operates in. A hypothetical firm value is constructed by estimating the value of diversified firms segments as if they were operated as separate firms. The ratio of the firm's actual value to its imputed hypothetical value measures the gains/losses from diversification. Positive excess value indicates that diversification enhances the value of segments beyond that of their standalone counterparts. Negative excess values indicate that diversification reduces value. Berger and Ofek (1995) using the excess value measure finds that diversification reduces value, whereas Campa and Kedia (2002), Villalonga (2004a) and Villalonga (2004b) find the opposite. Lang and Stulz (1994) find that firm

diversification and Tobin's Q-a measure of franchise value-are negatively related Whereas Baele et al. (2007) using a similar measure find diversification to be benefical for European banks. Saunders and Walter (1994), measure profitability of a diversified bank as the linear weighted sum of the returns from each activity it undertakes. The risk also depends on the riskiness of each activity the bank engages in weighted by the proportion it invests in each activity, as well as the correlation among the returns from the different bank and non-bank activities. Stiroh (2006) use the variance of equity market return as the measure of risk whilst simply measuring diversification as the non-interest share of net-operating revenue and do not find diversification to be beneficial.

In summary, regarding analytical approaches, studies using accounting data are less unanimous on whether or not diversification is beneficial for banks. Further investigation into causes of the discord in this strand of literature reveal data segmentation, endogeneity of the diversification decision, sample characteristics and geographic location are factors that continue to foster the disparity in results, with measures of diversification and performance playing less of a critical role. Table 1a and 1b summarizes some of the key papers in the literature on diversification that has been reviewed in this chapter.

Table 2a: Summary of selected studies on diversification

Research Study	Measures of: (1) diversification, (2) performance and (3) risk	Estimation Approach	Data	Is diversification Beneficial?
Synthethic bank simulations				
Boyd and Graham (1988)	(1) Hypothetical mergers (2) ROAE (3) SDROAE & Z-score	Simulating synthesized mergers	Listed financial firms (U.S) 1971-1984*	Yes (a)
Rose (1989)	(1) Hypothetical mergers (2) ROA & SPC	Synthesized mergers	Random sample of all firms 1966-1985*	Yes (a)
Boyd et al. (1993)	(1) Hypothetical mergers (2) ROAE (3) Z-score	Simulating synthesized mergers	Listed financial Firms (U.S) 1971-1987*	Yes (a)
Lown et al. (2000)	(1) Hypothetical mergers (2) ROAE (3) SDROAE & Z-score	Pro forma mergers	Listed financial Firms (U.S) 1984-1998	Yes (a)
Accounting analysis				
Berger and Ofek (1995)	(1) Multisegment operations in firms, (2) Excess of imputed stand-alone values for individual business segments to the firms actual value	Estimating excess value in multisegment firms	US listed firms 1986-1991	Yes (b)
DeYoung and Roland (2001)	(1) Fee income (2) Total revenue (3) standard deviation of TR	Degree of total leverage estimation technique	US commercial banks 1988-1995	No
Campa and Kedia (2002)	(1) Dummy variable that takes the value 1 when the firm has multisegment operations in COMPUSTAT and zero otherwise. (2) Excess of imputed stand-alone values for individual business segments to the firms actual value	Fixed effects, Instrumental variable regressions and Heckmans two stage procedure	US listed firms 1978-1996	Yes
Stiroh (2004)	(1) Non-interest income share (2) Net income growth & ROE (3) Sharpe ratio & Z-score	Cross sectional correlations within and across banks	US commercial banks 1978-2001	No
Villalonga (2004a)	(1) Dummy variable that takes the value 1 when the firm has multisegment operations in COMPUSTAT and zero otherwise. (2) Excess of imputed stand-alone values for individual business segments to the firms actual value	Matching estimators, Heckmans two stage procedure and the Probit model	US listed firms 1978-1997	Yes

Source: Authors own calculation. **ROA**: return on asset, **ROE**: return on equity, **ROAE**: return on average equity, **SDROAE**: Standard deviation of the return of equity, **SPC**: relative stock price change, **Non-interest income share**: non-interest income share of net operating revenue, HHI: diversification measures fashioned along the Herfindahl Hirschman indices, **SRV**: stock return volatility, **NPL**: non performing loans, **OLS**: Ordinary least squares, (a) BHC and life insurance mergers deemed particularly beneficial,(b) only when the firms diversify into similar activities (c) Only for large institutions.

Table 2b : Summary of selected studies on revenue diversification cont'd

Research Study	Measures of: (1) diversification, (2) performance and (3) risk	Estimation Approach	Data	Is diversification Beneficial?
Accounting analysis cont'd				
Villalonga (2004b)	(1) Dummy variable that takes the value 1 when the firm has multisegment operations in COMPUSTAT and zero otherwise. (2) Excess of imputed stand-alone values for individual business segments to the firms actual value	Comparison of Excess value estimates using two different datasets	US listed firms 1989-1996	Yes
Stiroh (2006b)	(1) HHI & non-interest income share (2) Market returns (3) volatility of Market returns	OLS regressions using pooled cross section data	US Listed BHC's 1997-2004	No
Stiroh and Rumble (2006)	(1) HHI & non-interest income share (2) RAROE, RAROA (3) Z-score	Cross sectional and panel regressions using OLS and fixed effects	US FHC's 1997-2002	No
Acharya et al. (2006)	(1) HHI (2) ROA (3) SRV and NPL	Instrumental Variable regressions	Italian Banks 1993-1999	No
Goddard et al. (2008)	(1) HHI & non-interest income share (2) ROA,ROE, RAROE, RAROA (3) SDROA, SDROE	Cross sectional instrumental variable regressions	US credit unions 1993-2004	Yes(c)
Stock price Impact				
Santomero and Chung (1992)	(1) Hypothetical mergers (2) Return on Asset (3) Volatility of ROA & Z-score	Simulating synthesized mergers	US listed BHC's 1985-1989	Yes
DeLong (2001)	(1) Bank mergers with non-bank firms (2) Abnormal stock return	Event study methodology	US publicly traded firms 1988-1995	Yes (b)
Stiroh (2006a)	(1) Noninterest income share (2) Market returns (3) Volatility of Market returns	OLS regressions using pooled cross section data	US Listed BHC's 1997-2004	No
Baele et al. (2007)	(1) Non interest income share, (2) Tobins Q (3) Idiosyncratic, systematic and total risk	OLS panel data regressions	Listed European Banks 1989-2004	Yes

Source: Authors own calculation. **ROA**: return on asset, **ROE**: return on equity, **ROAE**: return on average equity, **SDROAE**: Standard deviation of the return of equity, **SPC**: relative stock price change, **Non-interest income share**: non-interest income share of net operating revenue, HHI: diversification measures fashioned along the Herfindahl Hirschman indices, **SRV**: stock return volatility, **NPL**: non performing loans, **OLS**: Ordinary least squares, (a) BHC and life insurance mergers deemed particularly beneficial,(b) only when the firms diversify into similar activities (c) Only for large institutions.

2.7 CONTRIBUTION OF THE THESIS TO THE EXISTING LITERATURE

The work in this thesis -for the first time in the literature- looks at the benefits of revenue diversification for banks in emerging economies. This represents a valuable extension to the scope of prior research, which had previously been on industrialized economies.

The main reason why the results using banks in emerging economies may differ from their industrialized counterparts is because economic growth and financial development increases the availability of profitable diversification opportunities and the long-term growth potential for new activities the firm proposes to undertake. Rising income, and average life expectancy in emerging economies also assures the long-term sustainability of non-interest activities such as insurance, increasing the likelihood that diversification strategies are successful (Lown et al. (2000)).

This thesis also introduces the System Generalized Method of Moments estimators (System-GMM) to address the endogeneity of the diversification decision. It is well established in the literature that when endogeneity is present past shocks to the dependent variable can cause a correlation between its past realizations and the error term which gives rise to a dynamic panel bias. This autocorrelation is a violation of an assumption necessary for the consistency of OLS (Highland and Diltz (2002) and Deng et al.(2007)). With the exception of Acharya et al. (2006) that look at small banks, studies on diversification that have fully controlled for endogeneity Campa and Kedia (2002), Villalonga (2004a), Villalonga (2004b) have found diversification to be beneficial as opposed to studies such as Stiroh and Rumble (2006) which only partially control for this problem. The method used in this chapter, is an auto regressive-distributed lag model for a panel of banks each observed over a short time period. This econometric methodology is better suited to this dataset for the following reasons; first, past changes in the explanatory variables, for example, performance measures- will be better predictors of current levels than past levels will be of

current changes. Second, System-GMM is more robust to missing data and short time dimensions, which is a characteristic of the dataset.

The core finding is that diversification *across* and *within* both interest and non-interest income-generating activities decrease insolvency risk and enhance performance especially for large banks with moderate risk exposure. This result thus contributes to the debates on bank stability particularly in emerging economies.

Chapter III

Can Banks in Emerging Economies Benefit from Revenue Diversification?

Can Banks in Emerging Economies Benefit from Revenue Diversification?

ABSTRACT

This chapter investigates the effect of revenue diversification on bank performance and risk. Using a panel dataset of 226 listed banks across 11 countries and a new methodological approach System Generalized Method of Moments estimators (System GMM), the results in this chapter provide empirical evidence of the impact of (i) the observed shift towards non-interest income and (ii) diversification within interest and non-interest generating activities on insolvency risk and bank performance. The core finding is that diversification *across* and *within* both interest and non-interest income generating activities decreases insolvency risk and enhances profitability. The results also show that these benefits are largest for banks with moderate risk exposures. By extension, these results have significant strategic implications for bank managers, regulators and supervisors who share a common interest in boosting bank performance and stability.

3.1 INTRODUCTION

Motivated by the ongoing debate in the literature concerning the impact of revenue diversification upon bank profitability; and the fact that thus far research has primarily focused on developed countries; this chapter assesses whether or not revenue diversification is beneficial to banks in emerging economies.[5] Specifically, it empirically analyzes this question: Does revenue diversification produce superior performance and enhance bank stability? In support of traditional portfolio and intermediation theories; the results show revenue diversification to be highly beneficial for banks in emerging economies.

There is a tension in the empirical literature about the benefits of diversification. Some researchers such as Grossman (1994), Wheelock (1995), Hughes et al. (1996), Berger et al. (1999), Reichart and Wall (2000), Campa and Kedia (2002), Landskroner et al. (2005) and Baele at al. (2007) find diversification increases bank stability, whereas others such as DeYoung and Roland (2001), Carlson (2004), Stiroh (2004a), Acharya et al. (2006), Stiroh (2006a,b), Stiroh and Rumble (2006), and Hirtle and Stiroh (2007) find evidence to the contrary. However, thus far, data limitations have narrowed the scope of prior studies on diversification to the US and other industrialized countries. The benefits of diversification particularly regarding banking stability in emerging economies cannot be overstated given the well-established link between finance and the real economy (King and Levine 1993). Accordingly, Nilsen and Rovelli (2001) and Bekaert and Harvey (2002) assert that soundness of the banking system in emerging economies is crucial to fostering stable capital flows, equality and economic convergence. In addition, the intensification of financial sector development in these economies is conditioned by the enhanced performance of banks as a result of diversification.

The motives for diversification (revenue diversification (across banks assets and income sources) or geographic diversification (across state and international

[5] Revenue diversification is viewed as an avenue through which credit risk, which would normally be concentrated in a bank's loan portfolio, can spread to the other non-interest generating activities that a bank engages in. As in developed economies, revenue diversification in emerging economies means that banks are able to engage in diverse non-interest income activities such as securities underwriting, insurance and real estate investment. Importantly, this chapter reports - for the first time- evidence of a shift towards these activities in emerging economies.

borders)) identified in the literature are highlighted as follows: First, Froot et al. (1993), and Froot and Stein (1998) infer diversification is a hedge against insolvency risk that reduces the occurrence of costly financial distress. Second, diversification is a mechanism to boost profitability and operational efficiency particularly if the scale and scope of operations increase (Landskroner et al. (2005)). Third, revenue diversification reinforces the role of banks as delegated monitors thereby increasing the volume of intermediation. This is due to the fact that banks can limit information asymmetry by using vital information from their lending relationship to boost provision of other financial services and vice versa (Baele et al. 2007). Fourth, non-interest income can lower the cyclical variations in profits provided that returns across bank activities are not perfectly correlated. In addition, diversification creates competitive pressures amongst banks competing on a wider range of market segments, which increases innovation and efficiency in the provision of services (Morgan and Samolyk (2003), Carlson (2004), Landskroner et al. (2005), Acharya et al. (2006), and Lepetit et al. (2008)). There are also strong theoretical arguments in the literature as to why the potential and actual benefits of diversification may diverge. The following are five of such explanations put forward in the literature.

First, the gains from diversification depend on the actual portfolio held by the bank. Hence benefits will be limited if banks do not hold a risk efficient portfolio. This is consistent with arguments in Froot and Stein (1998) and Cebenoyan and Strahan (2004). The former finds banks that engage in active credit risk management hold riskier loans, while the latter suggests that diversified banks take on more risk and operate with greater financial leverage. Therefore, the problem is not the diversification strategy per se, but rather, the choices made by individual banks about how to use their diversification benefits that determine to what extent they benefit from diversification.

Second, traditional arguments in favour of diversification typically do not take into account the agency problems between bank owners and creditors thus overstating its benefits. For example, Winton (1999) and Deng et al. (2007), show diversification benefits are maximized when insolvency risk is moderate and

monitoring incentives are strong. This is because when bank risk is high the benefits from diversification will mainly accrue to creditors (uninsured depositors and providers of borrowed funds). This erodes monitoring incentives and increases the risk of failure. Similarly, if insolvency risk is low and monitoring effectiveness is constant across sectors then the benefits of diversification to a specialized bank will be minimal.

Third, while diversification decreases vulnerability to idiosyncratic shocks, there is a corresponding rise in exposure to systemic shocks as a result of the number of markets banks become active in (De Vries 2005). For example, Wheelock (1995) shows that during the great depression, states in the US that had more branch banks had lower failure rates. However, Grossman (1994) cautions against the optimism of this view as banks in Belgium and France, which were geographically diversified also, suffered crises, whereas the unit bank system of Bulgaria was relatively more stable during the same period. A further clarification of this discord was provided in Carlson (2004), who suggest that diversification need not increase risk in banks, however, in their view the peculiarities of diversified banks determines their susceptibility to systematic shocks. For example, they find that the geographically diversified banks in their sample held less liquid reserves in anticipation of more stable deposit withdrawals. However, this increased illiquidity meant that banks could not respond quickly to customer "runs" during the same period.

Fourth, diversification may worsen risk-adjusted performance, particularly when banks over expand into industries where they face higher competition or lack expertise. The subsequent inability to effectively monitor loans may increase asymmetric information between a bank and its pool of borrowers (Carlson (2004), Stiroh (2006a, b), and Mercieca et al. (2007). In addition, the tendency to diversify beyond risk optimal levels has been found to mar the relationship between diversification and risk. In other words, once a bank becomes too exposed to non-traditional banking activities its idiosyncratic risk increases.

Finally, the benefits of diversification have been severely limited by the indiscriminate adoption of the universal banking principle across banks of all asset sizes. This is consistent with results in Goddard et al. (2008), which find that diversification only benefits large credit unions in the US. Other studies such as Mercieca et al. (2007) and Lepetit et al. (2008) report limited diversification benefits for small banks in Europe. This may explain why studies that have a high proportion of small banks in their sample such as Acharya (2006) also find similar results.

While the above arguments present a sound theoretical and empirical underpinning of the benefits and costs associated of diversification, to the best of my knowledge, this thesis is the first to analyze the issue of revenue diversification using banks in emerging economies. Apart from this clear extension in the scope of current literature, this chapter also makes the following important contributions to the literature. First, on the methodological side, a new framework not previously used in this context is introduced to control for the endogeneity of the diversification decision. This method is the System Generalised Method of Moments estimators (System-GMM) for dynamic panel data outlined in Arellano and Bover (1995) and more fully developed in Blundell and Bond (1998). This model is specifically designed to address the econometric problems induced by unobserved bank specific effects, joint endogeneity of the explanatory variables as well as autoregressive properties in the dependent variable.[6]

In this bank level analysis, controls for the macro economic environment are included. This is a dimension which many studies in this area have ignored but is however important in this context. Previous studies suggest that volatility in the macroeconomic and institutional environments banks operate in undermines their role in efficient risk management (Hardy and Pazarbaşioğlu (1998), Nilsen and Rovelli (2001), Vives (2002), Demirgüç-Kunt and Detragiache (2005) and Hackbarth et al. (2006)). Furthermore, the results in this study suggest that

[6] The concern here is that explanatory variables (e.g. profitability ratios) can be related to measures of diversification, for example the benefits of diversification for an ailing bank that has chosen to diversify in order to improve its performance may be understated.

economic growth and development will widen the scope of diversification opportunities for banks as well as boost profitability.

In this study, revenue diversification is measured by using information obtained from banks' income statements to determine the sources of net operating revenue. If a bank's net operating revenue is solely derived from net-interest income the bank is considered to be concentrated and a bank whose net-operating income is evenly split between non-interest and net-interest income is considered fully diversified. The analysis begins with a panel framework of 226 listed banks across 11 countries over the period 2000-2007. The fact that banks' revenue diversification activities occur, through shifts *between* non-interest income and interest income generating activities, and/or through shifts *within* these two types of income generating activity is incorporated into the analyses.

In line with the literature, the contribution of different income sources to bank performance is also assessed. The results show commission income relative to other sources of non-interest income to be most beneficial. However, there is evidence of non-linearity in the benefits of diversification as high exposures to non-interest income reduce risk adjusted profits. The results are robust to controls for changes in market power as measured by bank concentration, institutional development as well as the regulatory and supervisory framework.

The remainder of the chapter is organized as follows, section (3.2) is a detailed review of existing literature, summarising the methods and results of other studies examining the impact of revenue diversification on bank portfolio risk, section (3.3) explains the methodology, the diversification measures and other variables used, section (3.4) and (3.5) present empirical results and robustness tests respectively and finally, section (3.6) concludes.

3.2 LITERATURE REVIEW

This literature review details the methods and findings of key studies in the revenue diversification literature and also identifies to what extent the artifacts of prior studies drive the results reported. For example, it is established in the literature that the benefits of diversification for medium to large banks are greater than for small banks that are less able to capitalize on diversification opportunities. Therefore, an inconsideration for the peculiarities of the dataset may lead to erroneous conclusions regarding diversification benefits.

3.2.1 Geographic and revenue diversification

Geographic and revenue diversification are the two main aspects of diversification that has been examined in prior literature even though there is still no clear prediction about their overall effect on firm value.[7]

Morgan and Salmolyk (2003) find that geographic diversification does not increase profitability or reduce overall portfolio risk among Bank Holding Companies (BHC's) in the US. Deng et al. (2007) investigates the relationship between geographic, asset revenue diversification and the cost of debt. Their findings show diversification lowers the cost of debt particularly when the endogeneity of the diversification decision is controlled for. This is because riskier BHC's tend to diversify, thus standard Ordinary Least Squares (OLS) regression procedures will incorrectly attribute the poor performance of diversifying banks to the diversification decision. Hyland and Diltz (2002) also confirm the endogeneity problem in studies of diversification as diversified firms in their sample are poorly performing even before they diversify.

[7] Geographic diversification is when a bank operates outside the state it is headquartered or outside its country of incorporation, whereas revenue diversification occurs when banks generate income outside their traditional lending activities.

This chapter mainly focuses on how revenue diversification in banks influences risk. Prior work on revenue diversification has taken three approaches to understanding the impact of diversification on bank profitability and risk. The first approach uses risk return analysis that result from merger simulations among existing individual banks and firms. This approach was popular before the passage of the Graham Leach Bliley Act (GLBA) in 1994, which permitted revenue diversification in U.S banks. However, simulating hypothetical mergers have some major shortcomings. First, it does not take into account the economies of scale and scope that arises in real life mergers. Second, this method randomly assigns firms that merge therefore, calling into question the relevance of the results since in reality mergers and acquisitions are strategic investments that are almost never randomly decided. Third, the relevance of the predictions of simulation studies particularly before the GLBA depends on how similar the bank eligible-activities before the enforcement of the GLBA closely mirror the range of permissible activities after this period. Nevertheless, these studies give insight into the potential risk effects of diversification strategies before they are fully exploited.

The second approach is an analysis of actual data of functionally diversified banks involved in non-interest generating activities using cross sectional and/or panel regressions which may or may not have dynamic properties. This is the most popular of the three and is the approach taken in this study to quantify the relationship between diversification and risk of banks in emerging economies.

The third and final approach exclusively focuses on stock market reaction to the diversification decision.

The three analytical approaches do not always give a consistent picture of the impact of revenue diversification. The following section aims to review the evidence in order to determine if there are potential explanations for the different conclusions that have been reached in the literature. It will also highlight whether or not the differences in results presented in the literature can be rationalized by the methods, data, and variable definitions used in prior studies that have used these three approaches and to what extent the results remain unexplainable. The idea is

to bring together the vast but nevertheless growing literature on revenue diversification, for the first time in a clear and consistent manner.

3.2.2 First approach: Synthetic bank simulations

Beginning with simulation exercises. Boyd and Graham (1988), Rose (1989) and Boyd et al. (1993) analyze the effect of BHC expansion by simulating mergers between bank holding companies and non-bank firms. The studies jointly covered the period between 1971-1987. The results from these synthesized mergers show that mergers between BHC's and life insurance companies reduce the risk of failure while BHC's combination with securities or real estate development firms increases the risk of failure. These results are also echoed in Saunders and Walter (1994) and Lown et al. (2000) who use a similar dataset and find the greatest risk-reductions from diversification arises when banks expand into insurance as opposed to securities activities. Drawing heavily on the characteristics of the life insurance market, Lown et al. (2000) explains that a successful diversification strategy must have the following key features: First, the new activities the firm proposes to undertake must have a long-term growth potential. Second, the new activities should impose minimal increases in operating costs to the diversifying firm. Third; there should be synergies due to the scale and scope of operations of the acquiring firm.

3.2.3 Second approach: Accounting analysis

The second approach to studying the benefits of diversification examines actual income statement and balance sheet data of bank activities. This approach to the study remains the most popular. This is because it requires less restrictive assumptions on the data generating process compared to simulation studies. In addition, large datasets can easily be collected and analyzed compared to stock market data analysis making this approach versatile and appealing to the researcher.

Kwan (1998), using a sample of 23 domestic U.S bank holding companies with Section 20 subsidiaries, Kwan (1998) over the period 1990 to 1997 show that

diversification into securities activities increased bank risk on securities activities of U.S bank holding companies with Section 20 subsidiaries .[8] This result is echoed in Lang and Stultz (1994), DeYoung and Roland (2001), Morgan and Samolyk (2003), and Acharya et al. (2006). Stiroh (2004a) examines how non-interest income affects variations in bank profits and risk. Results from both aggregate and bank data provide little evidence that diversification benefits exist. The results are attributed to the fact that potential diversification benefits are receding as the correlation between net and non-interest income growth increases for the average bank in the sample. This result is also corroborated when Stiroh (2006a), use the same portfolio framework on equity market data for U.S. BHC's during the period 1997 to 2004. Furthermore, Stiroh and Rumble (2006) comprehensively analyze balance sheet data for US financial holding companies (FHC's) using both panel and cross sectional analysis. Their analysis show the "double-edged" nature of this phenomenon as revenue diversification does bring benefits however there are greater offsetting effects from an increased reliance on non-interest income, which are more volatile and not necessarily more profitable than interest generating activities. Goddard et al. (2008), in their study of diversification for small US credit unions find similar results.

3.2.3.1 The need to correct for endogeneity

A number of studies using this balance sheet data have highlighted the need to correct for the endogeneity of the diversification decision since they find that high-risk banks in their sample were more likely to diversify (Lang and Stultz (1994) and Acharya et al. (2006)).

Templeton and Severiens (1992), find diversification to be beneficial for high-risk banks after identifying and controlling for the endogeneity of the diversification

[8] A bank holding company or a foreign bank may be granted permission to engage to a limited extent through a so-called section 20 subsidiary in underwriting and dealing in securities that a member bank may not underwrite or deal in directly (bank-ineligible securities). Section 20 subsidiaries are subject to limitations and/or standards designed to address certain safety and soundness concerns. One of the more prominent constraints is that it can derive no more than 25 percent of its gross revenue from underwriting or dealing in other bank-ineligible securities.

decision. Berger and Ofek (1995) without controlling for endogeneity find that diversification reduces franchise value especially when the diversification is within unrelated industries. However, when Campa and Kedia (2002), Hyland and Diltz (2002) and Villalonga (2004a) replicate the work of Berger and Ofek (1995) and control for endogeneity they find the opposite. More specifically, when systematic differences in diversified and non-diversified firms are controlled for the diversification discount disappears or even turns into a premium.

3.2.4 Third approach: Stock price impact

The third approach uses market data to evaluate potential diversification benefits. Santomero and Chung (1992) use the option-pricing techniques to simulate the volatility of asset returns from diversification. Their study presents full support for diversification into similar lines of activity- the so-called "related mergers". This result is similar to Villalonga (2004b) who finds a "conglomerate discount", to unrelated mergers and at the same time a premium to related diversification. Because related diversification is relatively more prevalent in banks than purely unrelated diversification the net effect of diversification on bank value should be positive. Saunders and Walter (1994), replicate the work of Boyd and Graham (1988) using equity market data. The results show that there are risk-reduction benefits of diversification. DeLong (2001), undertakes an event study methodology on US firms to measure the Cumulative abnormal returns (CAR) in Mergers. The results show bank mergers into similar lines of business did not destroy value. Furthermore, Baele et al. (2007) use stock market data to quantify the effect of diversification on bank risks in European Banks. Their results show diversification increases firm value ad decreases idiosyncratic risk. However, Stiroh (2006a) use a portfolio framework to evaluate the impact of diversification on the return and risk of U.S. BHC's and find banks most reliant on activities that generate non-interest income do not have higher average equity returns.

3.2.5 Does the analytical approach explain differences in the results?

The results from studies using simulation analysis are unanimous about the benefits of diversification particularly with regards to mergers between banking and insurance firms. Regarding the use of balance sheet data, most of the disparity in results in the literature on revenue diversification stems from studies that have analyzed balance sheet data. These studies are often plagued with inconsistencies in the dataset and econometric methodology. For example, the segmented structure of the U.S banking system and the relative shorter history of diversification make it more likely that diversification benefits in U.S banks are lower compared to their European counterparts. Regarding the structure of the banking system, a number of studies particularly in the U.S, have found benefits of diversification for medium to large banks. According to Goddard et al. (2008) this is due to their expertise and technological advancement in effectively diversify away from their core product of loan provision, the benefits of diversification for small banks are virtually non-existent for the same reasons even in European banks (Mercieca et al. 2007, Goddard et al. 2008). Hence irrespective of the geographic location of banks, there are differences in diversification benefits across asset classes. There is also sufficient evidence to show that the endogeneity of the diversification decision biases the relationship between diversification and bank performance. According to Santomero and Chung (1992), a deeper look at the shortcomings of balance sheet data analysis suggest that the existence of diversification benefits as suggested by portfolio theory should not be discredited.

With the exception of studies such as (Stiroh 2006a) based on U.S banks, most studies on the third approach, using stock market data, have addressed the data segmentation problem endemic in analysis of the U.S banking sector. Thus, whilst the volatility of stock market data is relatively higher than balance sheet data, there appears to be a consensus on the fact that the benefits of diversification exist. This result may be due to the fact that the listed banks are larger banks with less financing constraints, and generally more homogenous in characteristics compared to if the banks had been randomly sampled. Therefore introducing this sample

selection criterion makes it easier to carry out cross-country analysis and increases the general applicability of the result as shown in Baele et al. (2007).

3.2.6 Does the econometric methodology or data explain the results?

Regarding geographic distribution of banks, there is less unison in studies based on BHC's in the U.S, whereas the results regarding diversification benefits are more positive from other countries around the world. For example, Landskroner et al. (2005) in their study of Israeli banks find diversification benefits exist. Likewise Baele et al. (2007) in a cross-country analysis of European banks also find evidence in support of diversification.

Regarding econometric methodologies, studies that use methodologies such as simple OLS or fixed effects estimators that do not control for endogeneity have found diversification to be value destroying especially for banks in the U.S. For example, DeYoung and Roland (2001) and Morgan and Samolyk (2003) do not find that diversification increases performance in U.S BHC's. Deng et al. (2007) on the other hand, find that diversification lowers the cost of debt for U.S BHC's when endoeneity is controlled for. Templeton and Severiens (1992) show high risk BHC's tend to be more diversified.

3.2.7 Do differences in measures of diversification and risk explain the results?

The results in the literature show differences in measures of diversification are less likely to explain the disparity of results in the diversification literature in comparison to the difference in methods and data used.

A number of studies construct their measure of diversification in a similar manner to the Herfindahl-Hirschman Index or HHI, which is typically a measure of concentration or competition among firms in an industry. These measures have gained popularity as preferred measures of diversification (Morgan and Samolyk (2003), Acharya et al. (2006) and Deng et al. (2007)). While the first two papers measure the HHI for the loan portfolio and find that further diversification of the

loan portfolio is not beneficial, Deng et al. (2007) derive HHI measures for non-interest income and find diversification reduces risk.

Regarding, measures of performance, researchers can use either accounting or stock market data to construct the measures of risk and return. Popular measures of profitability are the Return on Assets (ROA), the Return on Equity (ROE) and z-score an indicator of the probability of bankruptcy. Stiroh and Rumble (2006), Morgan and Samolyk (2003) and Stiroh (2004a) use these measures of performance and find that diversification does not reduce risk. However, the lack of evidence on diversification benefits cannot be explicitly linked to the use of these measures as Boyd et al. (1993), Boyd and Graham (1988) and other simulation analysis that use both the ROE/ROA and Z-score, find diversification to be beneficial to banks.

Other measures of performance exist in the literature such as changes to the excess value of banks due to diversification.[9] Berger and Ofek (1995) using the excess value measure finds that diversification reduces value, whereas Campa and Kedia (2002), Villalonga (2004a) and Villalonga (2004b) find the opposite. Baele et al. (2007) using a similar measure find diversification to be beneficial for European banks.

To summarize, regarding the three different analytical approaches the main tension seems to be with studies that use actual balance sheet data. Studies using simulation analysis and stock market data are unified on the fact that diversification benefits exists for banks. However, the fact that both analytical approaches require a more homogenous dataset than studies that use accounting data may be driving the results. The results remain mixed with studies that only use accounting data. Given that the lack of consistency in data, methodology and

[9] Excess value is defined as the log of the ratio of firm value to its imputed value. Each segment of a diversified firm (multi-segment firm) is valued using median sales and asset multipliers of single-segment firms in that industry. The imputed value of the firm is the sum of the segment values. Negative excess value implies that the firm trades at a discount, while positive excess values are indicative of a premium.

measures of diversification used in prior literature will affect the results; conclusions will have to be made carefully. However, due to the weight of evidence showing that the endogeneity of the diversification decision biases the results, a compulsory requirement for further work in this area is to recognize and explicitly control for this endogeneity.

3.3 METHODOLOGY

3.3.1 Empirical Methodology

In this chapter, an auto regressive-distributed lag model for a panel of banks each observed over a short time period using the System Generalized Method of Moments estimators (System-GMM) is estimated. Prior research such as Acharya et al. (2006), Baele et al. (2007) and Stiroh and Rumble (2006) have identified the need to control for the endogeneity of the diversification decision as banks may diversify in strategic response to their business opportunities.[10]

A problem with applying OLS when endogeneity is present is that past shocks to the dependent variable ($y_{i,t}$) can cause a correlation between its past realizations ($y_{i,t-1}$) and the error term which gives rise to a dynamic panel bias. In addition, if significant events such as mergers and acquisition are not explicitly modelled, they will remain embedded in the error term and continue to influence subsequent contemporaneous observations. This autocorrelation is a violation of an assumption necessary for the consistency of OLS.

[10] Researchers such as Stiroh and Rumble (2006); use standard estimators such as fixed effects estimators to eliminate the potential bias caused by omitted heterogeneity. The fixed effect estimator which is a method of moment estimator based on the data after subtracting time averages is popular for three reasons: it is simple, easily understood and robust standard errors are readily available. In fixed effects estimators there are two common assumptions, first; an assumption of strict exogeneity for the covariates which is crucial for the consistency of the fixed effects estimator; and also an assumption about the constant variance and no serial correlation used primarily to simplify calculations of standard errors. However, if either heteroskedasticity or serial correlation is present a Generalized Method of Moments procedure can be more efficient than the fixed effects estimators (Wooldridge 2001).

In order to address these biases, Arrellano-Bond uses the first differenced generalized method of moment (first-differenced GMM) estimators. The estimator, originally developed by Holtz-Eakin et al. (1988) and Arellano and Bond (1991), is commonly used in macroeconomic growth and development literature by Caselli et al. (1996); Easterly et al. (1997), Benhabib and Spiegel (2000), Levine et al. (2000) and more recently in the banking literature Maechler and McDill (2006).

Below is an exposition into the first-differenced GMM, with particular emphasis on its inefficiency in addressing the persistence of the endogeneity bias in the dataset used in this chapter. It also demonstrates sound statistical intuition behind the use of the System-GMM as the preferred estimator over others in the GMM family.

Equation (3.1) and (3.2) is a derivation of the first-difference GMM in a uni-variate setting:

$$y_{i,t} = \alpha_0 y_{i,t-1} + (\eta_i + v_{i,t}); \qquad |\alpha| < 1;\ i = 1,2,....., N;\ t = 2,3,....., T \tag{3.1}$$

Taking first differences of equation (3.1) yield:

$$\Delta y_{i,t} = \alpha \Delta y_{i,t-1} + \Delta v_{i,t}; \qquad |\alpha| < 1;\ i = 1,2,....., N; t = 3,4,....., T \tag{3.2}$$

Where $y_{i,t}$ is the measure of insolvency risk *(Z-score)*, or risk adjusted performance measures (risk adjusted return on assets *(RAROA)*, and risk adjusted return on equity *(RAROE))* for each bank i in period *t.* $y_{i,t-1}$ are the same measures observed in the previous period. η_i is the unobserved bank specific effect. The error term $v_{i,t}$ is assumed to be independent across banks. Taking first differences of equation (3.1) eliminates the bank specific effects η_i from the model. The second order lag of the dependent variable $y_{i,t-2}$ is assumed to be uncorrelated with $\Delta v_{i,t}$ and will thus serve as suitable instruments in estimating equation (3.1). Additional instruments will be available provided the panel has more than three

year's observations. For example, for period $t = T$ the range of instruments $(y_{i,1}, y_{i,2}, ..., y_{i,T-2})$ can be used as instruments in the first differenced equation. This first-difference GMM is an efficient estimator in this context.

Below is the first step of the multivariate dynamic model used in this analysis. It is also an extension to equation (3.2) above and it takes the form;

$$\Delta y_{i,t} = \alpha \Delta y_{i,t-1} + \Delta x_{i,t} \beta + \Delta v_{i,t} \qquad (3.3)$$

Where $x_{i,t}$ is a vector of additional explanatory variables, which includes bank-specific variables (measures of diversification) and two country specific macroeconomic variables. For as long as the $v_{i,t}$'s are not serially correlated, the explanatory variables in the model need not be strictly exogenous (Bond 2002)[11].

There is however, a serious drawback to estimating Equation (3.3) in isolation as it is well known that biases as well as imprecision can occur when instrumental variables are weak, (Bond et al. 2001). Also one cannot continue to instrument the differenced dependent variable in equation (3.3), with lags of $y_{i,t}$ particularly in small samples where the lagged dependent variable could still be endogenous as $y_{i,t-1}$ term in $\Delta y_{i,t-1} = y_{i,t-1} - y_{i,t-2}$ is correlated with the $v_{i,t-1} = v_{it} - v_{i,t-1}$. The same way predetermined explanatory variables can be related to $v_{i,t-1}$, even though longer lags of the dependent variable remain orthogonal to the error term and may still be available as instruments. Also, if past levels of bank fundamentals convey little information about future changes in the same, then lagged variables will be weak instruments in the estimation of equation (3.3).

[11] In fact the $x_{i,t}$ may be endogenous in that they are correlated with $v_{i,t}$ and earlier shocks, but uncorrelated with $v_{i,t+1}$ and subsequent shocks; predetermined in the sense that $x_{i,t}$ and $v_{i,t}$ are also uncorrelated, but may still be correlated with $v_{i,t-1}$ and earlier shocks; or strictly exogenous, - uncorrelated with all past, present and future realizations of $v_{i,s}$ (Bond 2002, Roodman 2006).

To increase efficiency in estimating equation (3.3), Blundell-Bond outline in Arellano and Bover (1995) an alternative estimator used in this study, called System Generalized Method of Moments estimators (System-GMM) to address the persistence of the endogeneity bias. This method combines two sets of equations, the first being the differenced equations specified above in equation (3.3) where suitable lags of $y_{i,t}$ and other explanatory variables $(x_{i,t})$ are used as instruments, and the other equation in the system have all variables specified in levels as shown in equation (3.4) below;

$$y_{i,t} = \alpha_0 y_{i,t-1} + \alpha_1 x_{i,t} + \eta_{i,t} + v_{i,t} \tag{3.4}$$

In the second set of equations instead of differencing the regressors to remove fixed effects, System-GMM differences the instruments to make them uncorrelated with the fixed effects. This approach is better suited to this dataset for the following reasons; first, past changes in the explanatory variables, for example, performance measures will be better predictors of current levels than past levels will be of current changes. Second, System-GMM also makes it possible to include time-invariant regressors such as specific regulatory and institutional adequacy controls necessary in the estimations but which will otherwise have disappeared in first-differenced GMM, and finally, System-GMM is more robust to missing data, since lagged observations enter the equation as instrument instead of being used explicitly as regressors.

A two-step estimate of the System-GMM is specified in the regression. Moreover, a windmeijer correction to the standard errors that improves robustness to heteroskedasticity is also stipulated. Time dummies are included in the regressions (not reported in tables) as strongly advised by Roodman (2006). This is because the precision of the SYS GMM estimates is highly dependent on the assumption of

no correlation in the idiosyncratic differences; therefore including time dummies makes this assumption more likely to hold.[12]

3.3.2 Measures of Diversification

To measure revenue diversification the Herfindahl Hirschmann Index (HHI) is computed for all banks to account for diversification *between* the two major types of income generating activities. The revenue diversification index HHI (rev) is computed from the revenue flows as follows:

$$\text{HHI(rev)} = \left(\frac{NON}{NETOP}\right)^2 + \left(\frac{NET}{NETOP}\right)^2 \tag{3.5}$$

Where $NETOP = NON + NET$

Non-interest income is captured by NON, NET is net-interest income and net-operating revenue is $NETOP$. The HHI (rev) measures shifts into non-interest income generating activities. The measure of diversification allows the breakdown of net-operating income into its two broad components. In line with Mercieca et al. (2007) these computations are also used to construct measures of diversification *within* non-interest income generating activities:

$$HHI(non) = \left(\frac{COM}{NON}\right)^2 + \left(\frac{TRD}{NON}\right)^2 + \left(\frac{OTOP}{NON}\right)^2 \tag{3.6}$$

Where $NON = COM + TRD + OTOP$; and COM captures commission revenue, TRD captures trading income and $OTOP$ is other operating income, and higher values indicate greater concentration. A rise in both indices shows increases in revenue concentration and less diversification.

[12] The number of observations is not reported since SYS-GMM is effectively an analysis of two samples and hence the standard observation count typically reported in the literature is somewhat redundant.

3.3.3 Measures of insolvency risk

The main measure of insolvency risk is the *Z-score*. Consistent with the literature on revenue diversification, the risk-adjusted returns on equity and assets are also used as additional measures of performance (Stiroh (2004a, b) and Mercieca et al. (2007)). The formulas for the *Z-score* and (*RAROE, RAROA*) are shown below:

$$Z-score = \frac{ROA + E/A}{\sigma_{ROA}} \tag{3.7}$$

$$RAROE = \frac{ROE}{\sigma_{ROE}}\ ,\ RAROA = \frac{ROA}{\sigma_{ROA}} \tag{3.8}$$

Where the return on assets *(ROA)* is the ratio of profit before tax to total assets, return on equity *(ROE)* is the ratio of profit after tax to total equity and *E/A* is the ratio of equity to assets. A higher ratio indicates higher risk-adjusted profits. The risk adjusted returns on equity and asset is calculated by dividing the Return on Equity *(ROE)* and Return on *Assets (ROA)* by their standard deviations respectively.

3.3.4 Controls for bank structure and strategy

Some control variables are included to reflect banks strategic choices and characteristics that can affect performance and insolvency risks. These variables are commonly used in studies of revenue diversification such as (Hughes et al. (1996), DeYoung and Roland (2001), DeYoung and Rice (2004), Stiroh and Rumble (2006) and Mercieca et al. (2007)). The primary objective of including these variables is to make sure that any potential independent effects they may have on performance and insolvency risk does not influence the primary relationships being investigated. A brief description as well as motivation for including specific variables is given below:

First, ***Size*** (the natural logarithm of banks' total assets)**:** This controls for the fact that larger banks may be inherently more stable particularly since idiosyncratic risk tends to decline with size (Baele et al. 2007). Larger banks may also have better diversification opportunities and thus less income volatility from branching into new markets. Demsetz and Strahan (1997) find evidence in support of this conjecture.

Second, ***Equity/Asset*** (the ratio of book value of equity to total assets): This controls for the relationship between bank fragility and levels of capitalization. According to Lehar (2005) capital cushions large shocks and protect banks when asset values decline reducing the probability of failure.

Third, ***ROA*** (return on assets): this variable controls for bank profitability. If poorly performing banks decide to diversify then any resulting diversification discount in the absence of controls for bank performance may be incorrectly attributed to the diversification decision. Low levels of profitability can also curb income flows, forcing banks to hold large cash reserves and weakening their earning position (Hughes et al. 1996, Grossman 1994).

Fourth, **Loan/asset** (the ratio of total loans to total assets): This measure captures differences in the banks' asset portfolios. Banks that have an asset based diversification strategy may shun non-interest income, make more loans, and grow more rapidly irrespective of the profitability of loans to other earning assets (Stiroh and Rumble 2006). It is also possible that the increased illiquidity of the banks portfolio may increase its vulnerability to customer runs. However, another body of literature suggests that net-interest income is revenue stabilizing; as customers are less likely to frequently switch lending relationships (DeYoung and Roland 2001). I am careful not to interpret loans to assets as an alternative indicator of the reliance of a bank on interest income since other types of assets such as securities also generate interest income. Inclusion of this variable however, controls for the independent effect the relative specialization of the bank in lending has on its performance.

Fifth, ***GDPgro*** and ***Inflation*** (Growth in annual gross domestic product and annual consumer price inflation): The link between economic development and financial stability has being well established in the literature, even though its impact on banks investment strategy - a determinant of bank stability - is ambiguous. According to King and Levine (1993), Levine et al. (2000), and Grossman (1994) there is a positive link between financial intermediary development and economic growth with bank failures themselves being a consequence of economic downturn. Furthermore, Nilsen and Rovelli (2001), suggest that a weak macroeconomic environment will deter foreign investments, reverse capital flows and discourage financial innovation. On the contrary, financial instability may also increase during periods of economic growth if banks find it more profitable to diversify rapidly during this period.

A measure of the growth of assets (A***sset_gro***) is included to control for the impact of rapid expansion strategy on bank insolvency risk.

My priors are that revenue diversification will have a positive effect on risk adjusted performance and insolvency risk in banks in emerging economies. This is because of the following reasons. First, the rapid rate of growth in these economies provides potential diversification opportunities. Second, diversification remains a valuable technique for reducing portfolio risks particularly when economic conditions are volatile. Third, non-interest come remains a prudent way of boosting banks revenues that may otherwise be affected by the link between interest earning assets and the macro economy.

It is important at this stage to note that the regression coefficients on the individual components share *(Non_inc ^2 and Commission^2)* of the revenue diversification measures, captures the effect of a shift from the omitted category of the component into an alternative one as one component has to be omitted to avoid perfect collinearity. For instance the coefficient of non-interest income share *(Non_inc^2)* measures the shift out of net-interest income (the omitted component) into non-interest income. If the proportion of non-interest income increases bank performance then its coefficient will be positive in the regressions and vice versa.

The inclusion of these variables also plays a key role in the econometric analysis. For example, without the linear term *(Non_inc^2),* the two polar cases of (NON/NETOP)=0 and (NON/NETOP)=1 are treated as identical (i.e. zero diversification or full diversification) because both produce the same value for *HHI (rev).* Inclusion of the linear term enables the regression to distinguish between these two polar cases. Other Herfindahl indices such as *HHI(non)* require similar treatment and hence the inclusion of one of its component *Commission^2*.

3.3.5 Data

All financial information data are taken from unconsolidated financial statements of listed banks obtained from the Bankscope database maintained by Fitch/Bureau van Dijk.[13] The macroeconomic data is from the World Bank: World Development Indicators database (World Bank 2009). Only banks from countries with at least six listed commercial banks on its main stock exchange are included. Using only listed banks also ensures comparability across countries and reduces concerns that access to capital as well possible poor reporting standards does not bias the results. Furthermore, banks with less than four reporting years in the sample are removed to limit the volatility from random data measurements. Only unconsolidated statements for commercial banks are used. These selection criteria left 226 banks with 1,810 observations in the primary sample.

3.4 EMPIRICAL RESULTS

Table 3.1 presents summary statistics for the main sample. There is significant variation in size of the banks in the sample. The mean of total assets is $8.2bn with a range from $1.8m to $ 206bn. This ensures that the results are not only reflecting benefits of diversification to large banks. Regarding bank performance, the sample includes both high and low performing banks as shown by the summary statistic on ROA, however, there is no evidence of the data being skewed towards either extremes as the mean is close to the median (0.026 compared to 0.017).

[13] Unconsolidated data is preferred in this analysis to separate the actions of the parent company from its other subsidiaries that may or may not operate in the same jurisdiction or under the same banking law.

Variations between the measures of revenue diversification *HHI(rev)* and *HHI (non)* are examined. For example, the sample mean (0.62) of *HHI(rev)* indicates a relative concentration of bank revenues towards interest generating activities. The banks in the sample however, appear diversified within the range of non-interest income activities they engage in, as shown by the mean and the median of *HHI(non),* 0.475 and 0.502 respectively.

The asset growth rate *(Ass_gro)* in the sample remains uniformly high as shown by a mean of 0.213 and a median of 0.172 This growth rates may reflect the benefits of high economic growth (mean of *GDP_gro* is 0.054).

In table 3.2, pair-wise correlation coefficients are presented as a first look into the relationship between the key variables. The correlation coefficients between *HHI (rev), HHI (non),* and the corresponding risk and performance measures (*Z-score and ROROA and ROROE)* suggest some benefits of diversification into new markets exists compared to diversifying *within* the markets the bank is already present in. This is intuitive, since banks will intensify exposure in markets which seem profitable and will prefer to diversify by exploring new markets as opposed to increasing activities in markets already found to be less profitable. However, the coefficient of (*Non_inc^2)* shows that that this relationship is non-linear. There may well be some point of inflection where further exposure to non-interest income decrease bank performance and stability. Stiroh and Rumble (2006) argue that the costs of financial distress, search costs for new management, as well as increased exposure to systematic shocks are some of the reasons for this non-linear relationship. In addition, the coefficient of Commission income (Commission_inc^2) shows that fee income generating activities are particularly beneficial for banks.

Regarding bank characteristics, the relationship between the capitalization ratio *(Equity/Assets)* ratio and both RAROA and RAROE respectively is negative and significant. The capitalization ratio is also positively correlated with the HHI(rev)

and negatively related to HHI(non). Taken together these results suggests that highly capitalized banks are less likely to diversify into non-interest income but more likely to diversify *within* the non–interest income activities they already engage in. This is consistent with evidence that banks with high value, may adopt conservative investment strategies in order to protect value and minimise shareholders loss. However, this extreme risk aversion reduces bank profitability.

The lending specialisation of the banks captured by *(Loan/Assets)* is associated with increased diversification and increased risk adjusted performance. These results can be jointly interpreted as follows: First, banks with a relatively large loan portfolio may seek to grow rapidly, and thus diversify as a means to achieve this goal. The revenue concentration associated with a large loan portfolio may promote diversification if bank managers seek to hedge the risk of their concentrated revenue flows. Moreover, the profitability of the loan portfolio may create some spill-over effects by providing banks with the necessary finance to expand into other business activities. The results also show that more profitable banks prefer to focus their activities and are less diversified but not particularly more stable. The pair-wise correlation coefficient between bank size *(Size)* and the diversification measures suggest larger banks are more diversified and perform better. A high growth strategy *(Asset_gro)* increases diversification into non-interest income *HHI(rev)* but not *within* non-interest income *HHI(non)*. This is prima facie evidence of a sub-optimal diversification strategy. This is because a bank will quickly exhaust the risk mitigating benefits of diversification if it is frequently moving into new markets.

With regards to the macroeconomic controls, rapid economic growth is found to increase revenue diversification and enhances bank performance, whereas the rate of inflation has the opposite effect. Table 3.3, reports simple correlation coefficients and the relationships shown are similar to those shown in table 3.2.

The primary goal is to investigate the link between revenue diversification, performance and stability in emerging economies. To address this, panel regressions are estimated and empirical results of the canonical model is presented

in Table 3.4. Across all regression specifications, both measures of diversification *HHI(rev)* and *HHI(non)* are found to increase risk-adjusted performance and stability. In other words, diversification *into* and *within* non-interest income generating activities is beneficial for banks. [14]

In terms of economic magnitude, the coefficients of *HHI(rev)* and *HHI(non)* in column 1-4 imply a one standard deviation increase in *HHI(rev)* increases risk-adjusted return on asset *(RAROA)* by 5.3 percent and increases the *Z-score* by 0.41 percent while a similar increase in *HHI(non)* increases *RAROA* by 8.5 percent and decreases risk by 0.48 percent as shown. These results show diversification benefits exists for banks in emerging economies and therefore supports the "diversification-stability" view in the literature. According to Baele et al. (2007), these benefits may originate from either improved income generating capacity of the bank, reduced operating costs from operational synergies or a combination of both.[15]

Regarding, other measures of exposure to non-interest income, the coefficients of *Non_inc^2* in Column (1) show the risk mitigating benefits of diversification persists at high levels of non-interest income, however risk adjusted profit does not increase. This is plausible as non-interest income can dampen the volatility of bank revenues to fluctuating macroeconomic conditions. The need for banks to reduce vulnerabilities to macroeconomic shocks as well as boosting operating revenue when interest-income declines may be a valid reason why banks diversify. However, beyond a certain point, this strategy will become cost inefficient, as it does not increase bank profits. It is unlikely that banks will diversify beyond this point.

This result stands in contrast to what is reported in the literature on developed economies. The main explanation for the lack of diversification benefits for banks in these countries is summed up as the tendency to "over diversify" i.e. diversification beyond risk efficient levels in order to maximize short-term profits.

[14] Note: increases in HHI (rev) represent increases in concentration.
[15] Economic magnitude is calculated as follows: standard deviation of explanatory variable multiplied by the ratio of its regression coefficient to the mean of the dependent variable.

The implication of this phenomenon for banks is as follows: first, banks exploiting non-interest income sources for a relatively longer period of time will only obtain very marginal benefits from further diversification which may well increase bank risk (Acharya et al. 2006, Stiroh 2006a,b). Second, banks that choose to use up the risk mitigation benefits of non-interest income by taking on additional risks will end up increasing their financial leverage and well its risk of failure (Morgan and Salmolyk (2003) and Cebenoyan and Strahan (2004)). It appears that this "over diversification" problem does not necessarily apply in emerging economies as the lack of a positive relationship between *Non_inc^2* and *RAROA* suggest that there is no scope for banks to adopt an indiscriminate diversification strategy to boost profit.[16]

There is no evidence that commission income is detrimental for banks in emerging economies. The coefficients of commission income *(Commission^2)* which are 0.134, 0.554, 0.507 as shown in column (3), (4), and (5) respectively, are significant and positively related to the *Z-score*, *RAROA* and *RAROE* . This is analogous to results in Stiroh and Rumble (2006) while Lepetit et al. (2008) find the opposite. This is attributed to fee based transactions having low start-up costs, being less capital intensive and the scale of operation can easily be varied in response to demand, and thus representing a cost-effective way for a bank to increase its income.

The control variables used are reported. As suspected there is evidence of autoregressive properties in the dataset as first-year lags of *Z-score, RAROA* and *RAROE* (*Z-scorelag, RAROA_lag* and *RAROE_lag* respectively) are strongly related to their contemporaneous levels. The coefficients of Loan/Asset (1.114 and

[16] DeYoung and Roland (2001) suggests three reasons for the positive association between non-interest income and the volatility of bank earnings. First, bank loans are mostly relationship based and thus have high switching costs. Second, for an ongoing lending relationship; in order to increase total product (produce more loans) the main input needed is variable (interest expense) whilst in contrast the main input needed to produce more fee based products is typically fixed or less variable (labour expense). This implies fee based activities may require greater operating leverage than lending activities which makes bank earnings more vulnerable to declines in bank revenues. Third, most fee based activities require banks to hold little or no fixed assets so unlike interest based activities like portfolio lending fee based activities like cash management require little or no regulatory capital. Thus, fee based activities are likely to employ greater financial leverage than lending activities (DeYoung and Rice, 2004).

0.975) are positive in the RAROA regressions. The coefficients of bank size *(Size)* proxied by total assets are also positive. This positive relationship is also reported in prior research such as Grossman (1994), Demsetz and Strahan (1997), and DeYoung and Rice (2004) who find the relative advantage that large banks have in making larger loans of better quality is another way in which large banks can be more profitable and stable.

The coefficients for levels of capitalization *(Equity/Assets)* are at best insignificant in the *Z-score* regressions, however, the relationship between the levels of capitalization and risk-adjusted returns on assets are negative. Although the conventional view is that high levels of capitalization will reduce risk, by placing banks in a better position to absorb losses, the relationship between equity capital and bank performance is ambiguous. According to Carlson (2004), equity is a relatively costly way of financing banks operations, especially since it can imposes agency costs between bank managers and owners. The level of capitalization may also decrease bank performance if equity owners prefer conservative investment strategies to protect their value. Furthermore, if banks decrease loans as a means of increasing regulatory capital to cover non-performing assets, then performance and stability will not increase in response to the higher capital ratios.

The significance and signs of the measure of profitability *(ROA)* and rapid growth *(Ass_growth)* in bank size is as expected. It is intuitive to expect profitable banks to be relatively more stable. Likewise banks pursing a rapid growth strategy are more likely to diversify indiscriminately and take myopic investment decisions which are detrimental to bank stability.

Regarding the macroeconomic controls, the rate of inflation *(Inflation)* increases insolvency risk and reduces bank performance. This is particularly so since; inflation can erode the value of assets, worsen the balance sheet position of a bank, and may reverse essential capital-flows necessary for economic development. In addition, the coefficients of *(GDP_gro)* are negative and significant in column (2) and (4) suggesting that banks take on higher risk during periods of high economic

growth. This is because economic booms can fuel credit expansion and undiscriminating diversification strategies.

The following diagnostic tests in the lower segment of all tables using SYS-GMM are reported; the Hansen test for over identifying restrictions, the instrument count and the number of panels (banks) used in the regression in levels. The second order AR (2) tests for autocorrelation in the residuals are also reported as well as the F-test for joint significance of regressors, which is satisfactory across all model specifications. The following is a brief insight into the relevance of each test and their implications for the results:

First, the Hansen test of over identifying restrictions in two-step GMM estimations is a chi squared (χ^2) test for the validity of the instruments, which is also known as a test for the exogeneity of instruments. Good instruments should be relevant and valid; i.e. correlated with the endogenous regressors while at the same time orthogonal to the errors (Baum et al. 2003). A rejection of the null hypothesis therefore, implies the instruments do not satisfy the orthogonality conditions required for their employment. Across all model specifications in this chapter, the null hypothesis cannot be rejected in any of the estimations implying that the internal instruments used are valid.

Second, reporting the instrument count is important because a large number of instruments weaken the power of the Hansen tests and can bias the regression coefficient. Because the GMM estimators generate internal instruments based on the number of regressors, it is difficult to stipulate guidelines about the ideal number of instruments, as the number of explanatory variables in the sample will typically bias the instruments count upwards. However, as a "simple rule of thumb", Roodman (2006) proposes that the instrument counts should not exceed the number of groups in the regression specification. Across all model specifications this condition is met.

Third, the Arellano-Bond test for autocorrelation in the residuals AR (1) and AR (2) respectively is reported. Since Δv_{it} is mathematically related to $\Delta v_{i,t-1}$, a negative

first order serial correlation AR (1) in the equation in differences is expected. However, in order to check for first order serial correlation in the residuals in the equation in levels, we look for second order- serial correlation in the differenced equation. This test for autocorrelation is separate from the fixed-effects η_i, which the model can address. The AR (2) test, also functions as an important test of the appropriateness of the limits imposed on the instrument test. In the estimations the second and third lags of the contemporaneous variable are specified as instruments in the differenced equation and the first lag of the differences as instruments in the levels regression. If for example, AR (2) is present, deeper lags of the instruments will need to be specified. The reason for not using all available lags of the variables is to keep the instrument count low and because of the fact that more recent lags are better predictors of current trends in the data. The hypothesis of no second order serial correlation in the first differenced residuals is not rejected for any of the estimations.

3.4.1 Why does the impact of diversification on bank risk differ in emerging economies?

The results presented in table 3.4, are based on the assumption that endogeneity, the autoregressive properties in the dependent variable and short data time series in the data used will bias the estimates of more traditional models such as fixed effects estimators used in the literature. Even though, so far, no work has been done on emerging economies, the results reported in the previous section are in contrast to results from prior studies on developed economies particularly the US.

There are some obvious potential explanations for this situation. The first explanation is that the System-GMM estimator is a better econometric technique, while the other explanation is that the different results are due to the difference in datasets used (banks in emerging economies as opposed to the US). If the results presented in section 3.4 are explained by the better econometric technique, the use of a less sophisticated methodology is likely to mask the true relationship between diversification and performance.

One way to check the first explanation is to re-estimate the base regressions in table 3.4, using the fixed effects estimators for cross sectional data which has been used by Stiroh and Rumble (2006) and has also been routinely used in the diversification literature.[17] If the results using fixed effects regressors are different from those reported in table 3.4 then it will appear that the better econometric technique used in the literature is driving the results. According to Stiroh (2004a, b) a way to disentangle these effects will be through an analysis of both non- and net-interest income. If non-interest income is more volatile that net-interest income as is indeed the case in developed economies then revenue diversification will increase the volatility of net operating revenue. However, diversification will be beneficial if non-interest income is less volatile than net-interest income and if the covariance between both streams of income is low. This idea has received widespread consensus in the literature (Stiroh and Rumble (2006), Acharya et.al (2006) and Goddard et al. (2008)).

The results of using the fixed effects cross sectional regressions are displayed in table 3.4.1. This cross-sectional analysis covers the entire dataset and uses the same explanatory variables as the system-GMM, however there is no explicit control for endogeniety in the explanatory variable. Cross sectional analysis also by default only tests a static relationship and not a dynamic /persistent link between diversification and bank performance. In other words, cross sectional analysis is better able to identify whether diversified banks at a particular point in time are stable as opposed to whether or not the process of diversification destroys value over time. In table 3.4.1 column 1 and 2 the coefficient for revenue diversification is insignificant and in column 4 and 5 it is actually indicating that diversification destroys value. This story is in line with the results reported in the literature. Table 3.4.2 produces very similar results to when non-interest income (***Non-inc***) is used as a quadratic. The net effects of diversification computed as the difference between indirect and direct effects is also reported in table 3.4.2. According to Stiroh and Rumble (2006), the shift toward non-interest activities affects bank performance in two ways: first, through a direct exposure effect from

[17] Another way to check the validity of the results is to apply the SYS-GMM to a dataset on developed economies which is beyond the scope of this literature. By undertaking this exercise one can exclude the possibility that the results are driven by the differences in the dataset.

increased non-interest income and second, through an indirect diversification effect as revenue becomes more diversified. The statistical significance of the difference between the two effects is also tested. In table 3.4.2, the coefficients on the revenue diversification and non-interest income variables (***HHIrev and Non_inc***) in column 1 and 2 is insignificant. The net effects (shown in the last row of the table) across specifications 1-3 is also insignificant. The net effects reported in specification 4 and 5 show revenue concentration within the banks activities is more beneficial for banks as opposed to diversifying into new activities . It is unclear at this stage whether the fixed effects or system GMM regressions is correctly predicting the relationship of interest.

In order to shed light on whether the SYS-GMM or fixed effects estimators is better able to analyse the relationship of interest, a further exploration of the relationship between interest and non-interest income for banks in emerging economies is undertaken. If non-interest income is less volatile than net-interest income, the benefits of direct exposure to these activities should have a dominant effect on bank performance. Figures 3.1 to 3.4 is a graphical analysis of the cross-sectional volatility of non- and net-interest income. Figure 3.1 show the volatility of net-interest income is higher than that of non-interest income. A reversal of the phenomenon experienced in the US (Stiroh (2004a, b), Stiroh and Rumble (2006)). There is notable resemblance in figure 3.2 and 3.3 which shows the performance and non-interest income profile of banks in emerging economies. It is clear that the risk-adjusted return on assets is more closely aligned with the evolution of non-interest income profile compared to the net-interest income profile of banks. While this should not diminish the traditional role of banks in lending, it appears that fluctuating macroeconomic environment makes lending more risky and increases the attractiveness of non-interest income generating activities. Therefore, banks shift to service based activities to boost revenue and diversify risk. This is possible in emerging economies as opposed to the US for example, because banks are the main players in the market for financial services due to lack of "depth" in financial market. The absence of competition translates into higher economic profits without a significant increase in risk exposures if banks expand into these activities. This is in sharp contrast to the situation in industrial economies, where the market for fee

based activities is more competitive, lowering the profit margins of institutions that engage in these activities and also increasing risk exposure of banks.

Figure 3.1

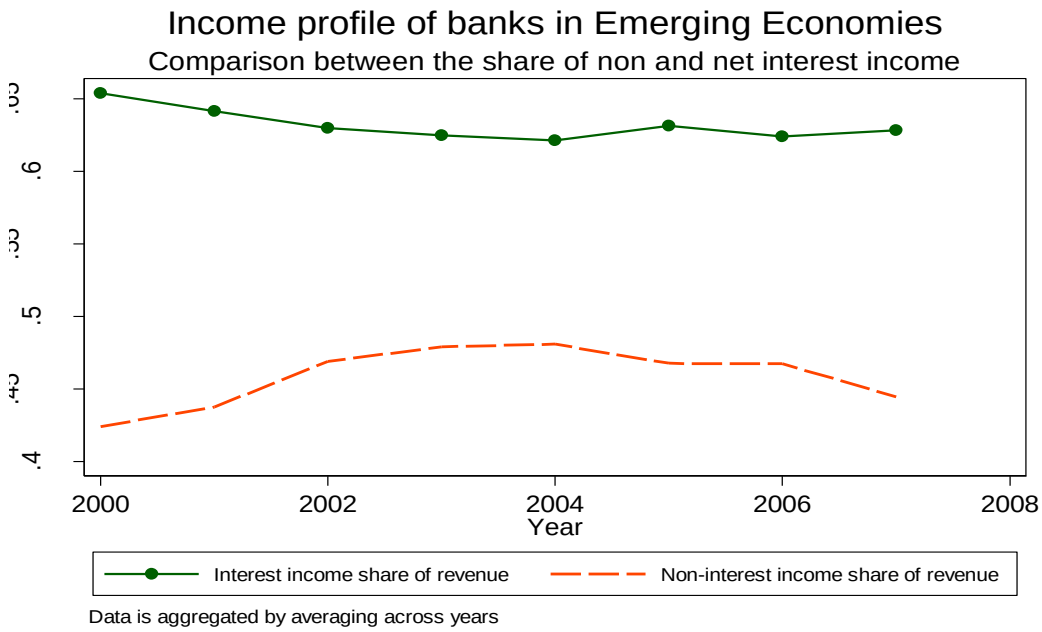


Figure 3.2

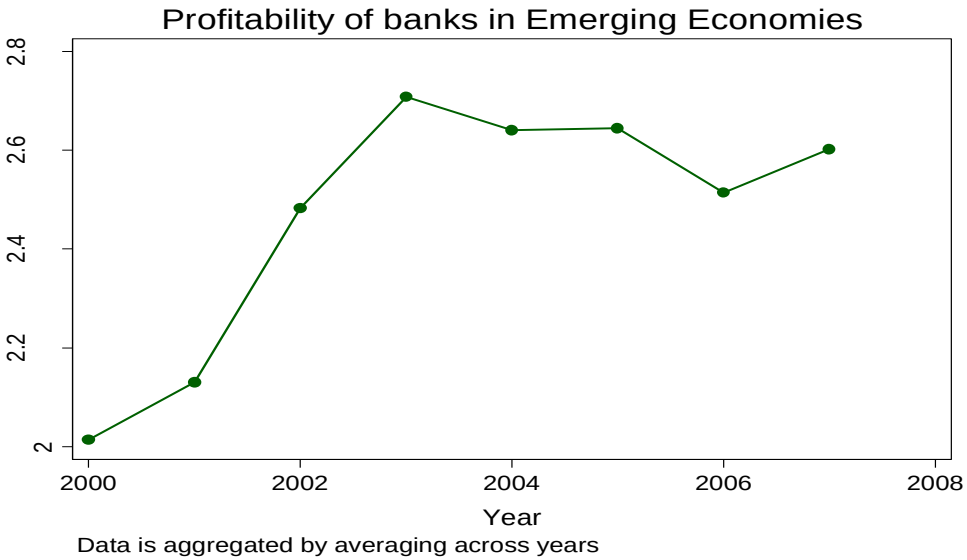


Figure 3.3

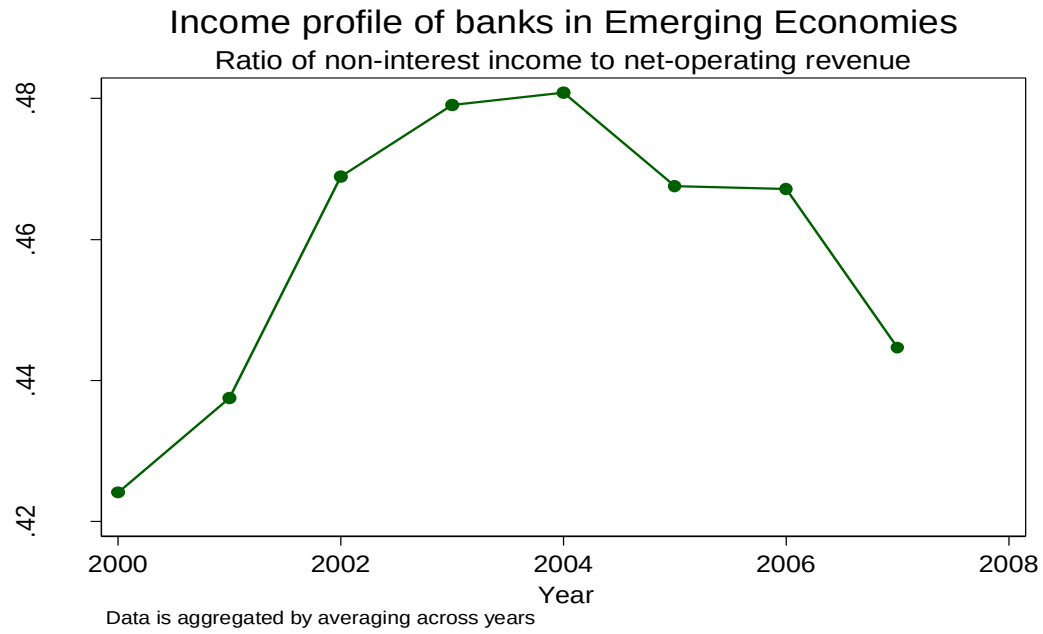
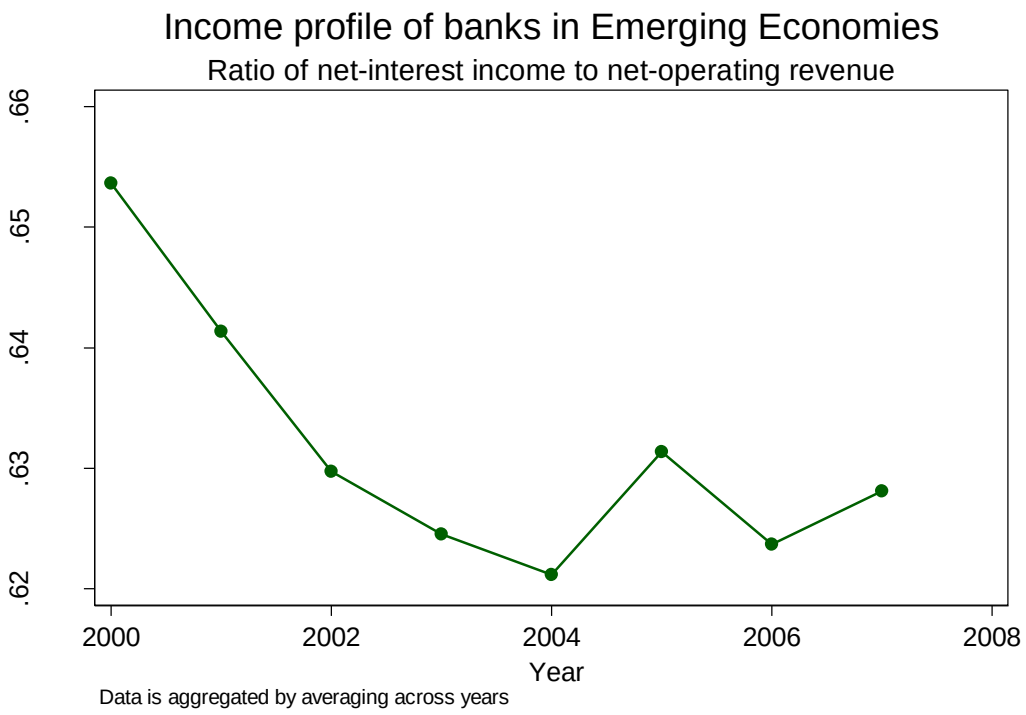


Figure 3.4



3.5 ROBUSTNESS TESTS

Using the same methodology described in the previous section robustness checks to control for other factors that may drive measures of performance and insolvency risk are presented in this section. The goal is to eliminate alternative explanations for the strong observed relationship between revenue diversification and insolvency risk.

3.5.1 Control for the structure of the banking system

There is an argument in the literature that banking system concentration reduces aggressive risk taking behaviour, increases bank profits and thus protects banks against adverse shocks (DeYoung and Rice (2004), Beck et al. (2006a) Yeyati and Micco (2007)). However, according to Carlson (2004), bank consolidation due to broader banking powers will force weak banks to exit the system. If this is the case, the absence of controls for the structure of the banking system overstates the benefits of revenue diversification reported in the previous section. The control for the structure of the banking system *(Concentration)* is calculated as the proportion of assets held by the three largest banks in each country per year. Similar measures of concentration are recognized in the literature (Beck et al. (2006b) and Al-Muharrami et al. (2006)).

Table 3.5 presents the results with the inclusion of "*Concentration*" an additional explanatory variable in the estimation of the canonical model. The coefficient of *Concentration* is negative and significantly associated with the performance measures in columns (4) and (5). This evidence is suggestive of the fact that concentration of the banking system reduces bank profitability. This results weakly supports the concentration-fragility view in the literature (Cetorelli et al. (2007), and Uhde and Heimeshoff (2009)). The size and sign of all measures of diversification are more or less the same. Thus it can be concluded that the relationship between revenue diversification, performance and stability remain robust to the structure of the banking system.

3.5.2 Controls for banks monitoring incentives

There is evidence in the literature that the benefits of diversification may vary according to the risk exposure in banks. For example, Acharya et al. (2006) find diversification reduces bank returns for high-risk banks. Winton (1999) gives two reasons why diversification appears to destroy value for high-risk banks. First, these banks are unable to effectively monitor risk in new markets. Second, there is a pervasion of monitoring incentives in high-risk banks since the benefits of monitoring will only accrue to depositors and preferred creditors should the bank fail. Based on this notion, the monitoring incentives of a bank determine whether or not the bank will benefit from diversification. If this argument holds, the benefits of diversification reported in section 3.4 would be stronger in banks with moderate to high-risk exposures. Excluding banks with Z-score above the 75th percentile from the sample creates a dataset of banks with moderate to high insolvency risk exposures, which are used to test this conjecture.[18] Table 3.6 presents results using this restricted sample. All measures of revenue diversification maintain the same level of significance as the base regressions; however the coefficients are larger in size. In terms of economic magnitude, the impact of a one standard deviation increase in *HHI (rev)* on *(RAROA)* changes from 5.3 to 5.8 percent while the impact of the former on the Z-*score* rises from 0.41 to 0.5 percent. There is a similar increase in *HHI (non)* and *RAROA* as they change from 8.5 to 11.5 percent respectively. The Z-score of the restricted data sample increases by more than 100 percent (from 0.48 to 1.1 percent). The changes in the coefficients of interest confirm that the benefits of revenue diversification are higher for banks with moderate-high risk exposures. The effect of high exposures to non-interest income on risk-adjusted performance shown in column 2 is now negative. This evidence suggests banks with moderate to high-risk exposures may over-diversify as they "gamble for resurrection".

[18] The intuition is that the level of insolvency risk is a proxy for both the willingness and the ability of banks to monitor their assets. The 75th percentile corresponds to 22.13, and a total of 64 banks had Z-score higher than this and were excluded from the sample.

3.5.3 Regulatory and supervisory controls

To draw precise inferences regarding the relationship of interest the regulatory and supervisory framework in emerging economies needs to be thoroughly considered. This is because banks in an emerging economy may be deriving benefits from institutional reforms in a way that overemphasizes the impact of diversification if these structures are not explicitly incorporated in the estimation. It is impossible to isolate the effects of all institutional reforms, as there is an expectation that they are deeply embedded in the bank fundamentals. Therefore only aspects of the regulatory environment that may directly bias the findings are controlled for. What follows is a brief summary of the specific regulatory initiatives as well as the resulting impact that holding these constant may have on the relationships of interest. Examining the relationship between bank regulations and banking system stability is also independently valuable since countries implement regulations to promote banking system stability. Isolating the effect of these regulatory tools ensures that the separate channels through which regulation influence bank performance and insolvency risk are independently captured.

3.5.4 Banking freedom

First, the Heritage Foundation index of banking and financial freedom *"Banking freedom"* which measures the security of the banking system as well as its independence from government controls is included. This country specific annual index captures the following aspects of bank regulation: "*whether foreign banks and financial services firms are able to operate freely, how difficult it is to open domestic banks and other financial services firms, how heavily regulated the financial system is, the presence of state-owned banks, whether the government influences allocation of credit, and whether banks are free to provide customers with insurance and invest in securities and vice-versa"* (The Heritage Foundation (2009)). Higher values indicate greater freedom to carry out banking operations. The result of the base regression with the inclusion of *"Banking freedom"* is reported in table 3.7. There is some evidence that higher banking freedom enhance

bank performance in emerging economies. However the relationships of interests remain unchanged.

3.5.5 Banking activity restrictions

Barth et al. (2004) highlight the following as reasons why regulators may limit banking activities: first, conflict of interest, as agency problems may arise from managing the resulting larger and more complex institutions. Second, to the extent that moral hazard encourages riskier behaviour, banks will have more opportunities to increase risk if allowed to engage in a broader range of activities, third complex banks may present regulatory and economic challenges. For example, these banks may be difficult to monitor and economically too powerful to fail. However, Beck et al. (2006a) and Barth et al. (2008), find that fewer restrictions on bank activities reduce banking system fragility - consistent with the argument that restricting bank activities limits diversification efficiency narrowing the scope within which banks can effectively reduce portfolio risk. An additional control variable *"Activity restrictions"* is included in the re-estimation of the base model to control for the independent influence (if any) that bank activity restrictions has on performance and stability. This variable is a sum of four measures that indicate whether bank activities in the securities, insurance and real estate markets and ownership and control of non-financial firms are (1) unrestricted, (2) permitted, (3) restricted, or (4) prohibited. Higher values indicate more restriction on bank activities.

The result including *"Activity restrictions"* as an additional control variable in the base model is shown in table 3.8. The sign of the coefficients of *"Activity restrictions"* even though insignificant suggests restricting bank activities increases bank fragility. The results also show that controlling for broad banking powers does not alter the size or sign of the other revenue diversification variables.[19] This result suggests that the relationships estimated, in table 3.4 above, are robust to the level of regulatory restrictions on bank activities.

[19] While *"banking freedom"* is an index that varies over time, the measure of "*Activity restriction*" is static and is fixed throughout the sample period, this limitation may reflect the insignificance of the variable when used in emerging market data where considerable institutional changes have taken place over the last decade.

3.5.6 Regulatory capital stringency

Furthermore, the influence of the regulatory capital stringency on bank stability is considered by including the capital regulatory index in the Caprio et al. (2008) database. This index measures regulatory capital adequacy based on the book value of capital. Higher values indicate more capital stringency and there is an expectation that this will reduce bank risk. In this regression, the base model is re-estimated by including the index *"Cap_Index"* as an additional explanatory variable. The results are shown in table 3.9. The regulatory capital stringency behaves more or less as *Equity/Asset* - the bank level measures of capitalisation in that it is not significantly linked to bank performance. However, the evidence suggests that regulatory capital stringency increases bank stability as the *Cap_Index* becomes positive and significant in the *Z-score* regression as shown in column 3. The measures of diversification - *HHI(non)* and (*Commission^2)* – in the same regression however lose their significance suggesting that higher regulatory capital requirements may discourage diversification *within* non-interest income activities. These results are intuitive, particularly considering high capital requirements, will either require existing shareholders to increase investment in the bank, or that the number of shareholders increases. Both of these options increase the agency problem between bank managers and owners and can be costly if risk aversion of the large shareholders prevents banks from venturing into new sectors to diversify their revenue base. High capital requirements can also reduce the availability of operating capital necessary to undertake new investment strategies.

2.4.7 The risk of Expropriation

In addition, the fact that the legal protection on private property as well as the judicial efficiency in enforcing these laws influences bank performance and stability in emerging economies. Lower risk of expropriation is crucial to the volume and stability of the flow of foreign capital – a key driver of financial development and economic growth in emerging economies. The findings in La Porta et al. (1998) and Klapper and Love (2002) suggest the law that protects investors differs significantly across countries and within firms in the same country.

This is based on the assumption that firms can augment state protection levels by implementing mechanisms that increases disclosure, and prevents the deliberate expropriation of minority shareholders. The latter study which uses data on firms in emerging economies find investors positively value this additional firm level protection in countries where state level protection is low. Based on this argument, limiting expropriation risk will have an independent positive effect on banks performance and stability especially if it promotes less volatile capital flows, enhances stable ownership patterns in banks, and increase access to capital. In this section, the independent effect of state level investor protection is controlled for by including "*Property rights"* an index that measures expropriation risk as shown in table 3.10. Higher scores indicate certainty of legal protection and limited expropriation risks (The Heritage Foundation 2009).[20]

The results in table 3.10 somewhat supports the notion that the property rights index improves bank performance as the sign of "*Property rights"* is positive and weakly significant in the RAROA regression reported in column 3. More importantly, the estimate relationships of interest remain unaffected in the presence of controls for the risk of expropriation in emerging economies.

Finally, analyzing the influence of the regulatory environment on bank risk taking is incomplete without an acknowledgement of the role played by the deposit insurance scheme on bank risk taking across all countries. This is shown by the ongoing debate in the current literature on the impact of deposit insurance on financial stability. For example, Diamond and Dybvig (1983): Allen and Gale (1998) find it an optimal policy to adopt when bank runs threaten bank solvency whereas Demirgüç-Kunt and Detragiache (2002) find that the generosity of the deposit insurance scheme encourages excessive risk taking behaviours in banks - a

[20] It is not necessary to control for firm level measures of investor protection for two main reasons; first, firm level protection is only valuable when state level protection is weak, therefore more interesting variations will occur at the state level. It is also important to bear in mind that firm level protection mechanisms such as increased disclosure are designed originally as regulatory incentives to increase market discipline and not to primarily substitute state level protection, using them in this manner in empirical estimations may unnecessarily increase the "noise" around coefficient estimates. Secondly, banks that are listed on the stock exchange may already be subject to increased disclosure requirements in which case firm level variations is minimal. Taking both arguments into consideration we find that state protection will better capture the effect of expropriation risk to these banks.

cost which they believe offsets any stabilization benefits. There is however, a consensus on the fact that deposit insurance can be a source of moral hazard if it encourages banks to finance high-risk, high-returns projects (Demirgüç-Kunt et al. 2005).[21] Alternatively, if the moral hazard argument holds, the effect of deposit insurance may reduce the need for risk reduction through revenue diversification hence weakening our estimated relationships. The data and methodological limitation that prevents the explicit reporting of these results are explained as follows:

The commonly used measure of the generosity of the deposit insurance scheme (the moral hazard index based on a survey in Demirgüç-Kunt et al. 2005) is unavailable for a number of countries in the dataset. The implied significant data loss is particularly not well tolerated by the model, which mandates a large number of panel identifier (banks) in order to derive consistent estimates. The alternatives considered are: first, to use alternative estimation methods that are more robust to this data loss or second, to use another proxy for the moral hazard index. The first option is discarded after carefully weighing the benefits obtained from the good fit of the System- GMM model to the peculiarities of the dataset against gaining additional insights into the influence of the deposit insurance scheme on the relationship of interest.

In response to the second option, a simple measure of the generosity of the deposit insurance scheme is developed based on simple "yes" or "no" answers provided in the same survey to the following three questions: (1) Is there an explicit deposit insurance provision? (2) Do banks pay risk-adjusted premiums? (3) Is there a provision for coinsurance? These 3 criteria are coded as dummy variables in which "yes" answers take the value one, and zero otherwise. The new measure is thus the difference between the answer to question (1) and the sum of answers to equation (2) and (3). Higher values of this index will reflect more generous depositor protection schemes. Of the countries surveyed only Russia offers coinsurance, and

[21] The principal component indicator measuring the generosity of deposit insurance and it is based on co-insurance, coverage of foreign currency and inter-bank deposits, type and source of funding, management, membership and level of explicit coverage. We obtain the moral hazard index from the World Bank database on Bank concentration and crises (Beck et al., 2006b).

most countries had an explicitly stated deposit insurance scheme as of 2003 when the survey was taken. This essentially reduces the index to a dummy variable, as there are now only two possible values the index can take which is –1 or 1. However, although the System- GMM estimation method can deal with time invariant variables it will still be a "mistake" to introduce explicit fixed effects dummy variables as it causes bias in the first-difference transformation (Roodman (2006)). Based on this limitation, the result on deposit insurance is not explicitly shown even though it did not appear to change the relationship of interest.

3.6 Conclusion

Using the systems Generalized Method of Moments estimator (System-GMM) to determine the impact of revenue diversification on bank performance and risk, evidence that diversification benefits exist for banks in emerging economies is presented in this chapter. More specifically, diversification across and within business lines increase risk adjusted profitability measures and decrease insolvency risk as measured by the *Z-score*. These results hold even though the relationship between diversification and performance disappear at high levels of exposure to non-interest income. The need to reduce vulnerabilities to macroeconomic and other systematic shocks may thus represent reasons why banks diversify and are less reliant on interest-income. However, beyond a certain point, this strategy becomes cost inefficient and is less likely to be adopted.

This result stands in contrast to the tendency to "over diversify" hypothesis put forward in the literature as a reason why diversification benefits is non-existent for banks in developed economies. The lure of "over diversification" does not necessarily apply to banks in emerging economies, as there is no link between high exposures to non-interest income and bank profitability. This limits the scope for banks to adopt an indiscriminate diversification strategy to boost profits. In addition, fee income is shown to be highly beneficial to profitability and risk. This is due to fee based transactions having low start-up costs, being less capital intensive and that the scale of operation can easily be varied in response to demand.

Thus, a cost-effective approach is for a bank to increase its income. This conjecture is not explicitly tested.

There is evidence that the benefits of revenue diversification is greatest for banks with medium risk exposures, however, these banks are also more likely to be adversely affected by over reliance on non-interest income particularly if diversification opportunities are irresponsibly used to "gamble for profitability".
The results are robust to necessary controls for bank specific characteristics such as size and strategic focus and the macroeconomic conditions in emerging economies. Furthermore, the results are substantiated when various regulatory initiatives that can obscure the impact of diversification on performance and risk are controlled for.

This chapter highlight the fact that revenue diversification within banks in emerging economies can create value, a very important insight for both bank regulators, and managers of banks in these countries.

The results presented in this chapter advance the current debate in the literature by considering how bank monitoring incentives, and the composition of portfolio held, affects the benefits diversification. More importantly, it suggests that further research on this issue abandon the implicit assumption that a diversified bank will always hold a risk efficient portfolio. This shift in the line of reasoning is beneficial in the following two ways. Any negative effects of over reliance on non-interest income would no longer be incorrectly attributed to the lack of diversification benefits, but will instead question internal managerial inadequacies or other factors that favour myopic investment decisions. This will therefore constitute building blocks for a new body of empirical research that moves the diversification debate forward, by considering how bank specific idiosyncrasies determines portfolio choices.

Table 3.1 Summary statistics on selected bank level variables

Variable	Mean	Median	SD	Minimum	Maximum
Bank specific controls					
Ratio of Equity to Asset ***(Equity/Asset)***	0.160	0.099	0.178	0.007	0.944
Ratio of Loan to Asset ***(Loan/Asset)***	0.509	0.539	0.191	0.000	0.968
Return on Asset ***(ROA)***	0.026	0.017	0.055	-0.534	0.624
Annual growth of total assets ***(Asset_gro)***	0.213	0.172	0.231	-0.735	1.000
Total Asset in US$ millions ***(Size)***	8209.480	2014.400	18447.330	1.800	206850.600
Insolvency Risk					
Risk adjusted return on asset ***(RAROA)***	2.482	2.160	2.495	-5.808	17.983
Risk adjusted return on equity ***(RAROE)***	14.598	4.142	23.005	-61.844	129.952
Z-score	17.693	13.436	15.065	-5.815	109.042
Revenue Diversification					
Diversification between interest and non-interest income ***HHI(rev)***	0.622	0.573	0.130	0.500	0.999
Diversification within non-interest income ***HHI(non)***	0.475	0.502	0.240	0.000	1.000
Ratio of non-interest income to net-operating revenue ***(Non_inc^2)***	0.212	0.124	0.236	0.000	0.999
Ratio of commission income to non-interest income ***(Commission^2)***	0.349	0.249	0.271	0.000	0.976
Macroeconomic Indicators					
Annual growth of gross domestic product ***(GDP_gro)***	0.054	0.051	0.035	-0.109	0.183
Annual consumer price inflation ***(Inflation)***	0.072	0.044	0.062	-0.011	0.311
Number of listed commercial banks sampled per country.					
Argentina (6), Brazil (24), Chile (6), Croatia (17), India (44), Poland (16), Russia (39), South Africa (10), South Korea (23), Thailand (22), Venezuela (19)					
Source: Bankscope, WDI and authors' calculations.					

The data set comprises of 226 banks in 11 countries between the period 2000-2007.

Table 3.2 Pair-wise correlation between selected variables

	Equity/Asset	Loan/Assets	Size	ROA	Asset_gro	RAROA	RAROE	Z-score	HHI(rev)	HHI(non)	Non^2	Com^2	Gdp_growth	Inflation
Equity/Asset	1													
Loan/Assets	-0.350*	1												
Size	-0.180*	0.072*	1											
ROA	0.410*	-0.161*	-0.075*	1										
Asset_gro	-0.080*	0.000	-0.047	0.054	1									
RAROA	-0.100*	0.075*	0.115*	0.175*	0.107*	1								
RAROE	-0.255*	0.022	0.126*	-0.049	-0.003	0.309*	1							
Z-score	0.046	0.093*	0.024	0.014	0.029	0.760*	0.093*	1						
HHI(rev)	0.456*	-0.278*	-0.126*	0.264*	-0.067*	-0.131*	0.218*	-0.111*	1					
HHI(non)	-0.121*	0.014	-0.084*	0.121*	0.156*	0.202*	0.058*	0.126*	-0.072*	1				
Non_inc^2	0.464*	-0.314*	-0.097*	0.117*	-0.079*	-0.175*	0.0166*	-0.074*	0.279*	-0.301*	1			
Commission^2	0.142*	0.003	-0.057	0.120*	0.009	0.058	-0.280*	0.100*	0.247*	0.714*	-0.220*	1		
Gdp_growth	-0.109*	0.151*	0.052*	-0.010	0.139*	0.078*	0.160*	0.002	-0.149*	-0.062*	0.023	-0.125*	1	
Inflation	-0.052*	-0.083*	-0.116*	0.032	0.313*	0.000	-0.120*	-0.119*	-0.028	0.233*	-0.128*	-0.149*	-0.066*	1

Source: Authors calculations

The data set comprises of 226 banks in 11 countries during the period 2000-2007. ***Equity/Assets*** measures capitalization, ***Loan/Assets*** ratio of loans to total asset, ***Size*** is the natural logarithm of the book value of assets, ***ROA*** profitability, ***Asset_gro*** the annual growth rate of assets, ***RAROA,*** risk adjusted return on asset, ***ROROE,*** risk adjusted return on equity. The Z-score is a measure of bank stability, ***HHI (rev)*** diversification between interest and non-interest income. ***HHI (non)*** measures diversification within non-interest income generating activities. ***NON_inc^2*** and ***Commission^2*** are squared shares of non-interest income in total operating income and commission income to non-interest income. ***Gdp_growth*** is the annual gross domestic product, and ***Inflation*** is measured at consumer prices.

Table 3.3 Correlation coefficients between selected variables

	Equity/Asset	Loan/Assets	Size	ROA	Asset_gro	RAROA	RAROE	Z-score	HHI(rev)	HHI(non)	Non^2	Com^2	Gdp_growth	Inflation
Equity/Asset	1													
Loan/Assets	-0.109	1												
Size	-0.163	-0.009	1											
ROA	0.118	-0.043	-0.036	1										
Asset_gro	-0.035	0.052	-0.040	0.237	1									
RAROA	-0.062	0.149	0.140	0.297	0.038	1								
RAROE	-0.329	-0.077	0.084	-0.015	-0.090	0.248	1							
Z-score	0.119	0.218	0.045	0.019	-0.053	0.698	0.036	1						
HHI(rev)	0.183	-0.131	-0.039	0.068	0.007	-0.033	-0.202	-0.086	1					
HHI(non)	0.185	-0.093	-0.078	0.120	0.039	0.111	-0.235	0.076	0.259	1				
Non_inc^2	0.030	0.052	-0.052	-0.073	0.005	-0.106	-0.123	0.010	-0.299	-0.078	1			
Commission^2	0.177	-0.002	-0.071	0.026	-0.013	0.014	-0.316	0.087	0.238	0.711	-0.280	1		
Gdp_growth	-0.176	0.178	0.043	0.002	0.194	0.024	0.196	-0.067	-0.214	-0.174	0.092	-0.150	1	
Inflation	0.172	-0.182	-0.093	0.288	0.367	-0.031	-0.211	-0.221	0.166	0.088	-0.072	-0.079	-0.144	1

Source: Authors calculations

The data set comprises of 226 banks in 11 countries during the period 2000-2007. ***Equity/Assets*** measures capitalization, ***Loan/Assets*** ratio of loans to total asset, ***Size*** is the natural logarithm of the book value of assets, ***ROA*** profitability, ***Asset_gro*** the annual growth rate of assets, ***RAROA,*** risk adjusted return on asset, ***ROROE,*** risk adjusted return on equity. The Z-score is a measure of bank stability, ***HHI (rev)*** diversification between interest and non-interest income. ***HHI (non)*** measures diversification within non-interest income generating activities. ***NON_inc^2*** and ***Commission^2*** are squared shares of non-interest income in total operating income and commission income to non-interest income. ***Gdp_growth*** is the annual gross domestic product, and ***Inflation*** is measured at consumer prices.

Table 3.4 Relationship between revenue diversification, performance and stability

	Diversification *between* interest and non-interest generating activities. HHI (rev)		Diversification *within* interest and non-interest generating activities. HHI (non)		
	Z-Score	**RAROA**	**Z-Score**	**RAROA**	**RAROE**
	(1)	(2)	(3)	(4)	(5)
Z-Score_lag	0.880***		0.920***		
	(0.047)		(0.054)		
RAROA_lag		0.607***		0.551***	
		(0.091)		(0.086)	
RAROE_lag					0.958***
					(0.023)
Loan/Asset	0.469***	1.114***	0.234	0.975***	0.116
	(0.180)	(0.356)	(0.146)	(0.363)	(0.311)
Equity/Asset	0.143	-1.842***	0.135	-2.198*	-2.051
	(0.274)	(0.603)	(0.346)	(1.169)	(1.443)
ROA	0.035	0.540***	0.100**	0.545***	0.293***
	(0.043)	(0.078)	(0.047)	(0.126)	(0.093)
Size	0.019**	0.023	0.024*	0.027	-0.33*
	(0.009)	(0.023)	(0.013)	(0.034)	(0.017)
Asset_gro	-0.469***	-0.465**	-0.504***	-0.084	-0.573***
	(0.113)	(0.216)	(0.092)	(0.244)	(0.217)
GDP_gro	-0.374	-1.361*	-0.416	-2.007***	0.536
	(0.374)	(0.767)	(0.291)	(0.520)	(0.878)
Inflation	0.470	-1.037*	0.172	-1.847**	-0.253
	(0.380)	(0.598)	(0.294)	(0.769)	(0.711)
HHI(rev)	-0.427**	-0.877**			
	(0.211)	(0.414)			
Non_inc^2	0.270**	0.178			
	(0.130)	(0.345)			
HHI(non)			-0.267**	-0.766**	-1.094***
			(0.128)	(0.364)	(0.304)
Commission^2			0.134*	0.554***	0.507**
			(0.078)	(0.211)	(0.197)
Diagnostic tests					
no of instruments	124	122	92	130	105
Number of groups	207	208	160	165	156
Hansen	109.26	111.06	73.75	113.94	93.89
P-value	(0.421)	(0.324)	(0.519)	(0.457)	(0.314)
AR2	0.49	0.83	-1.18	0.538	0.15
P-value	(0.625)	(0.408)	(0.239)	(0.620)	(0.880)
F-test	42.83***	18.59***	64.71***	11.92***	461.98***

This table reports the two stage System GMM regression results. ***, **,* indicates statistical significance at the 1%, 5% and 10% level respectively. Regression coefficients are reported with standard errors in parenthesis. The dependent variables are the measures of bank risk ***(Z-score)*** and risk adjusted performance measures ***(RAROA, and ROROE)*** respectively. ***HHI (rev)*** and ***HHI (non)*** measures revenue diversification *between* and *within* non interest income generating activities. ***Non_2*** and ***Commission_2*** measure the squared share of non-interest income in net-operating revenue and the squared share of commission income in non-interest income. The following bank specific controls are included in the regression; ***Z-score_lag, RAROA_lag, and ROROE_lag*** are the first lags of the dependent variable included as regressors. ***Loan/Asset*** is the ratio of loans to total assets, ***Equity/Assets*** is the ratio of equity to total assets, ***Size*** is the natural logarithm of total Assets in million of US$, ***Ass_gro*** is the annual growth rate of total assets. Two macroeconomic controls are included as follows; ***GDP_gro*** is the annual growth rate of Gross Domestic Product and ***Inflation*** is the annual consumer price inflation. The following diagnostic tests are reported. (1) The instrument count (2) the number of banks used in the sample. (3) The Hansen test for over identifying restrictions (the null hypothesis is that instruments are exogenous) (4) The Arellano-bond tests for first and second order serial correlation in the residuals (The null hypothesis is that there is no serial correlation of the first and second order respectively). (5) The F-test for joint significance of instruments.

Table 3. 4.1 Relationship between revenue diversification, performance and stability using cross sectional time-series regression model. (fixed effects model)

	Diversification *between* interest and non-interest generating activities. HHI (rev)		Diversification *within* interest and non-interest generating activities. HHI (non)		
	Z-Score	**RAROA**	**Z-Score**	**RAROA**	**RAROE**
	(1)	(2)	(3)	(4)	(5)
Z-Score_lag	0.167***		0.114***		
	(0.029)		(0.039)		
RAROA_lag		0.214***		0.214***	
		(0.057)		(0.056)	
RAROE_lag					0.208***
					(0.043)
Loan/Asset	0.266***	-0.304	0.124	-0.816***	-0.795**
	(0.073)	(0.474)	(0.094)	(0.488)	(.0420)
Equity/Asset	3.584***	3.803***	4.778***	4.214***	0.307***
	(0.393)	(0.779)	(0.705)	(0.996)	(0.868)
ROA	0.115***		0.105***		
	(0.013)		(0.012)		
Size	0.010	0.122**	0.013	0.157***	0.158***
	(0.014)	(0.051)	(0.013)	(0.056)	(0.055)
Asset_gro	-0.038	-0.317	-0.085	-0.166	-0.090
	(0.040)	(0.357)	(0.038)	(0.123)	(0.101)
GDP_gro	-0.410***	-1.069	-0.390**	-2.007***	-0.502
	(0.010)	(0.809)	(0.187)	(0.520)	(0.699)
Inflation	0.260*	1.807*	0.180	-1.847**	0.681
	(0.013)	(0.968)	(0.138)	(0.769)	(0.890)
HHI(rev)	0.003	-0.317			
	(0.066)	(0.357)			
Non_inc^2	-0.036	0.435			
	(0.062)	(0.266)			
HHI(non)			-0.018	0.649***	0.606***
			(0.044)	(0.163)	(0.174)
Commission^2			0.038	-0.347**	-0.368**
			(0.034)	(0.144)	(0.150)
Diagnostic tests					
No of observations	997	959	800	783	747
Overall adjusted R^2	0.09	0.14	0.07	0.13	0.43

This table reports fixed effects cross sectional regressions. ***, **,* indicates statistical significance at the 1%, 5% and 10% level respectively. Regression coefficients are reported with standard errors in parenthesis. The dependent variables are the measures of bank risk ***(Z-score)*** and risk adjusted performance measures ***(RAROA, and ROROE)*** respectively. ***HHI (rev)*** and ***HHI (non)*** measures revenue diversification *between* and *within* non interest income generating activities. ***Non_2*** and ***Commission_2*** measure the squared share of non-interest income in net-operating revenue and the squared share of commission income in non-interest income. The following bank specific controls are included in the regression; ***Z-score_lag, RAROA_lag, and ROROE_lag*** are the first lags of the dependent variable included as regressors. ***Loan/Asset*** is the ratio of loans to total assets, ***Equity/Assets*** is the ratio of equity to total assets, ***Size*** is the natural logarithm of total Assets in million of US$, ***Ass_gro*** is the annual growth rate of total assets. Two macroeconomic controls are included as follows; ***GDP_gro*** is the annual growth rate of Gross Domestic Product and ***Inflation*** is the annual consumer price inflation.

Table 3.4.2 Relationship between revenue diversification, performance and stability using cross sectional time-series regression model (fixed effects model) and including the non -interest income share as a quadratic

	Diversification *between* interest and non-interest generating activities. HHI (rev)		non-interest generating activities. HHI (non)		
	Z-Score	**RAROA**	**Z-Score**	**RAROA**	**RAROE**
	(1)	(2)	(3)	(4)	(5)
Z-Score_lag	0.167***		0.113***		
	(0.029)		(0.038)		
RAROA_lag		0.214***		0.214***	
		(0.057)		(0.057)	
RAROE_lag					0.208***
					(0.043)
Loan/Asset	0.266***	-0.304	0.128	-0.801	-0.810*
	(0.073)	(0.474)	(0.084)	(0.499)	(0.429)
Equity/Asset	3.584***	3.802***	4.807***	4.290***	3.343***
	(0.393)	(0.779)	(0.723)	(0.996)	(0.861)
ROA	0.115***		0.106***		
	(0.013)		(0.012)		
Size	-0.010	0.122**	0.011*	0.156***	0.162***
	(0.014)	(0.051)	(0.013)	(0.059)	(0.506)
Asset_gro	-0.038	-0.008	-0.082**	-0.151	-.0.77
	(0.040)	(0.135)	(0.038)	(0.123)	(0.102)
GDP_gro	-0.410***	-1.069	-0.411**	-0.601	-0.609
	(0.132)	(0.809)	(0.173)	(0.823)	(0.708)
Inflation	0.260*	1.807*	0.210	2.005***	0.644
	(0.380)	(0.968)	(0.135)	(0.940)	(0.877)
HHI(rev)	-0.015	-0.100			
	(0.078)	(0.411)			
Non_inc	-0.036	0.435	0.101	0.143	-0.107
	(0.062)	(0.266)	(0.075)	(0.315)	(0.272)
HHI(non)			-0.053	0.615***	0.675***
			(0.057)	(0.209)	(0.196)
Commission^2			0.074	-0.305*	-0.420**
			(0.049)	(0.170)	(0.172)
Diagnostic tests					
No of observations	997	959	798	782	746
Overall adjusted R^2	0.09	0.04	0.07	0.12	0.43
HHI(rev)/HHI(non)-Indirect effect	-0.015	-0.100	-0.053	0.615***	0.675***
	(0.078)	(0.411)	(0.057)	(0.209)	(0.196)
Non_inc (Direct effect)	-0.036	0.435	0.101	0.143	-0.107
	(0.062)	(0.266)	(0.075)	(0.315)	(0.272)
Net effect	-0.051	0.335	0.048	0.758***	0.568**

This table reports fixed effects cross sectional regressions. ***, **,* indicates statistical significance at the 1%, 5% and 10% level respectively. Regression coefficients are reported with standard errors in parenthesis. The dependent variables are the measures of bank risk ***(Z-score)*** and risk adjusted performance measures ***(RAROA, and ROROE)*** respectively. ***HHI (rev)*** and ***HHI (non)*** measures revenue diversification *between* and *within* non interest income generating activities. ***Non_2*** and ***Commission_2*** measure the squared share of non-interest income in net-operating revenue and the squared share of commission income in non-interest income. The following bank specific controls are included in the regression; ***Z-score_lag, RAROA_lag, and ROROE_lag*** are the first lags of the dependent variable included as regressors. ***Loan/Asset*** is the ratio of loans to total assets, ***Equity/Assets*** is the ratio of equity to total assets, ***Size*** is the natural logarithm of total Assets in million of US$, ***Ass_gro*** is the annual growth rate of total assets. Two macroeconomic controls are included as follows; ***GDP_gro*** is the annual growth rate of Gross Domestic Product and ***Inflation*** is the annual consumer price inflation. Direct effect is estimated impact of a 1% increase in the non-interest income share. Indirect effect is estimated impact of a change in revenue diversification from a 1% increase in the non-interest income share. Net effect sums the direct and indirect effects.

Table 3.5 Controlling for the structure of the banking system

	Diversification *between* interest and non-interest generating activities. HHI (rev)		Diversification *within* interest and non-interest generating activities. HHI (non)		
	Z-Score	**RAROA**	**Z-Score**	**RAROA**	**RAROE**
	(1)	(2)	(3)	(4)	(5)
Z-Score_lag	0.863***		0.920***		
	(0.054)		(0.057)		
RAROA_lag		0.612***		0.548***	
		(0.090)		(0.083)	
RAROE_lag					0.952***
					(0.029)
Loan/Asset	0.455**	1.254***	0.170	1.190***	0.423
	(0.190)	(0.442)	(0.154)	(0.400)	(0.344)
Equity/Asset	0.105	-1.941***	0.141	-2.412**	-1.691
	(0.291)	(0.594)	(0.397)	(1.031)	(1.440)
ROA	0.013	0.562***	0.102**	0.585***	0.334***
	(0.042)	(0.087)	(0.047)	(0.119)	(0.085)
Size	0.013	0.017	0.040**	-0.039	-0.049**
	(0.012)	(0.022)	(0.018)	(0.048)	(0.022)
Asset_gro	-0.498***	-0.441*	-0.543***	0.022	-0.491*
	(0.117)	(0.228)	(0.097)	(0.238)	(0.260)
GDP_gro	-0.315	-1.260*	-0.500	-1.661***	0.662
	(0.369)	(0.758)	(0.304)	(0.482)	(1.024)
Inflation	0.622	-0.553	0.021	-1.345	0.746
	(0.520)	(0.820)	(0.308)	(0.866)	(0.772)
Concentration	-0.147	-0.357	0.249	-0.969*	-1.095***
	(0.288)	(0.581)	(0.160)	(0.501)	(0.387)
HHI(rev)	-0.574**	-1.020**			
	(0.251)	(0.501)			
Non_2	0.248**	0.265			
	(0.119)	(0.321)			
HHI(non)			-0.289**	-0.703**	-0.960***
			(0.142)	(0.331)	(0.355)
Commission^2			0.163*	0.470**	0.367
			(0.091)	(0.205)	(0.268)
Diagnostic tests					
no of instruments	127	122	92	130	105
Number of groups	207	208	160	165	156
Hansen	111.74	108.15	73.96	112.50	95.37
P-value	(0.409)	(0.371)	(0.479)	(0.469)	(0.253)
AR2	0.54	0.83	-1.17	0.56	0.41
P-value	(0.586)	(0.408)	(0.242)	(0.577)	(0.683)
F-test	44.20***	20.57***	58.83***	12.21***	292***

This table reports the two stage System GMM regression results. ***, **,* indicates statistical significance at the 1%, 5% and 10% level respectively. Regression coefficients are reported with standard errors in parenthesis. The dependent variables are the measures of bank risk ***(Z-score)*** and risk adjusted performance measures ***(RAROA, and ROROE)*** respectively. ***HHI (rev)*** and ***HHI (non)*** measures revenue diversification *between* and *within* non interest income generating activities. ***Non_2*** and ***Commission_2*** measure the squared share of non-interest income in net-operating revenue and the squared share of commission income in non-interest income. The following bank specific controls are included in the regression; ***Z-score_lag, RAROA_lag, and ROROE_lag*** are the first lags of the dependent variable included as regressors. ***Loan/Asset*** is the ratio of loans to total assets, ***Equity/Assets*** is the ratio of equity to total assets, ***Size*** is the natural logarithm of total Assets in million of US$, ***Ass_gro*** is the annual growth rate of total assets. Two macroeconomic controls are included as follows; ***GDP_gro*** is the annual growth rate of Gross Domestic Product and ***Inflation*** is the annual consumer price inflation. The following diagnostic tests are reported. (1) The instrument count (2) the number of banks used in the sample. (3) The Hansen test for over identifying restrictions (the null hypothesis is that instruments are exogenous) (4) The Arellano-bond tests for first and second order serial correlation in the residuals (The null hypothesis is that there is no serial correlation of the first and second order respectively). (5) The F-test for joint significance of instruments. Finally, we report the F-test for joint significance of instruments.***Concentration*** is the share of assets in the banking system held by the largest banks.

Table 3.6 Relationship between revenue diversification, performance and stability for banks with moderate exposures to insolvency risk

	Diversification *between* interest and non-interest generating activities. HHI (rev)		Diversification *within* interest and non-interest generating activities. HHI (non)		
	Z-Score	**RAROA**	**Z-Score**	**RAROA**	**RAROE**
	(1)	(2)	(3)	(4)	(5)
Z-Score_lag	0.940***		0.844***		
	(0.042)		(0.074)		
RAROA_lag		0.339***		0.473***	
		(0.067)		(0.088)	
RAROE_lag					0.914***
					(0.045)
Loan/Asset	0.185	1.625***	0.852**	1.060**	0.310
	(0.147)	(0.498)	(0.336)	(0.477)	(0.520)
Equity/Asset	0.157	-1.635	1.111*	-3.908**	-2.554*
	(0.289)	(1.795)	(0.660)	(1.632)	(1.316)
ROA	0.009	0.540***	0.100**	0.570***	0.353***
	(0.050)	(0.112)	(0.046)	(0.135)	(0.116)
Size	0.023**	0.076*	0.050***	0.092**	0.000
	(0.010)	(0.039)	(0.019)	(0.042)	(0.021)
Asset_gro	-0.570***	-0.266	-0.157	-0.085	-0.458
	(0.117)	(0.346)	(0.128)	(0.270)	(0.298)
GDP_gro	-0.193	-1.686***	-0.577	-1.970***	-0.112
	(0.409)	(0.593)	(0.370)	(0.595)	(1.069)
Inflation	0.831**	-1.565**	-0.351	-0.743	0.505
	(0.340)	(0.631)	(0.339)	(0.726)	(1.023)
HHI(rev)	-0.528**	-0.957*			
	(0.237)	(0.532)			
Non_2	0.187*	-1.688***			
	(0.110)	(0.433)			
HHI(non)			-0.593**	-1.036**	-1.416***
			(0.262)	(0.443)	(0.516)
Commission^2			0.311**	0.724***	0.825**
			(0.132)	(0.262)	(0.344)
Diagnostic tests					
no of instruments	105	73	72	73	76
Number of groups	146	109	72	109	46
Hansen	81.73	58.54	44.12	59.24	71.22
P-value	(0.668)	(0.382)	(0.853)	(0.358)	(0.132)
AR2	0.69	0.24	-1.49	-0.02	-0.10
P-value	(0.668)	(0.808)	(0.135)	(0.983)	(0.919)
F-test	164.01***	26.26***	34.34***	25.22***	116.80***

This table reports the two stage System GMM regression results. ***, **,* indicates statistical significance at the 1%, 5% and 10% level respectively. Regression coefficients are reported with standard errors in parenthesis. The dependent variables are the measures of bank risk ***(Z-score)*** and risk adjusted performance measures ***(RAROA, and ROROE)*** respectively. ***HHI (rev)*** and ***HHI (non)*** measures revenue diversification *between* and *within* non interest income generating activities. ***Non_2*** and ***Commission_2*** measure the squared share of non-interest income in net-operating revenue and the squared share of commission income in non-interest income. The following bank specific controls are included in the regression; ***Z-score_lag, RAROA_lag, and ROROE_lag*** are the first lags of the dependent variable included as regressors. ***Loan/Asset*** is the ratio of loans to total assets, ***Equity/Assets*** is the ratio of equity to total assets, ***Size*** is the natural logarithm of total Assets in million of US$, ***Ass_gro*** is the annual growth rate of total assets. Two macroeconomic controls are included as follows; ***GDP_gro*** is the annual growth rate of Gross Domestic Product and ***Inflation*** is the annual consumer price inflation. The following diagnostic tests are reported. (1) The instrument count (2) the number of banks used in the sample. (3) The Hansen test for over identifying restrictions (the null hypothesis is that instruments are exogenous) (4) The Arellano-bond tests for first and second order serial correlation in the residuals (The null hypothesis is that there is no serial correlation of the first and second order respectively). (5) The F-test for joint significance of instruments.

Table 3.7 Controlling for Banking freedom

	Diversification *between* interest and non-interest generating activities. HHI (rev)		Diversification *within* interest and non-interest generating activities. HHI (non)		
	Z-Score	**RAROA**	**Z-Score**	**RAROA**	**RAROE**
	(1)	(2)	(3)	(4)	(5)
Z-Score_lag	0.856***		0.926***		
	(0.052)		(0.058)		
RAROA_lag		0.616***		0.557***	
		(0.091)		(0.085)	
RAROE_lag					0.955***
					(0.023)
Loan/Asset	0.390**	1.094***	0.281*	0.862***	0.166
	(0.183)	(0.358)	(0.150)	(0.329)	(0.317)
Equity/Asset	0.151	-1.725***	0.221	-2.469*	-1.980
	(0.259)	(0.611)	(0.401)	(1.347)	(1.372)
ROA	0.000	0.538***	0.088*	0.576***	0.299***
	(0.042)	(0.084)	(0.050)	(0.140)	(0.092)
Size	0.018*	0.033	0.026*	0.024	-0.031*
	(0.009)	(0.024)	(0.013)	(0.037)	(0.018)
Asset_gro	-0.479***	-0.356	-0.531***	0.126	-0.605**
	(0.116)	(0.224)	(0.091)	(0.208)	(0.234)
GDP_gro	-0.426	-0.807	-0.564*	-1.251***	0.460
	(0.392)	(0.932)	(0.330)	(0.469)	(0.840)
Inflation	0.395	-0.613	0.236	-1.888**	-0.484
	(0.374)	(0.571)	(0.307)	(0.799)	(0.724)
Bank freedom	0.001	0.006*	-0.001	0.007**	-0.003
	(0.001)	(0.004)	(0.001)	(0.003)	(0.003)
HHI(rev)	-0.416**	-1.065**			
	(0.194)	(0.483)			
Non_2	0.272**	0.128			
	(0.121)	(0.358)			
HHI(non)			-0.220*	-0.988***	-1.049***
			(0.124)	(0.352)	(0.290)
Commission^2			0.125*	0.493**	0.561***
			(0.072)	(0.202)	(0.208)
Diagnostic tests					
no of instruments	127	122	92	130	105
num of obs	997	959	760	783	736
Hansen	101.28	110.72	76.48	111.60	94.03
P-value	(0.688)	(0.308)	(0.399)	0.493	(0.285)
AR2	0.50	0.98	-1.07	0.68	0.08
P-value	(0.619)	(0.329)	(0.283)	(0.498)	(0.934)
F-test	46.81***	17.06***	60.35***	12.91***	426.50***

This table reports the two stage System GMM regression results. ***, **,* indicates statistical significance at the 1%, 5% and 10% level respectively. Regression coefficients are reported with standard errors in parenthesis. The dependent variables are the measures of bank risk ***(Z-score)*** and risk adjusted performance measures ***(RAROA, and ROROE)*** respectively. ***HHI (rev)*** and ***HHI (non)*** measures revenue diversification *between* and *within* non interest income generating activities. ***Non_2*** and ***Commission_2*** measure the squared share of non-interest income in net-operating revenue and the squared share of commission income in non-interest income. The following bank specific controls are included in the regression; ***Z-score_lag, RAROA_lag, and ROROE_lag*** are the first lags of the dependent variable included as regressors. ***Loan/Asset*** is the ratio of loans to total assets, ***Equity/Assets*** is the ratio of equity to total assets, ***Size*** is the natural logarithm of total Assets in million of US$, ***Ass_gro*** is the annual growth rate of total assets. Two macroeconomic controls are included as follows; ***GDP_gro*** is the annual growth rate of Gross Domestic Product and ***Inflation*** is the annual consumer price inflation. The following diagnostic tests are reported. (1) The instrument count (2) the number of banks used in the sample. (3) The Hansen test for over identifying restrictions (the null hypothesis is that instruments are exogenous) (4) The Arellano-bond tests for first and second order serial correlation in the residuals (The null hypothesis is that there is no serial correlation of the first and second order respectively). (5) The F-test for joint significance of instruments. Higher values of ***Bank freedom*** correspond to higher freedom from government controls.

Table 3.8 Controlling for bank activity restrictions

	Diversification *between* interest and non-interest generating activities. HHI (rev)		Diversification *within* interest and non-interest generating activities. HHI (non)		
	Z-Score	**RAROA**	**Z-Score**	**RAROA**	**RAROE**
	(1)	(2)	(3)	(4)	(5)
Z-Score_lag	0.853***		0.914***		
	(0.055)		(0.056)		
RAROA_lag		0.602***		0.546***	
		(0.088)		(0.087)	
RAROE_lag					0.955***
					(0.024)
Loan/Asset	0.399**	1.068***	0.284*	0.987***	0.034
	(0.182)	(0.360)	(0.159)	(0.370)	(0.368)
Equity/Asset	0.173	-1.620**	-0.007	-2.251*	-1.911
	(0.242)	(0.647)	(0.230)	(1.178)	(1.424)
ROA	-0.003	0.515***	0.109**	0.541***	0.288***
	(0.043)	(0.085)	(0.050)	(0.127)	(0.092)
Size	0.018**	0.032	0.032**	0.035	-0.037**
	(0.009)	(0.022)	(0.013)	(0.035)	(0.018)
Asset_gro	-0.524***	-0.477**	-0.489***	-0.085	-0.555**
	(0.117)	(0.195)	(0.090)	(0.243)	(0.217)
GDP_gro	-0.517	-1.191	-0.457	-2.062***	0.473
	(0.358)	(0.836)	(0.284)	(0.517)	(0.891)
Inflation	0.293	-1.347**	0.134	-1.807**	-0.149
	(0.376)	(0.656)	(0.283)	(0.755)	(0.737)
Activity restrictions	-0.010	-0.051	-0.014	-0.020	0.035
	(0.010)	(0.032)	(0.012)	(0.028)	(0.030)
HHI(rev)	-0.400**	-0.963**			
	(0.189)	(0.470)			
Non_2	0.248*	0.188			
	(0.129)	(0.362)			
HHI(non)			-0.229*	-0.701**	-1.217***
			(0.130)	(0.347)	(0.330)
Commission^2			0.080	0.428*	0.747**
			(0.078)	(0.238)	(0.294)
no of instruments	127	122	92	130	105
Number of groups	207	208	160	165	156
Hansen	102.50	108.40	71.54	113.18	90.39
P-value	(0.657)	(0.364)	(0.560)	(0.451)	(0.381)
AR2	0.37	0.67	-1.35	0.56	0.12
P-value	(0.708)	(0.505)	(0.175)	(0.574)	(0.907)
F-test	47.16***	18.49***	67.84***	11.07***	369.91***

This table reports the two stage System GMM regression results. ***, **,* indicates statistical significance at the 1%, 5% and 10% level respectively. Regression coefficients are reported with standard errors in parenthesis. The dependent variables are the measures of bank risk ***(Z-score)*** and risk adjusted performance measures ***(RAROA, and ROROE)*** respectively. ***HHI (rev)*** and ***HHI (non)*** measures revenue diversification *between* and *within* non interest income generating activities. ***Non_2*** and ***Commission_2*** measure the squared share of non-interest income in net-operating revenue and the squared share of commission income in non-interest income. The following bank specific controls are included in the regression; ***Z-score_lag, RAROA_lag, and ROROE_lag*** are the first lags of the dependent variable included as regressors. ***Loan/Asset*** is the ratio of loans to total assets, ***Equity/Assets*** is the ratio of equity to total assets, ***Size*** is the natural logarithm of total Assets in million of US$, ***Ass_gro*** is the annual growth rate of total assets. Two macroeconomic controls are included as follows; ***GDP_gro*** is the annual growth rate of Gross Domestic Product and ***Inflation*** is the annual consumer price inflation. The following diagnostic tests are reported. (1) The instrument count (2) the number of banks used in the sample. (3) The Hansen test for over identifying restrictions (the null hypothesis is that instruments are exogenous) (4) The Arellano-bond tests for first and second order serial correlation in the residuals (The null hypothesis is that there is no serial correlation of the first and second order respectively). (5) The F-test for joint significance of instruments. Higher values of ***Activity restrictions*** correspond to higher regulatory controls on bank activities.

Table 3.9 Controlling for the stringency of regulatory capital requirements

	Diversification *between* interest and non-interest generating activities. HHI (rev)		Diversification *within* interest and non-interest generating activities. HHI (non)		
	Z-Score	**RAROA**	**Z-Score**	**RAROA**	**RAROE**
	(1)	(2)	(3)	(4)	(5)
Z-Score_lag	0.869***		0.907***		
	(0.051)		(0.062)		
RAROA_lag		0.603***		0.560***	
		(0.091)		(0.086)	
RAROE_lag					0.959***
					(0.024)
Loan/Asset	0.379**	1.025**	0.263*	1.000***	0.153
	(0.170)	(0.091)	(0.152)	(0.360)	(0.331)
Equity/Asset	0.131	-1.865***	0.346	-2.223*	-1.995
	(0.251)	(0.595)	(0.507)	(1.220)	(1.442)
ROA	0.003	0.539***	0.081	0.555***	0.292***
	(0.043)	(0.077)	(0.051)	(0.127)	(0.092)
Size	0.015*	0.020	0.026*	0.025	-0.032*
	(0.009)	(0.023)	(0.014)	(0.038)	.(0.018)
Asset_gro	-0.503***	-0.469**	-0.532***	-0.052	-0.571**
	(0.112)	(0.214)	(0.100)	(0.232)	(0.223)
GDP_gro	-0.426	-1.418*	-0.620**	-1.917***	0.622
	(0.369)	(0.742)	(0.242)	(0.514)	(0.968)
Inflation	0.635**	-1.130*	0.213	-2.003**	-0.321
	(0.312)	(0.596)	(0.299)	(0.789)	(0.723)
Cap_Index	0.007	0.019	0.024**	-0.010	-0.015
	(0.018)	(0.045)	(0.010)	(0.025)	(0.029)
HHI(rev)	-0.418**	-0.814*			
	(0.209)	(0.453)			
Non_2	0.269**	0.132			
	(0.126)	(0.369)			
HHI(non)			-0.203	-0.807**	-1.110***
			(0.134)	(0.341)	(0.329)
Commission^2			0.141	0.540***	0.505**
			(0.088)	(0.208)	(0.215)
Diagnostic tests					
no of instruments	128	122	92	130	105
Number of groups	207	208	160	165	156
Hansen	106.76	111.20	74.71	114.43	91.30
P-value	(0.570)	(0.297)	(0.455)	(0.419)	(0.355)
AR2	0.61	0.82	-1.03	0.59	0.11
P-value	(544)	(0.412)	(0.301)	(0.556)	(0.916)
F-test	47***	17.40***	81.81***	13.05***	433.42***

This table reports the two stage System GMM regression results. ***, **,* indicates statistical significance at the 1%, 5% and 10% level respectively. Regression coefficients are reported with standard errors in parenthesis. The dependent variables are the measures of bank risk ***(Z-score)*** and risk adjusted performance measures ***(RAROA, and ROROE)*** respectively. ***HHI (rev)*** and ***HHI (non)*** measures revenue diversification *between* and *within* non interest income generating activities. ***Non_2*** and ***Commission_2*** measure the squared share of non-interest income in net-operating revenue and the squared share of commission income in non-interest income. The following bank specific controls are included in the regression; ***Z-score_lag, RAROA_lag, and ROROE_lag*** are the first lags of the dependent variable included as regressors. ***Loan/Asset*** is the ratio of loans to total assets, ***Equity/Assets*** is the ratio of equity to total assets, ***Size*** is the natural logarithm of total Assets in million of US$, ***Ass_gro*** is the annual growth rate of total assets. Two macroeconomic controls are included as follows; ***GDP_gro*** is the annual growth rate of Gross Domestic Product and ***Inflation*** is the annual consumer price inflation. The following diagnostic tests are reported. (1) The instrument count (2) the number of banks used in the sample. (3) The Hansen test for over identifying restrictions (the null hypothesis is that instruments are exogenous) (4) The Arellano-bond tests for first and second order serial correlation in the residuals (The null hypothesis is that there is no serial correlation of the first and second order respectively). (5) The F-test for joint significance of instruments. Higher values of ***cap_index*** show more stringent regulatory capital requirements.

Table 3.10 Controlling for the Risk of Expropriation

	Diversification *between* interest and non-interest generating activities. HHI (rev)		Diversification *within* interest and non-interest generating activities. HHI (non)		
	Z-Score	**RAROA**	**Z-Score**	**RAROA**	**RAROE**
	(1)	(2)	(3)	(4)	(5)
Z-Score_lag	0.854***		0.915***		
	(0.056)		(0.059)		
RAROA_lag		0.601***		0.524***	
		(0.089)		(0.082)	
RAROE_lag					0.970***
					(0.036)
Loan/Asset	0.420**	1.120***	0.196	0.914**	0.052
	(0.203)	(0.362)	(0.178)	(0.357)	(0.366)
Equity/Asset	0.127	-1.869***	-0.005	-2.389**	-1.910
	(0.259)	(0.570)	(0.386)	(1.057)	(1.619)
ROA	0.006	0.562***	0.094*	0.558***	0.290***
	(0.044)	(0.100)	(0.048)	(0.124)	(0.086)
Size	0.014	0.020	0.014	-0.047	-0.039**
	(0.011)	(0.022)	(0.026)	(0.038)	(0.019)
Asset_gro	-0.494***	-0.466**	-0.512***	-0.026	-0.555**
	(0.110)	(0.222)	(0.094)	(0.228)	(0.234)
GDP_gro	-0.406	-1.123	-0.417	-1.600***	0.687
	(0.423)	(0.785)	(0.286)	(0.554)	(0.999)
Inflation	0.467	-0.681	0.259	-1.467*	0.1000
	(0.529)	(0.752)	(0.286)	(0.875)	(0.914)
Property Rights	0.001	0.003	0.001	0.010*	0.003
	(0.003)	(0.007)	(0.003)	(0.006)	(0.005)
HHI(rev)	-0.426*	-0.941**			
	(0.240)	(0.418)			
Non_2	0.273*	0.147			
	(0.139)	(0.317)			
HHI(non)			-0.297*	-0.850**	-1.053***
			(0.158)	(0.354)	(0.335)
Commission^2			0.149*	0.559**	0.546***
			(0.089)	(0.219)	(0.195)
Diagnostic tests					
no of instruments	127	122	92	130	105
Number of groups	207	208	160	165	156
Hansen	104.91	109.68	102.21	110.62	94
P-value	(0.593)	(0.333)	(0.476)	(0.519)	(0.285)
AR2	0.48	0.84	1.38	0.70	0.14
P-value	(0.629)	(0.400)	(0.169)	(0.481)	(0.889)
F-test	46.32***	20.54***	64.97***	12.81***	380.59***

This table reports the two stage System GMM regression results. ***, **,* indicates statistical significance at the 1%, 5% and 10% level respectively. Regression coefficients are reported with standard errors in parenthesis. The dependent variables are the measures of bank risk ***(Z-score)*** and risk adjusted performance measures ***(RAROA, and ROROE)*** respectively. ***HHI (rev)*** and ***HHI (non)*** measures revenue diversification *between* and *within* non interest income generating activities. ***Non_2*** and ***Commission_2*** measure the squared share of non-interest income in net-operating revenue and the squared share of commission income in non-interest income. The following bank specific controls are included in the regression; ***Z-score_lag, RAROA_lag, and ROROE_lag*** are the first lags of the dependent variable included as regressors. ***Loan/Asset*** is the ratio of loans to total assets, ***Equity/Assets*** is the ratio of equity to total assets, ***Size*** is the natural logarithm of total Assets in million of US$, ***Ass_gro*** is the annual growth rate of total assets. Two macroeconomic controls are included as follows; ***GDP_gro*** is the annual growth rate of Gross Domestic Product and ***Inflation*** is the annual consumer price inflation. The following diagnostic tests are reported. (1) The instrument count (2) the number of banks used in the sample. (3) The Hansen test for over identifying restrictions (the null hypothesis is that instruments are exogenous) (4) The Arellano-bond tests for first and second order serial correlation in the residuals (The null hypothesis is that there is no serial correlation of the first and second order respectively). (5) The F-test for joint significance of instruments. Higher values of ***Property_Rights*** indicate higher levels of state protection on private property.

Chapter IV

Ownership Structure, Revenue Diversification and Insolvency Risk in European Banks

Ownership Structure, Revenue Diversification and Insolvency Risk in European Banks

ABSTRACT

In this chapter the link between ownership structure, revenue diversification and insolvency risk is investigated. Using a panel dataset of 153 listed European banks over the period 2000-2007, and the three stage least squares (3SLS) estimation technique, which treats all three as endogenous, we find that revenue diversification reduces insolvency risk in banks that have large shareholder. This is because, the need for the majority shareholder to protect its wealth is often accomplished through its ability to influence strategic investment decisions positively. Hence the presence of a majority shareholder is consistently associated with risk efficient levels of diversification. The results are robust to an array of controls including alternative methodology, sample and variable specifications. The results are also robust to controls for the regulatory environment that banks operate in. The link identified between ownership concentration and revenue diversification is a novel way of analysing the impact of the latter on insolvency risk in banks. This previously undiscovered link contributes to the debate on the benefits of revenue diversification that currently exists in the literature.

4.1 INTRODUCTION

Safeguarding the financial system is an issue of key importance for bank regulators and supervisors. Consequently, an insight into how specific bank characteristics such as levels of revenue diversification and ownership structure interact with bank insolvency risk is of particular interest.[22]

The evidence regarding the impact of revenue diversification on insolvency risk is mixed but continues to generate interest as shown by the active body of literature in this area, DeYoung and Rice, (2004); Acharya et al. (2006); Mercieca et al. (2007); Goddard et al. (2008) and Lepetit et al. (2008). A reason for this sustained interest is that the intuition that diversification will lessen banks vulnerability to specific shocks as suggested by portfolio theory still seems logical. However, the link appears to be tenuous as only a few studies such as DeYoung and Roland (2001) Stiroh (2004a) and Stiroh and Rumble (2006) have been able to show marginal benefits of combining traditional lending with non-interest income activities that tends to disappear when exposure to non-interest income increases beyond what is risk optimal.

While most studies on diversification implicitly assume that increased profitability and trends in financial markets are the main drivers of revenue diversification (Albertazzi and Gambacorta 2009), this may not necessarily be the same in banks with a large shareholder. In the absence of agency costs that exist with dispersed ownership, the prior is that the level of revenue diversification seen in banks with concentrated ownership structures will be risk efficient, as little incentive exists otherwise for the majority shareholder. For example, if a large shareholder seeks to diversify its wealth through the banks portfolio of assets - the so-called personal

[22] Revenue diversification is when banks shift into non-interest income generating activities such as traditional bank service charges (checking, cash management, and letters of credit), and more recently the range of activities that is part of universal banking, investment banking and market trading. Ownership structure has been defined along the following dimensions: first, the degree of ownership concentration, Iannotta et al. (2007), Lefort and Walker (2007). Second, the nature of owners: in which case given a specified degree of concentration, firms may differ according to the nature of the majority stock holder.

wealth diversification hypothesis (PWH), the lure of over-diversifying for short-term profit will diminish.[23]

Testing this conjecture poses an estimation problem due to the endogeneity of the revenue diversification decision, bank performance and also the ownership concentration decision. This limitation implies a need to specify a model in which the impact of ownership concentration on revenue diversification and insolvency risk is jointly analyzed. This chapter addresses these problems by simultaneously analyzing the influence of ownership structure on the relationship between revenue diversification and insolvency risk.[24] The fact that ownership concentration does not necessarily imply wealth concentration is recognized, especially since the large shareholder may hold similar sized investments in a diversified portfolio of firms who may be focused in their individual line of business. However, wealth constraints, as well as positive correlation of returns in similar firms limit the ability of large shareholders to efficiently diversify in this manner.[25]

In this chapter, the effect of ownership concentration on revenue diversification and insolvency risk in the IMF list of advanced European economies during 2000-2007 is analysed. The main contribution is to empirically test the significance of ownership concentration on the relationship between revenue diversification and bank stability. To the best of my knowledge this is a novel approach in this area. The aim of this research is to better illuminate and enrich the growing literature on

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[23] According to Amihud and Lev (1981) the personal wealth diversification hypothesis is based on the premise that an individual whose wealth is concentrated in one bank will seek to diversify risk through the banks portfolio of assets. They further argue that the fact that an investor has a large holding in a firm does not exclude the possibility that he has holdings in other firms, thus attaining the desired risk reduction. However, this does not impair the validation of the Personal Wealth diversification Hypothesis (PWH) in banks because risk exposures in banks are similar and it is unlikely that diversifying personal wealth across banks especially in the same region will be a successful diversification strategy.

[24] According to Campa and Kedia (2002), banks only choose to diversify when the benefits outweigh the costs of diversification. Demsetz and Villlalonga (2001) and Gugler et al. (2008) also highlight the endogeneity of measures of ownership concentration. This is because a specific entity may decide to take up majority shareholding in a bank with diversification opportunities, or in banks that are already efficiently diversified in order to reduce its risk.

[25] Controlling for the endogeneity of the diversification decision requires identifying variables that affect the decision to diversify while being uncorrelated with firm value. This becomes difficult as most variables that bear on the diversification decision also impact firm value.

revenue diversification in banks. To accomplish this, the three stage least squares (3SLS) is used to simultaneously analyse the impact of ownership structure on revenue diversification and insolvency risk. The well-known econometric problems introduced by the endogeneity bias from both the decision to diversify and the decision to buy significant holdings of banks equity capital is controlled for. This discussion guides the priors as follows; first, ownership concentration in a bank increases risk efficient revenue diversification supporting the personal wealth diversification hypothesis (PWH). In other words, revenue diversification will decrease insolvency risk in banks with a large shareholder, through the validation of the PWH.

The result from this study shows that revenue diversification increases bank stability for banks with large shareholders - a validation of the personal wealth diversification hypothesis. The gains from diversification between interest and non-interest activities persist and offset the risk from increased exposure to non-interest activities, which are much more volatile than interest-generating activities. The results have significant implications for the investor whose decisions will be better informed by understanding the link between ownership structure and performance. It is also beneficial for supervisors and regulators whose role in safeguarding the financial system will benefit from an understanding of how governance in banks impacts risk-taking behaviour.

The remainder of this chapter is organized as follows; section (4.2) gives an overview of the literature on revenue diversification and corporate governance in banks, (4.3) describes the research methodology as well as the key variables used. In this section an overview of the source of data and a brief description of the sample characteristics is also provided. Section (4.4) and (4.5) present empirical results and robustness tests respectively and finally, section (4.6) concludes.

4.2 LITERATURE REVIEW

4.2.1 The link between ownership concentration and performance

The misalignment of objectives of managers and equity owners is a pressing concern in the corporate governance literature. There is a general consensus that concentrated ownership structure in firms can moderate the agency problem if the large shareholder influences the firm's investment decisions in an attempt to manage its default risk.

In general, empirical studies show more of a dichotomy in the results as some studies identify a strong link between ownership structure and profitability: Shleifer and Vishney (1997) and Iannotta et al. (2007), whereas, others argue that no significant benefits exists (Bearle and Means (1932), Jensen and Meckling (1976), Demsetz (1983), Demsetz and Lehn (1985), and Silva et al. (2006)).

The impact of the external regulatory environment was further introduced with limited success to illuminate the debate on ownership concentration and firm performance. In particular to understand the incentives that large shareholder have to engage in monitoring banking institutions when there is an external regulator. Where bank supervision and regulations (external governance mechanism) can be perfectly substituted with banks' internal governance mechanism (ownership concentration), block ownership of shares will be prevalent when the external governance mechanism is weak. Evidence of this hypothesis is provided by Micco et al (2004) in their analysis of a broad sample of 119 countries who find that the relationship between ownership concentration and bank performance was stronger in developing countries with weak external regulatory environment. Studies such as La Porta et al. (1998), Kole and Lehn (1999), Anderson and Fraser (2000), Booth et al. (2002), Caprio et al. (2003) and Konishi and Yasuda (2004), also find evidence of a positive relationship between ownership concentration and risks in unregulated firms.

Furthermore, Iannotta et al (2007) use a sample of 181 large banks from a similar sample of countries to those used in this study and find ownership concentration lowers insolvency risk. In addition, Micco et al. (2004), Wang (2005), and Shleifer and Vishny (1997) find government owned banks to be less profitable and have higher asset risk than private and other types of banks in their sample. They explained the poor performance of state owned banks identified on the influence of their political affiliations on operating objectives and risk taking behavior. In a similar vein, some other studies look at employee and managerial shareholding; for example, Sullivan and Spong (2007) in their analysis of US banks find equity ownership by bank managers reduces earning variation, whereas Demsetz and Villalonga (2001), Lefort and Urza (2007) identify a weak influence of ownership concentration on bank risk and performance .

4.2.2 Motive for revenue diversification

The following are motives for revenue for diversification the literature highlighted: First, Froot et al. (1993), and Froot and Stein (1998) infer diversification is a hedge against insolvency risk that reduces the occurrence of costly financial distress. Second, diversification is a mechanism to boost profitability and operational efficiency particularly if the scale and scope of operations increase (Landskroner et al. (2005)). Third, revenue diversification reinforces the role of banks as delegated monitors thereby increasing the volume of intermediation. This is due to the fact that banks can limit information asymmetry by using vital information from their lending relationship to boost provision of other financial services and vice versa (Baele et al. 2007). Fourth, non-interest income can lower the cyclical variations in profits provided that returns across bank activities are not perfectly correlated. In addition, diversification creates competitive pressures amongst banks competing on a wider range of market segments, which increases innovation and efficiency in the provision of services (Morgan and Salmolyk (2003), Carlson (2004), Landskroner et al. (2005), Acharya et al. (2006), and Lepetit et al. (2008)).

4.2.3 Methodological approach used in diversification studies

Prior work on revenue diversification has taken three approaches to understanding the impact of diversification on bank profitability and risk. However, the three analytical approaches do not always give a consistent picture of the impact of revenue diversification.

The first approach uses risk return analysis that result from merger simulations among existing banks and firms. This approach was popular before the passage of the Graham Leach Bliley Act (GLBA) in 1994, which permitted revenue diversification in U.S banks. However, simulating hypothetical mergers have some major shortcomings. First, it does not take into account the economies of scale and scope that arises in real life mergers. Second, this method randomly assigns firms that merge therefore, calling into question the relevance of the results since in reality mergers and acquisitions are strategic investments that are almost never randomly decided. Third, the relevance of the predictions of simulation studies particularly before the GLBA depends on how similar the bank eligible-activities before the enforcement of the GLBA closely mirror the range of permissible activities after this period. Nevertheless, these studies give insight into the potential risk effects of diversification strategies before they are fully exploited. The second approach is an analysis of actual data of functionally diversified banks involved in non-interest generating activities using cross sectional and/or panel regressions which may or may not have dynamic properties. This is the most popular of the three and is the approach taken in this study to quantify the relationship between diversification and risk of listed banks in industrial economies. The third and final approach exclusively focuses on stock market reaction to the diversification decision.

Accounting analysis

The balance sheet approach to the study of revenue diversification remains the most popular of studies. This is because it requires less restrictive assumptions on the data generating process compared to simulation studies. In addition, large

datasets can easily be collected and analyzed compared to stock market data analysis making this approach versatile and appealing to the researcher.

Using this approach, Kwan (1998) examines the mean and variance of the return on securities activities of U.S bank holding companies with Section 20 subsidiaries and compares them to those of banking activities.[26] This result is echoed in Lang and Stultz (1994), DeYoung and Roland (2001), Morgan and Samolyk (2003), and Acharya et al. (2006). Stiroh (2004a) examines how non-interest income affects variations in bank profits and risk. Results from both aggregate and bank data provide little evidence that diversification benefits exist. The results are attributed to the fact that potential diversification benefits are receding as the correlation between net and non-interest income growth increases for the average bank in the sample. This result is also corroborated when Stiroh (2006a), use the same portfolio framework on equity market data for U.S. BHC's during the period 1997 to 2004. Furthermore, Stiroh and Rumble (2006) comprehensively analyze balance sheet data for US financial holding companies (FHC's) using both panel and cross sectional analysis. Their analysis show the "double-edged" nature of this phenomenon as revenue diversification does bring benefits, however there are greater offsetting effects from an increased reliance on non-interest income, which are more volatile and not necessarily more profitable than interest generating activities. Goddard et al. (2008), in their study of diversification in small US credit unions find similar results.

[26] A bank holding company or a foreign bank may be granted permission to engage to a limited extent through a so-called section 20 subsidiary in underwriting and dealing in securities that a member bank may not underwrite or deal in directly (bank-ineligible securities). Section 20 subsidiaries are subject to limitations and/or standards designed to address certain safety and soundness concerns. One of the more prominent constraints is that it can derive no more than 25 percent of its gross revenue from underwriting or dealing in other bank-ineligible securities.

4.2.4 Factors that may drive differences in prior conclusions made in the literature?

Structure of the banking system

Regarding geographic distribution of banks, studies based on U.S banks tend to find a diversification discount, as opposed studies on other countries. For example, Landskroner et al. (2005) in their study of Israeli banks find diversification benefits exist, likewise Baele et al. (2007) in a cross-country analysis of European banks also find evidence in support of diversification. This may be due to the more diffuse banking system in the US, characterized by small, regional banks that lack the expertise and size to engage in revenue diversification. In addition, European banks have been diversifying for longer as the Gramm-Leach-Bliley Act that opened up the markets between banks, insurance and other non financial institutions in the US only came into effect in 1999.

Endogeneity

Regarding the three different analytical approaches the main tension seems to be with studies that use actual balance sheet data. Studies using simulation analysis and stock market data are unified on the fact that diversification benefits exists for banks. However, the fact that both analytical approaches require a more homogenous dataset than studies that use accounting data is at the core of these differences.

A number of studies using this balance sheet data have provided strong arguments in support of correcting for the endogeneity of the diversification decision since they find that high-risk banks in their sample were more likely to diversify (Lang and Stultz (1994) and Acharya et al. (2006)). Templeton and Severiens (1992), also find diversification to be beneficial for high-risk banks after identifying and controlling for the endogeneity of the diversification decision. Berger and Ofek (1995) without controlling for endogeneity find that diversification reduces franchise value especially when the diversification is within unrelated industries. However, when Campa and Kedia (2002), Hyland and Diltz (2002) and Villalonga

(2004a) replicate the work of Berger and Ofek (1995) and control for endogeneity they find the opposite. More specifically, when systematic differences in diversified and non-diversified firms are controlled for the diversification discount disappears or even turns into a premium

4.2.5 Studies that have used simultaneous equation models to control for endogeneity of the diversification decision

While some studies investigate the effect of diversification on risk as being unidirectional, in reality the interaction may be of mutual character because high portfolio risk may motivate or even compel firms to diversify. In this chapter we use the three stage least squares 3SLS model, which simultaneously addresses the endogeneity of the diversification decision and the ownership structure in banks. The results of other studies on revenue diversification in the literature have also used simultaneous equation models to estimate the relationship between diversification and bank performance without controlling for the ownership structure of banks are summarized below:

Acharya et al (2006), study the relationship between diversification and performance of Italian banks during the period 1993–99, they do not find benefits of diversification for banks in their sample. Even though, their detailed study employs the two Stage Least Squares (2SLS) regressions, as well as measures of diversification and performance similar to those used in this chapter, one cannot ignore the peculiarities of their dataset. They sampled 105 Italian banks in total, of which 80 percent were small banks, 55 percent were provincial and about 60 percent of the banks were state owned at the beginning of the sample period.[27] Government ownership in banks is reported in the literature to be an inefficient form of corporate control that subsidizes risk taking behaviour.

[27] Acharya et al.(2006) provide a more detailed breakdown of their sample of bank are as follows: of the 105 banks, only 15 are large (as defined by the Bank of Italy), 15 are medium and the remaining 75 are "small." In terms of geographical scope of banking activities, nine of these banks are "national," 18 are "regional," 13 are "intraregional," 10 are "local," and the remaining 55 are "provincial."

Deng et al (2007), also investigate the relationship between various dimensions of diversification and the cost of debt (bond yield spread) for publicly traded-mostly large bank holding companies (BHCs) during the period 1994-1998. [28] Their result show that diversification into non-traditional banking activities leads to a lower cost of debt only when yield spread and diversification are estimated simultaneously, using the (3SLS) with bond yield-spread and diversification measure both treated as endogenous variables. This confirms the fact that BHCs with higher yield-spread (riskier BHCs) choose to diversify more extensively in non-traditional activities. They also find that the medium sized BHCs experience the greatest reduction in bond yield-spread compared to small and large BHCs. This is consistent with the theory that small BHC's may be unable to obtain synergy gains from diversification due to lack of scale in operations and technology and expertise deficiency. However, larger banks that can benefit more from diversification on the other hand may have over-extended in these types of activities in such a way that increases their insolvency risk.

Finally, Goddard et al. (2008) use the two stage least squares instrumental variable regressions to control for the endogeneity of the diversification decision in their study of revenue diversification and financial performance of US credit unions during the period 1993–2004. Their study also uses risk adjusted measures of financial performance and diversification measures that are standard in the literature (The risk adjusted return on assets and equity is used to measure bank performance and the revenue diversification measures is also a variant of the standard Herfindahl Hirschman index). Their result show revenue diversification worsens bank performance in all but the largest credit unions. They also find the adverse effect of revenue diversification is larger, the lower the initial value of non-interest income. The explanation for their result is based on the fact that banks incur a high cost in developing staff expertise and technology capabilities to compete in the new markets. These costs are often prohibitive for smaller credit unions that do not have the production scale to later reap these benefits. The arguments put forward in their study is valid for the type and size of banking

[28] Bond yield spread is the difference between bond yield and the yield of a matched treasury security with similar coupon rate and maturity- which also measures risk.

institutions they survey, however the same argument creates reasonable expectation that the results will be somewhat different in this study of listed predominantly large European banks that have longer experience with diversification. This expectation is validated in the empirical work of Demsetz and Strahan (1997) that show a positive relationship between diversification and firm size.

4.2.6 Can the ownership structure of the bank affect the relationship between diversification and bank performance?

The discussions in previous sections focused on methods and findings of key studies in the revenue diversification literature, while this section identifies to what extent the ownership structure of banks can influence the results. For example, studies on large US banks have found diversification to increase bank risk while the results with regard to European banks are mixed. What has been ignored in these studies is the fact that banks in the US have more diffused ownership structure compared to their European counterparts, a peculiarity that can influence the results if the large shareholder is able to reduce the undertaking of risky diversification strategies. Most studies on corporate governance and firm performance exclude the banking industry because of its unique asset composition, high leverage, and degree of external regulation and supervision.

The following two arguments highlight the role of the large shareholder in mitigating difference between potential and actual benefits of diversification reported in the literature;

First, the results in the current literature on revenue diversification underplay the incentives of a large shareholder to block investment decisions that compromises banks stability and ultimately its own wealth. This is an important consideration since there is consensus in the literature that the gains from diversification depend on the actual portfolio held by the bank (Froot and Stein (1998) and Cebenoyan and Strahan (2004)). The ability to influence portfolio decisions thus becomes important factor in determining whether or not a bank benefits from diversification.

Second, traditional arguments against diversification is based on the intensity of competition in the new industries coupled with the lack of expertise particularly when small banks diversify (Stiroh (2006), and Mercieca et al. (2007), Goddard et al. (2008)). This argument puts strong emphasis on the agency problems between bank owners and managers and suggests that owners of equity are unable to exert control over portfolio choices. The benefits of diversification in banks with concentrated ownership structure will thus be understated if there is a large shareholder that has both the incentive and ability to monitor managerial investment decisions. It is important to note that monitoring incentives have strengthened in recent periods since the corporate governance mechanism (ownership structure) has to respond to the weaker external regulatory mechanisms in recent periods of deregulation.

Even though the literature on ownership structure is substantial for banks and non-bank firms, there are some gaps regarding the effect of the largest shareholder on revenue diversification and insolvency risk. So far the literature on ownership concentration and revenue diversification is thin and focuses on non-bank firms. For example, Denis et al. (1997), and Amihud and Lev (1999) find that ownership concentration is associated with lower levels of corporate diversification.[29]

According to Truong and Heaney (2007), the large shareholders' investments are particularly sensitive to the cost of under-diversification associated with maintaining such a large investment in a bank. The recent deregulation of the global banking system has induced the need for close monitoring of bank activities by investors and shareholders who can no longer rely on the regulatory mechanism to discipline risk taking behavior in banks (Prowse (1997) and Booth et al. (2002)). Given that the ability to actively monitor a bank and influence strategic decision-

[29] The results from studies on non-bank firms may not be applicable to banks because the primary purpose of diversification may be different in both types of institutions (profit maximization vs. risk minimization) and because banks are in general highly leveraged and more regulated than other firms. Risk driven revenue diversification will see banks pursue efficient risk mitigating strategies and diversification will not only be achieved through shifting into non-interest income but also by selecting the appropriate mix of products for which the bank can remain risk efficient. All other motives for diversification will tend to be risk inefficient especially if it is in pursuit of increased profitability and market power.

making will depend on the size of the shareholders investment, ownership concentration is expected to eliminate sub-optimal diversification decisions that are not risk efficient including the tendency to over-diversify reported in the literature.

To the best of my knowledge, this thesis is the first to analyze the influence of the ownership structure in banks on the decision to diversify- a timely and innovative approach. While prior studies present a sound theoretical and empirical evidence of the benefits and costs diversification, they have broadly excluded the corporate governance dimension which is particularly important in banks.

4.3 RESEARCH METHODOLOGY

4.3.1 Sample overview and variable construction

The initial sample examined in this chapter consists of listed banks from the IMF list of advanced European economies over the period 2000-2007. However, after applying specific sample selection procedures the final sample comprises of 153 banks across nine countries.[30] Detailed information about the banks balance sheets as well as ownership structure is sourced from Bankscope database maintained by Fitch IBCA/Bureau van Dijk. Ownership data from the same database is as reported in December of each year. The focus on listed banks enhances comparability across countries and banks and reduces concerns that liquidity constraints may influence the results. Other databases used are the Bureau van Dijk mint global database (2009), The Heritage Foundation Index of Economic Freedom (2009), World Bank World Development Indicators, Bank regulation and supervision database by Caprio et al. (2008), and the database on financial development and structure by Beck et al. (2006b).

[30] The initial selection criterion is to ensure that there are at least seven listed reporting banks for each country. This restriction is necessary to ensure that countries with a large number of banks do not dominate the sample.

4.3.2 Diversification Measures

To measure revenue diversification, Herfindahl Hirschmann Indices (HHI) are constructed for all banks to account for diversification *between* the two major types of income generating activities. The revenue *HHI (rev)* is computed from the revenue flows as follows:

$$\text{HHI(rev)} = \left(\frac{NON}{NETOP}\right)^2 + \left(\frac{NET}{NETOP}\right)^2 \tag{4.1}$$

Where $NETOP = NON + NET$

Non-interest income is captured by NON, NET is net-interest income and net-operating revenue is $NETOP$. The *HHI (rev)* is a very simple measure of revenue diversification, which measures shifts into non-interest income. The measure of diversification allows the breakdown of net operating income into its two broad categories. In line with Mercieca et al. (2007), these computations are also used in constructing measures of diversification *within* non-interest income generating activities:

$$HHI(non) = \left(\frac{COM}{NON}\right)^2 + \left(\frac{TRD}{NON}\right)^2 + \left(\frac{OTOP}{NON}\right)^2 \tag{4.2}$$

Where $NON = COM + TRD + OTOP$; and COM captures commission revenue, TRD captures trading income and $OTOP$ is other operating income. Higher values of both indices shows increased revenue concentration and less diversification.

In this study the main focus on the measure of diversification *within* the different types of non- interest income *HHI (non),* even though the *HHI (rev)* is also used as a robustness test. This is because of the assumption that revenue diversification already occurs to a certain extent in the banks in the sample, however, bank

managers have a keen interest in understanding how different types of non-interest income generating activities affect risk adjusted profitability.

Another measure of diversification used in prior studies is the squared share of the ratio of non-interest income to net-operating revenue (NON/NETOP)^2 which is a component of HHI(rev). Stiroh and Rumble (2006) and Goddard et al. (2008) include this term in its linear form to separate the direct exposure effect of marginal increase in non-interest income, from the indirect benefits of diversification which is a function of the institutions own degree of diversification measured by the coefficient of the diversification indices. In this study the variable is mainly included in the quadratic form for the following reasons:

First, the construction of the diversification index HHI (rev) suffers from a major drawback, in that banks appear equally diversified at two different values of non-interest income. For example, the value of HHI (rev) will be the same for a bank with all its revenue from non-interest sources and a bank with all its revenue from interest income (NON= 1 or 0) even though these are different operating strategies with different expected returns. This is why the HHI(non) -which does not quite suffer the same limitation- is the preferred measure of diversification in this chapter. Although the reduced-form relationship between revenue diversification and performance is the relationship of primary interest, it is important to include the non-interest share directly as an independent variable to control for this variation in the model.

Second, the average share of non-interest income for banks in the sample is 41 percent as shown in table 4.1 which indicates that the banks are at or approaching full diversification (50 percent share of non-interest income). Bank managers will therefore be more interested in understanding the effect of increases in non-interest income at the relatively high value of non-interest income in their portfolio as opposed to marginal additions to low values of non-interest income implied by the linear term. Including the linear term instead of the quadratic is in itself not wrong and more suited for smaller or less diversified financial institutions such as credit unions or banks with lower shares of non-interest income. The 41 percent share of

non-interest income in total revenue for banks in our sample is comparatively higher than the reported 20 percent share for the sampled US Financial Holding Companies by Stiroh and Rumble (2006) and 12 percent in the US credit unions studied by Goddard et al.(2008) that used the non interest income share in its linear form. In line with these studies, I also test and report the net effects of significant coefficients that measure diversification.

4.3.3 Measures of ownership structure

The following measures are used to proxy ownership concentration in banks;

***Highest_sh**:* The percentage of equity capital held by the largest shareholder.

Top10: this is a variable that measures the total number of shareholders in rank order (largest first) that cumulatively own 10 percent of a banks equity capital.

***Top25**:* this is a variable that measures the total number of shareholders in rank order (largest first) that cumulatively own 25 percent of a banks equity capital (as an alternative to *Top10*). The higher the value of *Top10* and *Top25* the more dispersed the ownership structure of the bank.

OwnerDiv: (*Top25 - Top10)* A continuous variable that measures ownership dispersion by taking the difference between *Top25* and *Top10*. For example, consider a bank in which the four largest shareholders own a total of 25 percent of a bank's equity capital with the largest shareholder owning 10 percent. In this case *OwnerDiv* would be equal to three. Now consider another situation in which the twenty five largest shareholders equally own 25 percent of a bank's equity capital hence *OwnerDiv* will be 15. The higher the value of *OwnerDiv* the more dispersed the ownership structure of the bank and the less likely any single shareholder will be able to exert influence over the decision making of the bank. Measures of ownership concentration are expected to have a positive relationship with revenue diversification.

*4.3.4 **Measures of insolvency risk** (Z-score and risk adjusted profitability measures)*

The main measure of insolvency risk used is the *Z-score*. Consistent with the literature on revenue diversification, the risk-adjusted returns on equity and assets Stiroh (2004 a, b) and Mercieca et al. (2007) are also used as additional measures of insolvency risk. The formulas for the *Z-score* and (*RAROE, RAROA*) are shown below:

$$Z-score = \frac{ROA + E/A}{\sigma_{ROA}} \tag{4.3}$$

$$RAROE = \frac{ROE}{\sigma_{ROE}}\ ,\ RAROA = \frac{ROA}{\sigma_{ROA}} \tag{4.4}$$

Where the return on assets *(ROA)* is the ratio of profit before tax to total assets, return on equity *(ROE)* is the ratio of profit after tax to total equity and *E/A* is the ratio of equity to assets. A higher ratio indicates higher risk-adjusted profits. The risk adjusted returns on equity and asset is calculated by dividing the Return on Equity *(ROE)* and Return on *Assets (ROA)* by their standard deviations respectively. The "modified version" of the Merton (1974) distance to default model as developed by Byström (2006) is also used. The reduced form of the model is stated below with the full derivation provided in appendix 4.1.

$$DD = \frac{\ln(1/L)}{\sigma_E(1-L)} = \frac{\ln(L)}{(L-1)}\frac{1}{\sigma_E} \tag{4.5}$$

One important observation that has implications for highly indebted firms like banks is that $\frac{\ln(L)}{L-1}$ does not vary significantly for high leverage ratios, L. This makes this "spread sheet" model insensitive to the exact nature of the banks (rather opaque) capital structure. The distance to default is the number of standard deviations that the firm value is from the default point and the smaller the value of DD, the larger the probability that the firm will default on its debt.

4.3.5 Controls for bank structure and strategy

The following control variables used in studies of revenue diversification Stiroh (2004a, b) to reflect banks strategic choices are also included. The primary objective of including these control variables is to make sure that any potential independent effects they may have on revenue diversification and insolvency risk does not influence the primary relationships being investigated.

First, ***Equity/Asset*** (the ratio of book value of equity to total assets): The level of capitalization reflects the risk profile of a bank. When equity levels are low, insolvency risk is high because capital serves as a buffer to protect banks when asset values decline.

Second, ***ROA*** (return on assets): this variable controls for the profitability of banks. Banks' profitability can influence the impact of ownership structure on revenue diversification if poorly performing banks diversify to remain solvent or if the need to increase profitability is an incentive for diversifying revenue.

Third, ***GDP*** (natural logarithm of the annual gross domestic product): This variable controls for the effect of economic growth on the diversification strategy as banks may find it more profitable to diversify during periods of rapid economic growth.

Fourth, **Mkt_power** (the ratio of total revenue/total assets): This variable is often used in the bank competition literature as a measure of a bank's ability to extract monopoly profits (De Guevara et al. 2005). Higher values indicate the likelihood that the bank can exert monopoly power in the pricing of its services. The pure "monopolist" will price its product to maximize its revenue and not necessarily prioritise production or risk efficiency. This variable is included in the study because the ability of listed banks in the sample to price product above the competitive price (monopoly profits) may in itself continue to spur banks to diversify even beyond a risk optimal point.

Apart from the variables described above, the instrumental variable technique also allows for explicit specification of instruments. Three main instruments are used in this study. First, the Ratio of loan to assets *(Loan)*, second the natural logarithm of the book value of assets (*Size*) and third a dummy variable that takes the value of 1 if the largest shareholder holds at least 10 percent of shares. This cut off point is chosen under the assumption that a single entity holding 10 percent or more of the banks equity capital will be able to exert control. The first two instruments are control variables previously identified to affect insolvency risk in banks (Stiroh, 2004a). For example, large banks are active in more markets and face better diversification opportunities (Lehar 2005). Also the size of the loan portfolio may be indicative of a banks chosen investment strategy, i.e. some banks choose to make more loans and grow rapidly as opposed to diversify. Whilst the third variable, proxies the ability of the controlling shareholder to influence the diversification-stability relationship. Hence, these variables and the control variables will serve as instruments for the endogenous variables.

4.3.6 The empirical model

In view of the endogeneity bias in the model, a 3SLS simultaneous equation model in which revenue diversification, stability and ownership concentration are treated as endogenous is specified. The preference of 3SLS over 2SLS is based on an estimation efficiency argument. In the presence of endogeneity bias, and correct specification of the structural equations, the 3SLS will produce more precise estimates of the parameters (Deng et al. (2007), Mantecon (2009)). The model is shown as follows:

$$Risk_{i,t} = \alpha_0 + \alpha_1 Ownership\,concentration_{ij,t} + \alpha_2 Diversification_{ij,t} + \alpha_3 \delta_{ij,t} + \alpha_4 \phi_{i,t} + \varepsilon_{ij,t} \quad (4.6)$$

$$Diversification_{i,t} = \gamma_0 + \gamma_1 Ownership\,concentration_{ij,t} + \gamma_2 Controls_{ij,t} + \gamma_3 \chi_{ij,t} + \gamma_4 \phi_{i,t} + \varepsilon_{ij,t} \quad (4.7)$$

In this model, vectors δ and χ are control variables and ϕ is the macroeconomic control (natural logarithmic of GDP) that is common to both equations. Each variable has a unique value for each bank j, in country i, at time t (with the exception of the macroeconomic control). The main measure of insolvency risk used is the *Z-score*. However, three other measures *RAROA*, *RAROE*, and the modified *Distance to default (DD)* are used as robustness checks. Even though *Highest_sh* is the preferred measure of ownership structure, other measures such as *Block10*, *Top10*, *Top25*, and *ownerdiv* are also used.

4.4 EMPIRICAL RESULTS

4.4.1 Descriptive statistics

Descriptive statistics and correlation coefficients are presented in table 4.1-4.3 respectively. In table 4.1, the mean of *Highest_sh* (0.34) shows that on average the largest shareholder in the sampled banks owns 34 percent of total shares. The mean of *HHI(rev)* and *HHI(non)* 0.62 and 0.74 respectively shows a significant level of diversification *between* and *within* the two main types of income sources, however, the banks in the sample appear to be less diversified *within* non-interest income generating activities. The mean of the share of non-interest income and commission income 0.41 and 0.78 further confirms these results. In other words, on average, the sampled banks derive about 41 percent of their revenues from non-interest income generating activities. Furthermore, about 78 percent of this non-interest income is generated by fee based activities. This somewhat suggests some strategic diversification which may be driven by risk averseness of the large shareholder. Table 4.2, provides a first look at the nature of the relationship between the key variables. An analysis of the pair-wise correlations between the measures of ownership structure and diversification suggest a broad based diversification strategy as opposed to a reliance on a particular activity in banks with a large shareholder. The pair-wise correlation coefficient for *Highest_sh* and (*Commission^2*) and *Highest_sh and non-interest income (Non^2)* further support this point. More specifically, the coefficient of the former relationship is negative and significant while the latter is positive and significant. Taken together it can be inferred that large shareholder discourages managements further reliance on commission income as the banks are already highly exposed to this type of income, in favour of a broad based diversification strategy by encouraging banks to venture into new markets. A preliminary explanation for this phenomenon can be seen in the relationship between insolvency risk (*Z-score)* and measures of revenue diversification. A standard correlation matrix showing similar results is also reported in table 4.3.

4.4.2 Does the ownership structure of the bank influence the relationship between revenue diversification and insolvency risk?

Table (4.4) column 1, reports 3SLS regression estimates of the relationship between diversification and insolvency risk. Column 2 to 4 report the same relationship using alternative measures of insolvency risk (*RAROA, RAROE and DD*), and column 5 and 6 uses alternative measures of ownership concentration *(Block10)* and revenue diversification respectively (*HHI (rev*)). The F-statistic, which tests for the joint significance of the regression coefficients, is also reported. This statistic is satisfactory across all model specifications. The set of three instruments described in section two are used in all regression estimates.

The estimation results are reported in tables with two panels. Panel A reports the main relationships of interest between revenue diversification, and insolvency risk. This panel also shows the independent effect of ownership structure on insolvency risk. This section of the reported tables is thus the main area of focus on the tables. Panel B on the other hand primarily shows the effect of the ownership structure in the sampled banks on diversification. Since the hypothesis in this chapter is that the large shareholder can influence strategic investment decisions in the bank such as diversification, Panel B shows if this in fact true for the banks in the sample. Across all specifications in table 4.4 and 4.5, I show that there is an independent significant relationship between the presence of a large shareholder and the decision to diversify across banks. Additional controls for bank fixed effects are not included in the regressions beyond that which is implied by the bank specific control variables included in the simultaneous equations and discussed in section 4.3.5.

In table 4.4 and 4.5, the coefficient for *HHI(non)* in panel A is negative across all specifications. This is also similar to results using the *HHI(rev)* in column 6, as an alternative measure of diversification. This result suggests diversification *int*o and *within* non-interest income generating activities reduces insolvency risk in banks (Lower levels of the HHI indices show increased diversification). The coefficient and sign of *HHI (non)* in column (2) and (3) also suggest that diversification

increases risk adjusted performance in banks with large shareholders (average shareholding by a single entity in the sample is about 34 percent as shown in table 4.1). The negative coefficient of the share of non-interest income in its quadratic and linear form (*Non-interest income ^2* and *Non-income*) in table 4.4 and table 4.5 is similar to what is reported in the literature as the "dark-side of diversification". This is because the benefits of diversification are outweighed by the negative effects of exposure to non-interest income which is more volatile and not more profitable than net-interest income. According to Stiroh and Rumble (2006) and Goddard et al. (2008), over small values of *non-income* the marginal effect of a small change in *non-income* on the Z-score or RAROA is negative, but they report that the absolute size of this negative effect diminishes as *non-income* increases.

The volatility of non-interest income is what motivates the reporting of net-effects of diversification in prior studies, which is a sum of the positive indirect effects and negative direct effects of diversification. Across the main specifications in this chapter the magnitude and sign of coefficients show that diversification is beneficial for banks in the sample. A visual inspection of the size of the coefficient also suggest that this indirect positive effect outweighs the negative direct exposure effect to non-interest income, however, I formally test this hypothesis by reporting the net-effects of diversification when the measures give significant but opposite results.

Nevertheless, the coefficient of *Non-interest income ^2* and *Non-income* is still of interest in understanding the risk and cost associated with entering new markets. Some of these costs are fixed such as search costs for new management and investment in technology and will decrease with higher proportion of non-interest income in net-operating revenue, and there are also certain aspects of these costs that are variable and will increase with the scale of operations. An example of such costs is the opportunity cost of forgone investments including making more loans. Therefore beyond a certain level of *Non-interest income ^2* these cost becomes significant. This is analogous to the "over-diversification" argument in the literature of diversification.

The preceding argument differs from the case made for the inability of small banks or banks with initial low levels of *Non-interest income ^2* to benefit from diversification. In the case of small banks, in addition to the rising opportunity cost of increased shift into non-interest income these types of banks are also not able to reduce their fixed costs due to the low scale of operations. These differences suggest that medium to large-sized banks face the biggest gains from diversification. As larger banks which have been involved diversification these activities for a longer period of time, have had time to reach the optimal level of diversification so marginal increases *non-income* do not translate improve risk-adjusted performance. Also these banks are more likely to have implemented the business practices and operations needed to be successful in the chosen diversification strategy. The net effect of diversification for these banks will thus greatly depend on how they choose to use up their diversification benefits (Stiroh and Rumble 2006).

In table 4.4 and 4.5, when the risk-adjusted measures of financial performance (RARROE, RARROA, Z-score) is used as a dependent variables the results show increased diversification improves risk-adjusted performance as the coefficient on *HHI(non)* and *HHI(rev)* is positive and statistically significant. At the same time, however, the coefficient on *Non-income* in the linear and quadratic form is negative and significant in most specifications. Thus we conclude that increased revenue diversity does bring benefits, the costs of a greater reliance on the more volatile non-interest income activities offsets some of these benefits, even though the overall effect remain highly significant as shown in table 4.5.

Given the high share of non-interest income in revenues in the sampled banks, one can assume that the average bank is close to full diversification. A decline in the the rate of diversification is necessary and managerial intents to further increase exposure to non-interest income be carefully examined for its effect on bank stability even if the area of activity is profitable. This level of monitoring investment decisions and management strategy can be carried out by the owners of equity capital.

Regarding the other variables in the regressions, the magnitude and sign of *commission^2* shows that commission income relative to trading income and other types of non-interest income has risk reducing benefits for banks. This is analogous to results in Stiroh and Rumble (2006), who find over diversification and trading income detrimental to risk adjusted returns. Even though the relationship between *highest_sh* and the *Z-score* is positive as shown in panel A, it is not always significant. This is because the role of a large shareholder in bank stability is through its influence on strategic decision-making and not a "de facto" outcome of this type of ownership structure. The evidence of diversification benefits is similar to what is reported on emerging economies in chapter 2.[31]

Further discussion about the role of corporate governance

The internal governance mechanism in the bank can be a check on the so called tendency to over-diversify. This is particularly so since the large shareholder can reduce its risk of failure through its influence on strategic investment decisions in the bank. While the relationship between the large shareholder and firm stability as seen in table 4.4 and 4.5 is a well established link in the literature, in order to determine whether or not the large shareholder influences insolvency risk through the level of diversification there has to be an independent effect of the ownership structure in banks on the decision to diversify. In other words, the *highest_sh* must also be significantly related to *HHI(non)* and *HHI(rev).*

Panel B, presents regression results simultaneously estimated as the equation in Panel A. The actual relationship between ownership structure and revenue diversification will depend on the current levels of diversification. If diversification opportunities have been fully exploited, and there is no case for further exposure to non-interest income, under assumptions of risk averseness, the presence of large shareholder will be associated with lower revenue diversification. On the other

[31] While these results appear to contrast results shown by the pair-wise correlation coefficients in table 3.2, results from regression analysis are typically more reliable. This is because regression results consider the influence of other bank characteristics on the relationships measured, whereas correlation coefficients only indicate hypothetical relationships that may not necessarily exist in reality.

hand, ownership concentration can increase diversification, if profitable sources of non-interest income are yet to be fully exploited.

Panel B, confirms that the large shareholder has an independent effect on the level of revenue diversification. The coefficient of *highest_sh* in panel B is positive and significant indicating that the presence of a large shareholder lowers the level of diversification. This relationship holds when alternative measures of ownership concentration and diversification are used in column 5 and 6. These results suggest that levels of diversification will be risk efficient in European banks when the large shareholder actively monitors investment decisions.

Table 4.4 and 4.5 present empirical evidence that shows the ownership structure of a bank to be one of the latent characteristics that induce a bank to be optimally diversified and simultaneously results in greater bank returns. Therefore, studies of diversification that do not take this into consideration may be misleading. For example, if banks that are optimally diversified are also the banks that have a large active shareholder that influences managers' investment decision, then a relationship between returns and diversification may be observed in the absence of any direct causal effect of diversification on bank performance. The same way the corporate governance of banks may help result the conflict in the literature on diversification. For example, US banks are often found to lack diversification benefits even though no study so far has considered the influence of the diffuse ownership structure in US banks on this relationship.

Figure 4.1 to 4.4 plot some key variables in the dataset. Aggregation is by averages for individual years across countries. Figure 4.1 displays the average values of *highest_sh* across countries, while figure 4.2 charts the level of revenue diversification *HHI(rev),* figure 4.3 is risk adjusted performance, *RAROA,* and figure 4.4 show the average level of stability as measured by the *Z_score.* There are two distinct patterns in the charts separated by two time periods 2002- 2005 and 2006- 2007. A hypothetical story can thus be told based on prior reviewed literature and observations from the current financial crisis;

Figure 4.1

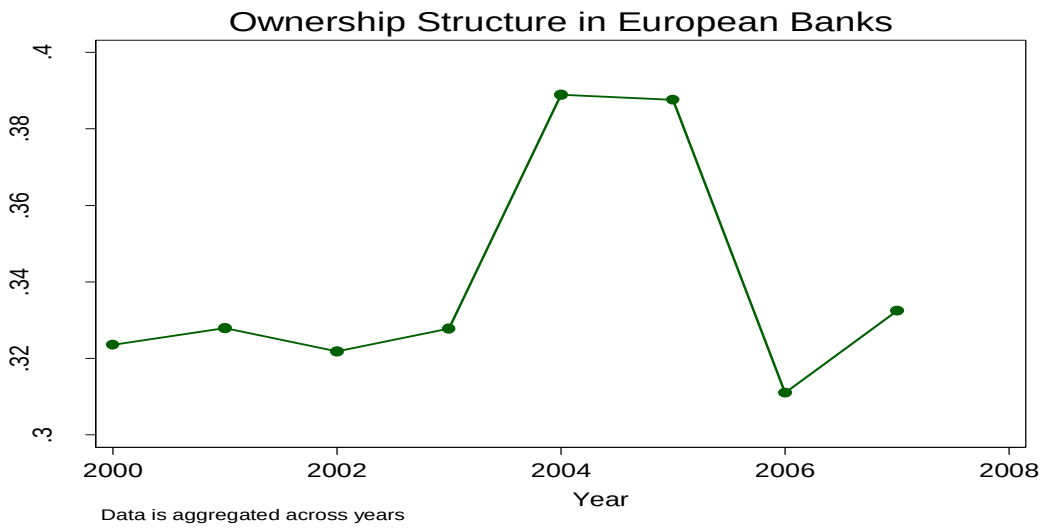
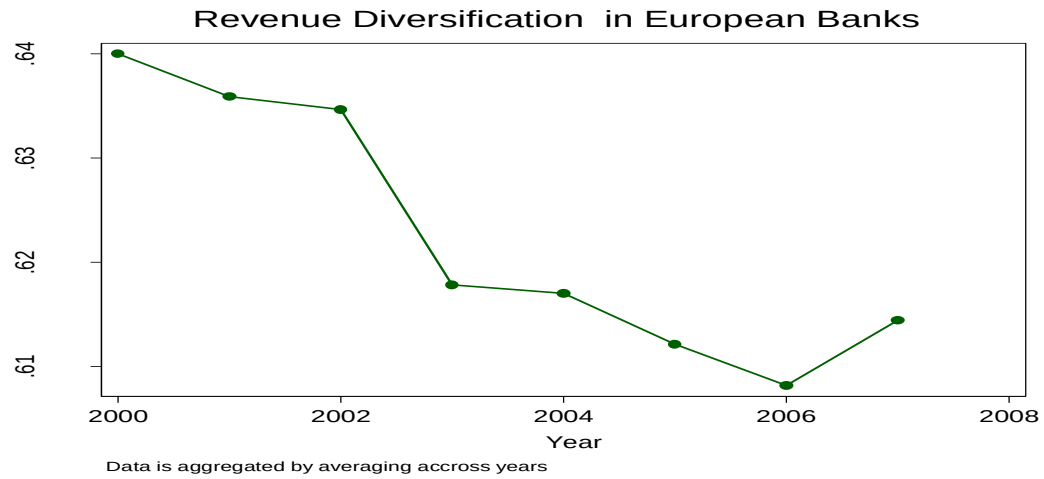


Figure 4.2



Initial high levels of ownership concentration, was associated with higher diversification as well as greater bank performance and stability. However, the year 2005 to 2006 highlights some of the impact of the financial market boom. This period also corresponds to slight lowering of ownership concentration. This relationship is valid if the external favourable environment decreased the returns to active monitoring by equity owners. A generalisation can thus be made in 2006 and 2007, whereby rising portfolio risk (lower performance and stability) increases ownership concentration as returns to monitoring portfolio risk is higher for the large shareholder. Increased monitoring also implies minimizing investment risk such as the level of diversification into non-interest income activities. This simple

analysis is by no means sufficient to determine causal factors or indeed sequencing of event, all which are of empirical interest but beyond the scope of this research.

Figure 4.3

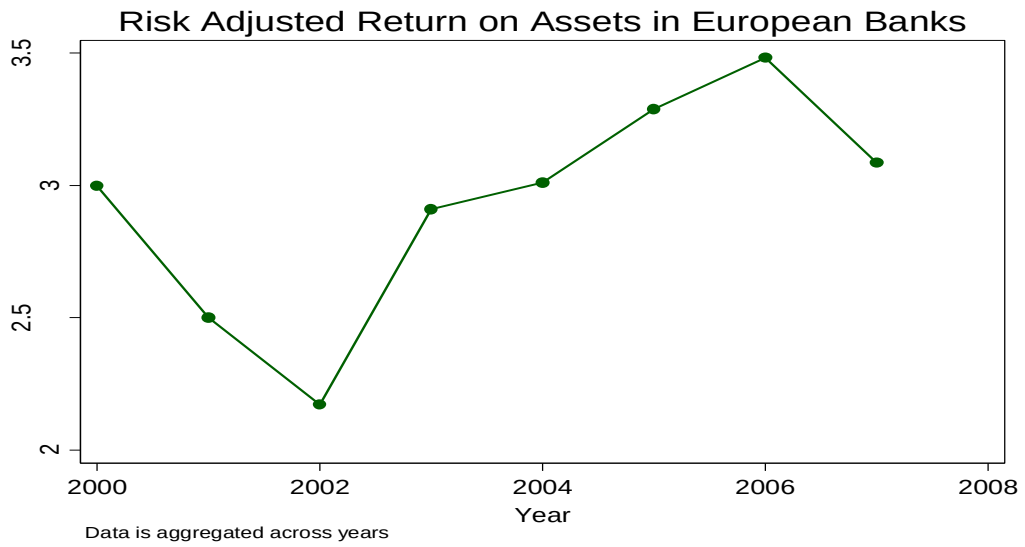
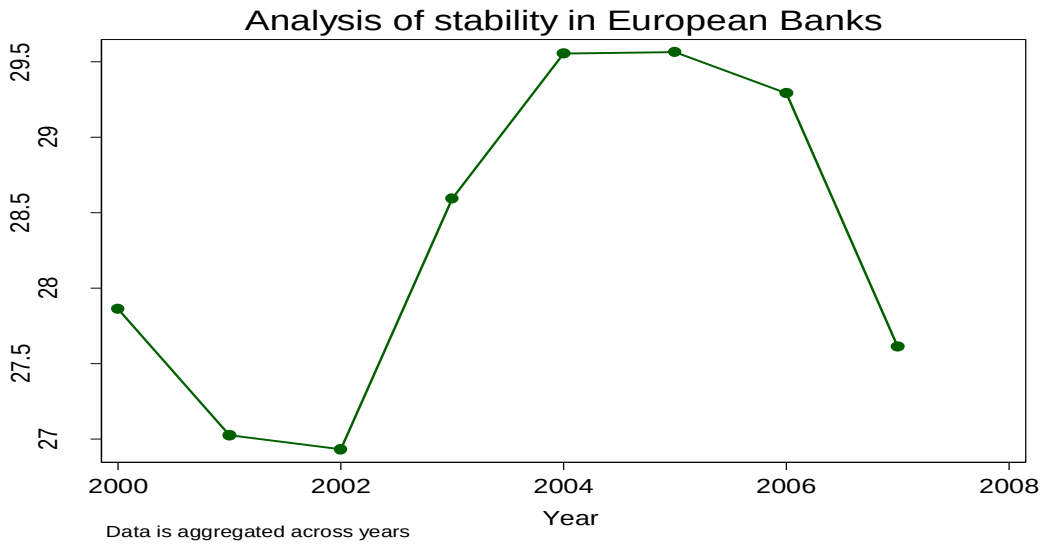


Figure 4.4



Regarding the control variables, the coefficient of *Equity/Assets* the level of capitalization is positive, even though not always significantly associated with bank performance and risk. In panel B the influence of capitalization on revenue diversification is only significant in specification 6, suggesting that well capitalized banks are less diversified. The argument put forward in the literature is that banks

with a high charter value will take less risk and may therefore be less diversified (Stiroh and Rumble 2006). The coefficient on *ROA* in panel A is significant, large and positive signalling a strong positive relationship between the profitability of banks and stability. However, we do not find profitability to be a significant driver of revenue diversification in banks with large shareholders. This evidence also indicates that monitoring by the large shareholder discourages over diversification to boost short-term profits. The coefficient of *Mkt_power* is mainly negative but insignificant in panel A. This suggests that ability of a bank to generate monopoly profit (or the lack of competition) increases bank risk. This may be because the ability to extract monopoly profits in a bank may cause inefficient investment decisions to be made. Finally, the coefficient of the GDP in both panels is as expected. The wealth effects associated with rapid economic growth may see banks diversify beyond the optimal in order to satisfy higher demand for financial services.

It is important to explain why *Size*, *Loans to assets*, and *Block 10* function better as instruments as opposed to regressors. This is because these variables tend to have a greater influence on what investment decisions are taken within a bank as opposed to an independent effect on bank performance. This is also an implicit assumption in prior studies. For example, the reason for including *Size* as a control variable when the benefits of diversification is being analysed is not because large banks are inherently more stable, however, the benefits of diversification may be imprecisely estimated if the fact that larger banks are better able to exploit the benefits of diversification is not controlled for.

4.5 ROBUSTNESS TESTS

4.5.1 Alternative variable and methodological specification

In addition to the alternative measures of ownership concentration and diversification reported in table 4.4 column (5) and (6), other measures of ownership structure; *Top10*, *Top25*, and *Ownerdiv* which are explained in section 4.3.3 are used as robustness checks. The results (unreported) remain unchanged. Across all regression tables net effect of diversification which is a sum of the effects of direct and indirect exposure are also reported.

Since the relationship of interest is between revenue diversification and insolvency risk two stage least squares regression are run which does not need an explicit specification of equation 4.7, but still treats ownership structure, revenue diversification, and insolvency risk as endogenous and uses the same sets of instruments described in the previous section. The added benefits of running a single equation model are that more diagnostics test can be employed to determine the fit of the model to the data, whilst at the same time easy comparison can be made between the instrumental variable (IV) regressions and other regression models with similar specification.

The results are presented in table 4.6. The signs and significance of the coefficients remain largely similar to those of the 3SLS reported in table 4.4. As previously mentioned in section 4.3, the 3SLS will yield more precise estimates compared to the 2SLS if the structural equations are correctly specified. The fact that the standard errors of coefficients in table 4.6 (2SLS) are larger than those produced by the 3SLS, supports the improvement in estimation efficiency from using the 3SLS. Using both estimation techniques the result that revenue diversification decreases insolvency risk for banks with a large shareholder still stands. This result is also robust to alternative measures of ownership structure and revenue diversification. The results using 2SLS also shows a large shareholder (*Highest_sh*) decreases insolvency risk even though the result is not always significant confirming that the main influence of the large shareholder on insolvency risk of

the bank is through its ability to actively influence investment decisions. Commission income as opposed to other types of non-interest income is consistently associated with lower insolvency risk. The results remain unchanged with regards to the control variables.

Regarding the diagnostic tests of the regression model, tests for instrument validity (instruments should be uncorrelated with the error term) and relevance (instruments should be correlated with the specified endogenous regressors) are specified. The reported diagnostic tests are explained as follows:

First, in testing for instrument validity the Hansen test of over identifying restrictions *(J-test for overid)* is employed. The null hypothesis is that the instruments are uncorrelated with the error term. Rejection of this hypothesis questions the validity of one or more of the instruments used. Across all specifications reported in table 4.6, the J-statistic is satisfactory and the null hypothesis cannot be rejected.

Second, the *Anderson's likelihood-ratio* test is employed to check the relevance of the instruments used. The null hypothesis is that the specified instruments are redundant. The null is rejected across all specifications in table 4.6 and conclude that the instruments used are relevant.[32]

The R^2, which shows how well the model fits the data is also reported. This test suffers serious drawback in the instrumental variable regressions. This is because, the use of other models that do not explicitly address the endogeneity problem in the data will yield biased and inconsistent results even if the R^2 is reasonably high. Hence a test that only signals the fit of the model to the data is of limited use.

[32] In table 4.6 specification 2 and 3, the original set of instruments did not satisfy the Anderson likelihood ratio for instrument relevance even though all other test statistics and coefficient estimates were satisfactory and highly similar to the result in column 1. Tests for the appropriateness of each instrument show that the proxy for bank size was the least relevant. This instrument was dropped and replaced it with the ratio of interest expense to total debt. This measure is related to insolvency risk in that a high ratio signals credit problems within the bank particularly where net operating income is not correspondingly high enough to cover interest expense. If banks diversify to increase their net operating income, this measure will also be related to revenue diversification.

Finally, a test of endogeneity bias in the estimated equation is taken. This test may appear redundant since the diversification decision is clearly endogenous. However, endogeneity need not bias coefficient estimates and in that case standard ordinary least square (OLS) estimators may still be appropriate. Furthermore, if instrumental variable regressions are estimated when there is no endogeneity bias, there is efficiency loss in using instrumental variable regressions over the standard OLS Wooldridge (2006) and Baum (2006). The Wu-Hausman F-test and the Durbin-Wu-Hausman chi-square tests check whether or not instrumental variable regression is necessary. In other words, can some of the endogenous variables be correctly treated as exogenous? The test involves fitting the specified model by both OLS and IV and comparing the resulting coefficients. The null hypothesis is that OLS is an appropriate estimation technique. Across all model specifications in table 4.6, the null hypothesis is rejected implying that the OLS is an inefficient estimator.

4.5.2 Regulatory and supervisory controls

Although the robustness tests using alternative variables specification and estimation methodology confirm the empirical results in section 4.4, in order to draw precise inferences regarding the relationship of interest there is need to consider the regulatory and supervisory structure in individual countries. According to Saunders at al. (1990), Caprio et al. (2003) and De Andres and Vallelado (2008), in periods of deregulation and regulatory forbearance bank managers take greater risks to maximize value; hence regulations as opposed to block ownership may be considered an additional and perhaps interrelated mechanism of exerting corporate control. If this is the case the active role played by the large shareholder will be incorrectly attributed to the need to diversify their wealth, as opposed to an outcome of the regulatory environment.

The impact of two aspects of the regulatory environment on the relationships of interest is therefore analysed. First, the impact of the overall efficiency of national institutions and bank regulation on the measured relationships is controlled for. Second, separate tools of bank regulation (deposit insurance and capital

requirements) that are likely to affect revenue diversification and insolvency risk are also controlled for. To assess regulatory efficiency of the broad national and banking institutions, the Heritage Foundation Index of financial freedom that measures the extent to which bank activities in securities, insurance and real-estate markets as well as ownership and control of non-financial firms are restricted is included.[33]

Table 4.7 presents results. In column 2, greater financial freedom is shown to lower insolvency risk. Controlling for these variables does not alter the main result of the canonical model shown in column 1.

Deposit Insurance

I also control for the impact of deposit insurance as a separate aspect of banking regulation to ensure that any effect it has on revenue diversification and insolvency does not bias the results. There is consensus on the fact that deposit insurance can be a source of moral hazard especially if it reduces competitive pressures among banks to effectively manage risks. It can also cause banks to diversify beyond optimal if it subsidizes the negative externalities of their investment decisions. To control for the effect of deposit insurance an indicator of the generosity of the deposit insurance regime is included. If the moral hazard argument holds, the effect of deposit insurance will be to reduce the need for risk reduction through revenue diversification in banks with concentrated ownership structure.[34]

Column 3 in table 4.7 show the regression results with the deposit insurance variable *(Moral Hazard)*, even though the signs of the coefficient estimate

[33] Financial freedom measures the relative openness of a banking and financial system: specifically, whether the foreign banks and financial services firms are able to operate freely, how difficult it is to open domestic banks and other financial services firms, how heavily regulated the financial system is, the presence of state-owned banks, whether the government influences allocation of credit, and whether banks are free to provide customers with insurance and invest in securities (and vice-versa) (see Beck et al. (2006)). The results show our main relationships are unchanged.

[34] The moral hazard index used is a principal component indicator measuring the generosity of deposit insurance and it is based on co-insurance, coverage of foreign currency and inter-bank deposits, type and source of funding, management, membership and level of explicit coverage. The index is from the World Bank database on Bank concentration and crises (Beck et al, 2006).

provides suggestive evidence of the detrimental effect of the deposit insurance scheme on insolvency risk, all other relationships measured remain unchanged.

Capital requirements

In line with the literature on ownership structure, the effect of stringent capital requirements on the relationship between ownership structure, diversification and insolvency risk is explored using an index of regulatory oversight of bank capital *(Capital stringency)*. The rationale behind these controls is as follows: first, the stringency of regulatory capital will reduce insolvency risk since capital provides a buffer for negative income shocks. Second, high capital requirements may discourage lending and encourage shifts into fee-based activities like insurance. If this is the case the impact of capital stringency on the diversification decision may mar the relationship the latter has on insolvency risk. Column 4 in table 4.7 displays the results. The coefficient of *Capital Stringency* is positive and significant, however, the main relationships of interest remain unchanged in the face of any direct or indirect effect that the level of regulatory capital may have on insolvency risk.[35]

4.5.3 Controlling for other subsidiaries owned by the largest shareholder

In the previous section, the possibility that the block holder (a single entity that owns 10 percent or more) is not interested in diversifying at the individual bank level is identified. This is because the large shareholder may instead choose to hold a diversified portfolio of shares in other companies. If a majority shareholder is not wealth constrained then it may find the process of diversifying across companies less complicated than trying to exert corporate control in the individual companies. If this is the case, the relationship observed in the canonical model as shown in column 1, becomes tenuous. Thus a control for the other subsidiaries a block holder may have is included in the form of a dummy variable - *Subs_dummy* that

[35] This may also be because block owners of the majority of banks in our dataset are institutional investors that are not wealth constrained and since altering the financial portfolio of a bank is easier than its ownership structure, the overall results are that shareholders can afford to maintain large holdings of bank shares in the face of rising capital requirements.

takes the value 1 if the block holder has other subsidiaries (both bank and nonbanking institutions), and zero otherwise. The results are reported in column 5. The coefficient of Subs_*dummy* itself is insignificant, however including this control does not affect the prior estimated relationships. In other words, diversifying across companies does not necessarily weaken the monitoring role played by the large shareholder in each individual institution.

4.5.4 Alternative sample selection

As a final robustness test, to further check the findings that the presence of a majority shareholder influences diversification decisions directly and thus insolvency risk indirectly, I exclude banks without a majority shareholder (a single entity who owns 10 percent or more of the banks shares) are excluded from the re estimation of the regressions in table 4.8. There is an expectation that the presence of many small shareholders who are not able to exert control on bank managers may resulting in sub-optimal investment decisions taken by bank managers that are not risk mitigating in the long run. The result using this restricted sample shown in table 4.8 columns 2-6 confirm this expectation. Column 1 shows the result from the full sample and it is included for the purpose of comparison. The coefficients of the measures of diversification become insignificant in the restricted sample. This suggests that revenue diversification does not increase stability or performance in banks with a diffuse ownership structure. The sign of *ROA* in panel B, become positive and highly significant implying that banks with many small shareholders are more likely to diversify for profitability.[36]

[36] As a related analysis I re-estimate the relationship of interest including only banks in which the largest shareholder holds no more than 25 percent which is the median value of shares. I also include interaction terms between *"highest_sh"*, *HHI(non)* and *HHI(rev)* in order to test if the relationship of interest will be weaker or inexistence if the ownership structure was more diffuse. The results (not reported in this chapter) were broadly in line with expectations. However, some caveats remain; First, the median value of *highest_sh* is 25 percent and relatively high to be considered inconsequential on the relationship of interest. While the sample size is larger (360 observations), if the data set is restricted by the median value as opposed to 10 percent suggested in the literature and used in table 4.8, the exercise is less informative as the level of *highest_sh* still does not reflect lower ownership concentration.

4.6 CONCLUSION

The aim of this chapter is to analyze how ownership concentration in listed European banks influences the relationship between revenue diversification and insolvency risk.

The results show revenue diversification reduces insolvency risk in banks with large shareholders. This is because the active monitoring role of one or more large shareholder deters risk inefficient investment strategies that may otherwise destroy shareholder value. Hence, the personal wealth diversification hypothesis (PWH) which postulates that the large shareholders will seek to diversify their wealth indirectly through the diversification of the banks portfolio, only holds up to a risk efficient point and no further. Thus concentrated ownership structure in banks is associated with a risk efficient portfolio.

All the results are robust to an array of checks including alternative variables, methodological and sampling specification, and the effect the regulatory and supervisory environment may independently have on revenue diversification and insolvency risk. Moreover, implicit in the methodology employed are controls for econometric problems arising from endogeneity of the ownership structure as well as the diversification decision.

I also show preliminary evidence that period of deregulation and financial market boom was associated with slightly lower levels of ownership concentration as returns to monitoring by the largest shareholder decreased. The reverse is also seen after 2006, when portfolio risks and bank performance worsened, the largest shareholder also increased equity holding presumably to better influence investment decisions and monitor risk of failure. This hypothesis lends support to the result presented in this chapter, however further research is needed in determining causality, and sequencing of event. For example, regarding sequencing, did the risk efficient portfolio in diversified banks encourage ownership concentration or vice versa as implied in this chapter?

The results shed light on the ongoing debate of the benefits of revenue diversification and also provide valuable insights for market participants, regulators and supervisors about what drives performance in banks.

Table 4.1 Summary statistics on selected bank level variables				
Variable	Mean	St. dev.	Min	Max
Ownership Structure				
Largest Shareholder (Highest_sh)	0.34	0.47	0.00	9.09
Control Variables				
Ratio of Equity to Asset(Equity/Asset)	0.22	0.26	0.00	0.95
Return on Asset (ROA)	0.02	0.08	-0.49	0.56
Total Revenue/Total Asset (Mkt_power)	0.09	0.09	-0.36	0.74
Revenue Diversification				
Revenue Diversification HHI(rev)	0.62	0.13	0.50	0.99
Diversification within non-interest income HHI(non)	0.74	0.16	0.35	1.00
Ratio of commission income to non-interest income	0.78	0.21	0.01	0.99
Ratio of Non interest income to net operating revenue	0.41	0.23	0.01	0.99
Insolvency Risk				
Distance to default (DD)	0.08	0.28	0.00	3.18
Insolvency risk (Z-Score)	28.40	21.38	-1.71	139.84
Risk adjusted return on asset(RAROA)	2.96	2.77	-2.69	19.98
Risk adjusted return on equity (RAROE)	3.02	2.56	-2.56	13.96
Instruments				
Ratio of Loan to Asset (Loan)	0.53	0.29	0.95	0.00
Total Asset in millions of US$ (Size)	58802.59	228406.70	2.30	2766077.00
Number of listed commercial banks sampled per country.				
Austria (7), Denmark (41), France (24), Germany (23), Italy(16), Norway (10), Spain (3),				
Switzerland (18), UK (11).				
Source: Bankscope, WDI and authors' calculations.				
The data set comprises of 153 banks in 9 countries between the period 2000-2007.				

Table 4.2 Pairwise correlation coefficients between selected variables

	Highest_sh	HHI(non)	Non^2	Commission^2	Z score	Equity/Asset	ROA	Price	Size	Loan/Asset	Block10
Highest_sh	1.0000										
HHI(non)	-0.0647	1.0000									
Non^2	0.1535*	-0.1931*	1.0000								
Commission^2	-0.1008*	0.8415*	-0.2574*	1.0000							
Z _score	-0.0627	0.1623*	-0.2649*	0.2522*	1.0000						
Equity/Asset	0.0902*	0.0706*	0.4847*	-0.0693	-0.1937*	1.0000					
ROA	0.0012	0.1626*	0.1086*	0.0194	-0.0480	0.3801*	1.0000				
Mkt_power	0.0493	0.0349	0.3988*	-0.0004	-0.1558*	0.3014*	0.4760*	1.0000			
Size	-0.0859*	-0.2679*	0.1518*	-0.2697*	-0.0956*	-0.1719*	-0.0637*	-0.1151*	1.0000		
Loan/Asset	-0.0485	0.0784*	-0.6111*	0.2905*	0.2976*	-0.5671*	-0.1179*	-0.1700*	-0.1772*	1.0000	
Block10	0.3082*	-0.1131*	0.1426*	-0.1106*	0.0069	0.0019	-0.0218	0.0503	-0.1533*	-0.0068	1.0000

Source: Authors calculations

* implies significance at the 5 percent level or better. The data set comprises of 153 banks in 9 countries during the period 2000-2007. ***Highest_sh*** is the largest amount of shares held by a single entity. ***HHI (non)*** measure diversification within non-interest income generating activities, ***NON^2*** and ***Commision^2*** are squared shares of non- interest income in total operating income and commission income to non-interest income. The ***Z-score*** is a measure of bank stability, the ratio of ***Equity/Assets*** measures capitalisation and ***ROA*** profitability. ***Mkt_power*** is a proxy of the banks ability to price above competitive levels and thus generate monopoly profits. ***Size*** is the natural log of the book value of assets. ***Block 10*** is a dummy variable that takes the value 1, when the largest shareholder holds at least 10 percent of bank shares and zero otherwise

Table 4.3 Correlation coefficients between selected variables

	Highest_sh	HHI(non)	Non^2	Commission^2	Z score	Equity/Asset	ROA	Price	Size	Loan/Asset	Block10
Highest_sh	1.0000										
HHI(non)	-0.0479	1.0000									
Non^2	0.2497	-0.1929	1.0000								
Commission^2	-0.1269	0.8753	-0.2367	1.0000							
Z _score	-0.1755	0.1875	-0.2481	0.2456	1.0000						
Equity/Asset	0.1209	0.0238	0.4433	0.0129	-0.0684	1.0000					
ROA	0.1094	0.0823	0.2100	0.0360	0.0228	0.4228	1.0000				
Mkt_power	0.1843	0.0633	0.5227	0.0215	-0.1520	0.7877	0.6287	1.0000			
Size	-0.1896	-0.2897	0.1947	-0.2948	-0.1498	-0.2010	-0.0893	-0.1518	1.0000		
Loan/Asset	-0.2312	0.1176	-0.6416	0.2352	0.3171	-0.2848	-0.1037	-0.3104	-0.2960	1.0000	
Block10	0.5802	-0.0699	0.2311	-0.1027	0.0359	0.1326	0.0260	0.1139	-0.2201	-0.1341	1.0000

Source: Authors calculations

* implies significance at the 5 percent level or better. The data set comprises of 153 banks in 9 countries during the period 2000-2007. ***Highest_sh*** is the largest amount of shares held by a single entity. ***HHI (non)*** measure diversification within non-interest income generating activities, ***NON^2*** and ***Commision^2*** are squared shares of non- interest income in total operating income and commission income to non-interest income. The ***Z-score*** is a measure of bank stability, the ratio of ***Equity/Assets*** measures capitalisation and ***ROA*** profitability. ***Mkt_power*** is a proxy of the banks ability to price above competitive levels and thus generate monopoly profits. ***Size*** is the natural log of the book value of assets. ***Block 10*** is a dummy variable that takes the value 1, when the largest shareholder holds at least 10 percent of bank shares and zero otherwise

Table 4.4 Three stage least squares regression (3SLS) regression results of Bank risk

		(1)	(2)	(3)	(4)	(5)	(6)
		Dependent variables					
		Z-score	RAROA	RAROE	DD	Z-score	Z-score
						Alternative measures of revenue diversification & ownership structure	
						Block 10	HHI(rev)
Panel A							
	Highest_sh	1.142***	1.086	0.648	0.088		0.931***
		(0.376)	(0.823)	(0.716)	(0.054)		(0.251)
	HHI(non)	-18.374***	-30.166***	-19.685***	0.645	-15.937***	
		(2.952)	(6.682)	(6.170)	(0.390)	(2.272)	
	Commission^2	8.312***	15.093***	9.257***	-0.295	7.408***	0.348**
		(1.486)	(3.496)	(3.139)	(0.190)	(1.149)	(0.150)
	Non interest	-0.831***	-1.402**	-1.490***	-0.183***	-0.804***	0.490*
	income^2	(0.243)	(0.603)	(0.509)	(0.035)	(0.222)	(0.253)
	Equity/Asset	0.238	0.573	-0.955	0.220***	0.289	2.736***
		(0.679)	(1.568)	(1.339)	(0.083)	(0.610)	(0.444)
	GDP	-0.456***	-0.622***	-0.751***	0.023**	-0.358***	-0.500***
		(0.074)	(0.157)	(0.143)	(0.012)	(0.058)	(0.074)
	ROA	10.795***	36.979***	32.820***	-0.850***	11.472***	5.574***
		(2.205)	(5.046)	(4.228)	(0.267)	(1.986)	(1.787)
	Mkt_power	-2.027	-7.348**	-4.216	0.045	-2.104	2.108
		(1.460)	(3.435)	(2.917)	(0.185)	(1.323)	(1.378)
	Block10					0.361***	
						(0.109)	
	HHI(rev)						-13.141***
							(1.211)
Panel B							
		Dependent variables					
		HHI(non)	HHI(non)	HHI(non)	HHI(non)	HHI(non)	HHI(rev)
	Highest_sh	0.114***	0.090***	0.084**	0.224***		0.108***
		(0.035)	(0.034)	(0.034)	(0.035)		(0.023)
	Equity/Asset	-0.013	-0.006	-0.004	0.021	-0.008	0.340***
		(0.049)	(0.048)	(0.048)	(0.045)	(0.048)	(0.032)
	GDP	-0.074***	-0.072***	-0.071***	-0.096***	-0.069***	-0.022***
		(0.006)	(0.006)	(0.006)	(0.006)	(0.005)	(0.004)
	ROA	0.132	0.234	0.221	0.021	-0.008	0.217
		(0.212)	(0.207)	(0.207)	(0.203)	(0.048)	(0.140)
	Block10					0.032***	
						(0.013)	
Panel A	no of obs	633	651	653	625	633	638
	F-stat	17.99***	14.74***	19.49***	6.96***	19.97***	62.83***
Panel B	no of obs	633	651	653	625	633	638
	F-stat	42.01***	43.58***	42.23***	64.90***	41.33***	57.09***

This table reports the second stage of the 3SLS estimation results on Bank fragility and revenue diversification for selected explanatory variables. The three instruments used are (1) ***Block 10*** (a dummy variable that takes the value of 1 if a single entity owns 10 percent or more of the banks shares, (2) ***size*** (natural logarithm of the total Assets in million of US$) and (3) ***The ratio of loans to assets***. Parameter estimates are reported with the small sample adjusted standard errors in parenthesis. ***, **,* implies statistical significance at the 1%, 5% and 10% level respectively. The dependent variables and the measures of ownership structure are treated as endogenous. The data set comprises of 153 banks in 9 countries during the period 2000-2007. ***Highest_sh*** is the largest amount of shares held by a single entity. ***HHI (non)*** measure diversification within non-interest income generating activities, ***NON^2*** and ***Commision^2*** are squared shares of non- interest income in total operating income and commission income to non-interest income. The ***Z-score*** is a measure of bank stability, the ratio of ***Equity/Assets*** measures capitalisation and ***ROA*** profitability. ***Mkt_power*** is a proxy of the banks ability to price above competitive levels and thus generate monopoly profits. Banks fixed effects are not included in the model

Table 4.5 Three stage least squares regression (3SLS) regression results of Bank risk using the non_interest income share as a linear term

		(1)	(2)	(3)	(4)	(5)	(6)
		Dependent variables					
		Z-score	RAROA	RAROE	DD	Z-score	Z-score
						Alternative measures of revenue diversification & ownership structure	
						Block 10	HHI(rev)
Panel A							
	Highest_sh	1.343***	1.396	1.006	0.096***		0.969***
		(0.431)	(0.881)	(0.785)	(0.055)		(0.241)
	HHI(non)	-21.624***	-34.813***	-26.024***	0.519	-18.131***	
		(3.498)	(7.287)	(6.909)	(0.402)	(2.506)	
	Commission^2	9.626***	17.066	11.845***	-0.243	8.307***	0.382**
		(1.759)	(3.810)	(3.513)	(0.195)	(1.266)	(0.156)
	Non_income	-0.579**	-1.022	-0.962*	-0.213***	-0.624**	-0.202***
		(0.284)	(0.660)	(0.564)	(0.036)	(0.254)	(0.182)
	Equity/Asset	-0.072	0.168	-1.504	0.230***	0.081	2.745***
		(0.774)	(1.658)	(1.445)	(0.082)	(0.664)	(0.430)
	GDP	-0.578***	-0.740***	-0.927***	0.023**	-0.410***	-0.417***
		(0.088)	(0.172)	(0.161)	(0.012)	(0.064)	(0.063)
	ROA	11.375***	38.031***	34.265***	-0.782***	12.084***	5.491***
		(2.471)	(5.289)	(4.522)	(0.260)	(2.157)	(1.712)
	Mkt_power	-2.165	-7.770***	-4.569	-0.022	-2.317***	2.184
		(1.614)	(3.542)	(3.062)	(0.178)	(1.416)	(1.325)
	Block10					0.390***	
						(0.119)	
	HHI(rev)						-11.997***
							(0.940)
Marginal effect of a change in Non_inc (sum of direct and indirect effects)							
	Net effects	-21.624***	-30.166***	-19.685***	0.645***	-15.937***	-13.141***
Panel B							
		Dependent variables					
		HHI(non)	HHI(non)	HHI(non)	HHI(non)	HHI(non)	HHI(rev)
	Highest_sh	0.116***	0.094***	0.087***	0.228***		0.118***
		(0.035)	(0.033)	(0.034)	(0.035)		(0.023)
	Equity/Asset	-0.013	-0.006	-0.004	0.021	-0.008	0.337***
		(0.049)	(0.048)	(0.048)	(0.047)	(0.048)	(0.032)
	GDP	-0.074***	-0.072***	-0.071***	-0.097***	-0.069***	-0.023***
		(0.006)	(0.006)	(0.006)	(0.006)	(0.005)	(0.004)
	ROA	0.130	0.230	0.219	0.016	0.261	0.211
		(0.212)	(0.208)	(0.208)	(0.203)	(0.008)	(0.140)
	Block10					0.032*	
						(0.013)	
Panel A	no of obs	633	651	653	625	633	634
	F-stat	17.30***	14.16***	18.18***	7.87***	18.91	64.30***
Panel B	no of obs	633	651	653	625	633	634
	F-stat	42.11***	43.70***	42.31***	65.00***	41.33	57.05***

This table reports the second stage of the 3SLS estimation results on Bank fragility and revenue diversification for selected explanatory variables. The three instruments used are (1) ***Block 10*** (a dummy variable that takes the value of 1 if a single entity owns 10 percent or more of the banks shares, (2) ***size*** (natural logarithm of the total Assets in million of US$) and (3) ***The ratio of loans to assets***. Parameter estimates are reported with the small sample adjusted standard errors in parenthesis. ***, **,* implies statistical significance at the 1%, 5% and 10% level respectively. The dependent variables and the measures of ownership structure are treated as endogenous. The data set comprises of 153 banks in 9 countries during the period 2000-2007. ***Highest_sh*** is the largest amount of shares held by a single entity. ***HHI (non)*** measure diversification within non-interest income generating activities, ***NON^2*** and ***Commision^2*** are squared shares of non- interest income in total operating income and commission income to non-interest income. The ***Z-score*** is a measure of bank stability, the ratio of ***Equity/Assets*** measures capitalisation and ***ROA*** profitability. ***Mkt_power*** is a proxy of the banks ability to price above competitive levels and thus generate monopoly profits. Bank fixed effects are not included in the model. Direct effect is estimated impact of a 1% increase in the **non-income**. Indirect effect is estimated impact of a change in revenue diversification **(HHI (non) and HHI(rev))** from a 1% increase in the non-interest income share. Net effect sums the direct and indirect effects. Robust standard errors are in parentheses.

Table 4.6: Instrumental variable regressions using 2SLS

		(1)	(2)	(3)	(4)	(5)	(6)
		Dependent variables					
		Z-score	RAROA	RAROE	DD	Z-score	Z-score
						Alternative measures of revenue diversification & ownership structure	
						Block 10	HHI(rev)
Panel A							
	Highest_sh	0.879**	0.698	0.414	0.145***		0.439**
		(0.386)	(0.800)	(0.817)	(0.047)		(0.224)
	HHI(non)	-15.840***	-23.433***	-17.301**	-1.969***	-10.479***	
		(3.523)	(7.530)	(6.812)	(0.750)	(3.579)	
	Commission^2	8.825***	14.445***	9.894***	0.975**	6.471***	0.357*
		(1.706)	(4.008)	(3.417)	(0.381)	(1.606)	(0.193)
	Non interest	-0.831***	-1.254**	-1.469***	-0.055*	-0.575	0.421
	income^2	(0.243)	(0.641)	(0.532)	(0.033)	(0.376)	(0.377)
	Equity/Asset	0.037	-0.472	-1.153	0.004	1.759	1.344
		(0.8612)	(1.823)	(1.513)	(0.096)	(1.854)	(0.835)
	GDP	-0.230**	-0.274	-0.502***	-0.042***	0.109	-0.378***
		(0.105)	(0.170)	(0.195)	(0.016)	(0.306)	(0.092)
	ROA	10.445***	38.690***	34.696***	-0.349**	11.893***	4.851**
		(2.424)	(6.704)	(6.702)	(0.174)	(2.363)	(2.063)
	Mkt_power	-1.665	-6.356	-4.393	0.359*	-4.626	1.462
		(1.912)	(3.895)	(3.142)	(0.192)	(3.460)	(2.090)
	Block10					-1.104	
						(1.462)	
	HHI(rev)						-8.147***
							(1.620)
Marginal effect of a change in Non_inc (sum of direct and indirect effects)							
Net effect		-16.671***	-24.687***	-18.77***	-2.024***	-11.054***	-7.726***
Model fit							
	R2(uncentered)	0.85	0.53	0.63	-0.73	0.89	0.93
	F test	8.03***	11.41***	17.06***	4.38***	11.65***	19.94
	no of obs	633	651	653	625	661	638
	J-test for overid	2.490	16.585***	3.737*	21.275***	0.000	2.112
	wu hausman F test	25.151***	7.741***	3.135**	14.960***	24.407***	19.712***
	Durbin-Wu-Hausman c	47.361***	15.375***	6.312**	29.041***	46.173***	37.743***

This table reports the second stage of the 2SLS regression results. The dependent variables are the measures of insolvency risk. The three instruments used for specification 1, 4 and 5 are (1) ***Block 10*** a dummy variable that takes the value of 1 if a single entity owns 10 percent or more of the banks shares, (2) ***Size*** (natural logarithm of the total Assets in million of US$) and (3) ***The ratio of loans to assets***. However, for specifications 2 and 3, the size of total assets is dropped from the instrument set and replaced with the ratio of interest expense to total debt of the bank. Parameter estimates are reported with the small sample adjusted standard errors. ***, **,* indicates statistical significance at the 1%, 5% and 10% level respectively. The R2 measures goodness of fit, the F-test measures the joint significance of coefficients. The J-test for overidentifying restrictions measures instruments exogeneity. The Andersons likelihood ratio test is a test of instrument relevance (correlation with the endogenous variables). The Durbin Wu Hausman (DWH) chi sq test and the Wu Hausman F-test also measures the efficiency of the 2SLS over OLS in estimating the model. Specification 4 is exactly identified and hence a J-test for overidentification cannot be estimated. However, using alternative measures of ownership concentration yielded coefficient estimates that are similar to specification 1 with satisfactory results for all tests of model fit. Using the modified distance to default yielded unsatisfactory results for the Anderson likelihood ratio test suggesting that the instrument set used is not valid. The dependent variables as well as measures of ownership structure and revenue diversification are treated throughout as endogenous. Bank fixed effects are not included in the estimation.

Table 4.7 Robustness tests using 3SLS

		Dependent variable Z-score				
		(1)	(2)	(3)	(4)	(5)
Panel A						
	Highest_sh	1.142***	1.383***	1.406***	1.694***	3.648***
		(0.376)	(0.436)	(0.473)	(0.645)	(1.116)
	HHI(non)	-18.374***	-21.901***	-23.840***	-34.543***	-28.882***
		(2.952)	(3.962)	(4.601)	(8.693)	(6.296)
	Commission^2	8.312***	9.556***	10.256***	14.437***	11.726***
		(1.486)	(1.941)	(2.258)	(4.207)	(2.980)
	Non interest	-0.831***	-1.051***	-0.591**	-0.215	-0.735*
	income^2	(0.243)	(0.285)	(0.297)	(0.446)	(0.418)
	Equity/Asset	0.238	-0.476	-0.384	-1.291	-1.239
		(0.679)	(0.867)	(0.886)	(1.362)	(1.130)
	GDP	-0.456***	-0.341***	-0.520***	-0.126	-0.923***
		(0.074)	(0.090)	(0.087)	(0.186)	(0.157)
	ROA	10.795***	9.822***	10.143***	11.790***	8.831**
		(2.205)	(2.516)	(2.671)	(3.602)	(3.520)
	Mkt_power	-2.027	-0.049	-0.785	0.080	0.878
		(1.460)	(0.007)	(1.875)	(2.665)	(2.585)
	Financial freedom		0.0174**			
			(0.007)			
	Moral hazard			-0.127***		
				(0.043)		
	Capital stringency				0.735***	
					(0.268)	
	Subs_dummy					0.247
						(0.178)
Marginal effect of a change in Non_inc (sum of direct and indirect effects)						
Net effect		-19.205***	-22.952***	-24.431***	-34.758***	-29.617***
Panel B						
		Dependent Variable (HHI(non)				
	Highest_sh	0.114***	0.122***	0.110***	0.109***	0.251***
		(0.035)	(0.035)	(0.035)	(0.035)	(0.062)
	Equity/Asset	-0.013	-0.014	-0.010	-0.012	-0.035
		(0.049)	(0.049)	(0.049)	(0.049)	(0.054)
	GDP	-0.074***	-0.074***	-0.074***	-0.074***	-0.076***
		(0.006)	(0.006)	(0.006)	(0.006)	(0.007)
	ROA	0.132	0.124	0.136	0.137	0.003
		(0.212)	(0.213)	(0.212)	(0.212)	(0.991)
Panel A	I	633	633	618	633	450
	f-stat	17.99***	15.28***	14.62***	13.93***	11.04***
Panel B	II	633	633	618	633	450
	f-stat	42.01***	42.27***	42.21***	41.90***	29.33***

This table reports the second stage of the 3SLS estimation results on Bank fragility and revenue diversification for selected explanatory variables. The three instruments used are (1) ***Block 10*** (a dummy variable that takes the value of 1 if a single entity owns 10 percent or more of the banks shares, (2) ***Size*** (natural logarithm of the total Assets in million of US$) and (3) ***The ratio of loans to assets***. Parameter estimates are reported with the small sample adjusted standard errors in parenthesis. ***, **,* indicates statistical significance at the 1%, 5% and 10% level respectively. The dependent variables as well as the measure of ownership structure are treated as endogenous. ***Financial freedom*** measures bank ***activity restrictions***, ***Moral hazard*** measures the generosity of the deposit insurance scheme, ***Capital stringency*** measures the extent of capital regulations. ***Subs_dummy*** is a dummy variable that takes the value 1 if the controlling shareholder (a shareholder that owns at least 10 percent of total shares of the bank) has other subsidiaries and zero otherwise. Bank fixed effects are not included in the estimations.

Table 4.8 3SLS regressions using banks where no single entity holds more than 10 percent of shares

		(1)	(2)	(3)	(4)	(5)	(6)
		Dependent variables					
		Z-score	Z-score	RAROA	RAROE	DD	Z-score
							Alternative measure of diversification
							HHI(rev)
Panel A							
	Highest_sh	1.142***	-2.325	2.162	5.937	1.829**	-1.974
		(0.376)	(2.894)	(4.003)	(7.112)	(0.755)	(2.033)
	HHI(non)	-18.374***	-6.617	7.450	23.420	-0.945	
		(2.952)	(6.328)	(14.130)	(19.883)	(2.091)	
	Commission^2	8.312***	3.909	-5.731	-16.099	0.428***	-0.687
		(1.486)	(4.484)	(10.525)	(14.174)	(1.489)	(0.690)
	Non interest	-0.831***	0.035	-3.290	-7.982	-0.153	-2.369
	income^2	(0.243)	(1.747)	(3.511)	(5.591)	(0.583)	(1.664)
	Equity/Asset	0.238	10.888***	1.634	0.599	1.712***	12.019***
		(0.679)	(1.526)	(1.852)	(3.279)	(0.332)	(1.479)
	GDP	-0.456***	-0.044	0.021	0.140	-0.022	-0.207
		(0.074)	(0.066)	(0.068)	(0.155)	(0.017)	(0.171)
	ROA	10.795***	25.358**	63.663***	17.093	-2.401	-4.094
		(2.205)	(11.618)	(16.283)	(36.301)	(3.496)	(14.065)
	Mkt_power	-2.027	-11.403***	-13.396***	-18.090***	-1.725***	-10.762**
		(1.460)	(2.887)	(4.872)	(6.786)	(0.714)	(5.201)
	HHI(rev)						-5.545
							(5.421)
Panel B							
		Dependent variables					
		HHI(non)	HHI(non)	HHI(non)	HHI(non)	HHI(non)	HHI(rev)
	Highest_sh	0.114***	-0.317	-0.414	-0.323	-0.381	-0.500**
		(0.035)	(0.498)	(0.468)	(0.477)	(0.473)	(0.235)
	Equity/Asset	-0.013	0.705**	0.632**	0.675**	0.715**	0.633***
		(0.049)	(0.297)	(0.285)	(0.290)	(0.289)	(0.140)
	GDP	-0.074***	-0.062***	-0.060***	-0.062***	-0.062***	-0.046***
		(0.006)	(0.014)	(0.013)	(0.014)	(0.013)	(0.007)
	ROA	0.132	4.784***	6.722***	5.565***	4.801***	-4.054***
		(0.212)	(1.736)	(1.814)	(1.804)	(1.731)	(0.007)
Panel A	no of obs	633	188	190	191	194	188
	F-stat	17.99***	20.83***	13.72***	6.11***	15.30***	24.01***
Panel B	no of obs	633	188	190	191	194	188
	F-stat	42.01***	30.77***	35.05***	32.09***	32.25***	26.69***

This table reports the second stage of the 3SLS estimation results on Bank fragility and revenue diversification for banks without a large shareholder. The three instruments used are (1) ***Block10*** (a dummy variable that takes the value of 1 if a single entity owns 10 percent or more of the banks shares, (2) ***Size*** (natural logarithm of the total Assets in millions of US$) and (3) ***The ratio of loans to assets***. Due to the lack of variation in Block10, the regressions are re-estimated excluding it from the instrument set and get highly similar results to those reported in this table. Parameter estimates are reported with the small sample adjusted standard errors in parenthesis. ***, **,* indicates statistical significance at the 1%, 5% and 10% level respectively. The dependent variables as well as the measure of ownership structure are treated as endogenous. No bank fixed effects are included and net effects are not included as the coefficients are insignificant.

Appendix 4.1

Merton used Black and Scholes (1973) framework to solve for the underlying asset value and volatility implied by the option price and volatility. These derived values are then combined into a risk measure called distance to default that is directly related to the credit worthiness of the equity-issuing firm. The Merton (1974) model links the market value of equity and the market value of assets as follows:

$$V_E = V_A N(d_1) - e^{-r(T-t)} DN(d_2) \qquad \text{A. (1)}$$

Where

V_E = Market Value of the firm's equity

V_A = Market value of the firm's assets

D = total amount of the firm's debt.

T-t = Time to maturity of the firm's debt

r = risk free interest rate.

$$d_1 = \frac{\ln(V_A / D) + (r + \frac{1}{2}\sigma_A{}^2)(T-t)}{\sigma_A \sqrt{T-t}} \qquad \text{A. (2)}$$

$$d_2 = d_1 - \sigma\sqrt{T-t}$$

N(.) = cumulative normal distribution

All debts are assumed to mature at time T.

$$DD_{Merton} = \frac{\ln(V_A / D) + (r - \frac{1}{2}\sigma_A{}^2)(T-t)}{\sigma_A \sqrt{T-t}} \qquad \text{A. (3)}$$

Merton's distance to default is the number of standard deviations that the firm value is from the default point and the smaller the value of DD_{Merton}, the larger the probability that the firm will default on its debt. The distance to default can easily be transformed into a probability of default or to rank firms according to their credit worthiness.

From this underlying intuition, Byström (2006) suggests a way of simplifying the expression in equation A. (3). The simplification is based on three assumptions:

- The drift term $(r - \frac{1}{2}\sigma_A{}^2)(T-t)$ is "small".
- That $N(d_1)$ is "close" to one.
- The book (face) value of debt is used as the leverage ratio, D/V_A

The rationale for the first assumption is, that in reality the drift term is found to be much smaller than the first term, $\ln(V_A/D)$, and also because it is actually difficult in reality to estimate the drift rates on financial assets. The intuition for the second assumption is based on the observation that only in extreme cases where V_A is close to D (the option is almost at the money) is $N(d_1)$ significantly different from one. Finally, the third assumption is made because it is the book value of debt and not the market value of the debt that represents the actual liability (i.e what needs to be paid back).

Combining the first assumption of a small drift term and a one-year time to maturity of debt reduces the expression for the distance to default to:

$$DD = \frac{\ln(V_A/D)}{\sigma_A} \qquad \text{A. (4)}$$

Moreover, one can show that equity and asset volatility are related by the expression

$$\sigma_E = \frac{V_A}{V_E} N(d_1)\sigma_A$$

Replacing σ_A with $\frac{\sigma_E V_E}{V_A}$ coupled with the assumption of $N(d_1)$ being close to unity, yields

$$DD = \frac{\ln(V_A / D)}{\sigma_E V_E / V_A} \qquad \text{A. (5)}$$

If the leverage ratio is defined as L = $\frac{D}{V_A}$, then the expression for distance to default simplifies to:

$$DD = \frac{\ln(1/L)}{\sigma_E(1-L)} = \frac{\ln(L)}{(L-1)}\frac{1}{\sigma_E} \qquad \text{A. (6)}$$

Since the idea is to only observable parameters to ease the burden of multiple calculations that are prone to errors, one final assumption is made that the leverage ratio, L, can be calculated as $\frac{D}{V_E + D}$ using the book value of debt D. One important observation that has implications for highly indebted firms like banks is that $\frac{\ln(L)}{L-1}$ does not vary significantly for high leverage ratios, L. This makes Byström (2006) "spread sheet" model insensitive to the exact nature of the banks' (rather opaque) capital structure.

Chapter V

Bank Behaviour after Crises in Mercosur

Bank Behaviour after Crises in Mercosur

ABSTRACT

Did the occurrence of systemic banking crises significantly bank behaviour in the Mercosur? The objective of this chapter is to answer this question by analyzing changes in bank behaviour after crises in the Mercosur region. This is the first analysis to apply the convergence methodology—which is common in the growth literature—to post-crisis bank behaviour. Using a panel dataset of commercial banks during the period 1990-2006, the impact of crises on four sets of financial indicators of bank behaviour—profitability, maturity preference, credit supply, and risk is analysed. The results presented show that most indicators of bank behaviour, such as profitability, in fact revert to previous or more normal levels. However, a key finding is that private sector intermediation is significantly reduced for prolonged periods of time and that a high level of excess liquidity persist well after the crisis.

5.1 INTRODUCTION

Most of the banking crisis literature has concentrated on the determinants of systemic banking crises (Calomiris 1990, Demirgüç-Kunt and Detragiache 1998, 2005). With the exception of studies such as Barajas and Steiner (2002), Demirgüç-Kunt *et al.* (2006a) and Dell'Ariccia *et al.* (2008), little attention has been given to the longer-term effect of crisis on the behaviour of bank fundamentals, particularly credit supply. Even though the recovery of some bank functionality can be implicitly assumed to be part of the post crisis stabilization process, evidence of some protracted recovery exists particularly regarding patterns of intermediation Demirgüç-Kunt *et al*. (2006a).[37]

The impact of bank credit contraction on the economy is typically more severe in countries that have experienced repeated crisis, and where alternatives to bank credit do not readily exist. This is because well functioning financial institutions mobilize savings for productive investments, diversify risk and ease external financing constraints on firms all of which is crucial to factor productivity (King and Levine 1993, Bencivenga *et al.* 1995, Dirmirguc-Kunt and Detragiache 1998, Dirmirguc-Kunt and Detragiache 1997, Kroszner *et al*. 2007).

Contraction in bank credit may not always be supply-induced. For example, a worsening economic outlook may lead to higher intermediation spreads or reduce profitable investment opportunities, either of which will reduce credit demand. On the other hand, supply-side factors such as capital erosion as asset prices slump or a run on deposits in domestic banks will typically affect the banks' willingness and ability to extend credit (Chen and Wang 2008). An analysis of simple aggregates suggested in the literature by Kashyap *et al.* (1994) and Bernanke and Gertler (1995) to compare

[37] Identifying the residual impact of crises on bank fundamentals is a considerably complex task because of the following two reasons. First, macroeconomic conditions and institutional frameworks may alter bank behaviour over time irrespective of whether a banking crisis has occurred or not. Second, because of the peculiarities in each banking system, the concept of a benchmark for "normal" bank behaviour becomes difficult to conceptualize theoretically and empirically measure.

demand and supply shocks to credit supply shows a greater effect of the latter in the Mercosur[38]. As shown in the table below, deposits and levels of capitalization fall after the systemic crisis. The credit decline in the aftermath of systemic crises reflects a "flight to liquidity" as banks restructure their portfolio towards highly liquid public securities and cash reserves and disproportionately decreases private sector credit.

This basic analysis is limited in its ability to fully disentangle the demand and supply effects as doing so necessitates rigorous analysis of the demand and supply function of bank credit which is beyond the scope of this research. However, the evidence shows the impact of adverse supply shocks on private sector intermediation only weakly explains the resulting change in bank credit allocation in the region. This further motivates this work which analyzes whether or not the decline in private sector intermediation in the region has unexplainable components.

Overview of Demand and Supply Conditions on Credit Allocation in the Mercosur
(percentage average growth rate after systemic crisis)

	Bank Credit				Demand- side factors		Supply-side factors	
	Total credit 1/	Private credit 2/	Public credit 3/	Liquid reserves 4/	GDP growth	Spread 5/	Deposits 6/	Capital 7/
Argentina	3.0	-2.9	15.2	27.7	2.5	13.2	3.6	2.4
Brazil	1.2	-4.0	10.7	4.1	7.6	-3.5	3.3	4.1
Paraguay	-3.1	-3.4	17.2	-0.2	2.3	10.3	-2.3	-1.0
Uruguay	-23.3	-22.4	-18.1	4.4	12.7	-39.3	-9.7	-10.2
Average	**-5.5**	**-8.2**	**6.3**	**9.0**	**6.3**	**-4.8**	**-1.3**	**-1.2**

Sources: Bankscope, IMF(*IFS*), and authors' calculations.
1/ Total credit provided by deposit money banks.
2/ Credit provided to the private sector by deposit money banks.
3/ Credit provided to the public sector by deposit money banks.
4/ Ratio of liquid reserves to GDP for deposit money banks.
5/ Intermediation spread (lending rate-deposit rate).
6/ Ratio of deposits to assets of deposit money banks.
7/ Ratio of equity to assets of deposit money banks.

This chapter analyses the post-crisis behaviour of banks in the Mercosur—a region that has witnessed a significant number of banking crises—using both aggregate and

[38] Argentina, Brazil, Paraguay, and Uruguay.

bank-level data during the period 1990-2006. There is a primary focus on credit supply even though other variables related to profitability, risk, and liquidity are also analysed. Convergence methodology—often used in the growth literature— is employed to identify the evolution of bank behaviour in the region after crises. This is a novel approach in this area. An added advantage of using this approach over others currently used in the literature is that the rate of convergence as well as the institutional and macroeconomic factors that condition the convergence can be empirically quantified. Moreover, the methodology allows one to identify—in some hierarchical order—factors that condition this persistent deviation from "normality".

There is a heavy reliance on the premise that banks' main economic function is efficient financial intermediation. This is the profitable mobilization of deposits to originate loans to finance productive concerns within the economy (Rajan 1994, and Boyd and Gertler 1994). Efficiency, however, also means that banks also have a responsibility to minimize risks on their balance sheet. This makes the level of credit supplied by banks correlated with the macroeconomic conditions as it affects the credit quality of borrowers. In other words, banks' natural hedge to institutional volatility will be credit contraction. As a result, there is a general disinclination to lend even if there are pressing needs to borrow. If this is the case, bank efficiency will correspond to lower credit supplied even if it is at cross-purposes with the notion of traditional financial intermediation.

Bearing in mind the above issues, "normal" post-crisis bank behaviour is measured as a convergence to two benchmarks. The first is the pre-crisis average levels, which has the advantage of reflecting the strategy chosen to minimize risk after systemic distress. The second is using carefully chosen regional and international benchmarks. These involve comparing the banking systems in the Mercosur to other countries in order to assess to what extent banks in the Mercosur perform the traditional intermediation role. In this case, the conflict between risk minimization and financial intermediation may pre-empt the lack of convergence to external benchmarks. Furthermore, identifying factors that condition convergence, illuminates discussions on how to mitigate the

adverse effects of crises on bank fundamentals. This is of particular interest to bank supervisors and regulators alike who are seeking to hasten post-crisis recovery in banks.

The main finding in this chapter is that banks in the Mercosur exhibit notable weaknesses within the specified parameters in two areas: insufficient private sector intermediation and holding of high levels of excess liquidity. These relate to the long-run persistence of non-convergence toward comparator benchmarks only. For example, the results shows that other bank fundamentals, such as capitalization, profitability and other measures of the risk profile of banks are similar to regional comparators and also to pre-crisis levels, and could support increased lending. These effects are more pronounced in domestic banks.

The rest of the chapter is organized as follows: Section 4.2 discusses the literature concerning post-crisis bank behaviour as well as the evolution of crises in the region. Section 4.3 discusses sample selection and methodology, while Section 4.4 presents the empirical results. Section 4.5 presents robustness tests, and Section 4.6 concludes.

5.2 BANKING CRISES IN MERCOSUR

5.2.1 General Overview of Post-Crisis Banking Behaviour

There is a general consensus in the literature on the following as leading indicators of banking crises. First, financial liberalization undertaken in conditions where financial institutions are underdeveloped, law enforcement is weak and regulatory supervision is inadequate can sow the seeds of a financial crisis (Hassan and Hussain 2006). Second, credit booms, if followed by weak and deteriorating economic fundamentals, can lead to weaknesses in bank balance sheets. Third, inconsistencies between fiscal and monetary policies and exchange rate commitments can lead to the simultaneous occurrence of currency and banking crises (Kaminsky and Reinhart 1999). Finally,

speculative attacks on the currency, often combined with investor-herding behaviour such as experienced in Argentina in 2001, deepens the crisis (Bleaney *et al.* 2008).

In the literature, the following types of post-crisis bank behaviour have been typically reported. First, there is often a substantial decline in credit to the private sector which may be demand or supply related (Kaminsky and Reinhart 1999, Gosh and Gosh 1999, Barajas and Steiner 2002 Demirgüç-Kunt *et al.* 2006a and Dell'Arriccia *et al*. 2008). The financial accelerator effect, first proposed by Bernanke (1983), can explain, to some extent, the behaviour of bank credit and its relationship with the persistence and amplitude of cyclical fluctuations in the economy. In the presence of credit-market frictions and asymmetric information, there is an external finance premium, or the difference between externally sourced funds and the opportunity cost of funds raised internally within a firm (Bernanke *et al* 1998). The external finance premium is inversely related to borrowers' net worth because borrowers with little wealth contribute less to project financing, leading to potential divergence of interests between borrower and lender. The latter thus needs a larger premium as compensation. To the extent that a borrower's net worth is pro-cyclical (profits and asset prices rise and fall with economic cycles), the external finance premium will be countercyclical. In this case, there will be acceleration in downswings in borrowing, and thus investment, spending and production during and after crises. This is all the more because financial crises typically destroy what Bernanke calls "informational capital" when some banks go bankrupt.[39]

Second, there is a decline in bank profitability. The negative effect of crises on bank profitability is often linked to the high levels of non-performing loans on banks' balance sheets (Carvalho and Cardim 1998, Pangestu 2003). Nonetheless, there is evidence of a quick recovery in profitability documented in Demirgüç-Kunt *et al.* (2006a) as banks typically get rid of their loans, and find new business lines such as

[39] Banks play a key role in screening and monitoring borrowers in order to mitigate information asymmetries and incentive problems. This expertise and on-going relationship with customers constitutes "informational capital".

fee-based activities and investment in government securities. For instance, in Brazil recovery of bank profitability was not a result of greater intermediation *per se,* but of the reorientation of banks portfolios towards liquidity, predominantly government securities (De Paula and Alves 2003).[40]

Third, an increase in intermediation spreads and dollarization often ensues (Gupta 2005, Honohan 2005). The increase in spreads is synonymous with macroeconomic volatility that may occur at or around the same time as a banking crisis. This is persistent in countries with poor legal infrastructure, concentrated banking systems and continued macroeconomic uncertainty (Gelos 2006).

Fourth, increased dollarization follows banking crises. Since banking crises are typically accompanied by currency crises, depositors often lose faith in the local depreciating currency. Dollarization is therefore a rational attempt to hedge against this risk as well as others, such as the collapse of the monetary regime and the return of high and unstable inflation (De Nicoló *et al.* 2003).

5.2.2 The Evolution of Bank Crises in Mercosur

The main common causal factors of banking crises in the Mercosur region are financial liberalization without adequate prudential safeguards, significant exposure to government risk (with the exception of Uruguay), currency mismatches on banks' balance sheet, and contagion. Multiple factors often combine to increase the frequency, depth and cost of banking crisis. These included sharp macroeconomic imbalances that weakened the operating capacity of the banking system, and inadequate regulatory and supervisory frameworks, allowing an incipient problem to reach systemic proportions. Moreover, financial globalization makes the contagious effects of instability more likely especially in emerging economies (IADB 2005). Furthermore, the interaction between currency pegs and banking stability has proven to be

[40] According to Pangestu (2003) bank holding of government securities is used to maintain capital adequacy requirements as the level of capitalization is often eroded during crises and existing levels cannot be stretched further to cover riskier loans.

significant in the Mercosur region in the 1990s as deposit runs provided the liquidity necessary for a successful speculative attack on the currency. Expected high returns from currency speculation may also destabilize an otherwise stable banking system (Bleaney *et al.* 2008). According to Gourinchas *et al.* (2001), the effects of credit growth after financial liberalization made the economies in Latin America considerably more volatile and vulnerable to financial and balance of payments crises than other regions around the world.

In what follows, some stylized facts on episodes of bank crises in the region from the 1990's are presented. The role and shortcomings of the relationship between the countries and the International Monetary Fund (IMF)- the main financier of the countries during the recovery- is analysed in greater depth in appendix 5.1.

Argentina

In 1991, Argentina adopted a currency board and implemented a convertibility law to fight hyperinflation and discipline fiscal governance.[41] While the economy performed well in the early 1990s, the continued success of the convertibility law was highly dependent on protecting its areas of vulnerability. First, there was insufficient budgetary control leading to significant fiscal deficits. Subsequent real appreciation of the peso led to a decline in international competitiveness, and worsened the current account position (Hornbeck 2003). The 1994 Tequila crisis in Mexico further raised doubts about the stability of Argentina's financial system, leading to large capital outflows in Argentina and triggering the 1995 crisis. The resulting effect was a net deposit withdrawal of $8 billion from the banking system and closure of a large number of financial institutions. It is worth noting that during 1991-1997 Argentina was one of the fastest growing economies in Latin America with an average growth rate of 6.7 percent (Barajas *et al.* 2006).

[41] The convertibility law legally guaranteed the convertibility of peso currency to dollars at a one-to one fixed rate

Broadly speaking, the banking crisis in Argentina in 2001 evolved in three similar stages to the 1995 crisis. First, there was a build-up of commercial bank foreign currency assets and liabilities. Second, an accumulation of government debt followed. Finally, the run on deposits ensued. The rapid dollarization of the liabilities side of the balance sheet left banks exposed to currency risks and increased default risk as borrowers' incomes was typically in domestic currency. In addition, as its financing needs rose and its ability to tap the international capital markets declined, the government increased reliance on banks for its financing. Domestic banks subsequently used government securities to dollarize the asset side of their balance sheet, resulting in an increased exposure of the banking system to the risk of government default. Finally, the exposition of risks in banks' balance sheets a spurred a significant withdrawal of deposits and by the end of 2001 the banking system had lost about 20 percent of deposits. In order to stem the massive drain on the banking system the government implemented the "*corralito*"[42]. This exacerbated the deposit run in subsequent months. With no sign of economic recovery and government default in December 2001, banks experienced a significant loss in the value of their assets (Barajas *et al*. 2006). In January 2002, when the government declared default and depreciated the peso by 29 percent, Argentina found itself with another systemic bank crisis, a currency crisis, and a debt crisis (IADB 2005)**.**

Brazil

In the run up to the 1994 crisis, Brazil was deemed to be in general good economic health. The pre-1994 high inflation climate helped Brazilian banks remain profitable despite relatively low levels of intermediation because banks were able to generate easy revenues by paying negative low real interest rates. The end of high inflation and the implementation of the "Real Plan" were accompanied by a rise in consumer expenditure. During this period two factors impaired the stability of the banking

[42] The "*corralito*" is the informal name for the economic measures taken in Argentina at the end of 2001 in order to stop the massive withdrawal of deposits, which prevented withdrawals from U.S denominated accounts.

system: First, the rise in credit supply, against a backdrop of poor credit risk management, and a regulation framework that did not keep pace with the levels of financial innovation/ liberalization.[43] Second, on the macro economic side, the appreciation of the domestic currency, financial liberalization and the deterioration of fiscal and external balances (Cinquetti 2000).

The nexus between banking system and economic instability quickly became evident in Brazil. While increased interest rates raised loan defaults, loan defaults further worsened macroeconomic activity by increasing unemployment. By August 1995, Banco Economico (Brazil's eighth largest private bank) went bankrupt. Other bank liquidations and restructurings followed as a combination of poor economic condition and high interest rates made it impossible for banks to recover profitability. Non-performing loans of the entire banking system were estimated to have risen from about 5 percent in September 1994 to about 15 percent throughout most of 1997 (Baer and Nazmi 2000). In the wake of financial crisis in Asia and Russia in 1997 and 1998, respectively, interest rates rose, capital flight continued and economic conditions and asset quality continued to worsen.

However, Brazil implemented drastic stabilization measures to calm markets and create the foundations for a relatively quick economic turnaround without further putting the banking system at risk (Cadim De Carvalho 1998). In 1999, Brazil abandoned a crawling peg currency regime, adopted an inflation-targeting framework for monetary policy, and allowed the currency to float. The overall effect is an economic system that is much more stable compared to its pre-crisis level (Goldfajn 2000, Tabak and Staub 2007).

[43] The Real Plan had similar characteristics with other currency stabilization programs in Latin America. It involved using a fixed or semi-fixed rate of exchange as a price anchor in combination with more open trade policy. It differed from the Argentina's convertibility plan by building in some flexibility into the permitted currency movements, rather than pegging the domestic currency at one-to-one parity with the U.S dollar (De Paula and Alves 2003).

Paraguay

Paraguay had a series of recurrent financial crisis from 1995 to 2003. During that period, more than half of the banks and two thirds of non-bank financial institutions closed or liquidated (Mlachila 2008). Prior to 1990, the financial systems as well as major economic activities were heavily regulated and restricted. In 1989, the country underwent a significant number of market-based structural economic reforms, and the exchange rate was unified and the *guaraní* floated. The subsequent indiscriminate financial liberalization that followed, with hindsight, was premature in the absence of suitable regulatory and supervisory institutional infrastructure (Fuertes and Espinola 2006).

Despite relatively high inflation during 1989-94, the economy was strong. Real GDP growth averaged over 3.5 percent and fiscal surpluses recorded during most of the period. The external sector also remained robust in part spurred by a sharp depreciation in the real effective exchange rate, which resulted in current account surpluses during most of the period. Significant financial deepening also occurred as the M2/GDP ratio increased from 22 to 37 percent and private sector credit grew rapidly. A large number of banking and finance companies emerged in 1990-94 because of the speed of financial liberalization. The effect of this was increased competition, high deposit rates, and even higher lending rates were charged, and thus contributing to the maintenance of high intermediation spreads.

By late 1994, citing liquidity needs, several banks sought support from the central banks and in mid-1995, the central bank had intervened in four banks and several finance companies. After this, the financial system remained weak, and the lack of decisive action especially regarding the resolution of technically insolvent banks in the first crisis solidified the foundation for the next one. In addition, by 1996 and the first half of 1997, Paraguay was witnessing a systemic run on its deposits with depositors fleeing to foreign-owned banks, which were perceived as less risky than locally owned banks. Once again, the authorities chose further regulatory forbearance and accounting

flexibility, coupled with central bank support, rehabilitation programs, and the transfer of public sector deposits to weak banks.

The combination of the economic recession from 1999, the full-blown currency crisis of 2001, and the slow pace of recovery as well as contagion effects from neighboring Argentina brought about the 2002 crisis. Virtually all indicators point to the fact that financial disintermediation occurred in the aftermath of the financial crisis. First, the financial deepening ratio (M2/GDP) declined considerably after the first crisis from over 35 to less than 30 percent in one year, and has steadily declined over time, to less than 25 percent at end 2006. A similar pattern is observed in private sector credit, as recovery is weakened by further bouts of distress.

Uruguay

The banking crisis in Uruguay in 2002 developed in three phases: a run by depositors on foreign banks (mainly Argentine); the deterioration of domestic sentiment regarding the stability of the exchange rate; and the imposition of a bank holiday. The effect of contagion was felt in Uruguay as 40 percent of bank deposits in Uruguay were held by Argentines. Following the imposition of the "corralito" in Argentina, there were large deposit withdrawals from two large banks with very strong Argentine links representing about 20 percent of total deposits within the banking system in early 2002. Although the Uruguayan banking system did not have the same level of exposure to government default risk as in neighbouring Argentina, the risks from dollarization were similar. About 80 percent of the loans were dollar-denominated and half of the dollar loans were extended to borrowers with Uruguayan peso-denominated accounts.

Second, the initial withdrawal of deposits resulting from contagion in Argentina and the worsening economic conditions raised fears that the government would also

impose a “deposit freeze” similar to Argentina. This caused further runs on domestic banks, which subsequently started experiencing liquidity problems.

Finally, after further deterioration in market sentiment in July and months of widespread deposit withdrawals and substantial liquidity support to the banking system, it became clear that the situation was untenable. Since the low levels of reserves were insufficient to service increasing external debt, and to continue backing the still highly dollarized banking system, the authorities allowed the peso to float freely. The subsequent depreciation of the exchange rate as a result of capital outflows further worsened the deposit run and by the end of July 2002 total withdrawal of deposits had reached 42 percent and the government was compelled to declare a 5 day bank holiday by the end of July (IADB 2005, De La Plaza and Sirtaine 2005).

5.3 METHODOLOGY AND DATA ISSUES

5.3.1 The Concept of Convergence and Bank Behaviour

Overview

To empirically analyze post crisis bank behaviour, the concept of convergence extensively used in the economic growth literature is employed. For instance, Barro and Sala-i-Martin (1992) and Mankiw *et al.* (1992) use it to analyze how long it typically takes poor countries to "catch up" with rich countries in terms of per capita GDP.[44] For convergence to occur, the measure of dispersion between countries should decrease over time. The growth rate and standard deviation form the basis for measuring the so-called σ-convergence in the growth literature. Therefore for countries to become similar over time the cross sectional standard deviation of their real per capita GDP should decrease over time (Salai-i-Martin 1996). A similar analogy is used to construct the measures of dispersion. In this study, post crisis recovery will correspond to a decrease in measures of deviation between current levels of credit supply and the specified benchmarks of normal levels of intermediation.

The approach differs from others used in the literature by comparing post crisis bank behavior to a specific benchmark. While the choice of benchmark may be debatable it anchors the interpretation of results. For instance, the lack of post-crisis recovery in private sector credit reported in the literature is a typical effect of crisis which becomes problematic if it persists for a long period.

[44] The general results in the economic literature indicate low levels of economic convergence (about 2 percent per year).

Defining Convergence

Two measures of deviations of bank behaviour from pre-crisis levels are constructed as follows:

$$Y_{ij,t} = \ln(X_{ij,t} / \overline{X}_{ij}) \qquad \text{for all } t>t_0 \qquad (5.1)$$

$$D_{ij,t} = \ln((X_{ij,t} - \overline{X}_{ij}) / \overline{X}_{ij}) \qquad \text{for all } t> t_0 \qquad (5.2)$$

$$\overline{X}_{ij} = \sum_{t=t_0-3}^{t_0-1} X_{ij,t} \Big/ 3 \qquad (5.3)$$

t_0 is year of occurrence of systemic crisis, $X_{ij,t}$ is the post-crisis level of the variable of interest in bank j in country i at time t, and $\overline{X}_{ij}$, the benchmark, is calculated as the average of the three years before the onset of a crisis for each bank. Three years is chosen because a longer time series may reflect the effects of structural changes in the economy and banking system unrelated to the episode of distress, while a shorter time series would probably give too much weight to the most recent observations which may be too close to the crisis. Abnormal bank behaviour is deemed to occur if $Y_{ij,t}$ and $D_{ij,t} \neq 0$.[45]

There are some other methods that may measure transition dynamics. For example, error correction models may also be an appropriate estimation method if one expects different long and short term effects of crisis on the level of private sector credit. However, the power of error correction models may be lost, given the improbability of true cointegrating relationships in short time series banking data. [46] Also, if one believed that an error correction model is appropriate in this study, the methodological question would be whether the level of private sector intermediation and the sets of control variables (macroeconomic condition, bank specific and the regulatory environment) are cointegrated-high unlikely. In fact, a time series may be related, or

[45] The choice of an internal benchmark is not without limitations that taint the credibility of the benchmark itself. To control for this, an external time varying benchmark is also used.

[46] Cointegration implies that two time series never drift far apart from each other, that is they maintain an equilibrium.

have long memories and still be stationary. As shown in figure 5.3-5.5 while the level of intermediation appears to have permanently deviated from its pre-crisis equilibrium it appears to be in fact stationary around a new equilibrium.

While the methodology has more recently being used in the literature on bank productivity Fung (2006) and bank efficiency in the new European Union member states and the OECD countries by Mamatzakis (2007) and Dahl et al. (2008), to the best of my knowledge this is the first study to use this method to analyze post crisis bank behaviour. Following the ideas in previous studies, two main concepts of convergence are analysed: β- and σ-convergence. Convergence of the β-type considers whether the growth in bank fundamentals, e.g., credit supply, exhibits a negative correlation with its current levels. In other words, for the level of intermediation to converge back to its pre-crisis level, subsequent rates of growth will decline if the initial level is higher than the pre-crisis level and vice versa. Convergence of the σ-type means dispersion between current levels and the benchmark decreases over time.[47]

The current tests for β- convergence used in the literature regresses the annualized growth rate of per capita GDP on its initial level to test for absolute convergence and on its initial levels and other "conditioning variables" (e.g., technology and behavioural parameters) to test for conditional convergence.

[47] In the literature on post-crisis behaviour of banks, some studies have used disequilibrium models (Kadiyali *et al.* 1999, Gosh and Gosh 1999, Barajas and Steiner 2002) to determine if there is a credit crunch after banking crisis and whether the crunch is caused by demand or supply deficit. This methodology is better suited for analyses that focus on one aspect of bank behaviour such as credit supply. However, since a number of bank characteristics are surveyed, employing this methodology will quickly be too cumbersome. Similarly duration models which have been used extensively in the banking and financial stability literature, e.g., Ongena and Smith (2001), Glennon and Nigro (2005), Schaeck *et al.* (2006), Mecagni *et al.* (2007) can also measure transition dynamics, but their use is not justified in this case. The duration model is also sensitive to survivorship bias problems that may cause the estimates of the speed of convergence to be higher. Since it is impossible to measure speed of convergence for failed banks, choosing a model that is not reasonably affected by the survivorship bias in the sample is more appropriate.

Absolute convergence in this case implies growth rates $Y_{ij,t}$ are equal for all banks and the benchmark $\overline{X}_{i,j}$ is the same for all banks. In other words, the occurrence of crisis is the only reason why bank behaviour deviates from a common benchmark. However, the conditions necessary for this assumption to be consistent are stringent and require all bank—or country-specific heterogeneity to be captured by the benchmark. If this is not the case, factors that drive dispersion embedded in the error term may affect the estimates of α_1 (Evans 1997). Since it is not necessary to be unduly constrained by this assumption, we also estimate conditional convergence.

5.3.2 The Regression Framework

The regression equations of the test for absolute β- and σ-convergence, respectively, have the following forms;

$$Y_{ij,t} = \ln(X_{ij,t} / \overline{X}_{ij}) = \alpha_0{}^{y} + \alpha_1{}^{y} \ln(\overline{X}_{ij}) + \varepsilon_{it}{}^{y} \quad (5.4)$$

$$D_{ij,t} = \ln((X_{ij,t} - \overline{X}_{ij}) / \overline{X}_{ij}) = \alpha_0{}^{d} + \alpha_1{}^{d} \ln(\overline{X}_{ij}) + \varepsilon_{it}{}^{d} \quad (5.5)$$

Absolute convergence implies that $\alpha_1^{(.)} < 0$.

The test for conditional convergence is specified as follows:

$$D_{ij,t}{}^{d} = \ln((X_{ij,t} - \overline{X}_{ij}) / \overline{X}_{ij}) = \gamma_0{}^{d} + \gamma_1{}^{d} \ln(\overline{X}_{ij}) + \gamma_2{}^{d} Z + \varepsilon_{it}{}^{d} \quad (5.6)$$

Nested OLS regressions are estimated to quantify the additional information added to the estimates of $D_{ij,t}$ by introducing the conditioning variables *(Z).* Z is a vector of conditioning characteristics in the Mercosur, which hold the benchmark constant for each bank *j*. The three sets of conditioning variables used are as follows. The first set controls for differences in bank characteristics that may condition convergence in bank

behaviour. They are size (measured by the logarithm of total assets); profitability (measured by return on assets); and capitalization (measured as the ratio of equity to total assets).

The second group of control variables reflects the overall institutional quality in the country. This is because of the well-established link between the quality of the regulatory and institutional framework and the levels of intermediation particularly in the area of contract enforcement and protecting the rights of investors as reported in Levine (2002), La Porta *et al.* (2000) and Beck *et al.* (2006b). The Kaufman, Kraay and Mastruzzi (2008) governance indicators are also used to build a composite index of six dimensions of governance based on the following sub-groupings: voice and accountability, political stability, government effectiveness, regulatory quality, the rule of law, and the control of corruption. This broad measure has been widely used in empirical studies such as (Dimirgüç-Kunt *et al.* 2006b). Controls for bank activity regulation using the Heritage (2008) index of financial freedom as well as a measure of the stringency of capital requirements (Caprio *et al.* 2008) are also included. This group also includes a control for differences in the structure of the banking system. This variable is the cumulative percentage of assets held by the three largest banks in the country as reported in Bankscope (2008).

The third set of controls reflects the macroeconomic environment. The real GDP growth, inflation, and the percentage of total reserves to external debt (as an indicator of the strength of the external balance) is included.[48]

Because of the preference of σ over β in measuring convergence, conditional σ-convergence is the main focus of the analysis. This is because β-convergence can still be observed as a result of measurement error and random shocks. Therefore if β-

[48] Other studies such as Islam (1995) and Serra *et al*. (2006) have suggested introducing country and time dummy variables instead of explicitly identifying a set of conditioning factors. In a similar study that does not use convergence measures, Dimirgüç-Kunt et al. (2006a) also include time and country dummy variables to control for heterogeneity across countries, but allude to the importance of identifying conditioning factors in understanding post-crisis recovery.

convergence is to measure real convergence it must coincide with σ-convergence (Salai-i-Martin 1996 and Fung 2006).

While the measures of deviation are constructed as close as possible to traditional measures of β- and σ-convergence used in the literature, some differences exist particularly with the measure of σ-convergence. In the growth literature, σ-convergence is deemed to occur if $\sigma_{t+t_{To}} < \sigma_t$, where σ_t is the time t standard deviation of log $(y_{i,t})$ across i, where $\log(y_{i,t})$ is the logarithm of economy i's GDP per capita at time t. Most studies on convergence analysis use the cross sectional standard deviation, or some other convenient measure of variation suited to the particular objective of the analysis as suggested in (Barro and Sala-i-Martin (1992), Dalgaard and Vastrup (2001)). Using this standard measures involves estimating variations from the arithmetic mean—a proxy of a long-term trend from which deviations are measured. However, the assumption is that the occurrence of systemic crisis led to a deviation from this long-term trend, using standard measures based on the arithmetic mean will not yield meaningful interpretations. Therefore the measure of σ is based on a simple measure of dispersion $D_{ij,t}$.

Summary of Coverage of Crises and Banks

	Systemic Crises	No. of Banks in sample	No.of Banks in the Banking System (Bankscope) 2005	Fraction of Total Assets
Argentina	1995, (2001)	62	111	65
Brazil	1994- 1999	20	201	56
Paraguay	1995-1999	13	26	100
Uruguay	2002	20	49	66
Total		115	387	

Sources: Bankscope and authors' calculations.

The fact that the validity of the results is based on the quality of the internal benchmark as a measure of normal bank behaviour necessitates the use of other external benchmarks to assess the robustness of the results—the first is Norway, an OECD country and the other is (Chile), a regional benchmark.[49] Using a regional benchmark incorporates controls for specific regional peculiarities in the banking system that may cause banks in Latin America, for example, to behave differently from other banking system in the world. Implicit in this is the fact that bank fundamentals in the Mercosur do not necessarily need to move in line with the rest of the world to be considered normal.

The test for absolute and conditional σ-convergence to external benchmarks is conducted by estimating equation (5) and (6) with the following modification to the measures of dispersion:

$$Y_{i,t} = \ln(X_{i,t} / X_{i',t})$$

For all $i = \{Argentina, Brazil, Paraguay, Uruguay\}, i' = \{Chile, Norway\}$ and across all $t's.$

$$X_{i,t} = \sum_{j=1}^{J} X_{ij,t} \Big/ J \ , \ X_{i',t} = \sum_{j=1}^{J} X_{i'j,t} \Big/ J \quad \text{j = 1, 2 …J (averaging is across banks)}$$

$D_{i,t} =$ The cross sectional standard deviation between i and i'.

5.3.3 Data Sources and Issues

The widely used database by Caprio and Klingebiel (2003) is relied on for the identification and timing of systemic banking crises. Accordingly, a systemic crisis episode is characterized by large-scale bank failures, the adoption of emergency

[49] Regarding using an internal benchmark, there are also criticisms in the literature about the relevance of convergence studies especially in panel data microanalysis like ours since pre-crisis average varies by banks hence banks are converging to different steady states. According to Islam (2005), there is probably little solace to be derived from finding which countries in the world are converging at a faster rate if the point to which they are converging is different.

measures by the government, significant bank runs, high levels of non-performing loans and significant bailout costs.

A panel dataset of banks is assembled, using bank-level data from the Bankscope database compiled by Fitch IBCA, for which there are 115 existing banks in the baseline sample. Macroeconomic variables are from the IMF *(International Financial Statistics, IFS)* and the World Bank (*World Development Indicators, WDI)* databases.[50] The sample period is 1990-2006 and the following systemic crisis episode occurring within the period is considered: Argentina (1995), Brazil (1994), Paraguay (1995), and Uruguay (2002). Observations are measured in yearly intervals from the onset of the systemic crisis. Hence the first year, will correspond with observations occurring in 1995 for Argentina and Paraguay, 1994 for Brazil, and 2002 for Uruguay. Treating post-crisis observations this way creates an unbalanced panel of post-crises observation, which poses some estimation problems. On the other hand, this allows for sharper characterization of the issues at hand.

Of the four countries, Argentina is the only country to have experienced systemic crises more than once within the sample period; first in 1995, and in 2002.

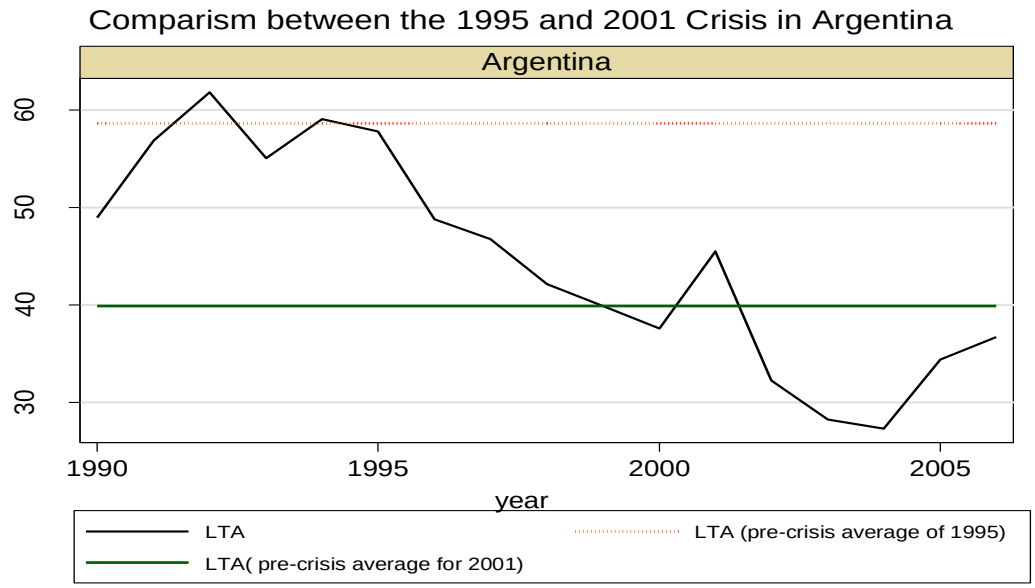
Summary of Coverage of Crises and Banks

	Systemic Crises	No. of Banks in sample	No.of Banks in the Banking System (Bankscope) 2005	Fraction of Total Assets
Argentina	1995, (2001)	62	111	65
Brazil	1994- 1999	20	201	56
Paraguay	1995-1999	13	26	100
Uruguay	2002	20	49	66
Total		115	387	

Sources: Bankscope and authors' calculations.

[50] A fuller description of data sources and definitions is given in Appendix 5.2.

Figure 5.1



Even though the 2002 crisis was arguably the more severe of the two, only the 1995 crisis is considered in the analysis. This is to ensure consistency with the way other countries are treated within the sample and also ensures that the lingering effect of the previous crisis on the variables does not bias the credibility of the internal benchmark chosen as the average of observations in the three years preceding the onset of a systemic banking crisis. Figure 1 show how such a bias may occur if the 2001 crisis was used. The ratio of loans to assets in the sampled banks clearly did not improve after the 1995 crisis.

5.4 THE RESULTS

In this section, two sets of results are presented. First a preliminary descriptive analysis of the data is conducted, and then a more detailed analysis of overall bank behaviour in the Mercosur is provided.

5.4.1 Descriptive Statistics

Tables 5.1 and Table 5.2 show summary statistics for the variables of interest. Yearly observations in the period within 1990-2006 are used for all banks in the sample.

Within the sample period, the average level of profitability (ROA) is negative. However the difference between the mean and median shows the influence of relatively lower levels of profitability in Uruguayan banks compared to the Mercosur on the average, the median is comparable to the sample of banks from Chile and Norway, which are 0.74 and 0.97 respectively (summary statistics for Chile and Norway not shown). Over the sample period banks in the Mercosur on average held a higher level of liquid assets (36 percent) of total assets compared to banks in Chile (with a much lower average of 9 percent). Also regarding the pattern of intermediation, the Mercosur countries compared to the external benchmarks are more heavily involved in government financing. Private and public sector credit by commercial banks is 26 and 12 percent of GDP, respectively, in the Mercosur compared to Chile where the levels are 90 and 1 percent of GDP. In Norway, the commercial banks credit to the private sector is 67 percent of GDP and 7 percent to the public sector.

Table 5.2 shows the correlation coefficients between intermediation measures and other fundamental bank characteristics such as spreads, profitability and liquidity. Evidence of some sub-optimal intermediation patterns and volumes can be seen. For instance, banks' preference for public sector financing is highlighted by the correlation coefficients between total credit supplied by banks and the proportion that goes to the public sector. Another apparent anomaly is the negative correlations between bank profitability and credit supply (-0.10), compared a strong positive relationship with the proportion of liquid assets held by banks (0.13).

Table 5.1. Mercosur: Bank Behavior Summary Statistics

Variable		Mean	Median	SD	Min	Max
Profitability						
Return on Assets (ROA)	***Aggregate***	***-0.46***	***0.79***	***8.14***	***-135.07***	***22.06***
	Argentina	-1.54	0.37	8.62	-94.58	22.60
	Brazil	1.67	1.44	3.15	-9.25	18.75
	Paraguay	1.79	2.19	3.31	-23.72	11.21
	Uruguay	-1.63	0.06	13.05	-135.07	6.20
Net Interest Margin	***Aggregate***	***7.39***	***6.02***	***8.62***	***-38.74***	***101.45***
	Argentina	5.45	4.62	6.86	-36.73	82.54
	Brazil	12.24	8.90	13.46	-2.74	101.45
	Paraguay	10.38	10.49	3.11	4.53	19.34
	Uruguay	4.94	5.01	5.72	-38.74	18.94
Risk						
Ratio of Equity to Asset	***Aggregate***	***15.96***	***11.61***	***18.82***	***-172.88***	***99.05***
	Argentina	18.65	12.45	20.18	-110.35	99.05
	Brazil	14.14	9.91	14.27	-45.56	99.04
	Paraguay	14.24	13.17	4.51	4.70	27.92
	Uruguay	8.86	7.85	18.66	-172.88	81.87
Spread (Lending- Deposit)	***Aggregate***	**16.04**	**10.46**	**15.75**	**1.98**	**58.36**
Credit Supply						
Bank Loans/Asset Ratio	***Aggregate***	***47.50***	***47.73***	***20.21***	***-10.18***	***99.72***
	Argentina	44.14	45.69	18.82	-10.18	86.88
	Brazil	38.22	36.83	13.88	-0.01	89.53
	Paraguay	49.26	53.12	14.43	5.47	83.54
	Uruguay	73.91	78.15	17.55	16.98	99.72
Domestic Money Bank Credit to the Private Sector/GDP	***Aggregate***	**0.26**	**0.22**	**0.17**	**0.10**	**1.33**
Domestic Money Banks Total Credit to the Public	***Aggregate***	**0.12**	**0.09**	**0.11**	**0.00**	**0.42**
Total Credit by Deposit Money Banks/GDP	***Aggregate***	**43.91**	**33.99**	**24.94**	**14.92**	**181.46**
Maturity Preference						
Banks Total Deposits/Assets ratio	***Aggregate***	***0.63***	***0.68***	***0.24***	***0.00***	***3.04***
	Argentina	0.61	0.67	0.24	0.00	3.04
	Brazil	0.38	0.38	0.18	0.01	1.09
	Paraguay	0.70	0.72	0.11	0.87	0.27
	Uruguay	0.89	0.89	0.27	0.18	2.54
Liquid Liabilities (Demand Deposits/Total Deposits and Short term Funding)	***Aggregate***	***0.22***	***0.11***	***0.27***	***0.00***	***1.53***
	Argentina	0.16	0.10	0.20	0.00	1.53
	Brazil	0.09	0.08	0.08	0.00	0.47
	Paraguay	0.64	0.80	0.33	0.00	1.00
	Uruguay	0.57	0.92	0.42	0.03	0.95
Liquid Assets (Liquid Assets/Total Assets)	***Aggregate***	***0.36***	***0.34***	***0.19***	***0.00***	***1.18***
	Argentina	0.38	0.34	0.20	0.03	1.18
	Brazil	0.42	0.42	0.14	0.00	0.73
	Paraguay	0.37	0.34	0.14	0.10	0.88
	Uruguay	0.19	0.14	0.16	0.00	0.77

Sources: Bankscope, *WDI, IFS* and authors' calculations.

Table 5.2 Correlations Between Selected Variables

Sigma convergence	Loans	ROA	Spread (overall)	Bank Loans to Assets	Banks Credit to Private Sector/GDP	Banks Credit to Public Sector/GDP	Total Bank Credit/GDP	Liquid Assets to Total Assets
Loans	1.00							
ROA	0.07	1.00						
Spread	0.38	0.02	1.00					
Bank Loan/Assets Ratio	-0.10	-0.02	0.00	1.00				
Deposit Money Bank Credit to Pvt. Sector/GDP	0.15	-0.09	0.64	0.33	1.00			
Deposit Money Bank Credit to the Pub. Sector/GDP	0.41	-0.04	0.52	-0.35	0.03	1.00		
Total Credit by Deposit Money Banks/GDP	0.39	-0.10	0.77	-0.08	0.54	0.83	1.00	
Liquid Assets/Total assets	0.11	0.13	0.00	-0.73	-0.19	0.16	0.00	1.00

Source: Authors' calculations.

5.4.2 Regression Analysis

Overall results

Table 5.3 show results for estimates of equations (4)-(6) using nested OLS regressions. The regression coefficients $\alpha_1^y, \alpha_1^d and \gamma_1^d$ and their associated standard errors are reported. The incremental R^2 (through nested regressions) is also reported to show the additional information (if any) that holding a specific group of control variables constant adds to the rate of convergence. To aid interpretation, the results are explained in light of the extent to which the benchmark is an appropriate measure of normal bank behaviour.

Since the measure of β-convergence must coincide with σ-convergence for real convergence to occur, the attention is focused on σ-convergence measures, even though both are reported in the canonical model. There are instances where the coefficients of β- and σ-convergence yield different estimates, particularly for variables where convergence is "bottom up"—in which case absolute values of $Y_{ij,t}$ will increase for convergence to occur, while absolute values of $D_{ij,t}$ will decrease to show convergence. This further highlights the bias that can be caused by relying on the β instead of σ to show convergence.

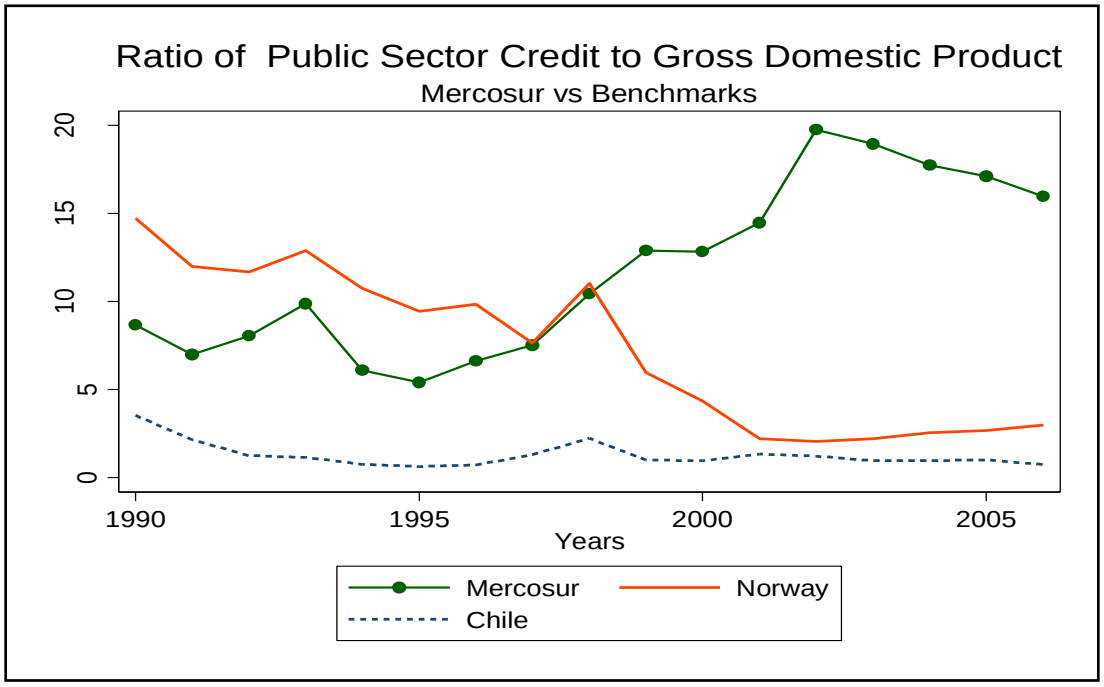
The most notable result is the lack of convergence in two measures of intermediation (*credit by banks/GDP* and *private credit/GDP*). The estimates of α_1^d and γ_1^d are positive and significant, which implies that the total credit supplied by banks as well as the proportion of credit to the private sector, have yet to recover to the pre-crisis level. This result remains robust to the inclusion of control factors. In other words, holding constant the possible effect the macro economic condition, institutional adequacy, as well as bank specific characteristics may have on the recovery of private sector intermediation does not change the results.

That said, if banking crisis is preceded by an unsustainable growth in credit, there may be lack of convergence to the pre-crisis levels of credit supply. Hence problematic bank

behaviour is not identified solely based on non-convergence in levels of intermediation without looking at changes to the pattern of intermediation.

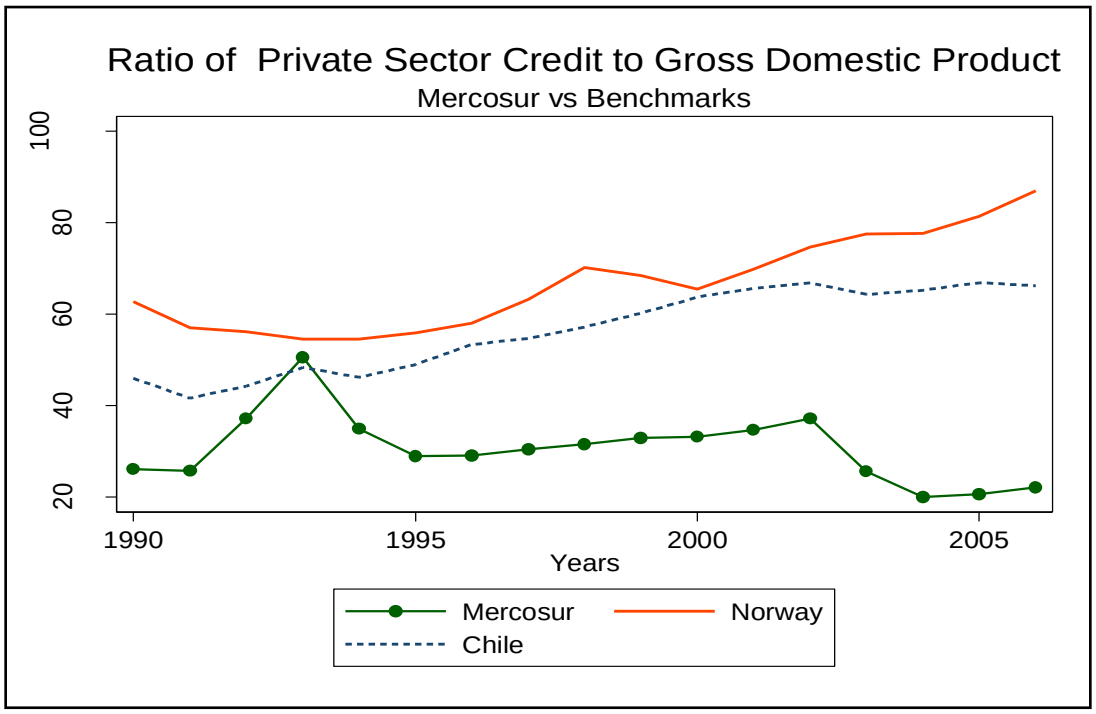
The results show a high rate of convergence (-0.72) in *public credit*, which indicates that pre-crisis levels of government financing will typically be exceeded within two years after crisis.[51] This increased public sector financing may explain the declining levels of credit to the private sector. Figure 2 and 3 show significant differences between levels of public sector intermediation in the Mercosur and the external benchmarks.

Figure 5.2



[51] The estimates of α_1^d and γ_1^d shows the yearly rate of recovery, for example, the rate of convergence in public sector credit of (-0.723) means that approximately 72 percent of the "gap" between current and pre-crisis levels of public sector intermediation will be closed annually. This implies that within 2 years pre-crisis levels of public intermediation will be exceeded.

Figure 5.3



Although there is evidence of convergence in the *loans/asset* ratio caution is advised in interpreting this as a rise in private sector credit for two reasons. First, because the variable does not distinguish between loans recipients (private or public sector) it is likely that the coefficient is simply capturing the effects of increased public sector financing. Second, since the condition imposed in the data collection process is for banks to be in existence before and after crisis, bank level data may indicate survivorship bias, as only the largest and most profitable intermediaries will have survived systemic banking.[52]

[52] As variables measured on the bank level is subject to some evidence of survivorship bias, where both bank level and aggregate variables are reported, the focus will be more on the aggregate measures. In order to mitigate some of the problems with survivorship bias in bank-level data due to mergers and acquisitions that may occur during a systemic crisis, the following steps are taken. When a merger or acquisition is identified and information is available for both banks (the acquiring and new bank), they are treated as one from the beginning of the sample otherwise the banks are dropped. This approach is similar to the one taken in the literature on post-crisis behavior Demirgüç-Kunt *et al.* (2006a). Taking this approach did not significantly change the sample composition in countries except in Brazil, which experienced a significant consolidation in the banking industry after systemic crisis.

Table 5.3 Summary Results for Absolute and Conditional Convergence 1/

	Absolute Convergence		Conditional Convergence		
			Bank level controls	Macroeconomic Controls	Institutional & Markert Structure Controls
	β -conv	σ- conv	σ- conv		
	1	2	3	4	5
Profitability					
Return on Assets	**-0.668*** **	**-0.602*** **	**-0.706*** **	**-0.606*** **	**-0.662*** **
	0.059	0.065	0.064	0.065	0.068
			0.22* **	**0.04*** **	**0.03*** **
Risk					
Capitalization	**-0.417*** **	**-0.360*** **	**-0.452*** **	**- 0.383*** **	**-0.313*** **
	0.055	0.09	0.107	0.086	0.099
			0.05* **	**0.03*** **	**0.02*** **
Spread (Lending –Deposit Interest Rate)	**-0.326*** **	**-0.238*** **	**-0.193*** **	**-0.076*** **	**0.367*** **
	0.024	0.039	0.049	0.052	0.073
			0.05*	**0.31*** **	**0.41*** **
Credit Supply					
Loans/Assets	**-0.418*** **	**-0.347*** **	**-0.448*** **	**-0.378*** **	**0.345*** **
	0.083	0.104	0.119	0.106	0.118
			0.00	**0.02*** **	**0.06*** **
Credit by banks/GDP	**-0.547*** **	0.106***	**0.016**	**0.304*** **	**0.761*** **
	0.01	0.021	0.039	0.029	0.051
			0.12* **	**0.21*** **	**0.28*** **
Private Credit/ GDP	**-0.525*** **	0.549***	**0.349*** **	**0.765*** **	**0.764*** **
	0.013	0.018	0.038	0.029	0.085
			0.08***	**0.20*** **	**0.45*** **
Public Credit/GDP	**-0.582*** **	**-0.723*** **	**-0.780*** **	**-0.791*** **	**-0.498*** **
	0.006	0.003	**0.011**	**0.013**	0.013
			0.02* **	**0.02*** **	**0.15*** **
Liquidity					
Total Deposits/Assets	**-0.905*** **	0.424***	0.424***	0.396***	0.341***
	0.04	0.047	0.035	0.04	0.035
			0.06* **	**0.09*** **	**0.007*** **
Demand deposits/Total Deposits	**-0.360*** **	**-0.216** **	**-0.290*** **	**-0.258**** **	**-0.375*** **
	0.078	0.092	0.085	0.083	0.088
			0.02* **	**0.06*** **	**0.26*** **
Liquid Assets/Total Assets	**-0.723*** **	**-0.769*** **	**-0.729** **	**-0.704*** **	**-0.680*** **
	0.031	0.11	0.113	0.109	0.117
			0.00	**0.05*** **	**0. 03*** **
Res/GDP	**-0.230*** **	**-0.912*** **	**-1.004*** **	**-0.558*** **	**-0.989*** **
	0.024	0.034	**0.042**	**0.036**	0.045
			0.14* **	**0.19*** **	**0.23*** **

Source: Authors' calculations.

1/ The first row is the parameter estimate, the second row is the standard error, and the final row shows the incremental R2. Nested OLS regressions include all banks. Robust standard errors are reported in parentheses. ***, **, and * indicate statistical significance at the 1, 5 and 10 percent levels, respectively.

Another possible explanation for the lack of convergence in levels of intermediation may be because other bank fundamentals have not recovered to their pre-crisis levels and hence cannot sustain higher levels of intermediation in the Mercosur. It is therefore also

necessary to examine whether or not there is convergence in levels of profitability, risk, as well as the maturity composition and funding structure of the banks portfolio.

The results in Table 5.3 regarding convergence in bank profitability (*ROA*) show a high and significant rate of convergence (-0.60), which shows that banks quickly recover pre-crisis levels of profitability (within 2 years). This is intuitive considering that only the most resilient banks will survive a banking crisis. It is therefore difficult to ascribe lower levels of intermediation to lack of profitability in banks.

To assess whether the lower level of intermediation is determined by increased default or credit risk, the speed of convergence of banks' capitalization (equity-to-assets ratio) and spreads is also analyzed. Lower levels of intermediation may occur if a systemic crisis leads to an erosion of bank capital and hence the existing capital cannot be stretched to cover additional loans. In this case, banks will experience a portfolio shift into highly liquid secure government securities that attract a smaller capital charge. A second scenario is that macroeconomic volatility—often synonymous with systemic crises in the region—may increase borrower default risk and result in higher intermediation spreads. If either bank *capitalization* or *spreads* fail to converge back to their pre-crisis level, this would be a *prima facie* reason for the fall in intermediation. However, this is not the case as the convergence in *capitalization* and *spreads* is significant.[53] While intermediation spreads within the region are still relatively high, they are nonetheless trending downwards. For example, in Brazil spreads have declined by about 17 percentage points between 1997 and 2006 and in Uruguay by about 30 percent within the same period. This fact is empirically supported by the low rates of convergence in intermediation spreads within the region. The estimates of α_1^d and γ_1^d for *capitalization* and *spread* are also robust to the inclusion of control factors. Holding the effect of the macroeconomy constant in the Mercosur significantly reduces the speed of convergence from about 24 percent(-0.238) to 8 percent (-0.076) per year, evidence of a significant influence of macroeconomic conditions on the pricing of risk in banks within the Mercosur.

[53]Capitalization as an indicator of bank default risk may be inadequate as it may be significantly driven by regulation in a way that cannot be unambiguously linked to bank stability, especially when there is a potential for capital arbitrage.

The funding structure and the liquidity composition of the banks asset portfolio is also analysed in order to explain the curtailment of credit supplied. Lower levels of private sector intermediation in banks can be explained, if banks hold more liquidity after a banking crisis. Both measures of liquid asset holding *(ratios of liquid assets/total assets* and *bank reserves/GDP)* converge at a very high speed. This is evidence that banks preference for liquidity including holding of government securities and excess reserves, may pre-empt lower levels of intermediation in the region. However, the lack of convergence in deposits (*total deposits/assets*) and well as the low rates of convergence in demand deposits (*demand deposits/total deposits*) shows that the persistent run on deposits particularly time deposits are additional factors that may wedge convergence in credit supply.[54]

In summary, there is evidence of persistent decline in private sector credit after systemic banking crises in the Mercosur even though the levels of other bank fundamentals have converged back to the pre-crisis levels and are such that can support increased levels of intermediation. There is also evidence that post-crisis recovery of banks is largely predicated on holding high levels of liquidity and increased lending to the public sector, typically in the form of purchasing highly liquid government securities and holding excess reserves, which is also a sub-optimal pattern of intermediation. The results also hold in the presence of controls for other bank characteristics, the condition of the macroeconomy, and importantly the level of institutional development as well as the structure of the banking system.

There may be endogeneity issues embedded in convergence analysis, as the levels of bank fundamentals may affect factors that condition the movement of bank fundamentals and vice versa. For example, the level of private sector intermediation is dependent on the macroeconomic environment, even though it is possible that the direction of causality may be reversed if economic growth is hampered by lack of intermediation to the private

[54]Continued deposit dollarization in the region causes a shift in deposits from domestic to foreign currency particularly for longer-term deposits. This may explain the lack of convergence of bank deposits since we do not differentiate between deposits in the domestic currency and deposits in foreign currency.

sector—a well-established link in the literature. Therefore conditional convergence is also estimated in which factors that may affect convergence independent of the occurrence of crisis is controlled for. The existence of this bias is worth mentioning even though the results remain robust to it. The next section analyses how the results vary across countries.

5.4.2.1 Results by country

Equation (4) and (5) is estimated for individual countries only using bank-level data and present estimates of α_1^d and γ_1^d in table 4 and 5.[55] We also introduce *the ratio of loan loss provisioning to net interest revenue* to capture another element of bank risk, which may further explain lower levels of intermediation.

Argentina

There is no evidence of post-crisis recovery in measures of intermediation (*loans and loans/asset ratios*) even when the other conditioning factors are held constant. As in the analysis of the full sample, these lower levels of intermediation cannot be attributed to lack of profitability in banks. However, the fact that there is a very high rate of convergence in *loan loss provisioning,* liquid asset holdings and a continued run on deposits in domestic currency may explain the persistent decline in levels of intermediation.

Brazil

In Brazil the high rate of convergence in the measure of intermediation (*loans/assets*) is conditioned by the overall institutional adequacy and banking system structure. This highlights the effective role played by the stabilization measures implemented to

[55] Estimating aggregate data is impossible in the panel of banks by country and the measures will not vary across panels.

strengthen the financial system after crisis on the recovery of bank credit (Cadim De Carvalho 1998, Goldfajn 2000, and Tabak and Staub 2007).

Contrary to the full sample result, there is no convergence in holding of liquid assets and levels of capitalization. The lack of recovery of deposits more or less reflects the shrinking of the institutions surveyed as opposed to a continued on deposits since aggregate levels of deposits remain stable.

Paraguay

In line with the full sample, there is a high rate of convergence in liquid asset holdings, and loan loss provisioning. However, there is no convergence in the measure of intermediation *(ratio of loan to assets)* and in the level of deposits especially longer-term deposits. It also appears that systemic crises and subsequent bouts of banking distress in the region have eroded the level of capitalization of banks as evidence by the lack of convergence, which may have contributed to the shrinking loan portfolio in banks.

Uruguay

Unlike the other countries, there is rapid recovery in levels of intermediation *(loans/assets ratio)*. Other measures of bank fundamentals such as *loan loss provisioning/net interest revenue*, *capitalization*, and *liquid assets/total assets* ratios also show rapid rates of convergence. There is no convergence in levels of deposits and intermediation spreads. Since the crisis in Uruguay is comparatively more recent than in the other Mercosur countries it is possible that post crisis-recovery is ongoing and results may be different in a couple of years.

Table 5.4 Results for Absolute and Conditional Sigma Convergence by Country

	Absolute				Conditional			
	Argentina	Brazil	Paraguay	Uruguay	Argentina	Brazil	Paraguay	Uruguay
					Bank-specific controls			
Profitability								
Return on Assets	**-0.583*** **	**-0.852*** **	**-0.727*** **	0.463	**-0.710*** **	**-0.913*** **	**-0.616*** **	0.400
	0.068	0.221	0.189	0.593	0.069	0.206	0.196	0.615
					0.29* **	**0.27*** **	**0.06*** **	**0.23*** **
Net interest Margin	**-0.660*** **	**-1.069*** **	**-0.540***	0.172	**-0.717*** **	**-1.028*** **	**-0.472***	0.395***
	0.097	0.167	0.305	0.116	0.101	0.174	0.302	0.125
					0.05* **	**0.05*** **	**0.06** **	**0.30*** **
Risk								
Loan Loss Provisioning/net interest revenue	**-0.761*** **	**-1.115*** **	**-0.711*** **	**-0.837** **	**-0.689*** **	**-1.105*** **	**-0.690*** **	**-0.797** **
	0.097	0.102	0.085	0.215	0.106	0.121	0.088	0.281
					0.09* **	**0.15*** **	**0.11*** **	**0.14** **
Capitalization	**-0.421*** **	0.166	0.405	**-0.840***	**-0.545*** **	0.176	0.417	**-1.159** **
	0.103	0.129	0.307	0.393	0.126	0.132	0.347	0.477
					0.05* **	**0.24*** **	0.01	**0.46*** **
Credit Supply								
Loans	-0.065	**0.058*** **	**-0.538*** **	-0.097	**0.640*** **	**0.057*** **	**-1.827*** **	0.316
	0.043	0.018	0.144	0.103	0.074	0.014	0.158	0.245
					0.25* **	**0.01** **	**0.49*** **	0.08
Loans/Assets	-0.112	**-0.726** **	-0.406	**-1.772*** **	-0.178	**-0.876****	-0.632	**-1.250** **
	0.145	0.348	0.511	0.485	0.155	0.356	0.614	0.574
					0.04* **	**0.10*** **	0.04	**0.09** **
Liquidity								
Total Deposits/Assets	-0.054	**0.410** **	-0.703	**0.797*** **	-0.120	**0.193** **	-1.007	**0.999*** **
	0.170	0.173	1.226	0.325	0.109	0.078	1.284	0.095
					0.11* **	**0.03*** **	0.03	**0.34*** **
Demand deposits/Total deposits	-0.051	**-0.400*** **	**-1.450*** **	...	-0.071	**-0.795*** **	**-1.103*** **	...
	0.046	0.109	0.610	...	0.051	0.111	0.431	...
				...	**0.073*** **	**0.07*** **	**0.10** **	...
Liquid Assets/Total Assets	**-1.382*** **	-0.011	**-0.812** **	**-0.505** **	**-1.360*** **	-0.115	**-0.813*** **	**-0.428***
	0.078	0.14	0.323	0.253	0.079	0.124	0.302	0.253
					0.01 **	**0.06*** **	**0.07** **	**0.11*** **

Source: Authors' calculations.

1/ The first row is the parameter estimate, the second row is the standard error, and the final row shows the incremental R2. Nested OLS regressions include all banks. Robust standard errors are reported in parentheses. ***, **, and * indicate statistical significance at the 1, 5 and 10 percent levels, respectively.

Table 5.5 Results for Absolute and Conditional Sigma Convergence by Country

	Conditional							
	Argentina	Brazil	Paraguay	Uruguay	Argentina	Brazil	Paraguay	Uruguay
	Macroeconomy				Institutions			
Profitability								
Return on	**-0.606*** **	**-0.864*** **	**-0.728*** **	0.462	**-0.620*** **	**-0.993*** **	**-0.712*** **	0.316
Assets	0.068	0.211	0.189	0.593	0.077	0.221	0.186	0. 619
	0.10* **	**0.08** **	0.00	0.09	**0.09** **	0.02	**0.06** **	0.09
Net interest	**-0.657*** **	**-1.079*** **	**-0.541***	-0.236	**-0.682*** **	**-1.167*** **	**-0.592** **	-0.232
Margin	0.098	0.166	0.307	0.159	0.102	0.173	0.294	0.164
	0.02 **	0.02	0.01	**0.25** **	0.02	0.01	**0.08*** **	**0.25** **
Risk								
Loan Loss	**-0.761*** **	**-1.191*** **	**-0.712*** **	**-0.807*** **	**-0.827*** **	**-1.080*** **	0.717***	**-0.817*** **
Provisioning/Net	0.100	0.113	0.086	0.226	0.117	0.140	0.081	0.229
Interest Revenue	**0.04*** **	**0.04*** **	0.00	**0.12** **	**0.04*** **	**0.05*** **	**0.06** **	**0.12** **
Capitalization	**-0.430*** **	0.114	-0.389	**-0.766** **	**-0.394*** **	0.096	-0.388	**-0.770** **
	0.104	0.125	0.310	0.396	0.114	0.131	0.313	0.395
	0.00* **	**0.12*** **	0.02	**0.13** **	0.01	**0.04***	0.00	**0.13***
Credit Supply								
Loans	-0.064	0.058***	**-0.550*** **	0.141	-0.055	0.059***	**-0.549*** **	-0.141
	0.044	0.018	0.145	0.106	0.045	0.020	0.146	0.107
	0.00	0.01	**0.04***	**0.11***	0.01	0.01	**0.12*** **	0.11
Loans/Assets	-0.026	**-0.732** **	-0.450	**-1.741*** **	0.143	-0.635	-0.469	**-1.741** **
	0.147	0.351	0.508	0.530	0.155	0.387	0.534	0.537
	0.04* **	0.00	0.02	0.03	**0.04*** **	0.03	0.02	0.03
Liquidity								
Total	-0.052	0.379***	-0.702	**0.811*** **	0.029	0.213***	-0.661	0.811***
Deposits/Assets	0.171	0.149	1.240	0.232	0.173	0.075	1.243	0.234
	0.00	0.04*	0.06	**0.05** **	0.01	**0.04***	0.01	**0.05*** **
Demand	-0.040	**-0.408*** **	**-1.404*** **	...	0.000	**-0.551*** **	**-1.278*** **	...
deposits	0.044	0.101	0.484	...	0.046	0.080	0.095	...
	0.08* **	0.142	0.01	...	**0.14*** **	**0.08*** **	0.01	...
Liquid Assets	**-1.391*** **	-0.027	**-0.791***	**-0.486** **	**-1.402*** **	.-0.078	**-0.794** **	**-0.484***
	0.079	0.137	0.320	0.243	0.079	0.133	0.323	0.245
	0.03* **	0.07	0.03	0.08	**0.02*** **	**0.01** **	0.022	0.08

Source: Authors' calculations.
1/ The first row is the parameter estimate, the second row is the standard error, and the final row shows the incremental R2. Nested OLS regressions include all banks. Robust standard errors are reported in parentheses. ***, **, and * indicate statistical significance at the 1, 5 and 10 percent levels, respectively.

In summary, there are variations in results regarding individual countries compared to the overall sample, particularly with respect to the role played by the conditioning variables

on the rates of convergence. However, some trends remain common. The first is the high liquidity characteristic of the balance sheet *(liquid assets and loan loss provisioning),* which may be sub-optimal for lending. While the observed bank behaviour regarding intermediation and liquidity may indeed be related to past experiences with instability in the region, it becomes a deterrent to private sector intermediation if it nurtures risk aversion. Unfortunately, the lack of convergence in private sector intermediation reported in the overall results may persist since banks in the Mercosur have maintained profitability independent of private sector intermediation.

5.5 ROBUSTNESS TESTS

5.5.1 Alternative Benchmarks

In this section changes in bank behaviour over time is analysed (without distinguishing between pre- and post-crisis period). To do this, an external time-varying benchmark is chosen, which also has the following added advantages. First, the use of pre-crisis average of bank fundamentals itself may be a flawed benchmark for normal bank behaviour. For example, levels of credit supply may be at an unsustainable high before the crisis and hence banks may now be at an equilibrium point that is different from their pre-crisis levels (Kaminsky and Reinhart 1999). Structural changes, regulatory and macroeconomic developments are other factors that can also pre-empt the lack of internal convergence.

Second, the use of a pre-crisis average as a benchmark for normal bank behaviour means that each bank is converging to a different benchmark even though the method of constructing the benchmark remains the same. In other words, the fact that there are different rates of convergence to different benchmarks may sometimes impair the interpretation of convergence. The use of alternative benchmarks mitigates this problem as convergence is not to an internal benchmark which would be unique for each bank, but to a single external benchmark. This enhances the meaning and comparability of the rates of convergence.

In addition, for robustness of the classification of bank behaviour as sub-optimal or not, bank behaviour in the Mercosur is compared to other countries that have experienced systemic banking crises. If some of the sub-optimal bank behaviour reported in the previous section, particularly regarding private sector intermediation, is due to the fact that the pre-crisis levels of the variables represent an unstable equilibrium for banks in the Mercosur, then high rates of convergence (more similarity) are expected to the relatively more stable banking systems used as external benchmarks.

The approach to the choice of alternative benchmarks is termed a "maximum of all feasible standards approach". Since banks differ by characteristics such as size, capitalization and profitability—which implicitly determine their systemic relevance—lack of convergence of some relatively smaller and regional firms will be of less systemic importance. On the other hand, the lack of post-crisis recovery of some large and systemically important bank may further interact with macroeconomic conditions to bias aggregate measures of credit supply downwards. Hence, some of the results in the previous section that show high levels of convergence may be reflecting the ease at which some of these largely capitalized and profitable banks can attain the pre-crisis standards. Hence the need to choose alternative benchmarks high enough to be able to capture behaviour of this group of banks, but also low enough to ensure that it is realistic for banks in the Mercosur to converge to.

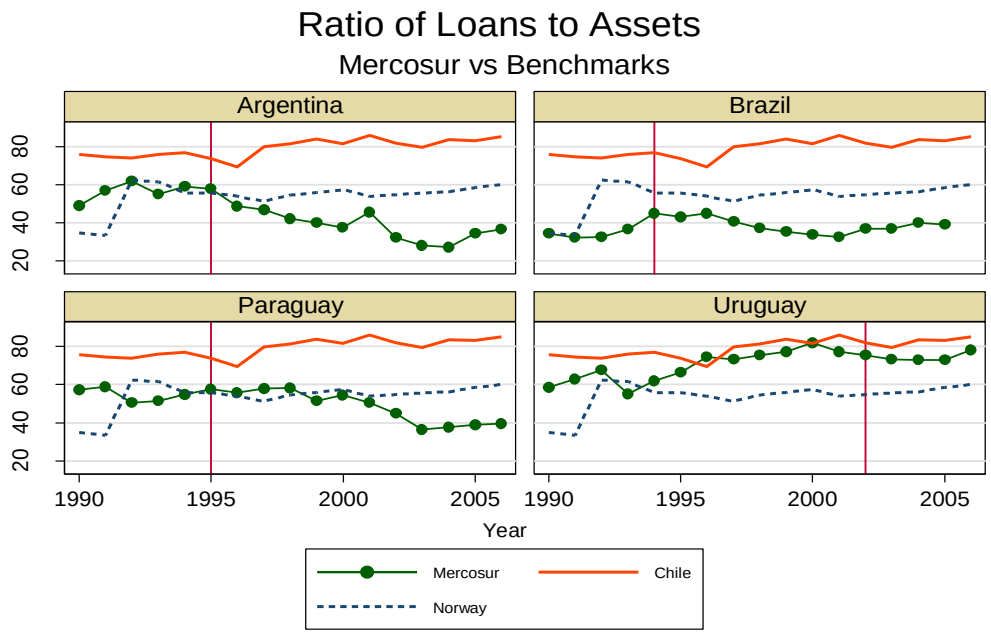
The choice of external benchmark is Chile (regional comparator) and Norway (OECD benchmark). Chile's last systemic banking crisis was in 1981-86 and Norway in 1987-93 (Caprio and Klingebiel 2003). The Norwegian banking crisis also has similar elements to crises in some of the countries in the Mercosur—a rapid economic boom and deregulation during 1984-87. However, sound macroeconomic conditions and well functioning institutions made for much quicker and effectively aided post-crisis stabilization.

Results

The panel dataset in this exercise is assembled in a different way from the canonical model. In using alternative benchmarks, all banks within each country in the original dataset is aggregated by mean values of the variables of interest to end up with a panel dataset identified by countries. Bank level data for the banks in Chile and Norway and aggregate in the same way. Mean values are used as a basis of aggregating the data to limit the influence of extreme values on the results. The results are presented in Table 5.6. Only the macroeconomic and institutional environment is controlled for due to the manner in which the data has been aggregated.

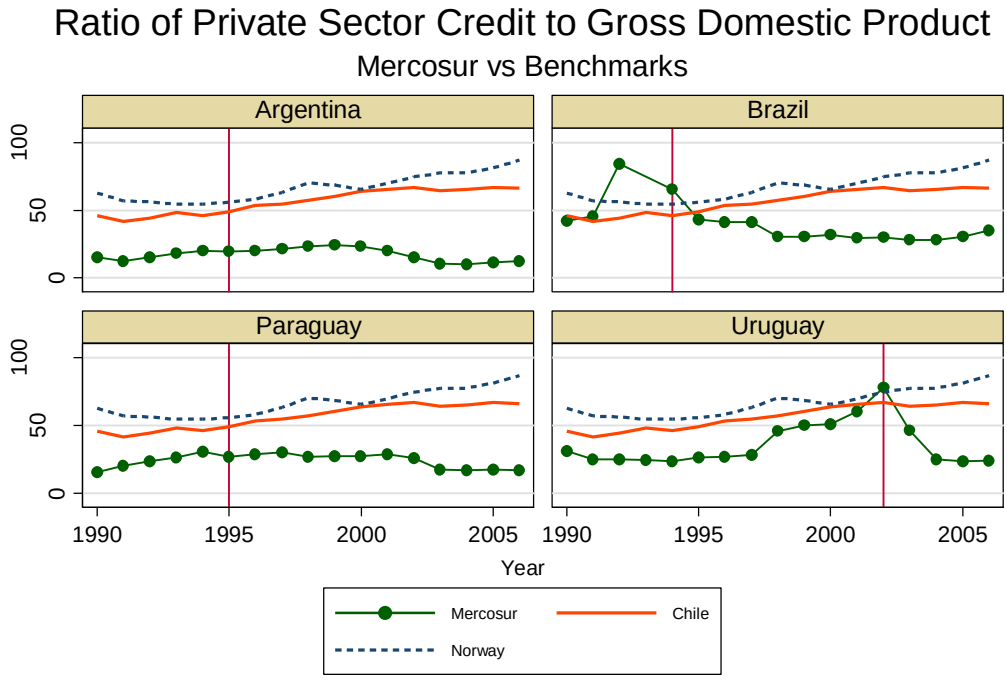
The results also show a lack of significant convergence in the amount of credit supplied particularly to the private sector to both external benchmarks. A more notable peculiarity is the fact that the coefficient of private sector credit is positive and significant (divergence). This means private sector credit has grown at a faster rate in Chile and Norway than in the Mercosur. Figures 5.4 and 5.5 reveal some peculiarities in volumes and nature of intermediation in the Mercosur countries. In Figures 5.4 and 5.5, there is a steady growth in the ratio of loans to assets and private sector credit in the benchmarks as opposed to the decline observed in the Mercosur.

Figure 5.4



Vertical line shows the occurence of systemic crisis

Figure 5.5



Vertical line shows the occurence of systemic crisis

Regarding other bank characteristics, in general there are higher levels of convergence to the regional benchmark than there is to the OECD benchmark even though overall levels of convergence to the external benchmark is lower than to the internal benchmark. Specifically, levels of bank *profitability* in the Mercosur are similar to both benchmarks, even though the estimates of α_1^d and γ_1^d have the right sign, but lack significance when the OECD benchmark is used.

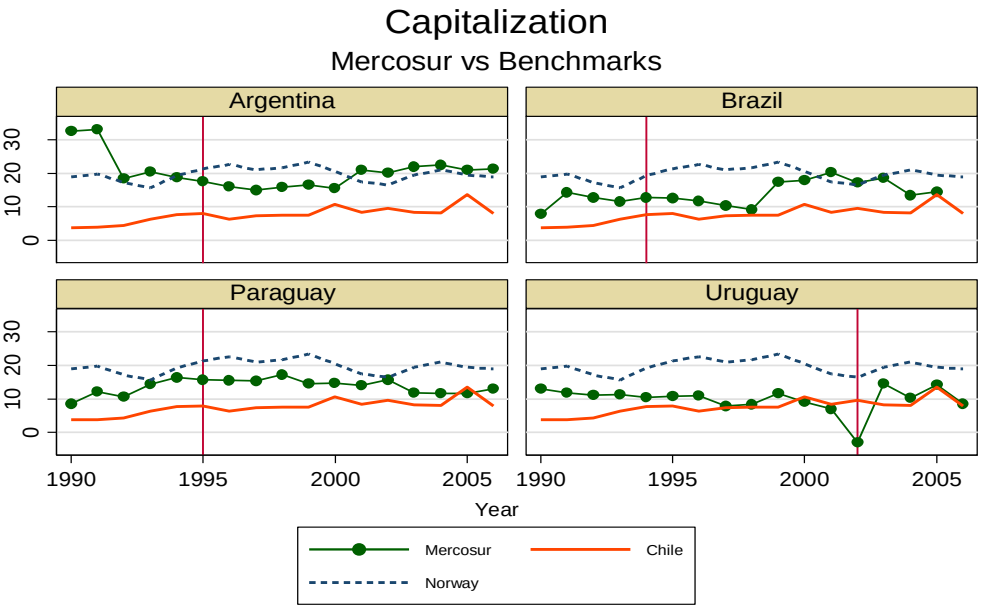
Figure 5.6 shows levels of capitalization in the Mercosur to be between the regional and OECD benchmark. Hence the evidence of rapid convergence to the regional benchmark, and no convergence to the OECD benchmark as the average levels of capitalization in the OECD benchmark exceed the Mercosur's.

Furthermore, intermediation spreads are also higher in the Mercosur than the benchmark countries. The results show that macroeconomic conditions in the Mercosur are the main reason behind the lack of significant convergence in spreads to any of the external benchmarks. This reflects the relatively higher levels of interest rates in the region, as banks typically set a higher interest rates in response to their risk exposure (Gelos 2006 and Angbazo 1996)[56].

In addition, there is evidence that the level of liquidity (Liquid assets and reserves) is consistently higher in the Mercosur particularly after crisis as shown in Figure 7. However, these results are reversed when the institutional adequacy in the Mercosur is controlled for.

[56] Rojas-Suarez (2001) argues that spreads in emerging economies can be interpreted differently compared to industrialized financial markets. This may be because narrow spreads in the latter reflect efficiency but in emerging economies may indicate increased risk taking in banks.

Figure 5.6



Vertical line shows the occurence of systemic crisis

Figure 5.7

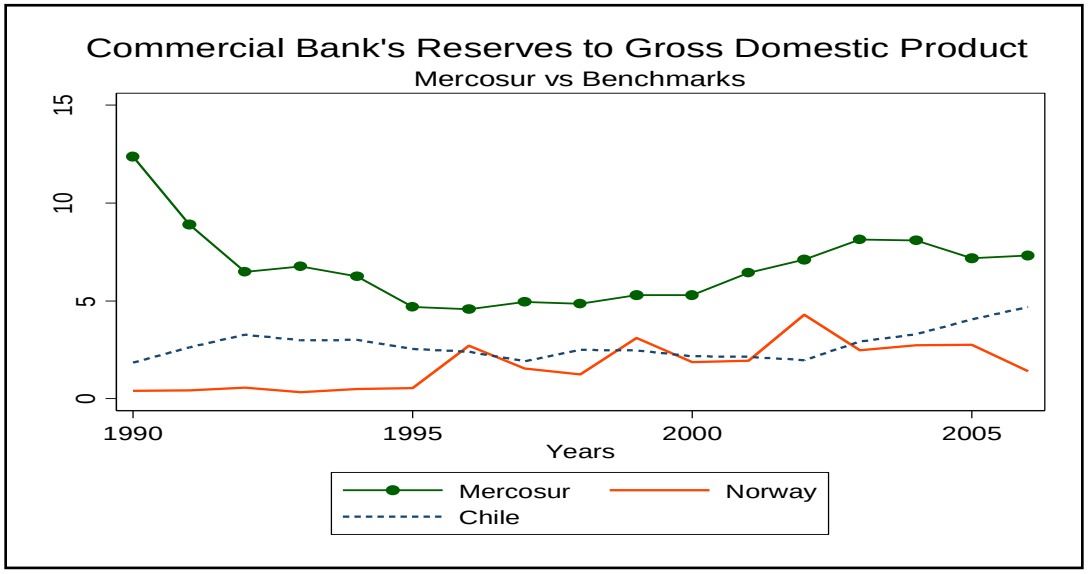


Table 5.6 Summary Results for Sigma Convergence Using Chile and Norway as Alternative Benchmarks

	Absolute		Conditional			
			Macroeconomy		Institutions	
	Chile	Norway	Chile	Norway	Chile	Norway
Profitability						
Return on Assets	**-0.476****	-0.093	**-0.409***	-0.353	-0.516	-0.152
	0.197	0.230	0.205	0.231	0.986	0.309
			0.040	0.17***	0.21*	0.23**
Risk						
Capitalization	**-0.992*****	0.287	**-1.147*****	3.090***	**-1.590****	1.720***
	0.284	0.687	0.271	0.832	0.705	0.934
			0.14***	0.13***	0.17**	0.190
Spread (Lending – Deposit Interest Rate)	-0.401	-0.150	**-1.476***	**-3.457*****	0.402	2.64
	0.732	0.739	0.792	1.041	0.757	3.871
			0.14**	0.21***	0.33***	0.37***
Credit Supply						
Loans/Assets	3.042**	0.310	3.193***	-0.666	1.286	3.919
	1.515	1.000	1.652	0.930	1.920	2.716
			0.09***	0.040	0.200	0.35***
Credit by Banks/GDP	0.441	-1.570	0.478	1.745	-0.566	2.874*
	0.535	1.886	0.665	1.253	0.921	1.435
			0.130	0.26**	0.47***	0.39***
Deposit Money Banks Private Credit/GDP	1.544***	1.544***	1.752***	1.601***	2.673*	1.594
	0.473	0.373	0.478	0.255	1.436	1.090
			0.13***	0.17**	0.14**	0.15*
Deposit Money banks	0.158	0.089	-0.460	0.183	1.078	0.009
Public credit/GDP	0.328	0.275	0.327	0.301	0.682	0.552
			0.33***	0.030	0.51***	0.29*
Liquidity						
Res GDp	-0.349	**-0.455****	-0.448	-0.206	0.198	-0.574
	0.567	0.200	0.567	0.220	0.681	0.544
			0.060	0.11*	0.100	0.120
Demand deposit/GDP	0.225	0.991***	-1.299	0.957***	0.919	1.012***
	0.845	0.039	0.818	0.038	1.104	0.044
			0.32**	0.01*	0.29**	0.04***
Liquid Assets/Total Assets	-0.686*	0.560	-0.630	-0.564	**-0.606*****	**-1.865****
	0.380	0.520	0.380	0.566	0.212	0.848
			0.020	0.020	0.110	0.11**

Source: Authors' calculations.

1/ The first row is the parameter estimate, the second row is the standard error, and the final row shows the incremental R2. Nested OLS regressions include all banks. Robust standard errors are reported in parentheses. ***, **, and * indicate statistical significance at the 1, 5 and 10 percent levels, respectively.

The results show the behaviour of banks in the Mercosur within the sample period is generally not inline with external benchmarks except in terms of profitability and capitalization. The convergence to the regional benchmark in terms of profitability and capitalization is not surprising as profitability may be necessary for the continued existence of the banks, and levels of capitalization may be driven by regulatory requirements. The wide disparity that is observed between the Mercosur and the benchmark seems to have been present before systemic crisis. However, it shows levels of private sector intermediation that are persistently low with no signs of recovery.

5.5.2 The Behaviour of Foreign and Large Banks

The second robustness test is to check if the results regarding the canonical model reported in Table 5.3 are conditioned by type of bank. The reasons are two-fold. First, foreign ownership in banks is expected to reduce the likelihood of failure. This is because of the ability to resort to upstream financing which may stabilize the supply of credit during bad times. Second, large banks benefit from implicit guarantees ("too-large-to-fail"), which makes them more likely to have a higher speed of post-crisis recovery. Both types of bank are systemically important, as post-crisis recovery in large banks may drive the total supply of credit in the economy, while the role of deposit stabilization as a result of depositors "flight to quality" played by both types of banks in times of banking distress helps mitigate the net loss of deposit in the banking system.[57]

As shown in Table 5.7, the results regarding σ-convergence for foreign and large banks closely mirror the results of the canonical model in Table 5.3 with some notable differences. On average, large banks in particular tend to recover *profitability* and *capitalization* quickly. However, they are also key drivers of *intermediation spreads* as shown by the high rates of convergence. This is because their significant market share grants them some monopoly power with which they are able to charge higher spreads. Levels of intermediation *(loans-to-asset* ratios*)* are higher in large and foreign banks than in the overall sample. However, this may also be for two reasons. Larger banks may be

[57]The reverse was the case in Uruguay when the run on deposits initially started with the Argentine foreign banks in Uruguay, which also coincidentally were also the large banks in the system hence aggravating the net loss of deposit.

more active in government financing while foreign banks may be providing credit mainly to large corporations, resulting in a large size of the loan portfolio. If both this situations prevail, then the culmination of these effects will further depress the supply of credit to the private sector.[58] While rate of convergence in demand deposits is lower in large banks, the rate of convergence of liquid assets is almost double that of the total sample confirming the suspicion that large banks are more active in government financing.

As extra measures of robustness, alternative measures of risk (loan loss provisioning) and alternative measures of credit supply (total loans) are used in the re-estimation of the regressions in Tables 5.3-5.5. The result using this other measures are not significantly different from what is reported on variables measuring similar bank behaviour.

In summary, the robustness tests reconfirm the key findings regarding volumes and patterns of intermediation as well as the maintenance of high intermediation spreads particularly in domestic banks. While the levels of capitalization, profitability and risk of banks are such that can accommodate increased private sector lending, the evidence show that macroeconomic and institutional volatility are far more significant in wedging private sector intermediation and spreads.

[58]Only present bank level results are presented, as the results using aggregate data will not differ from what is shown in Table 4.3.

Table 5.7 Absolute Sigma Convergence by Bank Type

	All Banks	Domestic	Foreign	Large
Profitability				
Return on Assets	**-0.602*** **	**-0.669*** **	**-0.774*** **	**-0.922*** **
	0.065	0.071	0.191	0.078
Net Interest Margin	**-0.619*** **	**-0.597*** **	**-0.694** **	**-0.779*** **
	0.084	0.093	0.127	0.099
Risk				
Capitalization	**-0.360*** **	**-0.485*** **	**-0.258**	0.183
	0.09	0.098	0.208	0.116
Credit Supply				
Loans/Assets	**-0.347*** **	-0.171	**-0.682*** **	**-0.719*** **
	0.104	0.121	0.249	0.191
Liquidity				
Total Deposits/Assets	**-0.905*** **	0.182	0.490***	-0.344
	0.04	0.116	0.032	0.295
Demand deposits/Total deposits	**-0.360*** **	-0.053	0.114	**-0.134** **
	0.078	0.064	0.102	0.057
Liquid Assets	**-0.723*** **	**-1.275*** **	-0.067	**-1.476*** **
	0.031	0.077	0.167	0.153

Source: Authors' calculations.
1/ The first row is the parameter estimate, the second row is the standard error, and the final row shows the incremental R2. Nested OLS regressions include all banks. Robust standard errors are reported in parentheses. ***, **, and * indicate statistical significance at the 1, 5 and 10 percent levels, respectively.

5.6 CONCLUDING REMARKS

This chapter explores the post-banking crisis behaviour of banks in the Mercosur, with particular emphasis on fundamental and undesirable changes. Using both bank-level and aggregate data for countries in the Mercosur over the period 1990-2006, a time marked by numerous banking crises, the relationship between bank behaviour before and after the occurrence of a systemic crisis is explored using convergence analysis, and focusing on volume and nature of intermediation. The characterization of sub-optimal behaviour is where there is lack of convergence to *both* the pre-crisis average and to an external benchmark. This two-way analysis is important because categorization by only using other countries banking systems as external benchmarks can be misleading. To the extent that the pre-crisis levels of bank behaviour is a peculiarity of the Mercosur countries and

not a standard for normal bank behaviour, banks in the Mercosur will be different from external benchmarks.

The chapter presents the following key results. There is evidence of a persistent decline in private sector intermediation, which is out of line with internal and external benchmarks. This can be attributed to the role played by macroeconomic and institutional volatility that has nurtured a relatively high level of risk aversion in banks in the Mercosur. There is also evidence that fundamental bank characteristics such as profitability and risk are typically not seriously affected by crises and rapidly converge back to benchmarks. This notwithstanding, intermediation to the private sector is curtailed. Moreover, there is evidence of increased government financing and holding of liquid assets and cash reserves. These results show a greater influence of supply factors on the reduction in bank lending. Therefore, policies aimed at stimulating bank lending should place emphasis on increasing credit supply.

Some caveats are in order. First, one of the weaknesses of the convergence measure is its inability to correctly deal with overshooting—current levels of a variable overshooting their pre-crisis average (very high speeds of convergence).[59] A second concern is that the rate of convergence may be biased by the choice of benchmark for normality. For example, there could be higher rates of convergence when comparing a bank's post-crisis to its pre-crisis level, and otherwise when comparing different banking systems. While these concerns may not be fully alleviated, the main results still stand. In line with the literature, the results show that estimating conditional convergence increases the rate of convergence and mitigates some of the downward bias from using an alternative benchmark.

Finally, some general policy conclusions for post-crisis recovery in bank fundamentals can be drawn from the results. The most fundamental recommendation is to implement policies that bring about a sustained increase of confidence in the banking system. As a

[59] This issue is less of a problem in the growth literature from which the methodology has been adapted, as poor countries GDP per capita do not tend to outstrip that of rich countries (Lucke 2008).

starting point, a stable macroeconomic environment alongside improved prudential institutional frameworks should be prioritized. In addition, it is important to understand the structure of the banking system that may emerge after systemic crisis. This is important if the less desirable effects of concentration and market segmentation are to be mitigated. For example, increased market share of public banks post-crisis may have a detrimental effect on the patterns of intermediation particularly to the private sector while a concentrated banking system may facilitate the maintenance of high spreads.

Appendix 5.1

A review of the IMF's engagement with the Mercosur countries

The use of International Monetary Fund (IMF) programs in the Mercosur countries after the crisis was mainly to achieve macroeconomic stability precipitated by the banking crisis, exchange rate misalignment, debt sustainability and the lack of solid institutional reforms.

Thus the need for structural reforms particularly in the banking system which is crucial to promoting intermediation cannot be replaced by financial arrangements countries have with the International Monetary Fund. In fact the IMF programs in the 1990's and early 2000 were not suited to dealing with banking crises: they tend to disburse too little upfront, and continue disbursing even after the crisis may have subsided.

In determining whether or not the IMF's programs conditions could have contributed to the collapse in private sector credit there are a number of factors to bear in mind:

First, most of the Mercosur countries managed exchange rate policies limited the use of monetary policy as a tool of macroeconomic management. Thus the IMF's focused more on fiscal management and enforcing fiscal discipline. Indeed this excessive focus on stringent structural reforms on the fiscal side meant the fund ignored some other sources of vulnerabilities from the banking sector. A counter argument is that IMF typically sets targets on monetary aggregates with the country authorities which indirectly affect the behaviour of private agents such as banks. Unfortunately some of the monetary targets ended up having negative effects on the level of credit to the banking sector. For example, increase or decrease in private sector credit is a residual outcome of targets on broad money growth in other to reduce inflation. As a general rule, the broader the range of monetary policy instruments at the disposal of the central bank to achieve its monetary policy objective, the lower the probability of reducing negative externalities to other sectors of the economy. Unfortunately, the case of limited instruments, multiple objectives and conflicting targets is all too common in emerging and developing economies.

This section briefly on the failings of the IMF- the major financier of the Mercosur countries during the crises, and highlights the lessons learnt from this experience. The discussion draws heavily on the ex-post independent assessment of the Funds relationship with the authorities for each country. Brazil does not make details of its relationship with the fund publicly available and hence on this occasion, I wish to reiterate that the discussion on Brazil is not based on internal documents but on publicly available information.[60]

Argentina

The adoption of the convertibility regime promoted macroeconomic stability in Argentina. The IMF's endorsement of this plan in hindsight was not based on substantive argument with the Argentine authorities on whether or not the exchange rate peg was appropriate for Argentina over the medium term. Discussions about the exchange rate was further hampered by two main factors; first, in the 1990's the country has the prerogative to choose their preferred exchange rate regime with little weight place on IMF's opinion about exchange rate regimes. Second, the IMF was worried about the sensitivity of discussions about exchange rate policy, since if leaked to the public, may cause a self-fulfilling speculative attack on the currency.

The choice of the convertibility regime also made fiscal policy especially important. Given the restrictions on use of monetary policy, debt needed to be kept sufficiently low in order to maintain the effectiveness of fiscal policy as the only tool of macroeconomic management. As fiscal discipline became an important determinant of the credibility of

[60] Resende, A-L, (1999), Brazil: Analyzing the crisis and prospects for recovery, edited transcript of remarks made made to the 1999 annual meetings of the trilateral commission in Washington D.C, http://www.trilateral.org/AnnMtgs/TRIALOG/trlgtxts/t53/res.htm
IMF, (2005), Uruguay: Ex Post Assessment of Longer-Term Program Engagement—Staff Report; Public Information Notice on the Executive Board Discussion; and Statement by the Executive Director for Uruguay, *IMF Country Report No. 05/202,*Washington D.C

IMF, (2004), The IMF and Argentina 1991-2001, evaluation report by the independent evaluations office, Washington D.C, International Monetary Fund

the convertibility regime, it also became the focus of discussion between the IMF and the authorities during and after the crisis. Insufficient attention was paid to revenue management at the provincial level, and the sustainable level of public debt for a country with Argentina's economic characteristics was overestimated.

The more critical error of the IMF, however, was its weak enforcement of fiscal conditionality. For example, when the annual deficit targets were missed the IMF maintained financing arrangements with Argentina by repeatedly granting waivers.

Brazil

There were two things that clearly went wrong in Brazil before the crisis that increased the countries vulnerability to a banking crisis and impaired private sector intermediation namely exchange rate policy and inadequate fiscal adjustment. Brazil introduced the Real in July 1994; it successfully managed to stabilize prices after over three decades of high inflation. However, the Real was overvalued in relation to the dollar because of extremely high domestic interest rates which temporarily attracted short term capital.
However, in April 1995, the exchange rate policy was changed to allow a gradual devaluation of the real. The government insisted on maintaining high interest rates to finance its increasing current account deficit but this action further worsened the exchange rate misalignment problem. Therefore, during the crises in Asia and Russia, confidence went down and the real was floated, causing a devaluation that also affected stability in the banking sector.
A second view of the problem is that Brazil was not able to promote the necessary fiscal reforms. Fiscal equilibrium in the long run depends on institutional reforms which includes reducing the size of the state. Instead, the government continued to finance a rapidly increasing public debt by increasing interest rates. The fiscal deterioration caused a loss of confidence which provoked the crisis when other emerging markets collapsed.
According to this view, the use of an overvalued exchange rate for so long, combined with high interest rates to attract short-term speculative capital and significant levels of fiscal indiscipline threatened macroeconomic and sparked the banking crisis.

In 1998 after the overhang of the Asian crisis Brazil entered into a preventive arrangement with the IMF. An agreement was reached, with the understanding that Brazil would not devalue. In January 1999, with foreign reserves continuing to fall, in spite of the agreement with the Fund, Brazil tried to change the exchange rate policy. The crawling peg was abandoned and an exchange rate band, with explicit rules of intervention, was announced. After two days it had failed miserably. Faced with massive capital outflow, Brazil had to stop defending the band and to adopt the float.
The attempt to change the crawling peg rate to a band was technically correct, but the timing was wrong. It was too late. Hence the timing and sequencing of the IMFs arrangement and conditions may be questionable.

Uruguay

Uruguay had a series of precautionary stand-by arrangement SBAs that were treated mostly between March 1996 and early 2002. These were viewed as a helpful seal of approval, for the significant reforms undertaken by the authorities during this period. However banking sector reforms—were either not undertaken or completed with a delay.

The IMF broke new ground with respect to the level of access to financing and the decision to explicitly support the lender of last resort function of the central bank in a dollarized economy. This is based on some of the experiences with the crisis of other neighboring Mercosur countries. The move to a float in June 2002 was a decisive moment in the unwinding of the crisis and, even in hindsight, a close call. At that time it was necessary for macroeconomic stability even though it was well understood that floating would cause major losses in the banking system and that the public debt, largely in foreign currency, would become more burdensome.

Paraguay

The persistence of high unemployment and low growth for an extended period of time was a major complication in restoring Paraguay's financial sector stability. Over the past 50 years, Paraguay has turned from being one of the most dynamic economies of Latin

America in the 1960s and 1970s to one of the most stagnant economies in the world in the 1990s and early 2000s. its inability to undertake major structural problems, coupled with poor macroeconomic policies increased uncertainty andreduced levels of investment and capital accumulation.

The financial sector in Paraguay was characterized by an intermediate level of dollarization, high volatility, and a weak banking system. Furthermore, the period 1996 to 2002, was associated with a series of domestic financial crises and global instability (including the Asian 1997 and Russian 1998 crises) and its impact on the regional economy, and some contagion of bad luck from its neighbors as Brazil exits its exchange rate regime in 1999 and Argentina defaulted on its debt in 2001. The start of the economic program supported by the International Monetary Fund coincided with high economic growth and reduction in unemployment rates.

In 2004, almost a decade after its last systemic crisis and after multiple smaller crisis, dollarization in Paraguay was still about one half of deposits and loans. Dollarization in the Mercosur is not just the legacy of a long history of macroeconomic instability but rather the impact of the contagion of financial uncertainty from other countries, and trade and financial linkages with two large neighbors that have turbulent economic history (Argentina and Brazil). Weak supervision of the banking system and external shocks has further contributed to a fragile financial system and reduced levels of private sector intermediation.

Lessons from the Crisis in the Mercosur

• **Lesson 1.** While the choice of exchange rate regime is one that belongs to country authorities, the IMF must exercise firm surveillance to ensure that the choice is consistent with other policies and constraints.

• **Lesson 2.** The conduct of fiscal policy should therefore be sensitive not only to year-to-year fiscal imbalances, but also to the overall stock of public debt.

• **Lesson 3.** When there is no balance of payments need, the IMF should not have financing or other standby arrangement with countries, thus subjecting the country to market discipline which is more stringent than the program reviews by the IMF.

• **Lesson 4.** In order to minimize error and increase effectiveness, the IMF's decision-making process must be improved in terms of risk analysis, accountability, and considerations of spillover effects to the financial sector.

Recommendations

On the basis of these lessons, the following recommendations are made to improve the effectiveness of IMF policies and procedures.

• **Recommendation 1.** The IMF should have a contingency strategy from the outset of a crisis, including in particular "stop-loss rules"—that is, a set of criteria to determine if the initial strategy is working and to guide the decision on when a change in approach is needed.

• **Recommendation 2.** Where the sustainability of debt or the exchange rate is in question, the IMF should indicate that its support is conditional upon a meaningful shift in the country's policy especially when a country seeking exceptional access has a solvency problem.

• **Recommendation 3.** The IMF should refrain from entering or maintaining a program relationship with a member country when there is no immediate balance of payments need and there may be serious political obstacles to policy adjustment or structural reform.

• **Recommendation 4.** A key criterion for exit from IMF arrangements over the next few years completing the resolution and restructuring of the banking system, returning to normal banking intermediation, and ensuring that prudential regulation and supervision are strengthened to avoid future crises.

Appendix 5.2 Variable Definitions and Sources		
Variable name	**Definition**	**Source**
Bank Behavior Variables		
Profitability		
Return on Assets	**Return on average assets**	**Bankscope 2008**
Net interest Margin	**Ratio of net interest income expressed as a percentage of earning assets**	**Bankscope 2008**
Risk		
Loan Loss Provisioning/Net Interest Revenue	**Ratio of loan loss provisioning to net interest revenue**	**Bankscope 2008**
Capitalization	**Ratio of equity to total assets**	**Bankscope 2008**
Spread (Lending –Deposit interest Rate)	**Interest rate spread (lending rate-deposit rate)**	**IFS/WDI**
Credit Supply		
Loans	**Net loans**	**Bankscope 2008**
Loans/Assets	**Ratio of net loans to total assets**	**Bankscope 2008**
Credit by banks/GDP	**Domestic credit provided by banking sector (percent of GDP)**	**WDI**
Private Credit/GDP	**Credit provided to private sector by commercial banks (percent of GDP)**	**Own calculation from IFS**
Public Credit/GDP	**Credit provided to public sector by commercial banks (percent of GDP)**	**Own calculation from IFS**
Liquidity		
Total Deposits/Assets	**Ratio of total deposits to total assets**	**own calculation using Bankscope 2008**
Demand Deposits	**Ratio of demand deposits to total deposits and short term funding**	**Bankscope 2008**
Liquid Assets	**Ratio of liquid assets to total assets**	**own calculation using Bankscope 2008**
Res/GDP	**Ratio of commercial banks reserves/GDP**	**Own calculation from IFS**
Control Variables		
Macroeconomy		
GDP Growth	**Annual percentage growth rate of GDP at market prices**	**IFS/WDI**
Inflation	**Inflation as measured by the consumer price index**	**IFS/WDI**
Total Reserves/External debt)	**International reserves to total external debt. (RES/EDT)**	**WDI**
Institutions		
Governance	**Average of 6 indicators measuring, voice and accountability, political stability, government effectiveness, regulatory quality, rule of law, and control of corruption**	**Kaufman Kraay and Mastruzzi (2008)**
Financial Freedom	**A measure of banking security as well as independence from government control**	**Heritage Index of economic freedom (2008)**
Capital Regulation	**Capital Regulatory Index: summary measure of capital stringency--sum of overall and initial capital stringency. Higher values indicate greater stringency.**	**Own calculalations using the formula prescribed in the World Bank bank regulation and supervision database**
Bank Concentration	**Assets of three largest banks as a share of assets of all banks**	**own calculations using Bankscope (2008)**

CHAPTER VI

CONCLUSION

5. OVERVIEW

The wastefulness of bank instability is a genuine concern in this thesis. Distress in financial institutions can cause "dis-intermediation" - a situation in which banks cannot efficiently channel funds from savers to ultimate users. Furthermore, asset price misalignments that typically underpin financial instability affect consumption and investment decisions, and lead to a misallocation of resources across sectors and over time. This final chapter provides general concluding remarks for each one of the three preceding chapters. This conclusion, highlights the unique contributions of each chapter to the literature, acknowledges limitations of the chosen methodology, reiterates public policy implications of the presented research and identifies avenues for future research.

6.1 Chapter III: Can banks in emerging economies benefit from revenue diversification?

Chapter III presents the starting point of the analysis of the benefits of revenue diversification. This first core chapter offers an empirical analysis into how revenue diversification affects bank stability and performance in emerging economies. Previous studies mainly focus on developed economies and predominantly find a lack of diversification benefits for the following three reasons; first most fee based activities have low switching costs compared to bank loans, this makes income from loans less volatile than non-interest income from fee based activities. Second consider a bank has an ongoing lending relationship the main production input needed to increase volume of loans is variable (interest expense) in contrast the main production input needed to produce more fee based activities is typically fixed or semi fixed (labour expense). Taken together, fee based activities necessitate greater operating leverage making banks more vulnerable to declines in revenues. Third, most fee based activities require banks to hold

little or no fixed assets and hence attract very little regulatory capital, which furthermore encourages diversifying banks to increase financial leverage (DeYoung and Roland 2001). In addition, this chapter presents a methodological advancement in the literature on diversification by using the systems generalised method of moment's estimators to address the endogeneity of the diversification decision. Furthermore, this research considers the impact of the regulatory and institutional environment on the benefits banks obtain from diversification.

Using a dataset of 11 emerging countries over the sampling period 2000-2007, this chapter presents evidence that revenue diversification increases bank profitability and decreases insolvency risk. It finds commission income to be most beneficial compared to other sources of income. The result in this chapter also shows that the benefits are largest for banks with moderate exposure to the risk of failure. The finding is insensitive to controls for bank specific characteristics; two controls for the macroeconomic conditions that bank operate in, and to numerous controls for the regulatory environment. Moreover, the core result for the positive impact of revenue diversification is corroborated in the presence of a broad set of institutional and regulatory controls. The empirical results cast serious doubt on previous research that suggests that there are no benefits to revenue diversification and banks should instead focus their core activities. This is due to the implicit assumption in prior literature that diversified banks will hold a risk efficient portfolio. This assumption is misleading, as banks typically choose how to use up their diversification advantage. Hence a distinction has to be made between potential benefits from diversification as opposed to the actual benefits which is significantly reduced if short sighted investment strategies are being pursued. Furthermore, based on the theoretical review of the literature for and against diversification, this chapter suggests that the "point of departure" in the analysis of revenue diversification should assume the null hypothesis that diversification benefits exists. Therefore, any rebuttal of the null

should also look into the internal structure of the bank for an explanation for why the null is not supported

6.2 Chapter IV: Ownership structure, revenue diversification and insolvency risk in European banks.

Chapter IV builds upon the results obtained in Chapter III and extends the analysis of the benefits of revenue diversification in European banks with large shareholders. Of key importance is the role of financial incentives for large shareholders. The main contribution of the research presented in this chapter is an analysis of how an insider's concentration of wealth in their bank affects incentives to take risk. The ownership structure of the bank is thus an endogenous factor that is isolated to help explain any deviations from the null hypothesis that diversification benefits exist. The intuition for this exercise is drawn from the personal wealth diversification hypothesis which postulates that as wealth concentration increases, the large shareholder bears a greater fraction of the costs associated with value-reducing actions and will be less likely to adopt diversification policies that are wealth destroying. Thus, if diversification is not beneficial to bank stability, the agency cost hypothesis predicts that there will be a negative relation between the level of diversification and concentrated equity ownership. More precisely, levels of diversification in banks with a large shareholder will be risk efficient (Denis et al. 1997).

To this end, this chapter tests two related hypothesis: first, the level of diversification is related to the ownership structure of the bank and second, revenue diversification in banks with a majority shareholder is risk efficient. Importantly, this chapter presents an important and novel way to explain whether or not diversification benefits exist in banks by looking at one of the internal factors that can determine bank strategic investment

decisions. In this chapter and the previous, the endogeneity of the ownership structure as well as the diversification decision is continually stressed. This is because the coefficient estimates are shown to be biased when alternative methodologies that do not address this problem are used. Furthermore, this chapter also offers insight into the impact of the institutional and regulatory environment on the benefits of diversification.

Drawing on a dataset of 153 banks during the period 2000-2007, this chapter uses the ownership structure of banks to explain why diversification benefits may differ across banks. The conjecture is that a large shareholder will seek to limit its own bankruptcy risk by influencing the investment decisions in firms where there wealth is concentrated. The estimation procedure is the three-stage least squares instrumental variables estimators that allows the diversification decision and the ownership structure of the banks to be modelled as endogenous. A vast array of robustness checks support the core results and the results hold when controlling for the number of other subsidiaries the large shareholder owns. When the econometric analyses are re-estimated, with banks that have a diffuse ownership structure (no controlling shareholder), there is suggestive evidence that a diffuse ownership structure will increase revenue diversification even though it is neither profitable nor safe to engage in these activities. The fact that this result is similar to what is reported in prior literature confirms that earlier analysis is incomplete because it does not consider that internal factors may make the diversification decision value destroying.

The benefit of risk efficient diversification is significant. Increasing levels of diversification into non-interest income generating activities reduces insolvency risk by approximately 10.35 percent, and diversifying within the scope of non-interest income activities bank diversify with reduces insolvency risk by 7.40 percent.

6.3 Chapter V: Bank Behavior after Crises in Mercosur

Chapter V examine what happens to the banking system after a systemic crisis. This is due to the following two reasons: First, due to the interlinkages between finance and the real economy the recovery of the financial system particularly banks and output recovery will move pari passu. Second, an analysis of factors that wedge post-crisis recovery particularly of private sector credit supply is highly beneficial in determining how post-crisis recovery can be hastened. In addition, this chapter introduces a methodological innovation to the literature on systemic crisis using convergence analysis. This is attributable to the fact that prior discussion on post-crisis recovery of bank fundamentals is not anchored as it often does not relate current levels of intermediation to a specific standard. To further investigate the abnormal bank behavior after crisis, this chapter contains a direct empirical comparison of bank fundamentals in the countries surveyed to other countries both in the region and outside that have experienced crisis at similar times and have made a full recovery.

Using a panel dataset of commercial banks during the period 1990-2006, the proposed convergence analysis used to analyze the impact of crises on four sets of financial indicators of bank behaviour - profitability, maturity preference, credit supply, and risk show that most indicators of bank behaviour, such as profitability, in fact revert to previous or more normal levels. However, a key finding of the chapter is that private sector intermediation is significantly reduced for prolonged periods of time and that a high level of excess liquidity persist well after the crisis. To that extent, these findings highlight the fact that post-crisis recovery cannot be assumed as given. Precisely convergence analysis shows that a weak macroeconomic setting, poor regulatory and institutional frameworks are responsible for blocking recovery. The same factors are responsible for increasing the dissimilarities between the levels of intermediation in the

Mercosur and other countries. We also show that protracted recovery has somewhat destroyed the capacity of the financial sector to generate credit**.**

6.4 Summary and Public Policy Implications

This thesis offers several important contributions to the literature on bank stability and patterns of intermediation. To this end, different econometric approaches (System generalised method of moments estimators, three stage least squares instrumental variable techniques, and convergence analysis) and a set of different samples (emerging economies, European, and Mercosur (Latin America) are employed for the purpose of this thesis. Using different samples has the advantage of supplementing most of the research in banking and finance which focuses on the most efficient markets in the world, in particular the US and Europe. This is because the conditions of these markets are most likely to be consistent with the assumptions of existing models and there is abundance of data for these economies. However, many emerging markets do not behave like developed markets, therefore the challenges that emerging market data poses to the researcher should be appreciated. Nevertheless, given the relation between finance and the real economy the research on emerging economies have a chance to make an impact beyond the research community, with the benefits often measured in macroeconomic terms. According to Bekaert and Harvey (2002), the benefits of research on emerging economies and its subsequent impact on economic growth can be measured not just in currency terms but in the number of people that are elevated from a desperate level of poverty to a more adequate standard of living.

Throughout Chapter III and Chapter IV, robust empirical evidence in a cross-country setting is found that higher levels of revenue diversification increases bank performance and risk. Chapter IV highlights the role of the governance structure on risk taking

behavior. The consideration shown in this thesis for wealth concentration effects could significantly alter prior findings in the literature if the owners of bank equity capital are more risk averse than otherwise expected. Chapter V focuses on bank behaviour after systemic crisis and furthermore aims to identify abnormal behaviour in banks after systemic crisis in respect to some specific benchmarks of "normal" post-crisis behaviour. This chapter provides a completely new approach to gauging post crisis recovery in banks. The result indicates that prior econometric techniques used in the literature are silent about when the disequilibrium in the credit market becomes abnormal. Evidence is provided in this chapter to show that any bank behaviour that is neither in line with pre-crisis levels or other relatively stable banking systems can be classified "abnormal".

These results give rise to important public policy considerations: first it is extremely relevant to note that the robustly positive association between revenue diversification, bank performance and soundness in Chapter III and Chapter IV stands in contrast to a group of researchers in the existing literature as no evidence is found for a trade-off between diversification and bank soundness. The results offered in this thesis directly addresses regulatory and supervisory concerns about broadening investment powers in banks. The results show that there is no compelling reason to restrain bank activities; however, banks ownership, managerial structures and specific characteristics that influence investment decisions should rather be subject to more scrutiny. Consequently, policy discussions and bank regulations based on the predominant view in the literature may warrant a re-evaluation. Second, the results presented in chapter V is particularly relevant and timely as national and supranational regulators of both developed and developing economies will be seeking to limit further output losses from the current crisis and are thus extremely interested in understanding the complexities of post crisis recovery of bank fundamentals particularly credit supply. The results presented in chapter V also has significant implications for supervisory agencies and bank regulators

particularly in emerging economies who need to ensure that the risk averseness of banks in these countries post-systemic crisis, does not permanently alter the patterns of intermediation – in which case banks show a preference for liquid assets as well as government securities to the detriment of economic growth. The success of this "pseudo banking strategy" raises concerns for growing fiscal indiscipline in economies where government funds it expenditure by borrowing internally from banks. The finding that macroeconomic that the regulatory and institutional frameworks can be strengthened to encourage lending may well be welcomed by regulators themselves who may find the task of monitoring "pseudo-banks" to be daunting. For example, the market segmentation due to larger number of these peculiar banks or increased market share of public banks post-crisis may have a detrimental effect on the patterns of intermediation to the private sector. Also, a concentrated banking system may facilitate the maintenance of higher spreads. Finally, Chapter V points out a significant influence of supply factors on the reduction in bank lending. Therefore, public policy debates and regulatory initiatives should be aimed at stimulating credit supply to the private sector.

6.5 LIMITATIONS

While this thesis presents very strong results and wide ranging implications for regulators, bank managers and owners as well as the general public, an assessment of the fit of the chosen methods and techniques is in order.

First, in Chapter III, the SYS-GMM methodology used is particularly sophisticated and adept to deal with endogeneity problems. However, the method is complicated and can be susceptible to data mining and over fitting of the model - a situation where additional instruments are added to the regression until the coefficients of the regressors conform to the researcher's expectations. While the literature using this new methodology is not deep

enough to suggest ways of detecting the abuse of the model, Roodman (2006) mentions the importance of reporting the instruments used in laying the researchers concern to rest. It is however, difficult to report on the large number of instruments in the estimations, the majority of which are internally generated. Therefore, a simpler albeit sufficient method for addressing endogeneity concerns is presented in Chapter IV.

Second, the analysis in Chapter III and IV only uses listed banks in the countries surveyed. In emerging economies this may cause a selection bias as listed banks are comparatively larger, more stable, demonstrate greater technological advancement and financial innovation which better places them to benefit from diversification, limits the general applicability of the results within countries and exaggerate the benefits of diversification. It should be noted that there are significant benefits to using these banks in terms of data availability, limiting reporting gaps and errors and ensuring that liquidity concerns as well as poor access to capital is not influencing the results which in my opinion outweighs the cost. Also, while this bias may cause fewer banks to enter the sample, the sample still remains representative as the concentration of total assets in the banking system within sampled banks are high. This problem is less acute in developed economies.

Third, the findings in Chapter IV support the conjecture that the causes of inefficient levels of diversification lie within the bank and should not be attributed to the lack of diversification benefits for banks. While, the results show that the ownership structure in banks is one of the internal factors that can determine how banks benefit from diversification we are unable to provide an exhaustive list of factors that affect the benefits from diversification. Hence there may well be scope for other factors other than ownership structure to influence the diversification decision. Another limitation of the applicability of the conjecture and indeed the personal wealth diversification hypothesis

that supports it is the lack of distinction between different types of shareholders. It is intuitive to see how a large shareholder who is an individual may actively monitor a bank where its wealth is concentrated, however if the majority shareholder is a business group, the assumption of active monitoring may be weakened as large shareholdings need not imply wealth concentration.

Fourth, the convergence methodology in chapter V is unable to correctly deal with overshooting — current levels of a variable quickly exceeding their pre-crisis average (very high speeds of convergence). While, this issue is less of a problem in the growth literature from which the methodology has been adapted, (Lucke 2008) it can quickly become a problem in bank level data. For example levels of capitalisation may be low in banks prior to systemic crisis and capital adequacy reforms implemented after systemic crisis will thus cause current levels of bank capital to outstrip their pre- crisis benchmark. In order to address this problem, graphical analysis is also employed to rule out "overshooting" as a reason for the lack of convergence.

Finally, the use of convergence methodology raises a second concern regarding the bias caused by the choice of benchmark for normality in the following two ways. First, bias originates from the implicit assumption that pre-crisis levels of bank fundamental represent equilibrium for banks. It is easy to see how this may not be the case. For example, in Brazil private sector intermediation before systemic crisis was unsustainably high and is therefore not a desirable equilibrium for banks and their regulators. Second, the rate of convergence may be more rapid when comparing a bank's post-crisis to its pre-crisis level (internal convergence), and otherwise when comparing different banking systems (external convergence). While these concerns may not be fully alleviated, with regards to the first source of bias, graphical analysis strongly shows that the lack of convergence in private sector credit is not because the benchmark is excessively high, but

because private sector intermediation has been falling steadily for over 12 years and more discomforting is the subsequent rise in credit to the public sector. Regarding the second concern, in line with the literature, estimating conditional convergence is found to increases the rate of convergence and mitigates some of the downward bias from using alternative benchmarks. Therefore the main results remain intact.

5.6 AVENUES FOR FUTURE RESEARCH

This thesis is comprehensive in analysis, coverage and methods used. The results shown will re-ignite research ideas and advance the debates in the different areas of the banking and finance literature, - as should all research of good quality. This chapter also demonstrates an awareness of a number of valuable avenues for future research as outlined below:

First, considering the divide in the empirical literature on revenue diversification, the need for a strong qualitative analysis is therefore pertinent to clarify some of the conjectures and indeed tested hypothesis in the literature. This alternative method of analysis will consist of interviews and qualitative surveys on strategic decision makers in the banks operational structure including managers who implement the investment strategies. The main aim will be to get an operational perspective on why the proposed and actual benefits of diversification diverge and also to get insight into the challenges of operating a successful diversification strategy. The benefits from this type of research are significant. This is because the practitioner's insight will help anchor the debate and sometimes conflicting results on similar samples obtained in the literature and will suggest the direction in which future research can be most beneficial to all stakeholders.

Second, more detailed study needs to be undertaken to determine how specific regulatory initiatives influence the diversification decision and indeed the benefits derived from diversification. While the results in Chapter III and IV controls for the influence of some of this regulations, valuable insights can be gained by splitting the sample based on the intensity of specific bank regulations, and controlling for how the interaction between specific policy instruments affect the benefits of diversification.

Third, while this thesis offers robust evidence for benefits of diversification in banks with large shareholders, it does not aim to fully separate the ownership structure from bank performance, or understand which other factors will produce similar results. Therefore, a rigorous attempt to disentangle the impact of ownership structure in banks and investment decisions need to be undertaken in greater detail, this may take the form of explicit modeling or simulating the impact of a diffuse ownership structure on bank performance. It is possible a true picture of the factors driving decisions about risk at banks may only emerge when factors such as manager stockholdings, monitoring, and wealth diversification of large shareholders are all examined at the same time (Sullivan and Spong 2007). These issues remain in the realm of the author's interests but are beyond the scope of this thesis.

Fourth, there is scope to continue to refine the benchmarks used to proxy "normal" bank behaviour. While some criticisms may arise as to the necessity of such a strong assumption, these fears will be allayed, the greater the sophistication of the method used to derive the benchmark, and the more it coincides with a desirable equilibrium that banks across continent can aim for.

In addition, the analysis in chapter V stresses the varying effects of groups of macroeconomic, institutional and regulatory variables, as well as bank specific

characteristics on the persistent deviation of bank fundamentals from “normal”. Future research could explicitly model the link between each of these variables and the convergence measures employed, and propose detailed means of correcting the negative influence of the implemented regulations.

Finally, the sample coverage of the distinctive pieces of research in this thesis could be extended. To circumvent the problems associated with the large dataset of banks that ensues, the analysis can move from the micro - to the macro prudential approach which focuses on the overall performance of the banking system. A macro-perspective would place greater emphasis on the exposure of banks to common shocks. Furthermore, by stressing the objective should not be to limit insolvency risks of individual banks per se, but to focus on the systemic consequences of financial distress, the macro-prudential approach can limit the risk official indiscipline that tends to provide excessive protection to the financial system (Crockett 2002).

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