Schriften zum europäischen Management
Roland Berger School of Strategy and Economics
Hrsg.

RESEARCH

Hartmut Brinkmeyer

Drivers of Bank Lending

New Evidence from the Crisis

Roland Berger
School of Strategy and Economics

Springer Gabler

Schriften zum europäischen Management

Herausgegeben von/edited by
Roland Berger School of Strategy and Economics
Academic Network
München, Deutschland

Die Reihe wendet sich an Studenten sowie Praktiker und leistet wissenschaftliche Beiträge zur ökonomischen Forschung im europäischen Kontext.

This series is aimed at students and practitioners. It represents our academic contributions to economic research in a European context.

Herausgegeben von/edited by
Roland Berger School of Strategy and Economics
Academic Network
München, Deutschland

Hartmut Brinkmeyer

Drivers of Bank Lending

New Evidence from the Crisis

With a foreword by Prof. Dr. Christoph J. Börner

Springer Gabler

Hartmut Brinkmeyer
Düsseldorf, Germany

Dissertation Heinrich-Heine-Universität Düsseldorf D61 / 2014

ISBN 978-3-658-07174-5 ISBN 978-3-658-07175-2 (eBook)
DOI 10.1007/978-3-658-07175-2

The Deutsche Nationalbibliothek lists this publication in the Deutsche Nationalbibliografie; detailed bibliographic data are available in the Internet at http://dnb.d-nb.de.

Library of Congress Control Number: 2014949154

Springer Gabler

Printed on acid-free paper

Springer Gabler is a brand of Springer DE.
Springer DE is part of Springer Science+Business Media.
www.springer-gabler.de

FOREWORD

The recent financial crisis hook the banking system to its very foundations. While the most acute phase of the crisis seems to be over, very challenging questions remain unanswered. In their capacity as financial intermediaries, banks both generate profits and contribute to social welfare by taking risks. Yet when the crisis revealed that there may be strong incentives for them to go too far, they were forced to reduce their risky positions in a very short space of time. This in turn, however, may result in less social welfare, particularly in the context of banks' lending business. Lending is the most significant source of both income and risk for the banking sector, but it is also the one outcome of financial intermediation that carries the greatest social importance. A number of studies have already analyzed the lending behavior of banks during the crisis. However, only a few studies examine the characteristics of banks and how they influence the supply of bank loans. Evidence for European banks in particular is very scant.

Hartmut Brinkmeyer's dissertation contributes to this field of research not only on a general level, but also with respect to individual euro area countries. His analysis provides a wealth of detailed results. One broad finding is that significant relationships exist between lending and bank characteristics. In particular, the level and nature of influence differs between countries and between times of crisis and normal times. While great care must – as always – be taken when interpreting these results, they clearly deliver a profound insight into the lending behavior of European banks. The findings of the study are the fruit of a well-founded theoretical framework. To develop hypotheses, the author applies a wide range of theoretical approaches to the transmission of monetary policy, nevertheless focusing primarily on the “new view of the bank lending channel”. This modern theoretical approach is tested against a proprietary set of data. The econometrical design deploys a number of remarkably innovative ideas. First, the author implements a bank-specific, self-chosen target capital ratio in which the capital structure of a bank is driven not only by general regulatory rules, but by internal considerations as well. This approach enables management decisions to be introduced in a sophisticated and realistic way. Second, the study adopts a very convincing approach to the disentanglement of loan supply and loan demand.

While some of the findings may line up with expectations, others are surprising indeed. The study explicitly urges academic and practical discussion; and I am convinced that it will have a place in the ongoing discussion of how banks acted in the crisis. My hope is therefore that this dissertation receives the attention it deserves.

Düsseldorf, April 2014

Christoph J. Börner

ACKNOWLEDGEMENTS

An undertaking such as writing a dissertation is a great challenge. Thinking of some hard times I had while working on it, I can definitely confirm that. At the same time, however, it has also been a very satisfying task, because I had the opportunity to work on a subject that I am truly interested in. This was one of the best sources of inspiration and motivation I could possibly have and that gave me the stamina and discipline required to pursue and successfully accomplish the present work.

All this would not have been possible without support of some people who I would like to acknowledge here.

First and foremost, I would like to express my profound gratitude to my thesis supervisor Professor Christoph J. Börner who accepted me as his doctoral candidate. I very much appreciate his style, his constructive guidance and his stimulation which made it easy for me to keep going. It has been a real pleasure to work under his supervision. I also want to thank Professor Ulrike Neyer who agreed to take the role as co-supervisor. Her unpretentious and enthusiastic nature is truly admirable.

My employer, Roland Berger Strategy Consultants, gave me the opportunity to take time off for my dissertation. During that time I received support in many different ways. Hence I would like to express my gratitude to the partner team of the CC Financial Services for nominating me for the company's PhD program and to Christian Krys for organizing it as well as for a great number of helpful pieces of advice. Thanks also to my colleagues Dirk Thiele and Süleyman Ertan for their support in accessing the required data.

Finally, I want to thank those whose contribution was less related to content but even more valuable and special: my family and especially my wife, Anne. Writing a dissertation is not always easy. Without your support, encouragement and understanding this undertaking would not have been possible and I would have never come this far.

Düsseldorf, June 2014 *Hartmut Brinkmeyer*

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF NOTATIONS AND ABBREVIATIONS[i]

CBPP	Covered bond purchase programme
Coeff.	Coefficient
e.g.	Exempli gratia; for example
ECB	European Central Bank
EMU	Economic and Monetary Union of the European Union
Eonia	Euro OverNight Index Average
et al.	et alii
et seq.	et sequens; and the following
etc.	et cetera
Euribor	Euro Interbank Offered Rate
FED	Federal Reserve System
FN	Footnote
GDP	Gross domestic product
GMM	Generalized method of moments
HICP	Harmonized Index of Consumer Prices
mon. pol.	Monetary policy
n.a.	Not applicable / not available
no.	Number
obs.	Observations
OIS	Overnight indexed swap
OLS	Ordinary least squares
Std. dev.	Standard deviation
Std. error	Standard error
UK	United Kingdom
US	United States

[i] Does not contain the variables used in the empirical section (see table 7.2)

1. Introduction

1.1. Motivation

The recent crisis has presented a major challenge to banks, monetary policymakers and the stability of the financial system as whole. The collapse of the investment bank Lehman Brothers marked the starting point of a protracted crisis period that went through different aspects and phases (e.g. the subprime lending crisis, banking crisis, global financial crisis and sovereign debt crisis). The latter phases are still ongoing.

Banks and monetary policymakers were impacted by the crisis in important and connected respects. The banks' granting of credit – one of the most important functions of banks in the economy – was temporarily threatened by serious disruptions. Since the lending business is the most significant source of income to the banking sector, the inability to supply credit does not only endanger profitability but, even worse, it also poses an existential threat to almost any bank. When faced with the crisis it took banks great efforts to prevent the worst consequences.

The subsequent challenge for monetary policymakers was based on the fact that one transmission channel of monetary policy impulses works through banks and impacts the supply of loans. Accordingly, the observation that the banks' ability to supply credit was threatened by the crisis has called the effectiveness of monetary policy and the achievement of its ultimate goal, i.e. price stability, into question.

However, only few studies address the question of which bank characteristics affect the supply of bank loans, especially during the recent crisis, and the available empirical evidence is relatively weak. What is missing is a systematic review of the crisis and its mechanics that focuses on the issue of bank lending.

Another gap in current research exists regarding the analysis of possible differences in the impact of certain bank characteristics on the supply of bank loans *between individual euro area countries*. The integration of European financial markets and the introduction of the euro as a single currency seem to have concentrated scholars' focus on the euro area as a whole. However, current discussion of whether key interest rates are appropriate for all euro area countries alike and the observation

H. Brinkmeyer, *Drivers of Bank Lending,* Schriften zum europäischen Management,
DOI 10.1007/978-3-658-07175-2_1, © Springer Fachmedien Wiesbaden 2015

that the crisis developed differently in different countries, while only ranking as anecdotal evidence, nevertheless points to the real existence of institutional and economic disparities that should not be neglected.

The present study addresses these gaps. It aims to deepen our knowledge of those bank characteristics that impact bank lending and the mechanics that play a role in this process, especially in light of the recent crisis.

1.2. Research questions and contribution

Generally speaking during the recent crisis banks were particularly affected toward the beginning.[1] Although this most threatening phase of the crisis is over and despite its severity and significance, studies devoted to analyzing the crisis with respect to banks and bank lending are still very much underrepresented in relevant literature. Only a very small number of such studies is available so far. The present dissertation seeks to address this issue.

Overall, this research undertaking focuses on the determinants of the supply of bank loans in the euro area especially during the crisis, and on their implications. The basic idea of the study can be summarized by four main research questions:

- Which bank characteristics have an effect on the supply of bank loans?
- How did the impact of bank characteristics on lending change during the crisis?
    - Which bank characteristics gained or lost influence?
    - Which bank characteristics had no impact on lending before the crisis but did play a role during the crisis?
- What are the implications for bank management and banks' business models?
- What other implications are of relevance to monetary policymakers and the debate on macroprudential supervision?

In this context, the euro area as a whole comes under scrutiny, but so too do the four most important euro area countries (Germany, Italy, France and Spain). Examining those bank characteristics that, according to existing literature, have been proven to affect bank lending, putting them in the context of crisis and analyzing their differential impact is one aspect of the present study. At the same time, it also

[1] The exact definition of the crisis period relevant in this study is discussed in section 7.4.3.2.

considers two other largely unexplored economic concepts. The first is whether a bank has a capital surplus or deficit *relative to a bank-specific, self-chosen target*. As argued below, there are good reasons to assume that banks target individual capital ratios. This being the case, it is natural to look at the impact on bank lending when such a target is missed or exceeded. This goes beyond the conventional analysis of "pure" capital ratios. The second is whether a bank is characterized by an overhang of insured retail deposits over the amount of loans (a "deposit overhang"). Any such overhang should make it easier for banks to fund their loan portfolios and other assets, which is an important aspect in context of banks' funding strategies.

Special attention is given to identifying the crisis period that is relevant in this context. The term "crisis" covers different aspects and phases, not all of which are equally important to all the research questions. The most relevant aspects and phases are those in which the banks were most seriously affected.

Another important issue regards the correct disentanglement of loan supply and loan demand (the "identification problem"). When certain events impact on factors that influence loan supply *and* loan demand *at the same time*, it becomes hard to distinguish whether the change in the observable loan volume on banks' balance sheets should be ascribed to supply-side or demand-side factors. Hence, a thorough identification strategy is chosen to ensure correct identification. In a novel approach, an attempt is also made to make use of information on loan demand contained in answers gathered in the euro area bank lending survey.

By answering the research questions, this study contributes to the existing literature in several ways: First, it deepens our understanding of the role of bank characteristics, especially under crisis conditions, and allows implications to be derived for the management of banks. This knowledge can help managers to organize banks in a way that is more resilient to adverse economic conditions. Second, a comprehensive framework into which all bank characteristics can be integrated is derived from literature on the bank lending channel. This framework can be used to show how the crisis altered the way in which bank characteristics affected the supply of loans – a finding that can be explained by the debt-deflation mechanism and liquidity spirals. The framework also reflects a new, up-to-date view of the bank lending channel that has not previously been presented in literature. Third, although it is not a focus of the study, the fact that measures taken by the ECB during the crisis

to restore the banks' ability to grant credit are accounted for in the empirical estimations also permits an assessment of the effectiveness of these measures. This information is valuable because the ability of banks to supply loans is an important cornerstone of economic activity and prosperity. Fourth, this study has implications for the debate surrounding macroprudential supervision.

1.3. Scope and limitations

This study focuses on the role of certain bank characteristics and their significance for the supply of bank loans. It is particularly interesting to note how the impact of these bank characteristics changed during the recent crisis relative to "normal" periods, and to explore the implications this has for bank management. To find an empirical answer to this question, a new framework is presented that accounts for developments regarding the integration of European financial markets and the field of financial integration, but that also captures the impact of the crisis on the role which bank characteristics play in the context of bank lending.

Although the framework derives from literature on the bank lending channel, this dissertation is not explicitly devoted to confirming the existence of a bank lending channel. Nor is it primarily geared to contributing to the debate on macroprudential supervision which seeks to answer the question of how not only individual financial institutions but the financial system as a whole can be made more resilient to crises. While not *focusing* on these adjacent fields of research, the findings of this study nevertheless certainly do have implications for monetary policymakers and for the debate on macroprudential supervision, over and above their implications for bank management.

The geographical focus of this study is on the euro area. In addition to analyzing the euro area as a whole, it also studies the four most important individual euro area countries (Germany, Italy, France and Spain). Since the number of banks per country is too small outside the four named ones, analysis of *every* euro area country is prevented by concerns about the validity of the results,.

The temporal focus is clearly on the recent banking crisis. In this context, it is important to note the period that was chosen for investigation: The sample period begins with stage three of European Economic and Monetary Union (EMU) in 1999 when the common monetary policy was introduced. It cannot be ruled out that this

event marks a structural break in the way bank characteristics impact bank lending so that an earlier begin of the sample might have biased the results.

This study is subject to a few limitations that are primarily of a technical nature and are caused by the character of the data. These are discussed in section 9.6 and allow to identify potential areas for future research.

1.4. Organization of the research

The research structure is shown in figure 1.1 and consists of five major blocks. The first block gives an introduction to the topic, presents the research question and sets the scope (chapter 1). It is complemented by an introduction to the transmission channels of monetary policy in chapter 2 that lays the basis for the theoretical framework in the second block.

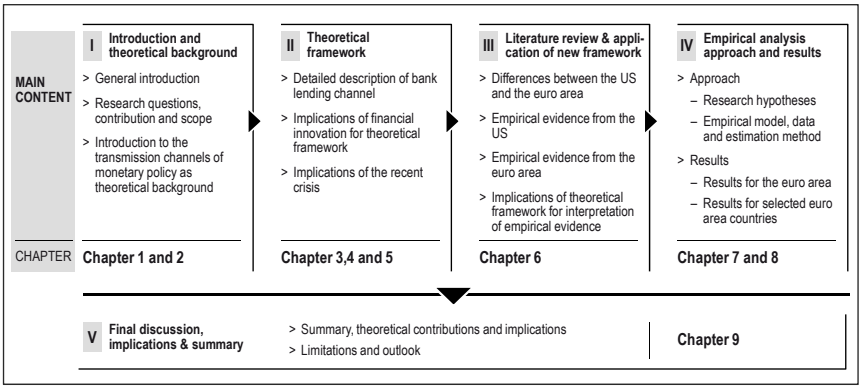


Figure 1.1: Organization of the research

The second block starts with a detailed description of the bank lending channel (chapter 3), complete with all its conditions and subconditions. No state-of-the-art theoretical framework would be complete without an account of the implications that developments in financial innovation have had for bank lending and the bank lending channel (chapter 4). This block also describes the theoretical foundation for the idea that certain bank characteristics have a different impact on lending during the crisis than they do in "normal" periods (chapter 5).

The third block comprises a review of relevant literature and is divided into empirical evidence obtained for the US and for the euro area (chapter 6). It concludes with

implications that derive from the theoretical framework for the interpretation of the available empirical evidence: By developing the theoretical framework further and by linking its economic concepts to the bank characteristics reviewed in literature, it represents a new systematization of bank characteristics in their ability to impact loan supply.

The fourth block – the biggest one – explains the empirical approach (chapter 7) and presents the results (chapter 8). Part of the approach includes explicit formulation of the hypotheses to be tested, the data sources and data handling method, and an outline of the estimation methodology. Chapter 8 presents all results for the euro area as a whole and for the four countries analyzed individually.

The final block (chapter 9) concludes with a summary of the results, the contributions they make to the body of research and the implications they have in practice, before looking ahead to possibilities for further research.

Although the various blocks differ in length, each one plays an important role. The first block spells out the author's motivation for choosing the topic and tackling this research undertaking. It also guides the reader regarding what to expect from the present study and provides an introduction to the subject matter. The second block builds a theory to prepare the ground for empirical analysis. The literature review in the third block identifies the research gap, which is addressed in the fourth block, the empirical analysis. The fifth block formulates the implications for bank managers, monetary policymakers and the discussion of banking supervision. It also elaborates on the contributions this study makes to the existing literature body and suggests possible directions for future research based on the findings.

2. Transmission channels of monetary policy

There is a consensus among economists that the instruments of monetary policy are able to generate real effects – at least in the short run. The exact mechanism is still the subject of controversial debate. Some time has passed since Milton Friedman concluded that “long and variable lags” are involved in transmitting monetary policy impulses (Friedman (1960), p. 87); yet the controversy has remained.

To shed some light on the question how the transmission of monetary policy works, this chapter introduces the topic and outlines the most important transmission channels.

This discussion then lays the basis for a detailed review of the bank lending channel in the next chapter (chapter 3). That is important, because the bank lending channel is a key tenet of the theoretical framework that is necessary to explain the determinants of banks’ lending reactions.

2.1. The money view

The most widely shared view on monetary policy transmission can be summarized under the heading "the money view".[2] The most important representative of the money view is the traditional interest-rate channel, which explains the effect of monetary policy on aggregate spending through changes in interest rates.

This mechanism is based on two key assumptions. The first assumption is that the central bank can affect the short-term nominal interest rate. This is doubtless the case, as empirically supported by Mojon (2000), for example. Control over the short-term *nominal* interest rate enables the central bank to influence both the short-term and long-term *real* interest rates. In seeking to understand the transmission from nominal to real short-term interest rates, the key concept is "price stickiness". Due to

[2] The systematization of the money view presented herein follows Mishkin (2010), chapter 26. Different approaches are taken by Bofinger (2001) or Jarchow (2003), for example.

H. Brinkmeyer, *Drivers of Bank Lending,* Schriften zum europäischen Management,
DOI 10.1007/978-3-658-07175-2_2, © Springer Fachmedien Wiesbaden 2015

factors such as menu costs and money illusion,[3] the aggregate price level adjusts slowly, with the result that an expansionary monetary policy shock lowers not only the nominal but also the real short-term interest rate.[4] The relationship between real short-term interest rates and real long-term interest rates is established by a concept called expectations theory and works as follows: In line with expectations theory, it follows that real long-term interest rates are the average of expected future short-term interest rates. For example, buying a bond with a maturity of one year, holding it to maturity and then buying another bond with a maturity of one year should yield the same expected return as a bond with a maturity of two years. Following the same logic, different maturities can be regarded as substitutes for each other.

The second assumption of the money view is that investment and consumption expenditures are sensitive to changes in the real interest rate. The more interest-rate elastic both are, the greater is the impact of monetary policy stimulus. This is especially plausible for long-term investments such as business fixed investment, residential housing investment and consumer durable spending.

To sum up: Monetary policy makes use of its influence on short-term nominal interest rates to affect long-term real interest rates. This precipitates a decline in the interest-sensitive components of spending, especially those that are geared to long-term considerations.

Three further prominent transmission mechanisms have also evolved under the heading of the money view: first, the exchange rate mechanism, which is also predicated on real interest-rate changes; second, the Tobin's q channel; and third, the wealth mechanism (with the latter two both based on stock price values). All three mechanisms are briefly sketched below.

The exchange rate mechanism of monetary policy transmission assumes that, if the domestic real interest rate rises, domestic deposits will appear relatively more

---

[3] Menu costs are the costs incurred in the change of prices. They include printing new price lists (e.g. menus in restaurants), re-tagging items, updating systems and updating merchandise material, etc. Money illusion refers to people's tendency to think of prices in nominal rather than in real terms. Consequently, they do not adjust instantly to new real price levels (see Fisher (1928) for the original reference to money illusion).

[4] The discussion of the third condition required for the bank lending channel examines price stickiness in more detail. See section 3.1.3.

attractive to investors than deposits held in a foreign currency. This leads to increased demand for the domestic currency, and the domestic currency appreciates relative to foreign currencies. Domestic goods thus become more expensive abroad, while net exports are reduced. Since net exports are also a component of aggregate spending, aggregate demand declines.

The Tobin's q channel (see Tobin (1969)) is based on the assumption that monetary policy can affect the market valuation of a company's stocks. If monetary policy is eased, more money flows into the stock markets, increasing the stock market value of companies. The question is: Where is the connection to aggregate spending? The necessary concept is the Tobin's q ratio, which is defined as the market value of an enterprise divided by the replacement value of the enterprise's capital. Given a high value for q, the market valuation of the company will exceed the replacement cost of capital, thereby making it attractive to issue new stocks (equity) in order to finance investments. An increase in investments also increases aggregate spending.

While the wealth mechanism (see Modigliani (1971)) is also based on stock prices, this concept focuses on stocks as a component of private wealth. The basic premise is that private individuals desire to smooth their periodic consumption[5] over time depending not on current financial resources, but on lifetime financial resources. Since stocks are a significant component of financial wealth, stock price movements can affect lifetime financial resources and, hence, private consumption. The increase in consumption positively affects aggregate spending.

These three mechanisms, together with the traditional interest-rate channel, add up to the money view.

Criticism has been leveled at attempts to explain what are relatively substantial real effects using the money view mechanism *only*. As pointed out above, the first assumption is that the central bank can affect the short-term nominal interest rate. The second assumption is that investment and consumption expenditures are sensitive to changes in the real interest rate. Both assumptions have been questioned mainly due to the fact that the relatively small impulses given by monetary policy are not sufficient to explain the relatively large real effects as explained, for example, by Bernanke and Gertler (1995) and Mishkin (1995). In

[5] Consumption in this context excludes consumer durables expenditures.

particular, in order to explain the strong real effects using the direct interest-rate channel only, the interest-rate changes effected by the central bank would have to be much more pronounced than those that are observable, especially in light of the relatively low interest-rate elasticity of investment. Furthermore, it is questionable whether the empirically strong influence of the central bank on the demand for long-lived assets can indeed be attributed to this channel: The power of the central bank to influence long-term interest rates is observable, yes; but it is also limited according to Bernanke and Gertler (1995).

These observations have led a number of authors, such as Gertler and Gilchrist (1993), Bernanke and Gertler (1995), Cecchetti (1995), Hubbard (1995) and Bernanke et al. (1996), to conclude that credit market imperfections too – in addition to the traditional interest-rate channel/money view – must play a crucial role in explaining the relatively large real effects stemming from relatively small monetary policy impulses. This view, called the credit view of monetary transmission, is central to the following section.

2.2. The credit view

As hinted at at the end of the last section, the beginnings of the credit view can be traced back to some puzzling observations that could not be brought into line with the conventional interest-rate channel view – or money view – of monetary transmission. Most notably, the federal funds rate, over which the US Federal Reserve exercises close control, is an *overnight* money market rate.[6] One would therefore expect the impact on (real) long-term interest rates to be relatively weak. Strikingly, however, research on monetary policy has found a substantial impact of short-term rates on aggregate demand, especially on long-lived assets such as housing or fixed business equipment, which should in theory primarily be sensitive to *long-term* interest rates (see e.g. Bernanke and Gertler (1995), Bernanke et al. (1996) and Peek and Rosengren (2010)).

[6] Reference is made here to the Federal Reserve and the federal funds rate simply because the observations mentioned were first made in a US context. The credit view is not limited to the US, of course, and its implications also hold for the euro area. Some differences between the US and the euro area are discussed in the course of the available empirical evidence (section 6.1).

The solution to the puzzle can be found in credit market imperfections, as myriad papers emphasize (see Gertler and Gilchrist (1993), Cecchetti (1995), Bernanke and Gertler (1995) and Bernanke et al. (1996), to name but a few). As pointed out by Bernanke and Gertler (1989), the important insight is that deadweight losses occur whenever there is an asymmetry in information between the borrower and the lender relative to an equilibrium in a world of perfect information. These agency costs are reflected in the difference between raising funds internally (e.g. through retained earnings) as opposed to externally (e.g. by issuing equity or debt). The cost differential is inversely related to the borrower's balance sheet position, especially the borrower's net worth, and referred to as the external finance premium. The external finance premium plays a role in both the balance sheet channel and the bank lending channel, as will be outlined in the sections that follow.

According to Bernanke and Gertler (1995), the external finance premium reflects three kinds of costs: first, the expected costs the lender has to bear for evaluating, monitoring and administering the borrower; second, the costs of the typical "lemon's premium" stemming from the fact that borrowers possess better information about their financial position than lenders; and third, the expected costs associated with moral hazard of the borrower.

When the European Economic and Monetary Union was established, the question of the importance of the credit view attracted renewed attention in the euro area. As a preliminary judgment of the ongoing debate it is fair to say this: In particular the conclusion that the interest rate channel is not sufficient to explain the magnitude of observable real effects also holds true for the euro area. Accordingly, there must be some mechanism(s) at work that is (are) amplifying or complementing the transmission of monetary policy impulses over and above what is explained by the money view. These mechanisms are the balance sheet channel and the bank lending channel.

2.2.1. The balance sheet channel

Central to the balance sheet channel is the concept of the external finance premium which was introduced by Bernanke and Gertler (1989). The external finance premium states that a borrower's cost of financing is inversely contingent on his financial position, measured especially in terms of net worth but also in terms of liquidity and

current and future expected cash flows. The stronger the financial position of the borrower, the more collateral he will be able to provide and the more he will be able to bear his own losses. This fact strengthens the incentive not to act in a morally hazardous way, but instead to do one's best to ensure favorable financial results, because the borrower has more 'skin in the game' which he risks to lose (Bernanke (2007)). This in turn makes investing in the borrower less risky, yielding more favorable credit terms and lowering the overall cost of financing. Since it was first introduced, the idea of an inverse relationship between a borrower's financial position and the cost of credit has gained popularity. The concept has, for example, been applied by Kiyotaki and Moore (1997), Bernanke and Gertler (1995), Bernanke et al. (1999), Carlstrom and Fuerst (2001) and Iacoviello (2005), most notably in a business cycle research context.

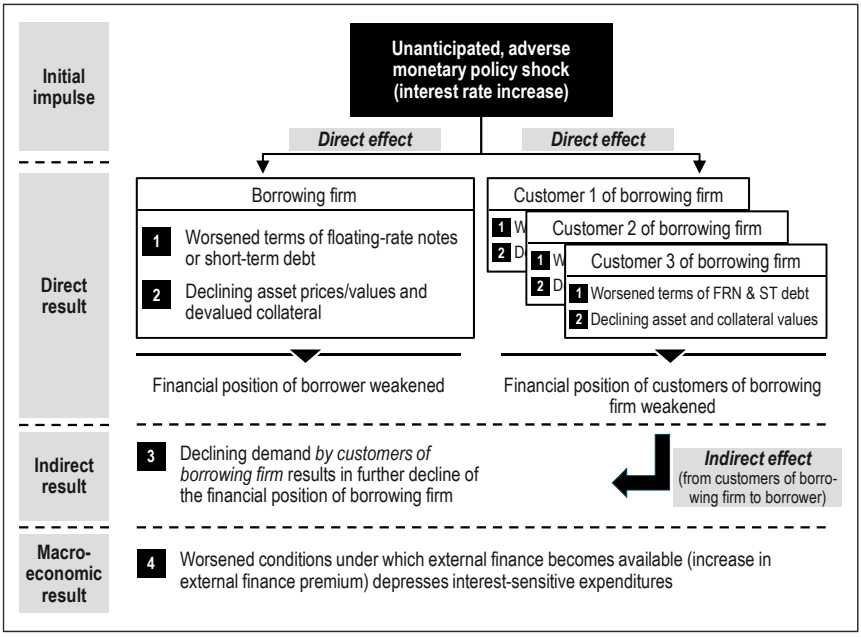


Figure 2.1: Mechanism behind the balance sheet channel of monetary policy transmission

The research on business cycles referred to above used the concept of the external finance premium to solve the puzzle of how relatively small, unanticipated monetary changes can have substantial and persistent real effects: A change in interest rates

provoked by monetary policymakers – an increase, say – negatively impacts a borrower's financial position both directly and indirectly (see figure 2.1).

Two distinct effects are immediately apparent (see Bernanke and Gertler (1995)). First, to the extent that borrowers are financed using short-term (floating) debt, they are directly affected by higher interest payments. This weakens their cash flows and their overall financial positions and increases the external finance premium. Second, a rise in short-term interest rates is usually accompanied by a decline in asset prices, thereby diminishing the value of collateral and the creditworthiness of companies through higher discount factors, again increasing the external finance premium.

Indirectly, there is also an effect on borrowing firms when *customers* of the borrowing firms are themselves directly and negatively affected by an unanticipated monetary policy shock, leading to a higher external finance premium for the customers of the borrowing firm. As a result, the customer companies are likely to reduce spending on goods or services from the borrower.

Ceteris paribus, this situation causes credit conditions to deteriorate and, ultimately, leads to a higher cost of financing. This effect amplifies the traditional interest-rate channel in the sense that the level of market interest rates which the borrower has to pay is higher because the increased financing cost – caused by the additional risk premium – places an even higher burden on spending and investment decisions, thereby making even more marginal investment opportunities unprofitable. As a consequence, aggregate spending, aggregate demand and real activity all slow down.[7]

The balance sheet channel is one of two channels in the credit view. The following section addresses the second of these two channels: the bank lending channel.

2.2.2. The bank lending channel – Overview

In a study on the Great Depression of the early 1930s building on the work of Friedman and Schwartz (1963), Bernanke (1983) suggests the existence of another distinct mechanism by which monetary policy can have non-transitory real effects.

[7] In the context of business cycle research, the fact "that endogenous procyclical movements in borrower balance sheets can amplify and propagate business cycles" (Bernanke and Gertler (1995)) is referred to as the 'financial accelerator'.

This idea was further developed by Bernanke and Blinder (1988) and explains how a central bank's monetary policy can impact the supply of intermediated loans by affecting banks' loanable funds. This leads to the bank lending channel, which focuses on the role of banks in the propagation of monetary policy.

Despite the fact that non-bank financial intermediaries have gained importance in recent decades and that firms today have access to alternative forms of funding via public debt markets, banks still play the leading role in financing firms, especially in the euro area.[8] The bank lending channel establishes the link between monetary policy and banks and between banks, firms and real activity.

Since it examines the circumstances under which monetary policy can affect the supply of bank lending, this is one of the key reference frameworks within the present study. Before going into the details of the bank lending channel in the next chapter, this section begins with a brief overview of the mechanism at work.

According to the traditional view of the bank lending channel, an increase in key interest rates by the central bank worsens the terms on which banks can equip themselves with reserves by the central bank. This has consequences for banks because reserves are always linked to deposits: Banks are required to hold a certain percentage of (insured) deposits as central bank reserves.[9] As a result, the shortage of or "drain" in reserves limits the banks' ability to create deposits and, at the same time, to grant loans, because granting a loan means creating a deposit on the account of the borrower. Therefore, reducing the availability of reserves impairs the ability to provide loans.

There is another mechanism through which the central bank impacts the availability of deposits as a funding source for banks. This mechanism works by affecting the yields on deposits relative to other assets Disyatat (2011). It can be explained by the motives for holding money.

---

[8] Arguments substantiating the view of an intact bank lending channel despite the increased significance of non-bank financial intermediaries and wholesale funding markets are outlined in section 4.1.

[9] The reserve requirement is 1% of all covered liabilities in the euro area (it was 2% until the end of 2011) and 10% in the US. It must be noted, though, that in the euro area the range of liabilities covered by reserve requirements is larger than in the US. For more details on reserve requirements, see Bofinger (2001), p. 343 et seq.

Excursus: motives for holding money

According to Keynes' famous disquisition (Keynes (1936), chapter 15), individuals hold money as deposits for three reasons: for transaction purposes, out of a precautionary motive and for speculative reasons.

First, the transaction motive reflects those parts of liquidity that are held in order to make immediate purchases of goods or services (such as food, rent, electricity, etc.). The desired money is mostly held in the form of demand deposits (rather than as cash). The quantity of money designated for transaction purposes depends on periodic income, but does not hinge on the level of interest rates.

Second, because individuals face expenses whose amount and probability of occurrence is uncertain they hold money out of a precautionary motive to cover these uncertain events (e.g. repairs, replacement purchases). Some textbooks group the precautionary motive together with the transaction motive and do not regard the two items separately. The reason for this is that the amount of money held for unanticipated events stemming from a precautionary motive can be thought of mainly as a function of the amount money spent on transactions and, therefore, ultimately as a function of periodic income.

Third, money is held for speculative reasons. In order to illustrate the logic suppose the simple case that economic agents have the choice between holding money in form of non-interest bearing deposits and a non-maturing bond.[10] The revenue from the bond, i, arises immediately from the quotient of the annual interest payment, K, and the purchase price, P: $i = K/P$. In addition, Keynes makes the assumption that every individual makes some assessment of what is the "normal" level of interest rates. The relation between the actual interest rates and the assessment regarding their normal level can be used to reflect the incentive structure for the individual (assuming constant interest payments): If the actual level of interest rates is below the level that is considered to be normal, then rising interest rates and falling bond prices will be expected in future. In this case, individuals hold money as speculative accounts. Conversely, if the actual level of interest rates is above the level that is considered to be normal, economic agents will expect falling interest rates

[10] The simplifying assumption of a non-maturing bond is only made in order to be able to abstract from repayment effects. Obviously, no conclusion is dependent on this assumption.

accompanied by rising bond prices. In this situation, purchasing a bond will be profitable not only because of the bond price gain. Over and above this gain, a high return is expected due to the low purchase price. *Ceteris paribus*, less money is therefore held in the form of deposits owing to the increased opportunity cost faced by individuals if they hold money in a non-interest bearing form as opposed to interest-bearing bonds. Ultimately, the amount of money individuals hold as speculative accounts correlates inversely to the level of interest rates.

To sum up: The amount of deposits available to banks is a function of (monetary policy) interest rates due to the opportunity cost that individuals face as a result of the speculative motive.

Coming back to the bank lending channel mechanism: In response to a shortfall in funding on the liabilities side of the balance sheet, banks are forced to reduce assets or to replace lost deposits with alternative forms of funding (liabilities).

Since adjusting the balance sheet solely on the asset side (e.g. by selling securities; see detailed explanation below) is a suboptimal approach, banks will also adjust their liabilities. This is where the concept of the external finance premium comes into play: To the extent that lost deposits are replaced by alternative, uninsured forms of funding (e.g. wholesale funding), banks, acting as borrowers in wholesale funding markets, are exposed to the external finance premium which, in turn, depends on the overall financial condition of the bank in question.

Generally speaking, because deposits are subject to deposit insurance schemes, they are the only source of funding to banks that is not subject to asymmetric information and moral hazard problems (see Stein (1998)).[11] Any other form of uninsured funding potentially implies asymmetric information and moral hazard issues, all of which involve an external funding premium.

[11] Depending on how deposit insurance schemes are implemented in individual jurisdictions, the contributions that banks have to make to the respective deposit insurance funds may be risk-related (e.g. in the US since 1993). However, although this might constitute an incentive to reduce risk from a bank's perspective (since the contribution to the insurance fund increases as the level of risk increases), this has no impact on the customers' propensity to provide (insured) deposits. Therefore, the issue of whether a bank's contribution to deposit insurance funds is risk-related or not has no direct consequences for the significance of the asymmetric information problem.

Because external funding is always more expensive due to the funding premium that investors demand, a bank will not be able to completely offset the reduction in its deposits by other forms of funding without additional cost. By consequence, a bank must reduce its assets in the same proportion as lost deposits cannot be replaced. As explained in greater detail in the next chapter, the optimal approach is to always hold a certain fraction of assets in the form of liquid assets; this is what makes banks reluctant to simply sell off liquid securities. Hence, banks also have to reduce the volume of loans they grant. To the extent that borrowers that need money from banks cannot replace bank loans without additional cost with credit from other sources, this impacts aggregate spending.

In a nutshell, the bank lending channel describes how the central bank can influence the real economy by exerting an influence on the supply of intermediated loans via the availability deposits.

Following on from this brief introduction to the main transmission channels of monetary policy, the next chapter focuses specifically on the bank lending channel. This channel is central to the current research undertaking, as it is a key tenet of the theoretical framework that explains lending reactions by banks.

3. The bank lending channel in detail

The bank lending channel focuses on the transmission of monetary policy actions via banks and bank lending and is, therefore, central to the purpose of this study. The concept of the bank lending channel is a key cornerstone of the theoretical framework which is used as a basis to explain the determinants of bank lending in the empirical section of this study. It is therefore necessary to review in detail both the mechanism itself and the conditions under which the bank lending channel is active.

The following sections focus on the theoretical foundations of the bank lending channel: first, by laying down the mechanism of the bank lending channel, and second, by discussing in detail the conditions and subconditions that must be fulfilled if it is to function.

In order to briefly pre-structure the further course of argumentation it should be noted that the following sections address what can be called the "traditional view" on the bank lending channel. With regard to certain aspects it is indicated to develop it further to what this study calls the "new view". Without touching the main essence of the bank lending channel the new view provides an enhanced interpretation against the background of today's operational frameworks of major central banks and recent developments in financial markets. The new view is dealt with in a separate chapter (chapter 4).

3.1. Structure and elements of the bank lending channel

The first element of the mechanism describes how the central bank influences the supply of bank loans by controlling both reserves and the ability to create deposits. The second element describes firms' dependence on bank-intermediated loans. Both elements are reflected in the first two conditions that must be met to create an active bank lending channel. On top of these conditions, there is also the general condition that prices must not adjust instantaneously subsequent to monetary policy changes. To establish a comprehensive understanding of the bank lending channel, it makes sense to introduce the conditions required for its distinct existence as a separate

H. Brinkmeyer, *Drivers of Bank Lending,* Schriften zum europäischen Management,
DOI 10.1007/978-3-658-07175-2_3, © Springer Fachmedien Wiesbaden 2015

transmission channel step by step (see figure 3.1 for a brief description of all three conditions).

	Condition 1	Condition 2	Condition 3
	Central bank must be able to affect supply scheme of bank loans	**Publicly issued debt and non-bank intermediated loans must not be perfect substitutes for bank loans**	**Prices must not adjust instantaneously (monetary policy must not be neutral)**
Explanation	> Banking sector as a whole must not be able to or willing to *completely* insulate lending portfolio from monetary policy shocks, either by – switching from deposits to other forms of funding or – selling securities (liquid assets)	> It must not be the case that firms are able to offset the decline in the supply of bank loans *completely,* i.e. *without incurring additional cost*, by borrowing more directly from household sector in public markets	> Frictionless price adjustments would imply that policy rate changes immediately translate into price adjustments of an equal proportion > This must not be the case

Figure 3.1: The three conditions for the existence of a bank lending channel

One of the most famous early descriptions of the lending channel and its conditions was penned by Bernanke and Blinder (1988). Another illustrative formulation can be found in Kashyap and Stein (1994). Essentially, the bank lending channel requires three conditions: The first condition states that central banks must be able to affect the supply of bank loans. The second condition is that publicly issued debt and non-bank intermediated loans must not be perfect substitutes for bank loans. The third condition is that prices must not be adjusted instantaneously subsequent to monetary policy changes, resulting in the notion, as touched on earlier, that monetary policy is not neutral. The first two conditions can be broken down further into subconditions (see figure 3.2 for an overview of the structure of conditions and subconditions. These subconditions are phrased in such a way that their fulfillment warrants the fulfillment of the governing condition.) [12]

[12] As presented here, the order of the first two conditions is swapped compared to the common approach found in literature, as this order better captures the sequence of steps in the bank lending channel mechanism from the central bank via banks to the real economy. A further modification to the customary manner of presentation concerns the subconditions under condition 2: The usual approach is to discuss whether bank loans can be substituted by non-bank intermediated loans in connection with condition 1 (e.g. Bernanke and Blinder (1988) and Kashyap and Stein (1994)). However, the author believes that this issue slots more naturally into the discussion in connection with condition 2: Whether a firm resorts to bonds or non-bank intermediated loans is effectively the same thing insofar as, in both cases, bank loans are avoided. For this reason, the wording of the conditions too differs slightly compared to the references stated.

As regards the first condition, the basic requirement is that the central bank must be able to affect the supply of bank loans. Let us consider a tightening of monetary policy, in the course of which the central bank increases key interest rates. For banks, this immediately means that the terms under which central bank reserves are available deteriorate. This is important insofar as banks are required to hold a certain proportion of deposits as reserves. As a consequence, banks are therefore limited in their ability to create new (reservable) deposits.[13]

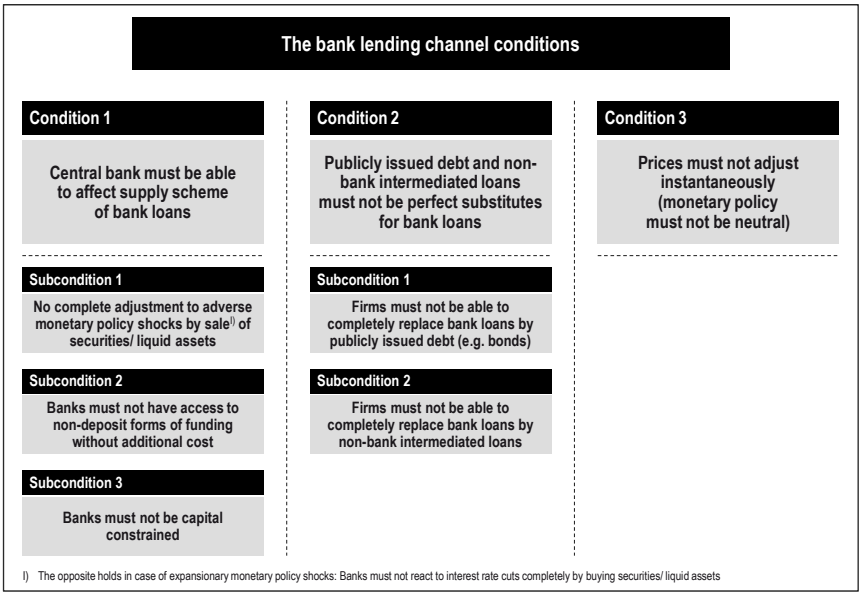


Figure 3.2: Structure of conditions and subconditions of the bank lending channel

Banks can react to this reduction in deposits as a funding source in several ways (see Peek and Rosengren (2010), p. 261, for example). In principle, they can make the necessary adjustments to rectify this imbalance on either the asset side or the liabilities side of the balance sheet. Attempts to replace deposits by alternative forms of funding (on the liabilities side) involve an external finance premium, because this kind of funding is, unlike insured deposits, subject to issues of asymmetric information. This makes the replacement of deposits by other forms of funding costly.

[13] Note that the granting of a credit is associated with the creation of a deposit on the account of the beneficiary which is subject to reserve requirements.

On the asset side, banks can either reduce loans or securities or both to countervail the drained deposits. Since the optimal approach is to always hold a certain portion of assets in the form of deposits, banks will never perform the adjustment *entirely* by selling securities, as is discussed below. In other words, banks will offset part of the drain on deposits by reducing lending – by cutting back on their loan supply.[14]

This mechanism is what gives the central bank the power to influence the supply of bank loans. This first condition and the subconditions are discussed below in greater detail.

A second condition of the bank lending channel is that publicly issued debt (e.g. bonds) and loans by non-bank financial intermediaries must not be perfect substitutes for bank loans, at least for some firms. In other words, firms must not be able to circumvent a decline in bank loans by resorting to other sources of funding. As hinted at by the formulation of the condition itself, there are two subconditions: The first subcondition is the imperfect substitutability of bank loans and publicly issued debt. The second is the imperfect substitutability of bank loans and loans by non-bank financial intermediaries. If both subconditions hold, then the reduced supply of bank loans will carry over to the real economy. This second condition and the subconditions are also discussed in greater detail below.

The third condition of the bank lending channel relates to imperfect price adjustments, in the sense that prices are sticky in the short run. Price rigidities are what enable monetary policy to achieve real effects. Without this condition, monetary policy shocks and the changes in reserves associated with them would immediately affect prices and would not have any real effects. Monetary policy would then be pointless. This is thus a general condition that is necessary for any channel of monetary policy transmission.

Since an overwhelming body of literature is devoted to imperfect price adjustments, and since this issue is not unique to the bank lending channel, the section on this third condition concentrates on the basic mechanism and certain historical aspects of price rigidities.

[14] The theoretical derivation of this proposition is commented on below in the course of the discussion of subcondition 1 of condition 1 (section 3.1.1.1).

To sum up: The theoretical mechanism of the bank lending channel establishes two main links. The first is from monetary policy actions to banks and bank lending. This link is reflected in the condition that the central bank must be able to affect the supply scheme of bank loans. The second link is the connection between bank lending and the real economy. This connection is captured by the condition that, at least for some firms, publicly issued debt (e.g. bonds) and non-bank intermediated loans must not be perfect substitutes for bank loans.

Only if neither of these two links is interrupted and if both conditions hold will the mechanism of the bank lending channel apply in practice. In addition, prices must not adjust instantaneously to changes in the monetary environment. Without this general precondition monetary policy would not exert any influence on the real economy, irrespective of the transmission channel considered.

The section below further elaborates on the conditions and subconditions that are required for the mechanism to take effect.

3.1.1. Condition 1: The central bank must be able to affect the supply scheme of bank loans

	Subcondition 1	Subcondition 2	Subcondition 3
	No complete adjustment to adverse monetary policy shocks by sale[l] of securities/ liquid assets	**No access to non-deposit forms of funding without additional cost**	**Banks must not be capital constrained**
Necessary condition for central banks being able to affect loan supply	> Banks must not fully compensate the drain in deposits resulting from a monetary policy tightening by selling securities	> Banks must not be able to compensate the drain in deposits by other non-insured forms of funding without additional cost	> Banks must not fail to expand lending due to too low capital ratios (induced by regulator or self-induced)
Theoretical substantiation – Is the condition likely to hold?	> Banks constantly face a certain probability of random deposit withdrawals (particularly after a change of monetary policy rates) > In order not to be forced to liquidate loans on short notice in face of random withdrawals banks hold a certain amount of securities > The optimal amount is subject to the banks' risk appetite > Hence banks will not completely compensate a drain in deposits by selling securities since this would reduce liquidity below the amount chosen to be optimal	> Investors face an asymmetric information and adverse selection problem when lending uninsured funds to banks > This requires a premium that banks have to pay which is associated with the underlying banks' credit risk > By this, non-deposit forms of funding are imperfect substitutes for deposits > The same logic applies to equity capital which is another potential form of funding	> Under the Basel Accords and under national legislation banks need to hold a certain fraction of loans as capital > Banks for which such a capital requirement is binding cannot expand their loan supply in case of monetary policy eases (interest rate decrease) > The same logic applies when a self-chosen capital target is missed

l) The opposite holds in case of expansionary monetary policy shocks: banks must not react to interest rate cuts completely by buying securities/ liquid assets

Figure 3.3: The three subconditions of the first condition of the bank lending channel

The first condition is the most important one in the context of this study, because it concerns itself with how banks respond to monetary policy shocks in terms of their lending. It can be broken down into the three subconditions summarized – together with the underlying theoretical mechanism – in figure 3.3. Fulfillment of all three of these subconditions is tantamount to fulfillment of the first condition.

3.1.1.1. Subcondition 1: No complete adjustment to adverse monetary policy shocks by the sale of securities/liquid assets

The first subcondition is related to the asset side of the balance sheet and to banks' holdings of liquid assets (e.g. securities). The requirement is that banks do not fully compensate for the drain in deposits when monetary policy is tightened by selling liquid assets. If banks did adjust on the asset side solely by selling liquid assets, the loan portfolio and, hence, loan supply would not be affected at all. The question is therefore: Is it theoretically plausible for banks to adjust not simply by selling liquid assets, but, instead, to also adjust via the more profitable loan portfolio, thereby incurring lost profits?

Tobin (1982) formulates a simple model for profit-maximizing banks that have to choose between loans and other relatively illiquid investments on the one hand and liquid assets on the other hand, not knowing beforehand the volume of deposits that will be available (stochastic flow of deposits). A volume of deposits lower than expected requires a bank either to sell (liquid or illiquid) assets or to borrow from alternative sources of funding. Both *instantaneously* trying to reduce illiquid assets such as loans (see Blinder (1984)) and borrowing from alternative funding sources (see King (1986)) are typically more costly options than reducing holdings of comparatively liquid assets.

Douglas and Rajan (2001) point in the same direction: Acting as a lender, a bank will not be able to redeem the present value of a loan by selling it when it needs to generate liquidity, but will instead lose money.

Therefore, in order to protect against instantaneous loan reductions becoming necessary because of random deposit outflows, banks will always hold a certain portion of liquid assets. The exact portion is determined by a bank's expectation regarding the available deposit volume and its appetite for or aversion to risk

regarding the volatility of deposit outflows.[15] As a consequence – and this is the important point – a bank will respond to a deposit outflow by also curtailing lending not in the short-term but in the medium term in order to maintain the desired ratio of deposits to liquid assets. It does this to ensure that it does not directly have to reduce loans or agreed credit lines for existing bank customers.[16]

The same logic applies when monetary policy is eased: In this case, banks will react to the excess in available deposits not only by increasing their lending, but also by holding an additional share of liquid assets.

Do these theoretical considerations fit actual economic circumstances? Kashyap and Stein (1994 and 2000) provide data on the share of securities held (as a percentage of total assets) by large, medium-sized and small banks.[17] For all three size classes, the data shows consistent patterns of portfolio composition that are in line with expectations: Large banks' share of securities is much smaller than that of small banks. Since small banks are more vulnerable to random large-scale deposit withdrawals (e.g. for diversification purposes), they have to hold a larger share of securities than large banks. The persistency of this pattern suggests that these kinds of portfolio compositions are not the expression of randomly chosen levels of liquidity.

3.1.1.2. Subcondition 2: No access to non-deposit forms of funding without additional cost

The second subcondition is related to the substitutability of deposits by alternative forms of funding. It states that banks must not be able to fully compensate for the deposit outflow by other forms of external funding, e.g. on wholesale funding markets. In other words: Alternative forms of funding must not be perfect substitutes for deposits from a bank's perspective in order for this subcondition to be valid. While

---

[15] In fact, as also pointed out by Tobin (1982), the desire of banks to hold liquid assets is an example of the precautionary motive for holding money in accordance with Keynes (see section 2.2.2).

[16] As explained by Bernanke and Blinder (1992), loans are quasi-contractual agreements that cannot easily be drawn on to reduce assets. This is reflected in the response pattern to monetary policy shocks: Banks' short-term reaction to reduced deposits is to sell securities. In the medium to long term, a reduction in loans is the dominant effect.

[17] Large banks are those in the 1st percentile of total assets in their sample. Medium-sized banks are those from the 99th through the 75th percentile. Small banks are those below the 75th percentile.

Romer and Romer (1990) stated that banks do, indeed, have the capability to easily replace drained deposits by alternative funding, important aspects of this view have been criticized. As pointed out by Kashyap and Stein (1994), the idea of Romer and Romer is posited on the assumption that demand in wholesale funding markets is perfectly elastic. This means that, following a drain in deposits when monetary policy is tightened, banks can issue as large a volume of open-market liabilities as needed or desired without the volume affecting their costs at all. This is not very likely to be realistic, for the following reasons.

Unlike deposits, wholesale funding is not insured. Wholesale funding includes the (secured or unsecured) borrowing in money markets and the issuance of short-term debt, commercial papers, for example, but also comprises longer-term debt such as bonds and covered bonds (see e.g. van Rixtel and Gasperini (2013)). The fact that it is not insured means that lenders (to banks) must concern themselves with the creditworthiness or riskiness of the borrowing bank. In this context, the concept of the external finance premium, first introduced by Bernanke and Gertler (1989), plays a key role. The external finance premium is the spread between the cost of raising funds externally and the opportunity cost of raising them internally. Due to standard asymmetric information and moral hazard problems and the resulting costs that lenders have to bear to monitor the borrower's actions, the external finance premium is always positive. Moreover, the premium that outside investors demand for the funding they provide should be a negative function of the borrower's financial position, as Carlstrom and Fuerst (2001) demonstrate by building on a model of Kiyotaki and Moore (1997). The financial position can be thought of as proxied by net worth, liquidity and current and future cash flows (see Bernanke (2007)). For "healthy" borrowers there is more at stake, which makes it less likely that they will act in a way that causes the lender to lose money. It thus becomes clear that the amount of external financing is, generally speaking, limited by the borrower's financial health, i.e. by the value of his net worth or collateral. As a consequence, the cost of external financing is indeed a function of its volume, which Kashyap and Stein (1994) show formally in a simple partial-equilibrium model.[18] While these arguments are more closely geared to debt financing, the same logic obviously also applies to equity

[18] The model of Kashyap and Stein (1994) also captures the argument why banks hold a certain fraction of deposits as liquid securities and is, therefore, also insightful for this reason.

capital. Because equity is junior compared to debt capital, the premium that equity investors demand should be even higher. Another problem that arises when raising new equity is stated by Myers and Majluf (1984), who point out the special asymmetric information problems between old and new shareholders that may prevent the issue of new equity (“debt overhang”). In short, potential new shareholders face the threat that their capital is used to service debt which has been accumulated during the leadership of the old shareholders. This overhang of "old" debt which becomes a burden on new capital will make potential new shareholders reluctant to invest if they are unsure regarding the exact financial position of investment target.

Why is this subcondition necessary for the bank lending channel to be active? Or, to put that another way, what would happen if alternative forms of funding were perfect substitutes for deposits? It is not difficult to see that, if alternative funding were a perfect substitute, adjusting for lost deposits could simply be performed at no cost on the liabilities side of the balance sheet. Since the cost of capital are not perfectly inelastic for a bank when the assumption of perfect substitutability of insured deposits and uninsured debt is abandoned, this has implications for the asset side. In connection with the first subcondition, which states (for the reasons given above) that adjustment for drained deposits is not *only* performed by selling deposits, a bank will curtail those lending opportunities that are, relatively speaking, the most unprofitable ones. Similarly, a bank that offers loan rates which reflect the higher cost of capital cannot expect to maintain the same volume of loans as before the drain in deposits.

To sum up: The key point concerning the second subcondition is not that a bank must be unable to replace the lost deposits. For the second subcondition to hold, it is only necessary that demand for a bank's wholesale liabilities must not be perfectly elastic, so that they are not perfect substitutes for lost deposits from a bank's perspective. This marks a departure from the famous Modigliani-Miller theorem (Modigliani and Miller (1958)), according to which the capital structure does not make any difference to the value of a firm.

3.1.1.3. Subcondition 3: Banks must not be capital constrained

The third subcondition is related to the capital position of a bank. Under the accords of Basel I (which was introduced in 1993), its successor Basel II (in force since 2007)

and the different national legislations, banks are required to maintain a certain equity capital ratio. Failure to do so can have serious consequences for the institution concerned and is ultimately threatened by the takeover of control or forced closure by the authorities.

The third subcondition requires that banks must not be capital constraint, i.e. that their ability to engage in additional lending should not be restricted because of too low capital ratios.

As stated in the context of the first subcondition (section 3.1.1.1), banks do not adjust for a drain in deposits following a monetary tightening only by selling securities. In the event of an adverse monetary policy shock, a bank will also adjust by curtailing lending in the medium term in order to maintain the desired ratio of liquid assets to deposits. The exact ratio that each bank can decide on at discretion depends on its expectations concerning future deposit availability and deposit flows.

There is one exception, in the event of which a bank will adjust to the reduction in deposits solely by selling securities: if it is bound by capital constraints. Under these circumstances, the bank already holds more securities than are considered optimal based on its expectations and risk appetite with regard to coverage of possible future deposit outflows. This is because the bank does not have the capital it would need to accommodate higher loan volumes. Hence, a bank in such a situation will handle adjustment solely by selling securities, as long as the proportion of liquid assets is still above the optimum.

In the opposite case, i.e. where monetary policy is relaxed, banks that are capital constrained cannot expand their lending, but will instead invest the additional available deposits in liquid assets.

Raising new equity is not an option, because it is even more costly than debt capital, as already discussed in the context of the second subcondition (section 3.1.1.2).

It is important to note that capital constraints need not necessarily be related to a regulatory requirement, as the subcondition also applies to self-imposed capital constraints (see Berrospide and Edge (2010)). The fact that a bank might operate at the limit of a self-imposed capital constraint, even though it is not restricted by regulatory requirements, is one of the hypotheses in section 7.1. It is incorporated in the empirical analysis following the methodology originally developed by Hancock

and Wilcox (1993 and 1994) for the application in context of regulatory capital constraints.

All three subconditions together ensure that the first necessary condition for the bank lending channel – that the central bank must be able to affect the supply scheme of bank loans – holds true. The first subcondition requires that lost deposits must not simply be compensated for by selling liquid assets. The second subcondition presupposes that banks cannot compensate for lost deposits by alternative forms of (uninsured) funding, including both external finance and equity. The third subcondition makes clear that the lending channel only works in the event that a bank is not capital constraint either for regulatory reasons or due to a self-imposed capital ratio.

3.1.2. Condition 2: Publicly issued debt and non-bank intermediated loans must not be perfect substitutes for bank loans

The condition that publicly issued debt and non-bank intermediated loans must not be perfect substitutes for bank loans is the second requirement for the bank lending channel. It establishes the link between the banking sector and firms and the real economy. Without this condition, there would be no guarantee that a monetary shock affecting the supply of bank loans filters down into the real economy. Or, to put that another way: If the condition did not hold, this would mean that firms could, at no additional cost, fully compensate for the supply in bank loans by borrowing from other sources, thereby escaping the influence of monetary policy.

As the formulation of the second condition implies, a firm has, in principle, two possibilities to circumvent a decline in the supply of bank loans: It can either take loans from non-bank financial intermediaries or it can rely on publicly issued debt, especially in the form of bonds or commercial papers. Thus, in order for the condition to hold, two questions need to be answered. First, why is it difficult for firms to replace bank loans with loans from non-bank financial intermediaries? And second, why are bank loans and publicly issued debt not perfect substitutes (at least for some firms)?

To begin answering the first question, it is helpful to clarify why firms are at all dependent on financial intermediaries. Three concepts play a role here: first,

transaction costs; second, risk diversification and liquidity transformation; third, the cost of (gathering) information.

Without financial intermediaries, both borrowers and lenders would need to handle all the details associated with a loan contract themselves, e.g. finding a lawyer to set up a proper contract between the two parties, formulating all the clauses, etc. Especially for small-scale borrowers and lenders, this would be enormously costly. Financial intermediaries such as banks can drastically lower this kind of transaction costs due to their economies of scale.

The second aspect is risk diversification. An investor not big enough to diversify in its own right can avoid "putting all its eggs in one basket" by giving money to a financial intermediary big enough to allow for proper diversification of investments and investment risk. Without the intermediary, the funds would not be available to borrowers because the investor lacked the opportunity to diversify risk. Closely linked to the idea that a bank offers a service to both investors and deposit holders without which funds would not be available is the function of liquidity transformation, which banks perform at the same time. Banks are able to transform relatively illiquid assets, such as loans, into liquid deposits, thereby insuring investors who want to consume whenever they need to ('liquidity on demand'; see Kashyap et al. (2002)). Both ideas, the one of risk sharing and of liquidity transformation, have been shaped by Diamond and Dybvig (1983).

The third aspect regards the cost of gathering information. Asymmetric information between borrower and lender is a natural consequence of the fact that the borrower usually has better information regarding the risk and reward profile of an investment and, therefore, regarding the probability of repayment than the lender who is asked to grant a loan. This problem is relevant *before* the loan contract is closed, i.e. when the lender seeks to avoid selecting the most risky borrowers (adverse selection), and *after* the loan contract is closed, i.e. when the lender needs to monitor and control the borrower's actions to prevent the borrower from acting in a manner contrary to the interests of the lender (moral hazard).

Based on the work of Jaffee and Russell (1976), Stiglitz and Weiss (1981) presents a theoretical model of asymmetric information which highlights their significance in the context of financial intermediation that leads to conventional moral hazard

problems.[19] Taking this argument further, Blinder (1987) notes that, for the same reason, specialized institutions exist that gather information about borrowers. These institutions can realize economies of scale with respect to the acquisition of information and monitoring borrowers' actions.

Although the above discussion makes the case for financial intermediaries in general, it still does not answer the question why firms depend on banks in particular.

By assessing risk before granting a loan and by monitoring borrowers' actions, lenders acquire a monopoly of information with respect to their borrowers. This monopoly results in lock-in effects, as theoretically underpinned by Sharpe (1990) and Rajan (1992). Ultimately, from a firm's perspective, it is not easily possible to switch lenders without incurring additional costs even though credit markets are competitive. The same argument, viewed from the perspective of a competing lender, states that it is hard to step into an existing and established lender-borrower relationship.

In addition, Nakamura (1984) makes a case for economies of scope stemming from the fact that banks already acquire information by managing a firm's deposits. This is clearly an advantage over non-bank financial corporations that do not manage deposits, but that only lend money.[20]

Moreover, competing lenders who try to lure away borrowers by offering lower rates could well be countered by an equivalent or even better offering from the current bank in case of a "good" borrower. Only in case of a "bad", i.e. riskier borrower do competitors have a chance to win the client.[21] Obviously, this adverse selection problem can lead to an undesired, risky portfolio (see Sharpe (1990)). This kind of

---

[19] Both Stiglitz and Weiss (1981) and Jaffee and Russell (1976) discuss the impact of monetary policy on the supply of lending in light of credit rationing. As Kashyap and Stein (1994) points out, even though shifts in the supply of bank loans may involve credit rationing to some degree, the bank lending channel is not predicated on whether there is credit rationing or not.

[20] This is empirically plausible against the backdrop of models that calculate a score on the basis of account movements and account balances over time. This score enters a borrower's risk assessment. Today, these models are used by all major commercial banks.

[21] This view is an abstraction of the concept of standard unit costs. Theoretically, it is also possible for a competitor to offer lower loan rates than the existing lender for a "good" borrower due to lower standard unit costs. This is also plausible in practice.

problem can be reduced if firms provide more transparent information; this should apply especially to large firms that may have also been rated by a rating agency.

These arguments show how gathering information can lead to a lock-in between the borrower and the lender. Although particularly large firms may not be subject to this effect, and although one could argue that it only applies in cases where the existing borrower is a bank (as newly founded firms may, theoretically, resort to non-bank financial intermediaries right from the beginning), at least small and medium-sized firms will not find it easy to switch to non-bank financial intermediaries.

As a matter of fact, comparison of the relative sizes of bank credit and non-bank credit, as performed by Kashyap and Stein (1994), shows that non-bank credit has gained in importance to some extent in recent decades. However, it also shows that bank credit is still by far the most important source of firms' funding, emphasizing the significance of the banking sector in the process of financial intermediation. This finding is supported by Mayer (1990), who, in a comparison of major OECD countries, shows that firms in all the countries surveyed obtain funds primarily through financial intermediaries, despite existing differences between countries. The work of Fiore and Uhlig (2005) points in the same direction. Fiore and Uhlig (2005) finds a high proportion of bank loans in the euro area in particular (as opposed to the US), and attributes this to the high efficiency of euro-area banks in acquiring information on borrowers.[22]

To sum up: The answer to the first question – why it is difficult for firms to replace bank loans with loans from non-bank financial intermediaries (the probable future gain in importance of non-bank financial intermediaries notwithstanding) – is that, up to now, the importance of banks as intermediaries is firmly established, particularly in the euro area. It is therefore not to be expected that a shift in the supply of loans following the tightening of monetary policy can be completely offset by non-bank financial intermediaries. [23]

Comparison with the US leads to the second question: why bank loans and publicly issued debt are not perfect substitutes. While the LM curve in the traditional IS/LM

[22] See section 6.1 for figures on the significance of bank lending in the euro area and the US.

[23] There are good reasons to believe that also non-bank financial intermediaries are impacted by changes in monetary policy. See chapter 4 for a discussion.

model implicitly assumes that they are indeed perfect substitutes, there are a number of reasons to believe that they are not (see e.g. Peek and Rosengren (2010)). First, the fixed costs associated with issuing a bond are likely to be too large for small firms and relatively small ticket sizes. Second, smaller firms are not transparent enough with respect to information they provide or sufficiently creditworthy, which prevents their direct access to the bond market. Third, one could argue that these constraints do not apply to large firms that enjoy an adequate credit rating from a rating agency and, therefore, could exploit direct access to public credit markets. However, the issuance of commercial papers typically entails making use of bank services and, more importantly, bank balance sheets. The fact that banks usually acquire a share of the issued volume to send a positive signal about the borrower's creditworthiness once again establishes firms' dependence on banks and leaves firms bound by the bank's ability to grant loans – along with all the sensitivities to monetary policy explained under the first condition of the bank lending channel.

The answers to both questions thus suggest that publicly issued debt and non-bank intermediated loans are not perfect substitutes for bank loans, at least for some firms. This satisfies the second condition that is necessary for the bank lending channel to be active.

3.1.3. Condition 3: Prices must not adjust instantaneously

The third condition reflects a general requirement without which monetary policy would not have any influence on the real economy, irrespective of the channel of transmission under consideration. In such a situation, monetary expansion would lead to immediate price increases and would therefore not have any real effect.

Given that the issue of imperfect price adjustment is dealt with by an enormous body of literature, is empirically well established and is an element of any macroeconomic textbook, this section focuses solely on the most important building blocks of its microfoundations.

The most important concept to which price rigidities can be attributed is what is known as the menu cost. The menu cost is the cost that firms necessarily incur when changing prices. Cost items range from printing new price lists (e.g. a restaurant's menu) and re-tagging items to updating systems and merchandise material. From a business perspective, price changes are only beneficial if the associated costs are

outweighed by the expected revenues, resulting in stepwise (rather than continuous) price adjustments.

Long-term contracts such as tenancy and lease contracts are an additional reason for price rigidities. In these contracts, prices are fixed for the entire duration of the contract without the possibility of adjustments.

The labor market is a further example of an area where price adjustments do not happen instantaneously. To a significant extent, nominal wages are settled in collective wage agreements and fixed for some period in advance. More frequent wage adjustments would involve prohibitively high negotiation costs.

What all these examples have in common is the idea that price rigidities exist because frequent revisions of prices and contracts entail transaction costs that move the parties involved away from their profit or utility maximum.[24]

This third condition completes the set of sufficient conditions that must hold in order for the bank lending channel to apply. This concludes the traditional view on the bank lending channel.

[24] As a historical reference to price rigidities: The role of price and wage rigidities is captured by the Phillips curve, pioneered by Phillips (1958). The key element is that nominal wages are a function of unemployment or, more generally, of the cyclical state of the economy. The link between unemployment and the inflation rate was formulated by Samuelson and Solow (1960) in terms of the modified Phillip curve, which suggests an exploitable trade-off between unemployment and inflation. The flaw in the modified Phillips curve was that it disregarded the crucial role of expectations. Since it is the real wage and not the nominal wage that is important for workers, this omission was accounted for by including inflation expectations as a factor in the rationale of wage negotiations. The theoretical foundation was delivered by Phelps (1967) and Friedman (1968) in the form of the expectations-augmented Phillips curve. It must be noted that the relationship between unemployment and inflation in the expectations-augmented Phillips curve exists only if there is a difference between the actual and expected rates of inflation. This can only be the case in the short run: In the long run, inflation expectations and inflation will be identical, and no money illusion exists. This gives rise to two implications: First, the Phillips-curve trade-off cannot be exploited by policymakers. Second, analysis of inflation on basis of the Phillips curve involves a relatively short time horizon.

3.2. Conclusion

This chapter has introduced the theoretical foundations of the bank lending channel with its conditions and subconditions. It has been outlined that three conditions need to be fulfilled for an active bank lending channel. The first condition of the mechanism describes how the central bank influences the supply of bank loans. The second condition describes firms' dependence on bank-intermediated loans. The third condition, which is a general one applying to all transmission channels of monetary policy, stipulates that prices must not adjust instantaneously subsequent to monetary policy changes.

As this study focuses on the determinants of the supply of bank loans in different economic circumstances, it is apparent that the first condition is of primary interest for the further reasoning since this condition directly addresses banks and their supply of loans in the transmission process.

The way in which the whole mechanism of the bank lending channel – and especially the first condition – has been presented above can be called the "traditional view". What makes it traditional? Typical of this view is the emphasis on deposits being affected by monetary policy via control over reserves.

However, according to today's operational frameworks of major central banks reserves are not controlled directly. Furthermore, developments with regard to deregulation and financial innovation in recent decades have important implications for bank lending. These facts challenge the bank lending channel in its traditional notion presented above.

Consequently, in the next chapter, it is argued that the traditional view must be reconsidered: On the one hand a comprehensive perspective on bank lending and the bank lending channel must account for the actual functioning and operational frameworks of central banks (such as the ECB or the FED). On the other hand it needs to account for developments in the financial sector.

However, this in no way undermines the importance of the bank lending channel as a concept to explain the lending reaction of banks, the essence of which is that the central bank influences the supply of bank loans. Why this is the case is central to the following chapter.

4. A new view: Implications of financial innovation for bank lending

The previous chapter has laid the important theoretical foundations of the bank lending channel by presenting the underlying mechanism in its *traditional* interpretation. The first section of this chapter addresses the question why a *new view* on the bank lending channel is necessary not only as a result of developments in the field of financial innovation but also against the background of today's operational frameworks of major central banks.

On basis of this, the new view is conceptualized in the second section of this chapter. The new view on the bank lending channel and its conceptualization is central to the reasoning of this study because it is a necessary condition for the argumentation in the subsequent chapter 5: The argumentation why bank lending has been different against the background of the recent crisis.

4.1. The bank lending channel revisited

So far, the arguments have followed the *traditional* vein of the bank lending channel, which relies heavily on central banks' control over the level of deposits via reserve requirements and the money multiplier. Because deposits are regarded as the most dominant form of funding, a deposit outflow impacts on the ability of banks to grant new loans, as discussed in detail in section 3.1.1.

Especially with regard to the European Central Bank's operational framework, within which the ECB provides any amount of reserves demanded by the financial system – given that the deposited collateral is of a satisfactory quality – and thus compensates for deposit outflows it seems questionable whether the traditional view is (still) a valid representation of one of the monetary policy transmission mechanisms used in modern financial systems, or at least in the euro area and the US (see e.g. Marques-Ibanez (2009), Borio and Disyatat (2010) and especially Disyatat (2011)).

This is not to say that the transmission of monetary policy via banks is less effective or even muted. It rather appears that developments in recent decades, namely those summarized under the heading of *financial innovation*, have acted as a "game changer" for the banking industry and now imply a *new view* on the mechanism of the

H. Brinkmeyer, *Drivers of Bank Lending,* Schriften zum europäischen Management,
DOI 10.1007/978-3-658-07175-2_4, © Springer Fachmedien Wiesbaden 2015

bank lending channel. Whereas banks previously had to resort chiefly to deposits as the main source of funding, the development of wholesale funding markets has given banks access to funding opportunities that were not available on such a large scale some 20 years ago.[25] This makes banks probably more dependent than ever on *risk* appraisals of investors and on the external finance premium (see Altunbas et al. (2010), Disyatat (2011) or Borio and Zhu (2012)). Uninsured funds can no longer be regarded as merely a marginal funding source, but have instead emerged as an important pillar of overall funding strategy in many institutions. One consequence of this is that the characteristics that influence a bank's risk position and the investor's risk perception of a bank determine to a significant extent both a bank's ability to fund loans through market sources of funding and its reaction to monetary policy.[26]

To avoid any misconceptions regarding the new view as opposed to the traditional view: This new view does not come in complete contrast to the traditional bank lending channel literature. Neither does it mean that there is no longer any role for deposits in this interpretation of the bank lending channel, nor does traditional literature neglect the fact that risk premiums influence a bank's ability to access uninsured funding.

There are two new aspects to the new interpretation. First, due to the dimension to which wholesale funding markets have grown and due to financial innovation (including securitization and credit derivatives), the problems associated with asymmetric information and moral hazard have also increased in significance. Second, the new view explicitly acknowledges that, even if a bank is not dependent *at all* on (insured) deposits, it is all the more subject to an external finance premium, which originates in the informational asymmetry between lender and borrower. In short, in accounting for the developments of financial markets over recent decades, the focus has shifted to the increased importance of funding via wholesale markets.

---

[25] Wholesale funding can be distinguished according to maturities into short-term and long-term funding. Short-term wholesale funding comprises unsecured and secured money market borrowings and the issuance of short-term debt (commercial paper, for example). Long-term wholesale funding includes bonds and covered bonds.

[26] One very telling example of the perceived riskiness of banks as a determinant for their ability to access uninsured sources of funding is the drying-out of the interbank capital markets following the collapse of Lehman Brothers: Uncertain about other institutions' levels of exposure, banks simply ceased to lend to each other (see van Rixtel and Gasperini (2013), for example).

The cost of raising funds on these markets is dependent on an institution's perceived riskiness and is affected by monetary policy.

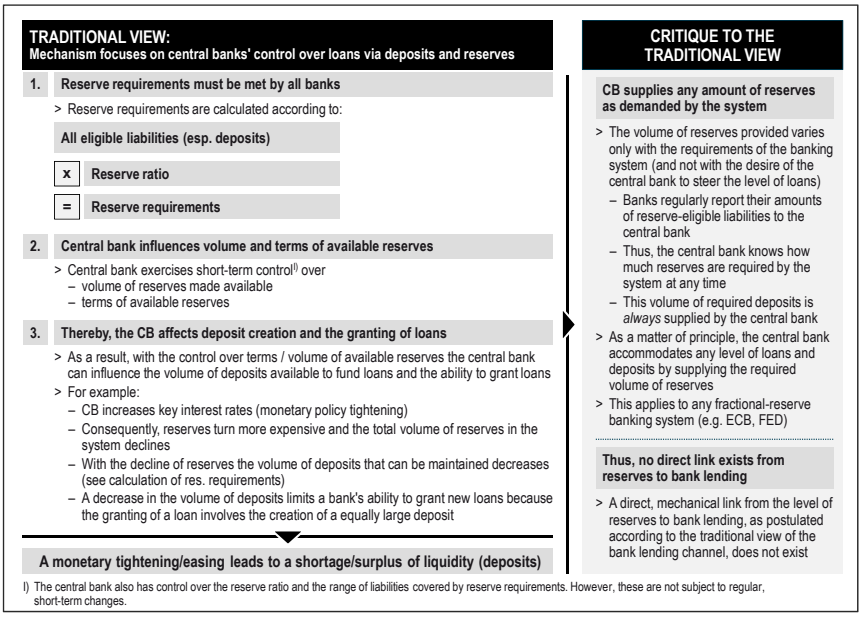


Figure 4.1: The traditional view and a critique of the traditional view

The traditional view of the bank lending channel mechanism and the critique of it in light of the developments mentioned above are shown in figure 4.1.

Before attempting to conceptualize this new view on the bank lending channel, it makes sense to clarify how monetary policy influences bank lending in light of the new view (see figure 4.2). The mechanism works through changes in the funding conditions for banks that are induced by monetary policy changes. It is then reflected in the cost of loans for borrowers: With the change of key interest rates, the central bank induces disproportionate changes in the funding conditions for banks. How does this happen?

According to Disyatat (2011), tighter monetary policy, for example, has a negative impact on banks' cash flow, net interest margins and asset valuations. These factors are all reflected, *ceteris paribus*, in negative changes to banks' capital positions. Lower capital ratios signal higher risks to providers of uninsured funding, for which they demand a higher external finance premium. Furthermore, the widespread use of

mark-to-market accounting exposes banks to higher interest-rate risks which, in the same way, trigger demand for a higher risk premium (see Adrian and Shin (2008a). Moreover, increased reliance on short-term funding adds further to banks' augmented sensitivity to changes in the monetary policy rate.

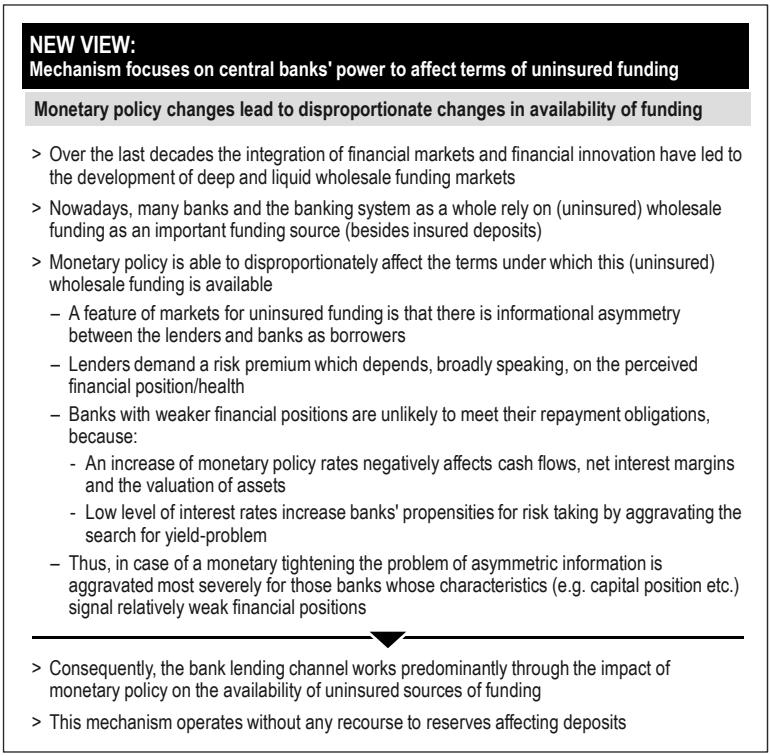


Figure 4.2: The new view on the bank lending channel

A further rationale is worth considering that also sees risk as an important factor, albeit from a slightly different angle: According to Borio and Zhu (2012), a central bank directly impacts banks' incentives to take risks. Low levels of interest rates have the potential to increase a bank's tolerance for risk by aggravating the *search for*

yield problem.[27] Riskier operations will, however, translate into a higher risk premium demanded on wholesale funding markets.

These examples show how monetary policy can trigger variations in the perceived riskiness of banks. The magnitude of the variation depends on banks' characteristics.[28] The result is that changes in the terms at which banks can borrow in funding markets are passed on to borrowers of loans.[29]

Interestingly, this new view on the mechanism of how monetary policy affects the supply of bank loans does not hinge on a drain in reserves. It reconciles the fact that insured deposits are not a limiting factor to the funding of banks' assets. As noted earlier, a deposit is created when a bank grants a loan because it credits the amount of the loan to the debtor's account as a deposit. Hence, deposits are not a constraint, but they are endogenously created in the financial sector as a function of demand for loans (see Disyatat (2011)). Reserves are then provided by the central bank depending on the amount of deposits and the reserve ratio. This is the reversal of what is claimed according to the traditional view.

Another interesting consideration is that non-bank financial intermediaries that do not fund themselves with insured deposits at all but that have to rely completely on market funding are likewise sensitive to the mechanism triggered by monetary policy changes. Their cost of funding too is dependent on their perceived riskiness. Via the same mechanism, monetary policy also influences the balance sheets, cash flows and capital of non-bank financial intermediaries, which determines the probability that

---

[27] Borio and Zhu (2012) coin the notion that monetary policy has an impact on the riskiness of an institution's *risk-taking channel*. Although the role of risk is fully acknowledged (and proven empirically; see e.g. Jimenez et al. (2008)), the question addressed in the present study is what factors impact the lending behavior of banks and their lending response to monetary policy. For this reason, the above notation of Borio and Zhu is not followed here. (The authors themselves do not claim it as a distinct channel.) Instead, *risk* is incorporated into the systematization of bank characteristics stemming from the conditions and subconditions of the bank lending channel (see figure 4.4 and figure 6.2).

[28] For a formalization of this idea, see the model proposed in Disyatat (2011), adapted from Disyatat (2004).

[29] It is important to note that this is *not* a reflection of the traditional interest-rate channel. The transmission of monetary policy through the interest rate channel leads to a proportional increase of costs of credit over the risk-free rate (see Disyatat (2011)).

they will be able to pay back borrowed funds. The implication is therefore that non-bank financial intermediaries are subject to monetary policy changes and to the bank lending channel in just the same way as “normal" financial intermediaries, and that the determinants of their lending reaction are closely comparable to those of banks. Claims that the bank lending channel may have become muted or have seen its significance reduced in light of the growing importance of non-bank financial intermediaries may, then, have been premature (see Bernanke (2007)).

4.2. Toward a conceptualization of the new view

As shown in figure 4.1, criticism has been leveled at the traditional view of the bank lending channel, which focuses on the central bank's influence on deposits as a funding source via its ability to control the volume of available reserves. The argument is that, in a fractional-reserve banking system, central banks can supply any amount of reserves as demanded by the system. However, the bank lending channel is unlikely to have ceased to exist. In light of developments such as deregulation and financial innovation, the channel continues to work through the central banks' impact on the availability of uninsured funding in public markets. Banks whose financial position is relatively weak are more severely impacted by monetary policy tightening, for example, because the problem of asymmetric information is amplified for these banks, in particular due to the negative impact on cash flows, net interest margins and asset quality.

Taking account of these new aspects of the bank lending channel and their theoretical substantiation as outlined in section 4.1, this leads to a new approach to conceptualizing the bank lending channel, its conditions and subconditions.

Before going into the details, one important theoretical step must first be acknowledged. There is no question that the total cost of alternative funding for a bank is determined not only by the risk premium, which is the *cost per unit* of borrowed funds: It also depends on the *amount or volume* of borrowed funds. This relationship is illustrated in figure 4.3. Figure 4.3 also previews the determinants of both volume and (the risk component of) cost per unit of alternative, uninsured

funding (see figure 4.4 for more details).[30] The key insight, from a theoretical point of view, is that all characteristics that either impact on the volume or on the unit cost of uninsured funding determine bank lending.

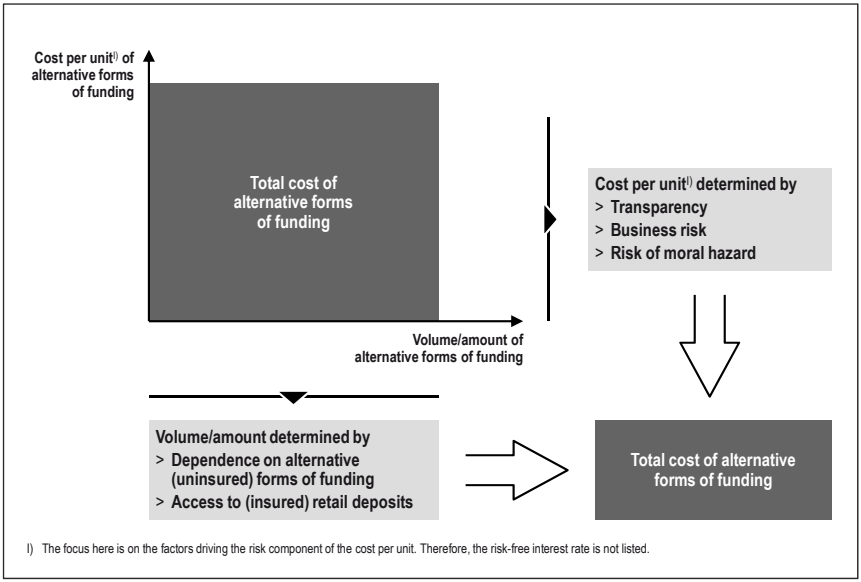


Figure 4.3: Determinants of cost or ease of access to alternative forms of funding

This leads to a enhanced conceptualization of the bank lending channel including the economic concepts determining bank lending. Figure 4.4 presents a breakdown of the subconditions of the relevant first condition of the bank lending channel into the related economic concepts.

On the left-hand side of the figure, all three subconditions of condition 1 are arranged one below the other. Moving one column to the right, the economic concepts that serve to operationalize the various subconditions are depicted. For the second subcondition, these economic concepts are split into concepts that impact the cost per unit of alternative forms of funding and concepts that impact the volume/amount of alternative forms of funding.

[30] These are the concepts on which the determinants are based that are used to explain banks' lending behavior in the empirical analysis in chapter 7. See also section 6.4 for the further translation and specification of the concepts toward individual bank characteristics.

Let us take an example: One of the economic concepts behind the second subcondition is "business risk". "Business risk" has an impact on the cost per unit of funding: The less risky the bank, the more favorable will be the terms on which external funds can be raised.

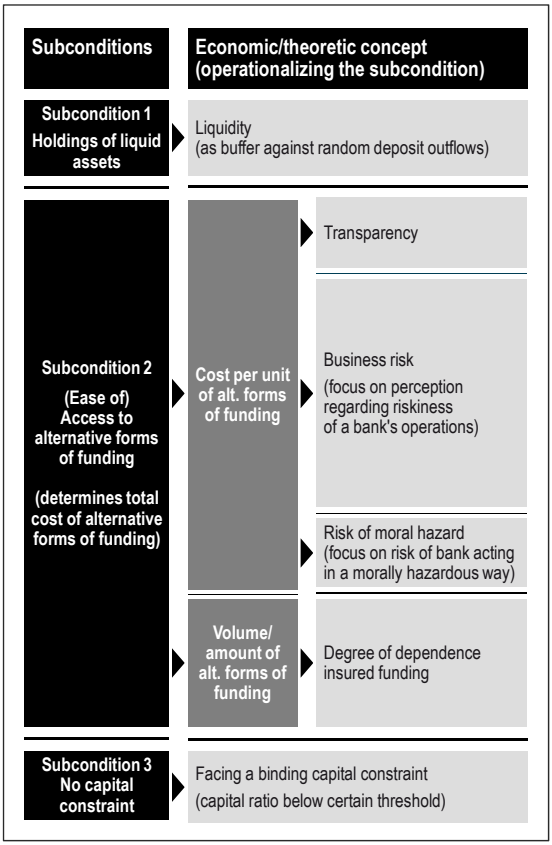


Figure 4.4: Breakdown of subconditions into economic concepts driving bank lending

Already previewing the following discussion, this way of depicting a framework for the breakdown of the subconditions has two main advantages regarding the further course of analysis in the next chapters.

First, after the review of empirical evidence in chapter 6, an attempt can be made to connect each of the bank characteristics that authors have identified to have an impact on bank lending to the economic concepts shown in figure 4.4 and thereby

integrating them into overall framework. This is useful as a way to transfer the subconditions into proxy variables used later in the econometric analysis. As such, it highlights structural relationships between bank characteristics and the conditions and subconditions. This exercise is done in section 6.4.

Second, it provides a framework into which each bank characteristic that is relevant must be meaningfully integrated, thereby serving as an initial plausibility check for any future developments in this field.

5. Bank lending against the background of the recent crises

The focus so far has been on changes in bank lending in the context of the theory of the bank landing channel. The bank lending channel and the conceptualization formulated in chapter 4 lay the foundation for the subsequent empirical analysis. However, this context must be extended by one important aspect: While initial and by no means exhaustive attempts have been made to investigate the *empirical* influence of the recent crisis on the factors that determine bank lending, the current literature lacks any framework that is able to *theoretically* account for a differential impact of bank characteristics on lending during periods of crisis. This chapter closes the gap by linking bank lending to two phenomena that were observable during the recent crisis in the financial sector and that acted as an amplification mechanism. Taken together, these two concepts form the basis, from a theoretical perspective, to substantiate the view that some bank characteristics played a different role in their influence on bank lending during the recent crises compared to “normal” times. The first concept is the loss spiral and the second is the margin spiral or leverage cycle.

These two negative feedback loops reveal externalities that can be seen as having significantly contributed to the propagation of the crisis in the financial system and as having promoted contagion among financial investors such as banks, insurance companies and others. In particular, while it is desirable from the perspective of an individual institution to sell assets in order to restore adequate capital ratios in response to initial losses to a bank’s equity, the same course of action might not be desirable from the perspective of the stability of the financial system as a whole. The forced and uncoordinated sale of assets (“deleveraging”) when a pronounced boom period turns negative can put the entire financial system under a level of stress that leads to economy-wide contraction in lending and economic activity.

This important issue is prominent in the ongoing discussion of “macroprudential supervision”. Macroprudential supervision aims to develop and implement measures

H. Brinkmeyer, *Drivers of Bank Lending,* Schriften zum europäischen Management,
DOI 10.1007/978-3-658-07175-2_5, © Springer Fachmedien Wiesbaden 2015

to guard financial stability against the risk of contagious effects and the build-up of structural imbalances.[31]

In the sections that follow, the general mechanics of the loss spiral and the margin spiral/leverage cycle are presented and linked to the lending of financial institutions. Implications are then drawn with regard to bank characteristics that impact lending in a crisis context.

5.1. The loss spiral

The loss spiral is one of the two concepts which give reason to believe that some of the bank characteristics that determine the credit supply behave differently during times of crisis than at "normal" (i.e. non-crisis) times.

To see the connection, it is helpful to first understand the general mechanics. At the heart of the liquidity spiral is the famous debt-deflation mechanism pioneered by Fisher (1933), which helps to explain business cycles against the background of the Great Depression.[32] However, mapping this idea onto the financial sector and applying it to financial crises, especially to the most recent one, is a fruitful exercise.

Without going into the details of the origins of the recent crisis and only in order to sketch a few important features, it is well established in literature that the US Federal Reserve created an environment of low key interest rates in response to events at beginning of the last decade in order to counteract the ensuing recession (see figure 5.1). This policy left the economy awash with liquidity which, in connection with other factors, such as development of credit derivatives and securitization markets, governmental subsidies for mortgages, etc., created a real estate boom. As long as real estate prices were rising (see figure 5.2) and debtors were able to meet their repayment obligations, this boom also drove up banks' net worth or equity. To the

[31] Macroprudential concepts are believed to be necessary to prevent individual, utility-maximizing financial firms from deviating from the actions a social planner would induce them to engage in, i.e. to avoid the social costs that result from a sudden, uncoordinated shrinkage of balance sheets. For a recent survey of literature on macroprudential policy, its goals and tools, see Galati and Moessner (2012).

[32] For a more recent analytical underpinning of business cycles, see Kiyotaki and Moore (1997) and Bernanke et al. (1999), for example.

extent that financial intermediaries' balance sheets had to be marked to market, e.g. due to their holdings of credit derivatives, net worth was impacted on a daily basis.

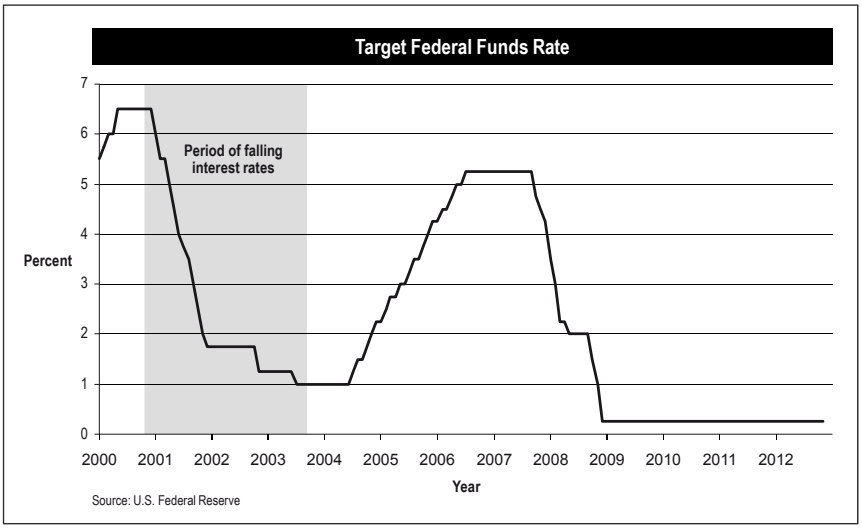


Figure 5.1: The US federal funds target rate, 2000-2012

As Adrian and Shin (2010b) argue, this development encouraged banks that were keen to find favorable investment opportunities to lend to borrowers of questionable creditworthiness. At the time, this was not a major concern due to the fact that rising housing prices guaranteed sufficient collateral.

When the Federal Reserve began to gradually increase target interest rates from the second half of 2004 onward and the economic outlook began to deteriorate, real estate prices started to decline by the end of 2006 (figure 5.2). This set the debt-deflation mechanism of the loss spiral in motion.[33]

The start of the actual spiral is marked by initial losses from which banks suffered as house owners began to struggle to repay their loans. Banks in such a situation are faced with a funding constraint in the sense the losses wipe out equity and increase the leverage. Increased leverage ratios exacerbate the asymmetric information problem between banks as borrowers and the providers of (uninsured) funds. The

[33] The focus here is more on the mechanism of the loss spiral rather than the sequence of events during the recent crisis. The latter topic is already amply dealt with by almost innumerable accounts that cover the crisis from many different angles.

borrower is more risky and, therefore, the problem is the more severe the higher an institution's leverage.

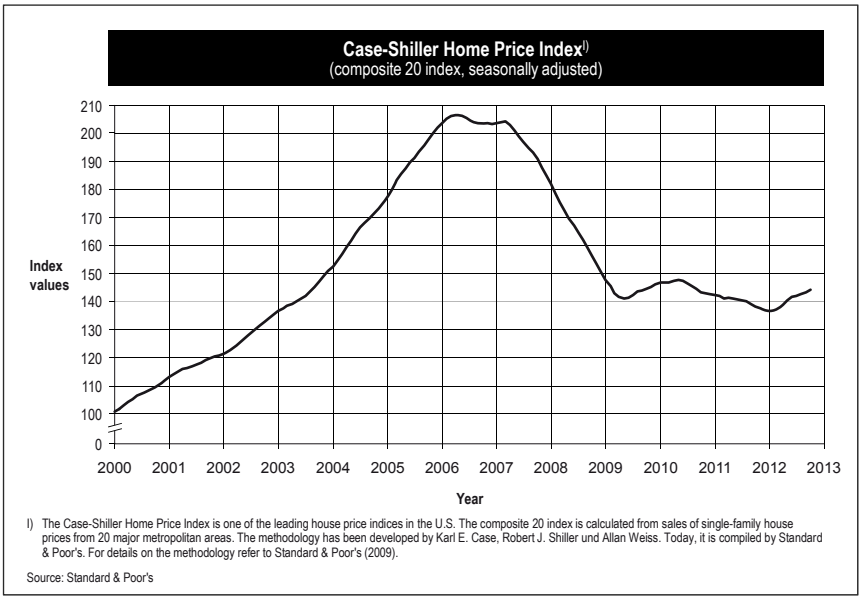


Figure 5.2: House price development in the US, 2000-2012

In response to the increased asymmetric information problem and to perceived riskiness, banks try to push leverage ratios down to earlier levels by selling assets to avoid being cut off from funding liquidity.[34, 35] Where not enough short-term assets are available, even long-term assets have to be sold at short notice, which becomes more likely the greater the maturity mismatch is on the bank's balance sheet.

Shleifer and Vishny (1992) cite an example from the real economy to point out that the forced sale of an asset in times of recession can lead to significant price

[34] The assumption of constant leverage ratios may be questioned. More light on that issue is shed in the next section on margin spirals in which the assumption is relaxed in favor of the even more severe one of procyclical leverage ratios.

[35] There different approaches to theoretically model the funding constraint stemming from too high leverages which all amount to the same result. For example, Bianchi and Mendoza (2011) impose that agents may not borrow more than given by a certain fraction of the market value of their collateral assets.

discounts (“fire sales”) precisely because potential buyers to whom the asset has the highest value are typically those who are from the same industry and tend to be affected by the same distress as the seller. This leads to an equilibrium in which the asset is sold to a buyer at a price below the value in best use (see also Geanakoplos (2010)).

The same pattern can be applied to securities in financial markets. Securities that are liquidated under fire-sale conditions are sold at a discount because those market participants who are most knowledgeable about the underlying asset and the risks associated with it are distressed as well. Only investors with deep pockets may have the capacity to buy these securities, but only at a discount due to a lack of knowledge and experience in this field. To the extent that securities are marked to market, the result is an immediate equity loss and a need to sell further assets.

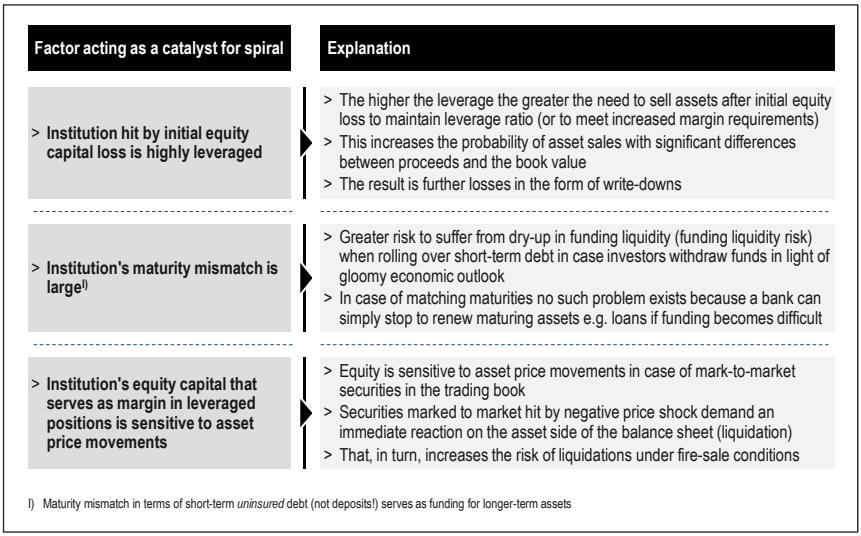


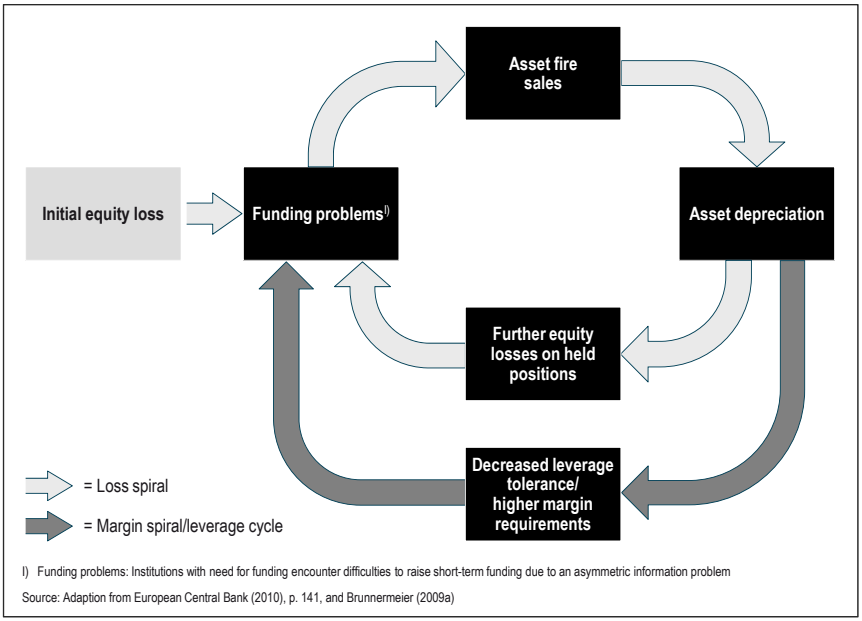
Figure 5.3: Catalysts to the loss and the margin spirals

The fact that securities are marked to market has another important effect, producing the following externality: Not only the bank selling the asset has to write down the difference between the book value and the price of the sale, but so too do all holders of the same asset. This results in further (mark-to-market) equity losses at all affected institutions which, in turn, triggers a vicious cycle: the aggravated asymmetric information problem, the need to sell assets even at fire-sale prices to keep leverage

ratios from rising too much and thus cutting the bank off from funding liquidity, the depreciation of assets, additional equity losses, and so on.

The factors acting as catalysts to the loss spiral are high leverage, a large maturity mismatch and the fact that an institution's equity is subject to marked-to-market asset price movements as shown in figure 5.3 (see also European Central Bank (2010a), p. 139). The overall mechanism of the loss spiral is illustrated in figure 5.4.

Needless to say, if a bank finds itself in a position where it has to liquidate assets at fire-sale prices, there is no room to expand lending because of the need to shrink the asset side of the balance sheet.



l) Funding problems: Institutions with need for funding encounter difficulties to raise short-term funding due to an asymmetric information problem

Source: Adaption from European Central Bank (2010), p. 141, and Brunnermeier (2009a)

Figure 5.4: The loss spiral and the margin spiral/leverage cycle

Against the background of the crisis, it is interesting to see that, while the friction was originally sparked off in the market for subprime mortgages, it also spilled over to other asset classes, as is apparent from the breakdown of the jumbo mortgage markets, the markets for asset-backed commercial papers and those for collateralized debt obligations, for example (see Greenlaw et al. (2008)). This effect had already been anticipated by Shleifer and Vishny (1992) in an example of fire sales of real assets.

The loss spiral is not the only mechanism that contributed to the propagation of the recent financial crisis. The second, closely related, mechanism is the margin spiral or leverage cycle.

5.2. The margin spiral or leverage cycle

A sibling of the loss spiral and equally involved in propagating the crisis and promoting its contagious effects is a concept to which Brunnermeier (2009a) refers to as the margin spiral, while Geanakoplos (2010) refers to it as the leverage cycle. It can be seen as a mechanism that enhances the sequence described in the concept of the loss spiral.

One assumption made in the case of the loss spiral is that banks react to initial losses in their equity by selling assets in order to keep their leverage ratio *constant*. In the case of the margin spiral, this assumption is abandoned in favor of a more realistic, but also more severe one: As the two cited studies argue, leverage is cyclical, with leverage ratios increasing in boom times and declining in recessions – a picture that is empirically supported by Adrian and Shin (2008b and 2010a) and Hanson et al. (2011). In short, the margin spiral centers the cyclicality of the leverage ratios of financial intermediaries.[36]

As in the case of the loss spiral, when an economic downturn is perceptible, initial losses to a bank's equity force a bank to sell assets. Given that, in a recession, borrowers have stronger incentives to act in a morally hazardous way, lenders of uninsured funds tend to have a *reduced tolerance for leverage* at such times.

The reduced tolerance for leverage is not only motivated by lenders seeking to avoid being negatively affected by moral hazard but also by the following, according to Brunnermeier and Pedersen (2009): The first unexpected asset price decreases could be interpreted by providers of uninsured debt as warning signals, and the higher volatility in the markets may lead to higher margin requirements. For borrowers, this is particularly harmful when resorting to short-term debt. This is

[36] Leverage ratios for households show exactly the opposite pattern: Households do not tend to adjust their "balance sheets" in response to asset price increases. For example, on aggregate, house owners who have raised a mortgage for which the house serves as collateral usually do not take on more debt when house prices rise (see Greenlaw et al. (2008)).

because short-term debt has to be rolled over more frequently so that changes in margin requirements take effect immediately.

To meet the lender's reduced requirements, borrowers must liquidate assets on a larger scale (as compared to the loss spiral with constant leverage ratios), causing even more losses due to fire sales stemming from the considerably greater need for depreciation. This is anticipated by borrowers, who demand even more collateral or, on the other hand, tolerate even lower leverage ratios. This aggravates the funding problems over and above the loss spiral which is at work at the same time. The margin spiral/loss cycle is depicted in figure 5.4.

The pressure on banks to sell assets in economic crises may further be aggravated by risk-management procedures that are used in banks resulting in even more pronounced procyclical leverage ratios. Brunnermeier (2009b) and Greenlaw et al. (2008) state this by pointing to the countercyclical character of conventional value-at-risk measures: In recessions, volatility tends to be higher than in boom phases, leading to higher possible losses in accordance with the value-at-risk methodology. The assumption is that a bank can only hold an amount of assets whose value at risk (or possible loss) must correspond to the equity capital that is available to absorb possible losses. This means that, in a recession, a given equity capital endowment only allows for a smaller balance sheet size or less leverage due to higher value-at-risk estimates. In a boom phase, the opposite is the case. Since banks manage their balance sheets on the basis of value-at-risk estimates, their leverage correlates positively to the business cycle.[37]

A possible question is why banks do not, in anticipation of this recurring pattern, raise sufficient equity capital and build up adequate buffers *before* a crisis.[38]

Clearly, once a crisis is underway and a bank is struggling to repay its debt, it might already be too late to do so because of the debt-overhang problem identified by Myers (1977): New equity that a bank raises to avoid having to reduce assets would then simply be siphoned off by more senior credit tranches.

---

[37] Note that *to lenders* of uninsured funds higher leverages are tolerable in boom times primarily due to the rising prices of those assets that serve as collateral. The opposite is the case in a recession.

[38] This question is also valid in the context of the loss spiral but especially indicated against the background of cyclical leverage ratios.

An explanation offered by Stein (2012) is that banks prefer short-term debt over equity capital (and over long-term debt) because it is cheaper.[39] The risk of default to investors is much lower and, consequently, the price of this kind of funding is lower, which leads to excessive bank leverage ratios. The problem with this excessive leverage is that banks do not internalize all the associated costs when they have problems rolling over their short-term debt in a recession and are thus forced to liquidate assets under fire-sale conditions. As already pointed out, the decline in value of the sold assets triggers write-downs at all banks that hold the same assets.

To conclude this chapter, it is worth briefly examining why the margin spiral in the recent financial crisis was worse than previous spirals. Geanakoplos (2010) believes that the recent crisis was characterized by several elements that have not occurred in previous spirals. The most important one is that leverage ratios were higher than ever before, leading to balance sheet adjustments on an unprecedented scale. In addition, there were actually two mutually reinforcing margin spirals: one in the housing market and a second one in the market for mortgage securities. Moreover, Geanakoplos (2010) claims that, with the development of credit default swaps (CDS), investors have been able to bet against a given underlying asset, thereby further pushing down asset prices.

What conclusions can therefore be drawn from this discussion? And what implications do the two spirals have for bank lending?

5.3. Conclusion

The loss spiral and the margin spiral/leverage cycle are both phenomena that occur at times of crisis. They become problematic for the financial system as a whole in an economic downturn due to the negative externalities they produce. The speed and severity of a crisis can be thought of as being related to the factors that promote these spirals.

Their mechanics suggest that certain bank characteristics or properties of banks' balance sheets affect bank lending differently at normal times compared to times of crisis. In the course of the review of empirical evidence and especially by deriving

[39] This assumption is a deviation from the Modigliani-Miller theorem (Modigliani and Miller (1958)), the capital structure irrelevance principle.

implications from the new view on the bank lending channel for the interpretation of available empirical results in the next chapter (chapter 6), it will become evident how the bank characteristics that play a special role during crisis periods fit in the framework which has been already developed in section 4.2.

Precisely those characteristics or balance sheet properties that set the spirals in motion and that are to be held accountable for the gravity of the course the crisis takes are of primary interest when comparing normal to crisis periods in the empirical analysis of this study. So which characteristics are they?

First, it has become clear that high **leverage** is an important factor. While high leverage does not pose a problem in itself during normal periods, it becomes harmful to a bank during a crisis because initial equity losses involve asset liquidations that amounting to values equal to the loss multiplied by the leverage.

Second, while a **maturity mismatch** can already be a sign of generally elevated funding risk even at normal times, this risk materializes in full force during a crisis. When investors withdraw their funds and funding markets start to dry out, rolling over short-term debt becomes much more difficult. This increases the risk that a bank will have to liquidate even long-term assets at short notice and leaves no room to expand lending activities – quite the contrary. In addition, even outside of a real banking crisis, an inverted yield curve[40] means that assets with longer maturities must be financed using more expensive short-term debt. This is an additional source of risk stemming from maturity mismatches.

Third, the share of **mark-to-market securities** increases a bank's exposure to asset price volatility. In an economic downturn, the increased volatility of the assets held leads directly to equity losses. Moreover, the sale of a security by a bank that is also held by other banks causes the other banks to write down the value as well. This is part of the negative externality described above.[41]

---

[40] An inverted yield curve shows higher interest rates for short maturities than for longer maturities.

[41] The vulnerability to asset price depreciations of banks' balance sheets characterized by a significant volume of mark-to-market securities on their trading books drove many banks to reclassify all eligible assets and transfer them to the held-to-maturity portfolio during the recent crisis, in accordance with amendments to IAS 39 and IFRS 7 (see International Accounting Standards Board (2008)).

Fourth, while counting as short-term (but insured) debt, a large proportion of funding in the form of insured retail **deposits** diminishes dependency on wholesale funding markets. Again, when liquidity on these markets evaporates as the recession worsens, a bank that funds itself to a smaller extent by means of short-term wholesale debt is more shielded by these adverse conditions.

These considerations suggest that there are, indeed, bank characteristics that play a different role during a crisis compared to normal times. Empirical verification of this claim is one of the central concerns of this study and is part of the empirical analysis in chapter 7.

All bank characteristics identified in this chapter will be incorporated in the framework shown in figure 4.4 which is further developed in section 6.4. This implies that the framework is also capable of capturing the effect of the crisis on bank lending. Before that, available empirical evidence is reviewed in the next chapter, on basis of which the exact research gaps are derived.

6. Review of empirical evidence on bank lending and its implications

This chapter deals with the empirical evidence that has been produced so far regarding bank lending and the bank lending channel. Furthermore it focuses on implications for the interpretation of the empirical evidence in light of the new view on the bank lending channel introduced in chapter 4.

To validate the entire bank lending channel mechanism from central banks via banks to the real economy, it would be necessary to provide evidence substantiating at least the first and the second conditions.[42] However, a complete proof of the bank lending channel is not within the scope of the present study. The aim of this research undertaking is to identify the driving factors behind the expansion or contraction of bank lending. The empirical approach necessary to do so is closely related to an analysis of the validity of condition 1. Accordingly, the review of relevant empirical literature is confined to the scope of the first condition of the bank lending channel.[43] The specific research questions and the hypotheses to be tested in the empirical section emerge from gaps in this literature.

There are various dimensions along which the literature can be organized, the most important of which are the country dimension, aggregate versus bank-specific data, and a chronological order. Since the first empirical tests were carried out using US data, starting with evidence from the US best captures the development and advancements that have been made in the past two-and-a-half decades.

The results of early bank lending channel tests are based on aggregate data. They have been deemed unsatisfactory for the reasons outlined below. In the course of econometric advancements toward panel estimation techniques, the characteristics of individual (US) banks came to be the center of attention.

[42] The validity of the third condition – prices must not adjust instantaneously and monetary policy must not be neutral – is taken as given.

[43] A detailed treatment of empirical work on the second condition would be too far off focus and is, therefore, not justified.

H. Brinkmeyer, *Drivers of Bank Lending,* Schriften zum europäischen Management,
DOI 10.1007/978-3-658-07175-2_6, © Springer Fachmedien Wiesbaden 2015

In order to capture the progress made in understanding the drivers of bank lending and the bank lending channel, the following sections first reconstruct the academic debate in the US based on aggregate and, subsequently, bank-specific data. Following on from the "US case", the empirical evidence produced in Europe is presented with a focus on the euro area, again based on bank-specific data.[44] The empirical literature review also includes an overview of existing contributions that already deal with the most recent financial crisis.

The chapter concludes with focusing on implications that can be derived from the empirical literature against the background of the new view on the bank lending channel outlined in chapter 4. An attempt is made to integrate all bank characteristics that have been identified to have an impact on the supply of bank loans into the framework that has been presented in figure 4.4. By applying this framework which leads to a systematization of bank characteristics driving bank lending, the basis is built not only for the formulation of hypotheses to test and but also for the empirical analysis as a whole.

Before reviewing the empirical literature and discussing how the available evidence can be reconciled with the new view on the bank lending channel, attention is drawn to some institutional differences between the US and the euro area whose implications for bank lending should be borne in mind.

6.1. Remarks on the difference between the US and the euro area

It is a well-known fact that there are substantial differences in the financial structures of different countries and, in particular, between the United States and countries belonging to the euro area. As shown in figure 6.1, enterprises in the euro area rely much more heavily on bank financing than their counterparts in the US. On the contrary, US companies avail themselves of the financial markets to a much greater extent, as reflected in the higher share of issued debt securities and the higher stock market capitalization (measured as shares of GDP) compared to the euro area.

Does this mean that the bank lending channel is relevant in the euro area but irrelevant in the US? Care must be exercised in deriving *a priori* implications from this

[44] When researchers started to focus their attention on European countries, analyses based on techniques involving aggregate data were already outdated and are, therefore not available.

pattern for the importance of the bank lending channel. One could be tempted to conclude that the economic impact of monetary policy on bank lending and the overall economy must be stronger in a country or region in which the bulk of corporate debt is reflected in assets on banks' balance sheets, as opposed to a country in which a relatively low share of corporate debt involves bank lending. On the contrary, however, not only the markets for debt that are tapped by corporations are more highly developed: The same also goes for the debt markets that are tapped by banks. Indeed, by aggravating the potential adverse selection and moral hazard problems merely through the higher volume of wholesale funding, banks might actually be even more sensitive to changes in monetary policy (as discussed in chapter 4), thereby amplifying the function of the bank lending channel.

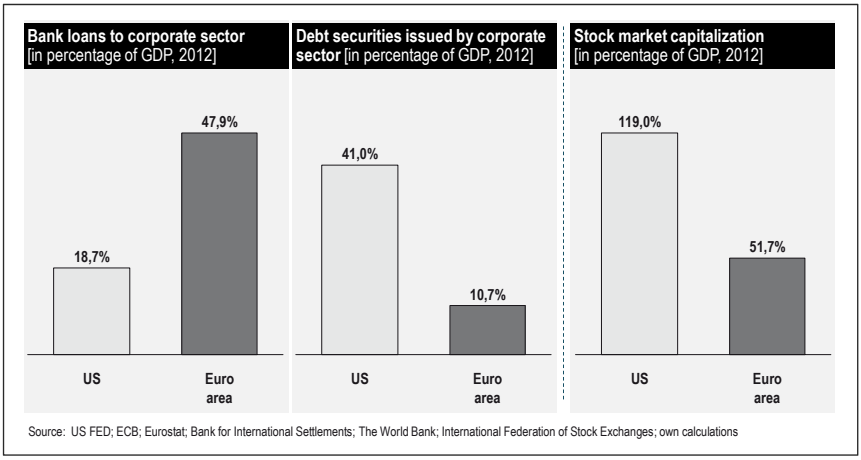


Figure 6.1: Financial structure in the US compared to the euro area

In the end, when judging economic significance, there are many reasons to believe that the role of the individual bank characteristics must be examined carefully in the context of the financial structure of a given economy, and also in the context of the prevailing economic conditions (e.g. during or outside a crisis period) before a meaningful conclusion can be reached. For this reason, most of the following sections on empirical evidence are devoted to the impact of bank characteristics.

6.2. Empirical evidence from the US

6.2.1. US evidence based on aggregate data

Beginning with evidence from the US, a first promising empirical attempt to establish the claim that monetary policy works in part through its effect on the availability of bank loans, over and above the traditional interest-rate channel, is presented by Bernanke and Blinder (1992) on the basis of aggregate data.[45] Building on their earlier work (Bernanke and Blinder (1988)), they show that loans respond to changes in monetary policy. But as they admit themselves, this finding is also consistent with the interpretation that the decline in bank loans merely reflects falling demand for credit caused by demand factors.

An alternative approach by Kashyap et al. (1993) investigates the composition of firms' external finance to identify a bank lending channel. These authors show that, in response to monetary tightening, the share of commercial papers rises while the share of bank loans declines. If this decline in bank loans were merely reflecting depressed economic conditions, one would expect commercial papers to decline by a comparable proportion, leaving the overall composition unchanged. Since this is not the fact, the empirical evidence gives rise to believe that the supply of bank loans is reacting to monetary policy.

The evidence presented by Ludvigson (1998) is based on automobile loans and goes along the same lines. The finding is that, after a contractionary monetary shock, the ratio of banks' automobile loans falls relative to the sum of bank and non-bank automobile loans, which indicates a decline in the supply of consumer loans by banks.

One objection to results obtained in the manner adopted by Kashyap et al. (1993), put forward by Oliner and Rudebusch (1996b), is that the observed change in the mix of bank loans and commercial papers is not necessarily due to a decline in the supply of bank loans. They suggest that the rising share of commercial papers could also be attributed to heterogeneous demand for credit: Large firms account for the bulk of commercial papers, while small firms usually do not have access to the

[45] A list of selected empirical research from the US on bank lending and the bank lending channel is provided in table 6.1

commercial paper markets. Now, if small firms are hit harder than large firms by a demand shock – probably because small firms are more vulnerable to the business cycle – the composition of bank loans and commercial papers will change without a decline in the supply of bank loans.

6.2.2. US evidence based on data from individual banks

Advances in panel estimation techniques made it possible to focus on the characteristics of individual banks and their role in the transmission process of monetary policy. Specifically, it is now possible to analyze the extent to which different bank characteristics account for the varying cross-sectional responses of bank lending to monetary policy shocks.

Most studies in this vein are primarily geared to exploiting the differences between banks in the way they access alternative forms of funding. These contributions explore those characteristics that are assumed to affect the magnitude of the asymmetric information and moral hazard problems (and, ultimately, the external finance premium) that is involved when banks are themselves borrowers of uninsured sources of funding. In terms of conditions of the bank lending channel this connection is stipulated in the second subcondition of the condition 1.

Other contributions focus on the analysis of the relationship between the holdings of liquid assets and bank lending which is the theoretical background of the first subcondition.

Studies arguing that the ability to expand lending is affected when banks are subject to binding self-imposed or regulatory capital constraints are related to the third subcondition of condition 1.

In the discussion that follows it has adhered to the numerical sequence of the subconditions (subcondition 1, subcondition 2, subcondition 3). This style is preferred to ensure congruence with the theoretical foundations of the bank lending channel as discussed in sections 3.1.1 and 4.2, and to make the present study easier to read.

Paper	Geographical focus	Sample period	No. of banks and no. of observations	(Main) Data source	Main findings
Bernanke / Lown 1991	US	1981-1991	Based on aggregate data	FED: call reports	Shortage of capital responsible for slowdown of lending
Bernanke / Blinder 1992	US	1957-1989	Based on aggregate data	DRI	Loans respond to monetary policy change
Hall 1993	US	1998-1992	11,507 banks (in '91) No. of obs.: n.a.	FED: call reports	Introduction of Basel I accord caused slowdown in lending
Kashyap et al. 1993	US	1964-1989	Based on aggregate data	FED: flow-of-funds publication	Mix of company financing consisting of bank loans and commercial paper (CP) changes toward CP after monetary policy change
Berger / Udell 1994	US	1979-1992	No. of banks: n.a. >600,000 obs. (unbalanced)	FED: call reports	Lending was reduced in reaction to Basel I accord to reduce funding costs and not due to a direct capital constraint
Kashyap / Stein 1995	US	1976-1992	14,280 Banks (in '84) 3,360 obs. (balanced)	FED: call reports	Small banks reduce loan portfolio more sharply in reaction to monetary policy rate increase
Peek / Rosengren 1995a	US	1976-1994	No. of banks: n.a. No. of obs.: n.a.	FED: call reports	Capital-restricted banks reduce lending more significantly then non-restricted banks
Peek / Rosengren 1995b	US (New England)	1989-1992	150 banks No. of obs.: n.a.	FED: call reports	Banks for which capital constraint becomes binding due to regulatory enforcement actions reduce loans faster in response to low capital ratios than unbound banks
Peek / Rosengren 1995c	US (New England)	1990-1991	407 banks No. of obs.: n.a.	FED: call reports	Better capitalized banks shrink lending by less after hit by negative capital shock
Peek / Rosengren 1997	US	1989-1995	n.a. (only US branches of Japanese banks) 370 obs.	FED: call reports	Capital ratio of Japanese parent of US branch has significant impact on lending in the US
Ludvigson 1998	US	1965-1994	Based on aggregate data	FED: G.19 & G.20 statistical release	Monetary tightening results in relative decline of bank loans used for automobile finance
Kashyap / Stein 2000	US	1976-1993	11,206 banks (in '93) 961,530 obs. (unbalanced)	FED: call reports	Banks with little holdings of liquid assets are most responsive to monetary policy changes (esp. small banks)
Kishan / Opiela 2000	US	1980-1995	13,042 banks No. of obs.: n.a.	FED: call reports	(Small) banks with higher capital ratios are less sensitive to monetary policy changes
Campello 2002	US	1981-1997	No. of banks: n.a. 547,390 obs. (unbalanced)	FED: call reports	Small banks that are affiliated to a multibank holding react less to monetary policy tightening
Kishan / Opiela 2006	US	1980-1999	No. of banks: n.a. No. of obs.: n.a.	FED: call reports	Banks with low capital ratios react more sensitive to monetary policy tightening than to monetary policy expansion
Holod / Peek 2007	US	1986-2005	No. of banks: n.a. 675,546 obs. (unbalanced)	FED: call reports and FR Y-9C	Loans portfolio of publicly traded banks are less sensitive to monetary policy tightening
Berrospide / Edge 2010	US	1992-2008	140 banks (holdings) 11,099 obs. (unbalanced)	FED: Consolidated Fin. Statement for Holding Companies (FR Y-9C)	Modest effect of low capitalization on credit supply; sizable impact of scarce liquidity

Table 6.1: Selected empirical research from the US on bank lending and the bank lending channel

Holdings of liquid assets: Turning to evidence regarding the question whether holdings of liquid assets have an impact on bank lending – as this is the essence of

subcondition 1 – leads us to a study composed by Kashyap and Stein (2000). These authors test the notion that banks with large holdings of liquid assets should be better able to shield their loan portfolio from monetary policy shocks because, instead of adjusting their balance sheet by resorting to external funding (i.e. on the liabilities side), they can respond to the effects of monetary policy by selling securities (i.e. on the asset side).[46] Based on a large sample covering every insured commercial bank in the US over more than 15 years, they find that the more liquidity a bank holds (measured as the ratio of securities to total assets), the lower is its sensitivity to monetary policy shocks – an effect they mainly attribute to small banks. Berrospide and Edge (2010) also report a positive relation between securities holdings and bank lending for bank holding companies.

Size (as a sign of transparency and also correlated with degree of diversification of business/income sources and professionalism)**:** Historically, the first idea when seeking to identify those bank characteristics that impact lending was to test the size of a bank in terms of its balance sheet, usually measured in total assets. Bigger banks are thought to be more professional and more diversified in terms of income sources, business lines etc. resulting in a lower risk. Furthermore, bigger banks should have more advanced controlling and reporting procedures in place, leading to a higher degree of transparency for investors. This results in lower risk premiums, more favorable conditions at which the banks can borrow *and* lend, and a bigger loan portfolio. Kashyap and Stein (1995) support this empirically by finding that smaller banks reduce their loan portfolio to a greater extent in response to an increase of the federal funds rate.

Stock exchange listing: Another characteristic which, like size, is linked to the transparency of a bank from the investor's perspective (see figure 4.4 and also figure 6.2) is whether a bank is listed on a stock exchange. Listed companies must fulfill a number of disclosure requirements stated in stock exchange market regulations, and this distinguishes them from non-listed companies. The result is that listed companies make more information available to the public, as Healy and Palepu (2001) report in

[46] A theoretical model which incorporates the impact of liquid asset holdings on the sensitivity of monetary policy changes has been developed by Stein (1998).

a survey of empirical disclosure literature. This enhanced transparency should result in a lower external finance premium and, therefore, in better access to uninsured external funding, which is exactly the hypothesis that Holod and Peek (2007) test. According to them, whether a bank is publicly traded or not is a better, i.e. more direct indicator of transparency than size, which is only an indirect measure. Their results show that listed banks are better able to raise large time deposits than otherwise similar non-listed banks. As a consequence, the loan portfolios of listed banks are, indeed, less sensitive to monetary policy shocks than those of non-listed banks, as their results indicate even after controlling for balance sheet size and capitalization (capital-to-assets ratio; not risk weighted). Moreover, Holod and Peek (2007) conclude that the explanatory power of the size of a bank as indicating the ease of access to alternative forms of funding is dominated by whether or not it is listed.

Affiliation to a bigger bank network: One interesting idea is raised by Campello (2002). According to this author, banks that are affiliated to a multibank holding conglomerate should have better access to funding due to internal capital markets. Supporting his hypothesis, he finds evidence that small banks affiliated to a bank network are better able to shield their loan portfolio from adverse monetary policy shocks than small but unaffiliated banks. This mechanism is supported by Ashcraft (2006), who finds that negative lending responses to adverse monetary policy shocks are mitigated in the case of banks that are affiliated to multibank holding companies.

Capitalization (as a signal of a bank's riskiness to providers of debt capital): In this context, there are two sides to capitalization. First, it reduces the incentive to take undue risks that run counter to the interests of the lender (moral hazard). Second, the amount of capital is an indicator of the buffer that is available to absorb losses. Both aspects of capitalization add to the perceived riskiness of a bank.[47] The effect of an

[47] In this context, capitalization is not related to the notion of whether a bank is facing a binding self-imposed or regulatory-induced capital constraint. The empirical evidence for the latter issue is discussed in this section below. Distinguishing between the different notions of capitalization has relevant theoretical and practical implications (see the end of section 6.4 for a theoretical discussion).

institution's capitalization in combination with its size has been examined by Kishan and Opiela (2000). According to the authors, the smallest and least capitalized banks are the ones most sensitive to monetary policy changes. They counter the possible refutation that this finding is also in line with the balance sheet channel by drawing on delinquency rates: An active balance sheet channel implies an inverse relationship between the quality of bank borrowers (measured in terms of delinquency rates) and capital. Since this inverse relationship does not hold, Kishan and Opiela suggest that the bank lending channel is at work.

In an extension of their earlier study, Kishan and Opiela (2006) examine whether capital is different in its effect on bank lending in an expansionary environment as opposed to a contractionary monetary policy environment. First, in line with the preceding empirical literature, they find asymmetric loan responses to monetary policy shocks between well capitalized and sparsely capitalized banks. The distinction made between the two directions of monetary policy reveals that sparsely capitalized banks react more strongly to a contractionary monetary policy than well capitalized banks. In addition, the former do not expand lending to the same degree as the latter in response to an expansionary monetary policy. The authors ascribe this effect to the binding application of the Basel capital requirements to small banks. The reaction of well capitalized banks is inverse: They do not react strongly to negative monetary policy shocks, but expand lending (especially mortgage lending) in response to expansionary monetary policy shocks. These patterns are only valid in the *post-Basel* era, whereas the minimum capital requirements in place in the *pre-Basel* era were not consistently enforced.

A slightly different picture is drawn by Berrospide and Edge (2010). Although their results also suggest a positive relationship between capital and loan growth, the effect is small in quantitative terms. Their principal interpretation is that banks do not actively manage their assets (and especially loans) as a function of their capital endowment. Against the backdrop of any real-life banking experience, this argument is barely conceivable and contrasts with that of Berger et al. (2008), for example, who show that banks do indeed actively manage their capital ratios, including both capital

and (risk-weighted) assets.[48] A different picture is also drawn by Gropp and Heider (2010), who find that banks seek to comply with self-chosen capital targets.

A more recent contribution is a study by Carlson et al. (2013). In order to largely rule out demand effects on loan growth, they match banks of comparable size in the same geographical area and analyze the extent to which differences in capital endowment can explain loan growth differentials. They find that there is a positive relationship between capital and loan growth, but only during the recent financial crisis and not in the period before, which is in contrast to findings of other scholars. Their conclusion is that, at normal times, banks have little difficulty managing their capital – by retaining earnings or issuing equity capital, for example. In times of turmoil, however, the depressed economic situation impacts earnings negatively and it is also much more difficult to raise new equity on the markets.

There is a huge body of empirical literature dealing with the argument that banks **constrained by binding (regulatory or self-imposed) capital requirements** (subcondition 3) play a lesser part in the transmission of monetary policy shocks. To a significant extent, this is to be ascribed to the attention scholars have given to the discussion of the Basel (I, II and, most recently, III) frameworks.

Before examining the details of the findings obtained regarding this argument, one distinction must be noted: Capital in this sense is *not* used in the notion of reducing risk for a lender who provides uninsured funding.[49] In this case, the focus is rather on capital as a way to determine whether or not a bank is operating under capital constraints.

Whether a constraint is binding for regulatory or self-imposed reasons is irrelevant since, like regulatory requirements, self-imposed constraints too can be considered as not arbitrarily variable, at least in the short run. This is plausible, because the change of a self-imposed capital ratio will not be without consequences for the

[48] A second interpretation of the authors is that the measure of capital they use is not informative for assessing the capital position of banks. This interpretation is also not satisfying as it questions their entire approach in one of its key points.

[49] Capitalization as an indicator of a bank's riskiness in the perception of providers of debt capital is discussed in this section above.

riskiness perceived by potential lenders and, therefore, for a bank's access to uninsured funding.

The question whether a bank is working under a binding constraint demands a yes or no answer: Either yes, a bank is operating under capital constraints, or no, it is not. If it is, the bank lending channel should be muted, because even if enough funding (debt) is available it lacks the required equity capital.

Beginning with studies that focus particularly on capital constraints in the wake of the implementation of the Basel I capital rules and the US “credit crunch” of the early 1990s, one of the first contributions was made by Bernanke and Lown (1991). They find evidence for the claim that a shortage of equity capital is responsible for the slowdown in lending during the credit crunch in the early 1990s.

Analyzing the same period, Hall (1993) finds that the Basel I accord that took effect in 1989 was accompanied by a decline in lending. His conclusion is that this was due to the incentives the Basel accord provided for banks: Since loans, especially to businesses, demand large amounts of capital relative to other investments, banks decide to constrain lending in favor of alternative investments, thereby contributing to the credit crunch.

Berger and Udell (1994) come to a similar conclusion, although they prefer alternative hypotheses that are equally consistent with the data, e.g. a voluntary reduction of leverage in order to reduce the cost of funding, rather than a reduction directly induced by regulation.

Peek and Rosengren (1995b) relate the credit crunch explicitly to the regulatory enforcement actions to which some banks have been subject. When the Basel I capital rules were implemented in the US and supplemented by additional regulatory standards to account for risks not covered by the Basel I framework (e.g. interest-rate risk), banks in New England were the first to be faced with regulatory enforcement actions.[50] Since their capital ratios were too low under the new regulatory standards, they had to significantly shrink their loan portfolios. In light of this observation, Peek and Rosengren (1995b) conclude a direct link between regulatory actions and bank lending. This view is supported by Furfine (2001), who draws this conclusion based

[50] Banks in New England were the first because they were the first to sign formal accords with the regulatory authorities.

on a structural dynamic model using a representative bank whose implications are subsequently tested with real US data.

Turning to evidence that abstracts from the US credit crunch in the early 1990s, two further studies are to be mentioned. Although the first is not explicitly related to literature on the bank lending channel, Peek and Rosengren (1995c) first show that, theoretically, banks subject to capital constraints react to negative shocks to their capital by reducing assets to a greater extent than unconstrained banks. This effect applies particularly to loan portfolios. The authors then show empirically that banks with lower capital-to-asset ratios behave in line with the predictions derived from their theoretical model: After controlling for demand factors, particularly by using a cross-section of banks in New England that are assumed to face similar economic demand shocks, the better capitalized banks shrink their lending to a lesser degree after being hit by a negative capital shock.

Extending their analysis explicitly to the responses of capital-constrained and unconstrained banks to monetary policy shocks, Peek and Rosengren (1995a) report at least slight evidence for the assumption that unconstrained banks' lending behaves in line with predictions based on the concept of the bank lending channel.

In an attempt to isolate loan supply effects and to avoid the objection that the decline in the observable loan volume can be ascribed to demand factors, two studies take a different path to identify the impact of capital. Peek and Rosengren (2000) and especially Peek and Rosengren (1997) use the Japanese banking crisis of the early 1990s as a natural experiment. In the late 1980s, Japanese stock markets suffered from significant declines. Due to the fact that large volumes of the stock of Japanese corporations are traditionally held by Japanese banks, these adverse stock market developments translated into losses that weakened the capital positions of Japanese banks. At the same time, the new Basel (I) Accord was introduced, resulting in stricter requirements for capital adequacy. These events put considerable pressure on the banks, with the result that they primarily reduced assets outside Japan, namely in the US, in order to restore acceptable ratios as measured against self-imposed or regulatory targets. Since the shock to the Japanese stock markets did not correlate to demand conditions in the US, the lending response of Japanese banks in the US can be regarded as reflecting supply factors only. As a result, Peek and Rosengren (1997) report that a decline of one percentage point in the risk-based

capital ratio of US branches/agencies of Japanese banks led to a 6% decline in loans during this period.

6.2.3. Conclusion

What, then, is the bottom line with regard to the determinants of bank lending in the US? Taking all factors into account, there is ample empirical evidence to support the hypothesis that the central bank is able to affect the supply scheme of loans. This suggests that the differences in the increase or decrease of banks' loan portfolios can be attributed to banks' characteristics.

Specifically, more liquid, more transparent banks (reflected in the size of a bank and the fact whether or not it is listed) and banks that are affiliated to a network are better able to shield their loan portfolios from monetary policy shocks, even though the details of interdependencies relating to size, listing and affiliation do not seem to be clear (e.g. under what precise conditions does size cease to be relevant in explaining lending?). Moreover, the fact that banks subject to binding capital constraints react by cutting down on lending is also documented. However, the various studies that mainly focus on the regulatory constraint also neglect the impact of self-imposed capital constraints to a large extent. Capital (as an indicator of the riskiness of a bank to providers of debt) has likewise been found to be an influential factor: The better a bank's capital endowment, the lower is its sensitivity to monetary policy shocks. This finding suggests that capital could be a means to alleviate problems associated with asymmetric information and moral hazard, although there is some evidence to suggest that the impact of capital might not be constant over time.

6.3. Evidence from the euro area

This section examines those contributions that have a geographical focus on European countries. Special emphasis is given to literature that reviews the recent financial crisis. [51, 52]

Toward the beginning of stage three of the European Economic and Monetary Union and the introduction of a common monetary policy, scholars addressed the question whether there is an active bank lending channel in each of the individual European countries and in the countries forming the euro area as a whole.

On the one hand, a bank lending channel might be particularly effective owing to the accepted fact that banks in the euro area are, generally speaking, more important to the provision of debt than their counterparts in the US. On the other hand, it must be admitted that, in line with the new view on the bank lending channel, the role of deposits no longer receives the same emphasis (see section 4.1): The ECB always provides the amount of liquidity that is required by the banks in the system to meet their reserve requirements, subject to the condition that collateral of an accepted quality can be provided.[53]

This fact which, at first sight, challenges the central bank's ability to affect the supply scheme of bank loans (condition 1), has recently begun to attract attention. The question is whether there is still an empirically identifiable effect on the conditions under which banks are able to raise funds. (The theoretical foundation of the belief that there might well be an effect is discussed in chapter 4).

---

[51] It should be noted that, in this section, the structure used to present evidence from the euro area differs from that based on data from the US in section 6.2. First, there is no section on evidence based on aggregate data. This is due to the fact that, when researchers began to focus their attention on European countries, analyses based on techniques involving aggregate data were already outdated. For this reason, no such evidence exists for the euro area. Second, the evidence from the euro area is subdivided into a pre-crisis section and a section that takes the effects of the crisis into account. The reason is that, since the recent crisis period is of particular interest to this research undertaking, the literature already available merits special attention.

[52] A list of selected empirical research from the euro area on bank lending and the bank lending channel is provided in table 6.2.

[53] For details of the operational framework of the ECB, see Bofinger (2001), p. 300 et seq. and European Central Bank (2011b), especially chapter 4.2, p. 96 et seq.

Evidence about whether the central bank (ECB) is able to affect the supply of bank loans in the individual countries of the euro area dating from the beginning of the first decade of this century is mixed. Evidence for supply effects has been found in some countries, but not in others.

Over time, more data on the consolidated euro area has become available. At the same time, the deregulation of the financial sector has advanced and the significance of financial innovation has grown into new dimensions.[54] These events again fueled both the discussion of the bank lending channel in general and the question whether the ECB is able to affect the supply scheme of bank loans in particular – and also improved the chances of arriving at a conclusive answer.

Analysis of the interaction of these developments with the recent financial crisis and the implications for bank lending has only yielded preliminary findings but is, at the present time, far from complete.

6.3.1. Euro area evidence from before the crisis

The earliest studies of the euro area made several important observations. Apart from the fact that, compared to the US, more corporate debt takes the form of bank loans rather than bonds (see figure 6.1), the banking system in many large European countries is characterized by major bank networks (see e.g. Ehrmann et al. (2003)). Taken as an indication that informational asymmetries play a lesser role, this is responsible for the finding that the **size** factor (total assets of a bank) is insignificant in many cases that use data on European banks, as Ehrmann et al. (2003) and Ehrmann and Worms (2004) report. How is this finding to be understood? The studies mentioned (along with many subsequent studies) attribute the absence of a size effect to the fact that a large proportion of small banks belong to a bigger bank **network**. In the event of funding difficulties that make it harder to roll over debt, intra-network flows of liquidity supply funds to the institutions affected to avoid reductions in their loan portfolios, as exemplarily shown for Germany by Ehrmann and Worms (2001). In addition, European small banks are especially strong in relationship lending and might therefore be particularly reluctant to constrain lending, preferring

[54] A study by Weber et al. (2009) suggests that the time period analyzed may indeed make a difference. They discovered structural breaks in euro area data in 1996 and 1999.

instead to sell liquid assets. These factors suggest that size is not a decisive factor for differences in the response of banks to monetary policy changes.

Paper	Geographical focus	Sample period	No. of banks and no. of observations	(Main) Data source	Main findings
Ehrmann / Worms 2001 & 2004	Germany	1992-1998	3,665 banks No. of obs.: n.a.	Deutsche Bundesbank: balance sheet statistics	Existence of bank networks important to explain lending reaction of banks to monetary policy changes
Worms 2001	Germany	1992-1998	2,659 banks 58,374 obs. (unbalanced)	Deutsche Bundesbank: balance sheet statistics	Loan portfolios of banks with large short-term interbank deposits react more sensitive to monetary policy changes
Altunbas et al. 2002 & 2004	All euro area countries	1991-1999	9,991 obs. (unbalanced) in total	Bankscope	Findings vary depending on country; refer to text for main findings
Angeloni et al. 2003	All euro area countries	1971-2000	18 to 3,207 banks No. of obs.: n.a.	ECB: area-wide model	Findings vary depending on country; refer to text and FN 55 for main findings
Ehrmann et al 2003	Euro area France Germany Italy Spain	'92-'99 '93-'00 '93-'98 '86-'98 '91-'98	4,425 banks 496 banks 3,281 banks 785 banks 264 banks	Bankscope Eurosystem dataset; respective national banks supervisory reports	Lending of less liquid banks react more strongly to monetary policy changes; Size and capital are not relevant for lending reaction
Gambacorta/ Mistrulli 2004	Italy	1992-2001	556 banks 17,792 obs. (unbalanced)	Bank of Italy: supervisory repots	Capital in excess of regulatory minimum determines lending reaction to monetary policy changes
Gambacorta 2005	Italy	1986-1998	759 banks 35,678 obs. (unbalanced)	Bank of Italy: supervisory reports	More liquid and better capitalized banks maintain lending after monetary policy tightening
Altunbas et al. 2009	Euro area	1999-2005	2,947 banks 15,403 obs. (unbalanced)	Bankscope	Banks that are active in securitization are less sensitive to monetary policy changes
Gambacorta / Rossi 2010	Euro area	1985-2005	Based on aggregate data	ECB	Monetary tightening has larger impact on lending than monetary easing
Albertazzi / Marchetti 2010	Italy	2008-2009	~ 500 banks ~ 19,000 obs.	Bank of Italy: credit register	Well-capitalized and liquid banks managed best to maintain loan supply during crisis
Bonaccorsi / Sette 2010	Italy	2007-2008	No. of banks: n.a. No. of obs.: n.a.	Bank of Italy: credit register	There are only significant effects of capitalization on bank lending if cap is interacted with liquidity, securitization activity, return on assets and degree of interbank funding
Gambacorta / Marques-Ibanez 2011	Euro area, UK, US	1999-2009	1,008 banks 30,920 obs. (unbalanced)	Bloomberg	Well-capitalized banks that are active in securitization, shield lending better against monetary policy changes; Central banks' non-standard measures helped to maintain loan supply during crisis
Brei et al. 2013	Euro area, UK, US	1995-2010	108 banks 1,615 obs. (unbalanced)	Bankscope	Central banks' rescue measures helped to sustain bank loan supply during crisis

Table 6.2: Selected empirical research from the euro area on bank lending and the bank lending channel

Interestingly, Ehrmann and Worms (2004) are able to show for Germany that, for those banks that are not affiliated to a bank network, size *does* matter. In this respect, the affiliation dominates the impact of size. Moreover, for affiliated banks, short-term interbank deposits in particular determine the lending reaction of an institution. This is also supported by Worms (2001). These findings further suggest that, within a bank

network, liquidity can be channeled effectively from head or affiliated institutions toward smaller members.

In an attempt to shed further light on the role of **liquidity**, Ehrmann et al. (2003) and Ehrmann and Worms (2004) find evidence for the hypothesis that high levels of liquid assets entail a certain robustness against monetary policy shocks in the most important European economies. In addition, using a sample for Italian banks, Gambacorta (2005) points out that small banks on average hold more liquid assets (as a percentage of total assets), and that small banks reduce the share of liquid assets to a greater extent than bigger institutions do in response to monetary tightening. This can be seen as supporting the idea that especially small institutions, which rely heavily on relationship lending, like to “insure” themselves against adverse monetary policy shocks or random deposit withdrawals by holding a relatively high share of assets in liquid forms.

Comparing the individual European countries, Angeloni et al. (2003) find evidence for loan supply effects in response to monetary policy in Germany, France and Italy. In all these cases, they identify liquidity as playing an important role in explaining the difference in lending reactions between banks.[55]

As regards the **capitalization** of a bank as a determinant of its lending reaction to monetary policy, the evidence for European countries in the period before the recent crisis is not fully conclusive. Ehrmann et al. (2003) do not find any statistically significant effects of capital on bank lending. The authors suspect that this might be due to the historically low number of bank failures compared to the US, which may be indicative of a generally lower level of informational asymmetries in the euro area.

On the contrary, Altunbas et al. (2004) find, if banks in France, Germany and Italy are ordered by groups of capitalization, the group of banks with the lowest capitalization is the one most sensitive to the tightening of monetary policy, especially in France

[55] Loan supply effects are also reported for Greece, the Netherlands and Portugal. The selection of countries mentioned above represents the most important economies. Of the major European economies, only Spain does not seem to exhibit shifts in the loan supply after a monetary policy shock. Bank lending channel effects are limited in Austria and doubtful in Finland.

and Italy. In Germany, banks seem to be able to avoid the contraction of their loan supply by reducing securities holdings and interbank borrowings – factors that suggest a relatively weak bank lending channel. Comparable country patterns have been observed by Altunbas et al. (2002), who conclude that the impact of monetary policy on the supply of bank loans is strongest in undercapitalized and small European countries.

Less ambiguous results are obtained by emphasizing a different aspect of capitalization, namely the amount that a bank holds in excess of the regulatory requirement. Using excess capital, Gambacorta and Mistrulli (2004) and Gambacorta (2005) show for Italy that an ample (excess) equity capital position provides better protection for the loan portfolio. This suggests that excess capital ensures better access to uninsured sources of funding due to a reduced risk of the bank acting in a morally hazardous way. This view is also consistent with the implications of the bank lending channel.

The relatively mixed indications with respect to the existence of a bank lending channel and the role of certain bank characteristics in the countries that form the euro area may be due to the time period selected, i.e. the fact that the samples used in the literature cited so far are either individual country samples or synthetic European ones formed by adding all the individual country samples together. Developments attributed to the European Monetary Union (such as deeper financial integration) and other trends observable in recent years (such as the shift toward a stronger market-based financial system) are not incorporated.

Asymmetric effects of monetary policy: A contribution to a new strand of literature, allowing for a more recent, "true" euro area sample, has been made by Gambacorta and Rossi (2010). They are, first, able to detect loan supply effects and, second, able to show that the effect on lending is larger in case of monetary tightening as opposed to the relaxation of monetary policy. The authors ascribe this pattern to differential reactions in investment and self-financing opportunities vis-à-vis monetary policy regimes, which they take as an indication of a broad credit channel.

Against the backdrop of developments in the financial sector, one interesting question is the extent to which changes in banks' business models play a role in influencing bank lending.

A study presented by Altunbas et al. (2009) finds that the lending of those banks that are more heavily engaged in **securitization** activities is less sensitive to changes in monetary policy.[56] Due to equity capital relief and the provision of liquidity, securitization allows banks to expand their supply of loans, generally making banks more flexible in the way they respond to monetary policy shocks. Altunbas et al. (2009) also point out that securitization partially explains the weakened impact of the size factor when large amounts of assets are transferred off the balance sheet. For the bank lending channel discussion, this means that securitization may weaken the effectiveness of monetary policy (see also Loutskina and Strahan (2009)).

The other side of the coin is that securitization could create incentives not to screen and monitor borrowers as diligently as under the "originate and hold" business model, as reported in a study of the US by Keys et al. (2010). Theoretically, this has the ability to aggravate the problem of asymmetric information between lender and borrower.[57]

What are the implications during a crisis period if incentives to screen and monitor borrowers for bank lending are probably affected?

6.3.2. Euro area evidence in the wake of the crisis

The last point mentioned – that the degree of securitization could have an impact on the quality of screening and monitoring of borrowers – is the reason, from a theoretical perspective, why securitization may have a different effect on lending during or outside of crisis periods. At times of crisis when the markets for securitization are distressed and tend to dry out, the lost opportunity to repackage and sell loans and the need to hold them to maturity may result in a loan portfolio

[56] For a more detailed overview of securitization instruments and their implications for financial markets, see Marques-Ibanez and Scheicher (2010).

[57] For the US, Dell'Ariccia et al. (2012) show that lending standards declined most in areas with lively securitization activities, which also suggests an exacerbated asymmetric information problem.

characterized by an increased risk and deteriorating opportunities to raise uninsured funds. Because securitization can no longer serve to absorb monetary policy shocks, this should magnify the effects on bank lending during a crisis. This reasoning is empirically supported by Gambacorta and Marques-Ibanez (2011), who find that, during crisis periods, the difference in the lending responses to monetary policy shocks between banks that actively pursue securitization and all other banks is smaller than at normal times.

To date, the analysis carried out by Gambacorta and Marques-Ibanez (2011) is one of the very few that is explicitly devoted to the impact the recent financial crisis had on how bank characteristics drive lending and how the different characteristics interact with changes in monetary policy. It must be noted however, that it is not exclusively geared to the euro area as it also comprises banks from the US and the UK.

Their results support the view that structural changes did indeed occur during the crisis. In addition to their findings on securitization activities, these authors' results suggest that banks that are weakly capitalized, more dependent on market funding and have a higher share of non-interest sources of income tended to restrict their loan supply more strongly during the recent crisis. The particularly strong in-crisis effect of an ample equity capital endowment found by Gambacorta and Marques-Ibanez (2011) can be attributed to the *flight-to-quality* behavior of risk-sensitive providers of debt capital. This supports our theoretical considerations regarding the role of those bank characteristics that have an impact on perceived riskiness.

According to the authors, the observation that lending is dependent on the importance of market funding to an individual institution is to be ascribed to the following pattern: Banks that rely heavily on deposit funding could make use of the opportunity not to lower their deposit interest rates in line with monetary interest rates, but to try to maintain an attractive level to avoid losing deposit funding. An alternative and more obvious interpretation is that banks with a high share of market funding have greater difficulty rolling over their debt.

The outcome of greater lending sensitivity toward a crisis among those banks whose income is characterized by a large proportion of non-interest income can be explained by the higher volatility of related business (especially investment banking business). During times of financial turmoil, the relevant markets feature a low level

of activity with fewer opportunities for banks to generate income, whereas the cost base does not adjust flexibly to the new business situation. This makes banks riskier for investors, undermining their ability to raise uninsured sources of funding.

An additional finding of Gambacorta and Marques-Ibanez (2011), though not geared to bank characteristics, is that the non-standard measures taken by central banks like the ECB significantly helped to prevent the supply of bank credit from drying up.

An analysis of bank rescue measures (provision of extended deposit insurance, capital injections, debt guarantees and asset relief programs) has been carried out by Brei et al. (2013). The authors find that capital injections are effective in strengthening the loan supply only in cases where the capital ratio rises above a certain "critical" threshold. In accordance with Bhattacharya and Nyborg (2010) they argue that beyond this threshold banks are relieved from the debt-overhang problem. Interestingly, they do not consider bank-specific, self-chosen capital targets as they will be discussed in detail in the present study below. In general, the impact of capital on lending is found to be higher during times of turmoil than at normal times.

A few additional observations have been made with regard to the recent crisis period, although their informative value and universal applicability are probably restricted by the limited geographical scope. Based on data obtained from the Italian credit register, Albertazzi and Marchetti (2010) finds that, during the crisis,[58] those banks with low capital ratios in particular cut back their credit supply to the greatest degree, while relatively liquid Italian banks managed to maintain their supply fairly well. Extending the empirical model to analyze the effect of a bank's size (in terms of total assets) or its affiliation to a banking network, however, they find only relatively minor effects that are dominated by the impact of capitalization. However, the largest group of banks in their sample had to reduce lending by more than the smaller banks.

Also referring to Italian credit register data, the contribution by Bonaccorsi di Patti and Sette (2012) establish no direct effect of the level of bank capital on lending. When capital is regressed on loans, they cannot detect any statistically significant effect. However, where capital interacts with other bank characteristics (liquidity, securitization, level of interbank funding and the return on assets), the authors find that these characteristics are affected by the level of capital a bank had at the outset

[58] The exact crisis period examined comprises September 2008 until March 2009.

of the crisis. The influence of securitization and the return on assets from lending is reduced for well capitalized banks.

These results – especially the finding that the (stand-alone, non-interacted) level of capital has no significant impact on lending – contrasts with the results of Albertazzi and Marchetti (2010), although this paper also use data on the Italian credit register and, at least to a large extent, both papers analyze overlapping periods of the crisis. It can thus be inferred that the exact role of capital in impacting bank lending during a crisis is not yet fully understood.

6.3.3. Conclusion

What is the bottom line with regard to the factors that impact bank lending in the euro area? Generally speaking, the evidence for a bank lending channel in Europe based on synthetically aggregated country samples dating from the period before stage three of European Monetary Union took effect is relatively heterogeneous. In some countries, evidence in support of a bank lending channel – or at least in support of the first condition – is stronger than in other countries.

Apart from geographical differences, with respect to the individual bank characteristics it can be noted – much the same as in the US – that interdependencies exist between the size of an institution and whether it is affiliated to a bank network. While some studies have not found any size effect at all, at least small institutions affiliated to networks do not seem to be at a disadvantage regarding their lending reaction to monetary policy. It is not entirely clear whether this pattern also applies to euro area countries for the period after stage three of European Monetary Union.

In line with the theoretical framework for the bank lending channel, liquidity can help to shield especially small banks' loan portfolios from adverse shocks at normal times.

As regards capitalization, the distinction between its two main roles – on the one hand capital as a buffer against losses and to mitigate problems of asymmetric information, and on the other hand capital resulting in a binding constraint if a bank falls short of either regulatory or self-imposed targets/standards – is widely neglected.[59] Furthermore, the largely identical implications following from a capital

[59] This issue is further elaborated on in the next section (section 6.4).

constraint that is binding either for regulatory or self-imposed reasons are widely disregarded. Probably owing to the inappropriate handling of capitalization, some scholars have produced results of (statistically and economically) insignificant relevance for an institution's capital endowment even during a crisis, while other scholars' results highlight the opposite.

Essentially, the crisis period and its impact on the characteristics that drive bank lending is still underrepresented in literature. There are reasons to believe that not all patterns have yet been recognized.

In this context, a closer look at rescue measures taken by national governments during the crisis would also appear expedient. Although initial evidence supports the view of a generally positive impact on lending, it is not clear whether there are any differences in the way the various kinds of rescue measures (e.g. debt guarantees, capital injections, asset purchase/insurance) affect aggregate lending and the *lending of individual banks*.

Moreover, the monetary policy indicator used hitherto in the euro area is the overnight (Eonia) interest rate. During the crisis, because interbank markets dried out and the overnight rate rose sharply, the ECB adopted the “full allotment” policy, which equipped all institutions with the amount of liquidity they demanded. This expansion of central bank liquidity together with low levels of liquidity in interbank markets is responsible for the fact that the overnight rate may not have been fully representative of banks’ funding conditions. Funding conditions during the crisis were probably better captured by the Euribor-OIS spread (reflecting the risk of default when banks lend to each other[60]).

6.4. Implications of theoretical framework for interpretation of empirical evidence

Before proceeding to the empirical part in the next chapter, it should be recognized how the bank characteristics reviewed in the previous sections can be integrated into the theoretical framework in the spirit of the new view on the bank lending channel

[60] For more details of the Libor-OIS spread, to which the same logic applies as to the Euribor-OIS spread, see Thornton (2009).

presented in section 4.2. The result is a systematization of bank characteristics that is unique to the bank lending channel literature.

With the development of the understanding of the bank lending channel and econometric advancements toward panel estimation techniques a number of bank characteristics have been found to influence banks' lending behavior as outlined in the previous sections on empirical evidence. All the reviewed bank characteristics can now be integrated into the framework reflecting the new view on the bank lending channel. As stated in chapter 4, the new view focuses on the significance of uninsured funding and on the bank characteristics that determine its costs and de-emphasizes the role of reserves for the loan supply in reaction to changes of monetary policy rates.

Figure 4.4 has already presented a novel framework which links the conditions and subconditions of the bank lending channel to economic concepts. Figure 6.2, showing a systematic outline of bank characteristics, is an enhancement of figure 4.4: The economic concepts that have been introduced in figure 4.4 can be further operationalized by formulating examples or proxies for these concepts. To give an example: In the case of "business risk", examples for representative concepts are a bank's "capitalization" or its "share of non-interest income". Banks that have more capital have a stronger buffer against losses and are, thus, less risky from an investor’s point of view. A high share of non-interest income may be interpreted as a sign that earnings will be more volatile during the business cycle, since investment banking earnings in particular account for non-interest income. In an economic downturn, these earnings usually decrease by more than traditional interest income.

These representative concepts are more narrowly defined than the corresponding economic concepts. They bridge the gap to the proxy variables that are used in empirical analysis. Each representative concept can be thought of as a proxy that is part of the econometric model which is introduced in section 7.3.

The depiction of the links between conditions and bank characteristics in figure 6.2 is an attempt to lend a more *structural* emphasis to the discussion of which bank characteristics may or may not play a role in affecting bank lending within the framework of the bank lending channel.

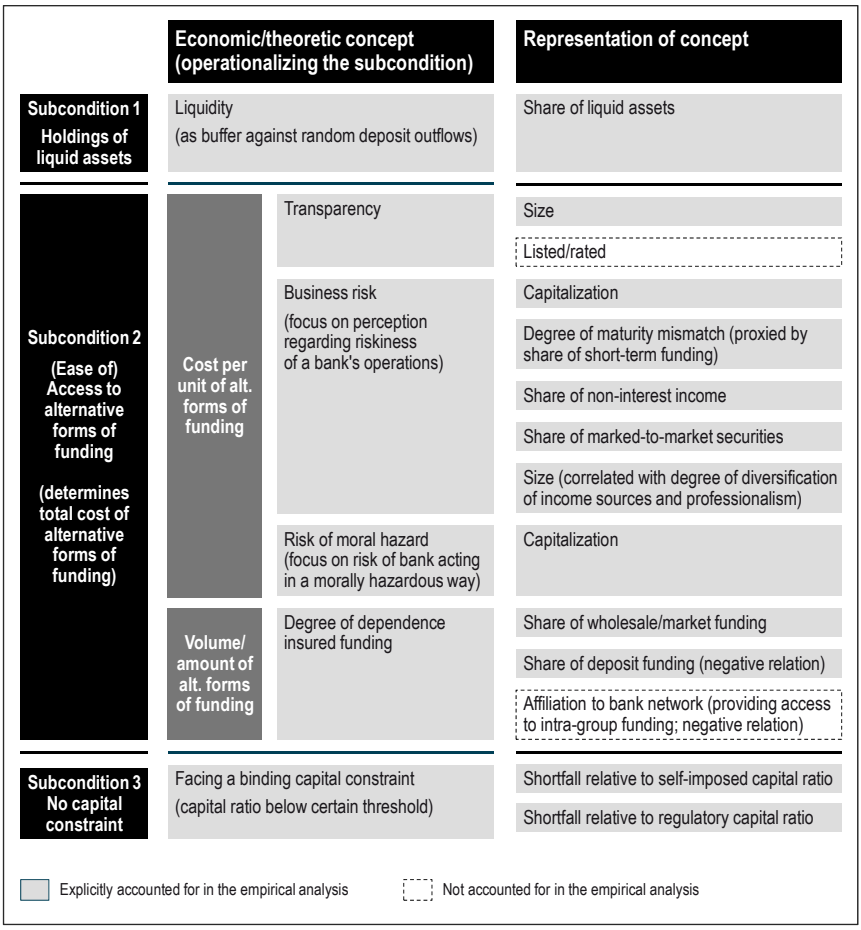


Figure 6.2: Systematization of bank characteristics as drivers of bank lending

One particular matter should be noted: As can be seen in figure 6.2, "capitalization" appears in two different roles (to which it has already been referred to in the literature review sections above). In the first role, capital is to be interpreted as providing a buffer against losses (related to "business risk") and as alleviating the potential conflict of interest between the providers of equity and the providers of debt (related to "risk of moral hazard"). As a result, a larger amount of capital causes lenders to demand a lower risk premium. Although two aspects of capital can be distinguished its first role, both aspects affect the unit cost of alternative forms of funding.

In the second role, the level of a bank's capital endowment is assessed against the background of regulatory or self-imposed requirements. Failing to comply with regulatory requirements can result in serious action by the regulator, including the takeover of managerial authority and even the forced closure of a financial institution. In this sense, there is a "yes or no" answer to the question of whether a bank is under constraints: Either a bank is impeded to supply loans by a capital constraint or it is not. If it is, it will not be able to expand lending in response to a relaxed monetary policy, nor will it participate in propagating the monetary policy impulse. The more constrained banks there are in an economy, the more muted the bank lending channel tends to be.

It is important to bear in mind that not only a regulatory capital ratio but also a *self-imposed capital target* can have the same constraining effect in the event that the target ratio is undercut. As reported by Gropp and Heider (2010), almost all institutions target a certain magnitude of capital endowment over and above regulatory requirements which they judge to be adequate. Berger et al. (2008) confirm that this magnitude is indeed well above the regulatory minimum. It is chosen by banks at their own discretion for the reason that the gains arising from a lower risk premium outweigh the higher cost of equity capital. In particular, failure to meet market standards could result in serious difficulties for rollover debt.[61] This being the case, a self-imposed constraint too shares the relevant "yes or no" implications of situations in which banks are subject to regulatory constraints.

It should be kept in mind that this kind of self-imposed constraint is adopted with a view to reducing the demanded risk premium or the unit cost of alternative funding. In this regard, both roles of capital are interrelated and connected. One implication of this interrelationship is the realization that even if a bank's capital is not constrained for *regulatory* reasons (which can be deduced from regulatory capital ratios), it can nevertheless be constrained by a *self-imposed* capital ratio stemming from considerations regarding the unit cost of alternative funding (see figure 6.3).

[61] As Hanson et al. (2011) show for the four largest US banks, even in middle of the crisis (Q1 2010) these institutions maintained capital ratios well above the regulatory minimum, i.e. ratios that were not binding. This is an indication of the significance of self-imposed capital ratios and ratios that are demanded by the market.

The bottom line is that the question whether the expansion of a bank's loan supply is constrained by a self-imposed or a regulatory capital ratio can be answered independently of the question whether a bank is struggling to expand its lending due to adverse funding conditions. This distinction must be borne in mind especially when conducting empirical analyses.

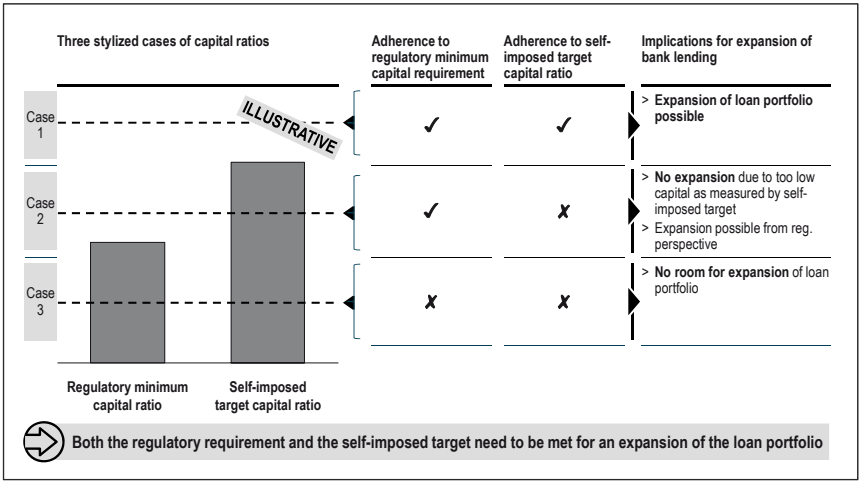


Figure 6.3: Three stylized cases of capital ratios against the background of regulatory requirements, self-imposed targets and their implications for expansion of the loan portfolio

Consequently, a hypothesis accounting for such a capital constraint is formulated in the following chapter. Additionally, the following chapter addresses the research gaps and ideas that are stated in section 6.3.3 as a result of the review of the literature body dealing with the euro area.

7. Empirical analysis – approach

7.1. Research hypotheses

As discussed in the previous chapters, there are still a number of gaps in the academic debate regarding analyses of those factors that influence bank lending which, up to now, have mainly been studied within the bank lending channel framework.

The gaps are related to the distinction between two different roles of capital (capital that mitigates the asymmetric information problem/buffers against losses and capital that leads to constraints when it falls short of self-imposed or regulatory capital ratios), related to an incomplete understanding of financial innovation and business models, which have only started to be explored very recently, and in particular to several aspects of the financial crisis, with its implications for bank lending (e.g. maturity mismatches, capital and the success of (unconventional) measures taken by the ECB).

Within the scope of this study these gaps are addressed in the following by formulating testable hypotheses. Hypotheses are classified according to whether they apply generally (i.e. also at normal times), or whether the rationale behind them necessarily involves a crisis context. Special attention is paid particularly to the latter aspect: disentangling the recent financial crisis and clarifying the question of which bank characteristics and other factors impact bank lending in times of financial turmoil. An overview of all hypotheses is given by figure 7.1 at the end of section 7.1.2

A further aspect of this study is to analyze whether the following hypotheses are valid not only in the euro area as a whole but also in the individual countries of the euro area. Accordingly, the hypotheses are tested with reference to the euro area but also with a focus on the four most important euro area countries in the next chapter (chapter 8).

H. Brinkmeyer, *Drivers of Bank Lending,* Schriften zum europäischen Management,
DOI 10.1007/978-3-658-07175-2_7, © Springer Fachmedien Wiesbaden 2015

7.1.1. General hypotheses

Existing literature does not satisfactorily account for a bank's capital endowment. The usual approach is to include “pure” capital or capital ratios in regressions. Where this is the case, the intention is to account for capital in its role in providing a buffer against losses, or in attenuating the asymmetric information problem. What is missing is a perspective on capital that takes into account whether a bank is operating below its self-imposed target capital ratio (or even the regulatory capital ratio; see figure 6.3).

Besides the extensive body of literature dealing with the capital structures of non-financial firms and their determinants (see Börner et al. (2010), among many others), there are also contributions that explicitly study the capital structure of banks. For example, Gropp and Heider (2010) estimate banks’ target capital ratios, an approach also pursued by Flannery and Rangan (2006) and Lemmon et al. (2008) in the context of non-financial firms. Their findings are that banks' capital ratios are best explained by time-invariant, bank fixed effects and that they converge to form bank-specific, time-invariant targets.[62]

The first hypothesis derives from this insight:

> *H1: A shortfall in capital relative to a targeted ratio leads to a reduction of the loan portfolio.*

The idea is to test whether the fact that a bank is close to the limits of defined capital constraints has an effect on its lending. It must be noted that this hypothesis claims that the relationship applies both at normal times *and* during a crisis. When a bank is short of capital or is already operating close to the limit of its self-imposed capital ratio, this should have an effect on its ability or willingness to provide loans. When a self-chosen capital target is missed, this should imply that a bank is operating under a constraint and will not expand its lending. This effect is assumed to be in addition to widely reviewed conventional measures of capitalization. The latter take only "pure"

[62] This is consistent with practical experience of how banks deal with the amount of capital available. In practice, virtually every bank targets a certain capital ratio which it deems adequate and opportune given all relevant circumstances, i.e. the returns expected by providers of equity, the requirements of providers of debt, the cost of debt, market disciplinary forces, etc. This determines to a large extent the amount of risk-weighted assets a bank is willing to hold.

capital ratios into account and are motivated by the connection between capital and access to uninsured sources of funding (which makes perfect sense).

To clarify the point: The use of a measure of capital surplus (or shortfall) does *not* mean that "pure" capital ratios have no influence on lending. However, the distinction between the two roles of capital marks an important extension to the well-documented impact of pure capital or capital ratios.[63]

Next, the total cost of alternative (uninsured, non-deposit) forms of funding can be divided into two aspects: the volume and the cost per unit – a relationship that is illustrated in figure 4.3. A precondition for the notion that certain bank characteristics affect the cost per unit is that a bank *does* raise funding on wholesale funding markets. The bank characteristics that impact the cost per unit affect lending *only if* a bank taps wholesale funding markets at all. The concept of the deposit overhang serves as to proxy if a bank does so or not. Accordingly, the hypotheses are:

H2: For banks that do not face a deposit overhang, lending depends on…

H2a: …the share of uninsured short-term funding.

H2b: …the share of non-interest income.

H2c: …the share of securities that must be marked to market.

As illustrated in figure 4.4 and figure 6.2, the hypotheses stated above reflect those factors that have an impact on how risky a bank is from an investor's point of view.[64] The link to bank lending is substantiated by the following rationale: The more difficult it is to obtain funding, the more likely it is that the loan portfolio will be reduced. To date, these factors have not been scrutinized in a coherent manner. By explicitly subjecting them to hypothesis tests, it becomes possible to account for differences in business models as well as changes in banks' funding practices.

[63] Consequently, "pure" capital measures are indeed part of the estimated empirical equations in chapter 8, but they are not subject to explicit hypothesis tests.

[64] The characteristics size and capitalization are also associated with the cost per unit, according to figure 6.2. Due to their multiples role, however, it is highly likely that they have an impact on lending not only if a bank has an overhang in deposits but also "stand-alone". This is tested in the course of the empirical analysis. (Results confirm this presumption.)

More precisely, the higher the share of short-term funding, the greater the risk that a bank will have difficulty rolling over its debt when the economy dips into recession. This could involve the problems associated with fire sales and the beginnings of vicious circles as discussed in chapter 5.

Furthermore, non-interest income is known to be more volatile (see Gambacorta and Marques-Ibanez (2011), for example). While a bank with a large proportion of non-interest income might therefore be more profitable at normal times,[65] this might also be an indicator of higher risk to investors.

The rationale for the share of mark-to-market securities is as follows: The bigger their share, the more vulnerable a bank will be to shocks such as increases in monetary policy interest rates. The resultant higher discount factors lead to immediate write-offs, thereby impairing the bank's financial position and increasing the external finance premium.

All three patterns reflected in hypotheses H2a, H2b and H2c should generally be present, irrespective of the economic circumstances, i.e. whether or not a crisis currently prevails.

7.1.2. Hypotheses involving the context of the recent crisis

In an attempt to isolate the impact of the crisis on bank lending, the first hypothesis can be derived directly from the theories outlined in chapter 5. In line with the theory of the loss spiral and the margin spiral, high leverage increases the liquidation of assets under fire-sale conditions and aggravates adverse effects. In a crisis, providers of uninsured funding should therefore be more concerned with banks' leverage ratios. Since leverage is the reciprocal of the capital-to-asset ratio, the hypothesis is this:

> *H3: During a crisis, the capital ratio has a more positive impact on lending than it does at normal times.*

[65] This is true with regard to profitability in terms of the return on equity, for example, because the business that generates non-interest income does not require the provision of any capital.

In addition, the theory of the loss spiral and the margin spiral suggests that, in an economic downturn, the inability to roll over short-term liabilities forces banks to reduce assets under fire-sale conditions and/or to liquidate longer-term assets at considerable discounts. Thus:

> *H4: During a crisis, the impact of a pronounced maturity mismatch (evidenced by a large proportion of short-term funding)[66] on lending is lower (in terms of the value of the coefficient) compared to normal times.*

Staying with the problem of raising funding during a crisis, this hypothesis serves as the motivation for further hypotheses. Another factor that determines the unit cost of uninsured funding is the share of non-interest income (see figure 4.4 and figure 6.2). This is because the business from which non-interest income is generated is more vulnerable to crisis conditions than interest income. A reduction in this income source increases the risk that a bank may not be able to meet its repayment obligations. Hence:

> *H5: During a crisis, the impact of a large proportion of non-interest income on lending is lower (in terms of the value of the coefficient) compared to normal times.*

A further bank characteristic that is suspected of influencing the cost per unit of uninsured funding is size. The literature review in section 2 shows that, in many studies, the pure size of a bank has not been found to impact lending at normal times. In a crisis, however, size could become more of an issue: Size is known to have been used as a proxy for transparency (see figure 4.4 and figure 6.2). During a crisis, however, providers of uninsured debt might also perceive size as a proxy for the professionalism of a bank in general – e.g. regarding its crisis management or its ability to take action to counter adverse developments – and as a proxy for a more favorable long-term outlook, e.g. due to the fact that larger institutions usually have more diversified sources of income. The resultant hypothesis is:

---

[66] Recall that the average maturity of loans is much higher than the maturity of the funding that is called "short-term". Hence, a higher share of short-term funding usually implies a stronger mismatch between the maturities on the asset and the liabilities side ("maturity mismatch").

H6: During a crisis, the size of a bank has a more positive impact on lending than it does at normal times.

The next hypothesis also derives directly from chapter 5 and focuses on the share of securities that have to be marked to market. In an economic downturn, if a bank holds marked-to-market securities that are sold by other banks under fire-sale conditions it also has to write down the respective asset. A high proportion of marked-to-market securities thus increases the risk for write-downs and makes the bank more vulnerable and risky. Write-downs are immediate losses and lower the capitalization of a bank. Even if a bank does not encounter write-downs the heightened risk should negatively impact the cost per unit of alternative funding and, ultimately the ability to grant credit. The seventh hypothesis is therefore:

H7: During a crisis, the impact of a large proportion of marked-to-market securities on lending is lower (in terms of the value of the coefficient) compared to normal times.

Furthermore, the more a bank relies on (insured) deposits as a funding source, the more it is independent of wholesale markets and the turmoil that was observable during the recent crisis. Thanks to deposit insurance schemes, depositors are not faced with an asymmetric information issue vis-à-vis deposit-taking banks and are thus less concerned about draining their funds. This leads to the following hypothesis:

H8: During a crisis, a large proportion of deposit funding has a positive impact on lending.

Building on this idea, a higher (than average) proportion of deposits is not the only factor that should have a positive impact on the loan portfolio. An overhang of deposits over the amount of loans should also be beneficial, since it implies that a

bank does not depend (to a very great extent[67]) on wholesale markets to raise funding. Especially during a crisis, a deposit overhang should provide relief for banks' funding problems. Since the literature reviewed shows no evidence that the test of a deposit overhang has been carried out, it will be interesting to see whether or not the data confirms the following hypothesis:

H9: During a crisis, a deposit overhang has a positive impact on lending.

The difference of hypothesis H9 and hypotheses H2a to H2c – all somehow related to a deposit overhang – is as follows: Hypotheses H2a to H2c are supposed to apply generally, including normal periods. The (lack of a) deposit overhang is used to proxy whether a bank needs to tap wholesale funding markets. When it needs wholesale funding, then factors that make a bank appear riskier from an investor's perspective should have an impact on funding costs and thereby also on loan rates and quantities. Only for those banks that do not face a deposit overhang a relationship is supposed between lending on the one hand and the share of short-term funding, of non-interest income and of securities that need to be marked to market on the other hand. Important to note is that in the end it is *not the fact that a bank needs wholesale funding at all* that affects the loan supply of this bank. It is the dependence on wholesale funding *in connection with* characteristics that make a bank appear riskier.

By contrast Hypothesis H9 is meant to directly address the impact of the need to tap wholesale funding markets during a crisis. The need of doing so is also proxied by a lack of a deposit overhang. The important difference is that during a crisis, according to hypothesis H9, the *fact that a bank needs wholesale funding is sufficient in itself* to suppose that a bank has to curtail lending due to the difficult funding market situation.

All the above hypotheses (see figure 7.1) derive from gaps in existing literature and from the rigorous application of the theoretical framework or concepts that address the lending behavior of banks. The following sections deal with the introduction of the

[67] Even with a deposit overhang, a bank could still rely on wholesale funding markets, e.g. because it has to fund liquid assets that banks hold for precautionary (and other) reasons. See section 3.1.1.1 for the underlying rationale. As discussed in context with hypotheses 2, nevertheless, (in)dependence of wholesale funding markets is proxied by a deposit overhang.

empirical framework, including the model, data and estimation method that are chosen to address these gaps and to test the stated hypotheses.

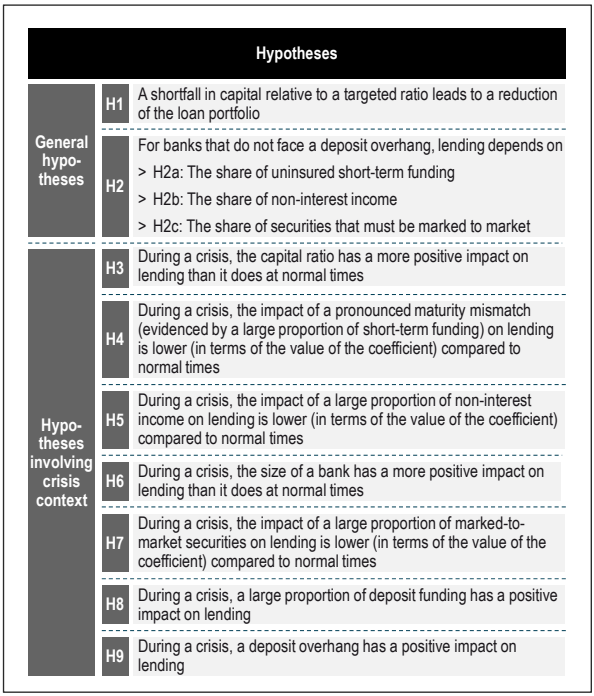


Figure 7.1: Overview of formulated hypotheses

7.2. Overall empirical strategy and approach

To test the above hypotheses, the key identification strategy is to relate cross-sectional differences in banks' characteristics to changes in the supply of bank loans, with a special focus on comparing bank lending at "normal" times to the lending practice adopted during the recent crisis. Doing so involves special challenges that are explicitly addressed below. The first is the need to draw a clear distinction between loan demand and loan supply. The problem here is that only the volume of loans on banks' balance sheets can be observed, without knowing *a priori* whether it is driven by supply or demand factors. The second challenge is to identify the criteria based on which the period of the crisis of relevance to this study can be defined. This is important to determine start, ending and duration of the crisis.

Before addressing these challenges, the first step is to derive an empirical model based on the work of Peek and Rosengren (1995a) and Kishan and Opiela (2000). The purpose of this exercise is to formalize the arguments set out especially in chapters 4 and 5, and to add some mathematical intuition. After that, the model is adapted to the empirical requirements of this study.

The data used has both a cross-sectional and a time series dimension, which yields a panel structure. The panel is estimated using the generalized methods of moments (GMM) methodology, or, more precisely, difference GMM. This estimator uses instrumental variables, as it is able to provide a solution to the endogeneity problem (explanatory variables are not strictly exogenous) which might otherwise compromise the results if not treated properly. Furthermore, difference GMM estimator is designed for panels comprising many cross-sectional observations and relatively few time periods, for capturing individual fixed effects, and for dynamic dependent variables that depend on past values – as is the case here.

This section is organized as follows: First, an econometric model is developed on the basis of a model of bank behavior, providing important insights into the relationship between bank characteristics and lending. Second, building on this model in conjunction with the hypotheses, the data required to feed the model is presented and an overview of the data sources is given. This includes a description of the purging/correction steps involved in preparing the data for use in the estimations. Special attention is given to construction of the capital surplus variable, the use of which in the context of bank lending in the euro area represents an academic innovation. A separate subsection is devoted to the special challenges involved in disentangling loan supply and loan demand and determining the duration of the crisis period. Finally, the motivation for using this estimation methodology is explained. The estimation methodology is an answer to all the challenges that emerge out of the structure and characteristics of the data and is therefore, discussed at the end of the chapter.

Together, these elements lay the foundation for empirical analysis, the results of which are presented in the next chapter (chapter 8).

7.3. Empirical model

7.3.1. Derivation of a model of bank behavior

The model on whose implications the empirical model is based is a version of the one presented in Peek and Rosengren (1995a and 1995c). It is especially suitable because, unlike other models in the context of bank lending and the bank lending channel, it explicitly specifies a capital constraint. Although the motivation for constraints in the present study is geared to a self-chosen capital target rather than strictly to regulatory requirements, as in the original version, the mechanics are very similar.[68]

The starting point is a balance sheet constraint which states that the sum of all assets must equal the sum of all liabilities. Each bank holds loans, L_i, securities, S_i and reserves, R_i, as assets. On the liabilities side there is (equity) capital, K_i, insured deposits, D_i, and uninsured deposits, UD_i:

$$L_i + S_i + R_i = K_i + D_i + UD_i. \tag{1}$$

Insured deposits are assumed to be inversely related to a market interest rate, e.g. the monetary policy rate (i_{MP}). The inverse relationship is motivated by opportunity cost considerations: In light of relatively high market interest rates that are determined by the monetary policy rate, individuals shift from deposits into other asset classes that yield returns market-linked rates. As a result, it is the less attractive to hold money as non interest-bearing deposits the higher the market level of interest rates:[69]

$$D_i = a_0 - a_1 i_{MP}. \tag{2}$$

Uninsured deposits are assumed to be the marginal source of funding. The market for these funds is characterized by imperfect competitiveness in the sense that a bank has the power to attract additional funds by raising the interest rate it is willing to pay (i_{UD}) above the market level ($i_{\overline{UD}}$):

$$UD_i = b_0 + b_1(i_{UD} - i_{\overline{UD}}). \tag{3}$$

---

[68] The following development of the model is based on Peek and Rosengren (1995a). A similar approach has been taken by Kishan and Opiela (2000), among others.

[69] This point is further elaborated on in the excursus on motives for holding money in section 2.2.2.

By raising interest rates on uninsured deposits above market rates, a bank not only profits from inflows of funds from the clients of other banks, but also from inflows of financial instruments that are close substitutes. The magnitude of this effect is captured by b_{1i}, where the index i indicates that this effect is bank-specific. In particular, b_{1i} is assumed to be a function of individual bank characteristics, which is an important feature of the model:

$$b_{1i} = f(x_{ik}) \tag{4}$$

The variable x_{ik} contains all bank-individual characteristics k that are postulated to have an impact on the supply of bank loans and to be sensitive to the economic situation (normal times versus periods of crisis). These characteristics were discussed in chapters 4, 5 and 6 and are shown in figure 6.2.

On the asset side, banks hold reserves as a certain percentage (c) of insured deposits exactly as demanded by the central bank, which means that they do not hold any additional reserves. This reflects a fractional reserve system such as the one run, for example, by the ECB:[70]

$$R_i = cD_i. \tag{5}$$

In addition, banks hold a certain fraction of deposits as securities to protect themselves against random and large deposit outflows. As discussed in section 3.1.1.1, if they did not hold securities, banks would, when confronted with large unexpected deposit withdrawals, be forced to terminate loan contracts prior to maturity to avoid being unable to replace the lost deposits with other forms of funding, which would normally not be possible without frictions. The premature termination of loan contracts is assumed to be relatively costly. The exact fraction of deposits held in the form of securities (d_1) is the result of a bank's expectations about the available deposit volume and its risk appetite or aversion regarding the volatility of deposit outflows. Securities as a fraction of deposits are held net of reserves. This yields:

$$S_i = d_0 + d_1 D_i - R_i. \tag{6}$$

Both the market for uninsured funding and the loan market experience imperfect competition. If a bank demands an individual interest rate for loans (i_{iL}) that is below

[70] One simplifying assumption made is that reserves are non-interest-bearing. In the euro area, however, required reserves are actually remunerated at the (marginal) rate of the main refinancing operations (see European Central Bank (2011b), section 4.3, p.102).

the market interest rate ($i_{\bar{L}}$), it will be able to increase the volume of loans on its balance sheet:

$$L_i = e_0 - e_1(i_{iL} - i_{\bar{L}}) \tag{7}$$

The market rates on loans, securities and uninsured deposits are modeled to be dependent on the monetary policy rate. In the interests of simplicity, it is assumed that a change in the monetary policy rate translates into an equal reaction (Φ) by each of the market rates for loans, securities and uninsured deposits:[71]

$$i_{\bar{L}} = f_0 + \Phi i_{MP}, \tag{8}$$

$$i_{\bar{S}} = g_0 + \Phi i_{MP}, \tag{9}$$

$$i_{\overline{UD}} = h_0 + \Phi i_{MP}. \tag{10}$$

A further feature of the model is the specification of a capital constraint. In the version of Peek and Rosengren (1995a), the capital constraint is motivated by minimum regulatory requirements. However, as discussed in sections 3.1.1.3 and 4.2, a constraint can also be self-imposed in the sense that a bank targets an individual equity capital ratio as a result of its judgment regarding what it believes to be its optimal capital structure.[72, 73]

Irrespective of its motivation, the capital constraint can be thought of as binding if the capital ratio falls below a certain (regulatory-imposed or self-imposed) fraction (μ_i) of total assets:

$$K_i \geq \mu_i(L_i + S_i + R_i) = \mu_i(K_i + D_i + UD_i). \tag{11}$$

---

[71] This assumption is only made to simplify the algebra. It is not critical in any sense for the further analysis.

[72] Again, this implies an objection to the Modigliani-Miller theorem (see Modigliani and Miller (1958)), according to which the capital structure is – under certain conditions – irrelevant to the value of a firm.

[73] The explicit modeling of an empirical target capital ratio for an individual bank including its derivation follows in section 7.4.2.

Reference is made to a fraction of *total* assets and not to a fraction of a subsample of assets – e.g. *risk-weighted* assets – in the interests of simplicity. All relevant conclusions remain unchanged.[74]

It is assumed that banks aim to maximize their profits, π. Since the model abstracts from loan losses, overhead costs and fee income, the individual profit maximization function is given by the sum of interest earnings on loans (i_{iL}) and securities ($i_{\bar{S}}$)[75] less interest expenses on insured deposits (i_D) and uninsured deposits (i_{UD}):

$$\pi_i = i_{iL} L_i + i_{\bar{S}} S_i - i_D D_i - i_{UD} UD_i. \tag{12}$$

The profit function (12) can then be maximized using the capital constraint as a side condition in a Lagrangian equation. The Lagrangian function, G, yields:

$$G = i_{iL} L_i + i_{\bar{S}} S_i - i_D D_i - i_{UD} UD_i + \lambda(K_i - \mu_i(K_i + D_i + UD_i)). \tag{13}$$

Equations (1) to (3) and (5) to (10) can be used to eliminate S_i, R_i, UD_i, D_i, i_{iL}, i_D and the three market interest rates, $i_{\bar{L}}$, $i_{\bar{S}}$ and $i_{\overline{UD}}$, from equations (11), (12) and (13).

At this point, the usual approach in literature on the bank lending channel – the approach adopted by Peek and Rosengren (1995a) and Kishan and Opiela (2000), for example[76] – is to analyze the effect of *monetary policy changes* on loans and on other variables, such as the amount of uninsured deposits. Mathematically speaking, to this end, the Lagrangian function, G, is maximized with respect to loans and the first-order conditions are used to solve for L_i. Testable hypotheses are then obtained by taking the loan equation with respect to the monetary policy variable.[77] It is then judged whether changes to the monetary policy variable are expected to have a positive or negative sign and impact on loans.

---

[74] Interestingly, the "pure" ratio of capital to total assets has now (once again) been included in the requirements stated in the Basel III accord in the form of the leverage ratio, although the exact specification is still to be settled at a later point in time (see Basel Committee on Banking Supervision (2012)).

[75] Securities are multiplied by the market rate, because banks are assumed to be price takers in the market for securities.

[76] The latter authors use a similar model to the former, but without incorporating a capital constraint.

[77] This process can also be employed to obtain values for other variables of interest, e.g. the amount of uninsured deposits.

In this study, the impact of monetary policy on bank lending is of secondary relevance. The focus here is more on the question of which bank characteristics drive bank lending at normal times and during crises. The monetary policy indicator is therefore used as a control variable, whereas the primary focus is on bank characteristics that have an impact on b_{1i} in equation (4).

Despite this slight difference of focus, it is still useful to exploit the predictions of the model regarding the impact of capital on banks' supply of loans both when capital is subject to constraints and when it is not.

In the event that a bank is subject to capital constraints, applying the approach outlined above – maximizing (13) with respect to loans, using the first-order conditions to solve for L_i and then taking the derivative of the loan equation with respect to K_i – yields:

$$\frac{dL_i}{dK_i} = \frac{1}{\mu_i} > 0. \tag{14}$$

Equation (14) must be positive, because μ_i is the equity capital ratio that a bank must not undercut for regulatory or self-imposed reasons. This means that, for a bank subject to capital constraints, a decrease in capital is associated with a decline in the supply of loans. The magnitude of the effect is the reciprocal value of the equity capital ratio and is, therefore, greater than one.

This result can easily be reconciled to economic intuition: When a bank holds only an amount of capital which exactly matches the desired quantity and, then, suffers capital losses, it obviously needs to reduce its assets.[78, 79] As securities do not change by construction, the capital loss translates into a reduction of loans. Because a bank needs, or has decided, to provide capital equal to the amount of loans times the capital ratio, the consequence of a loss of one unit of capital is a loss in the capacity of accommodating loans in the magnitude of the reciprocal value of the capital ratio. It should be noted that, in the case of a bank subject to capital

[78] It is abstracted from the possibility of raising additional funds on the liabilities side of the balance sheet. See section 3.1.1.1 for a deeper discussion of this issue.

[79] As a reminder: Capital in this case is not a bank characteristic that acts as a buffer against possible losses from an investor's perspective. This motive is captured in b_{1i} (see equation (4)). Here, capital is used to decide whether its quantity satisfies a self-imposed or regulatory target.

constraints, the model does not predict any influence of bank characteristics on the supply of loans, *ceteris paribus*.

In the case where no capital constraints apply, the picture is different when the capital ratio is already above the targeted threshold:

$$\frac{dL_i}{dK_i} = \frac{e_1}{b_{1i}+e_{1i}} > 0. \quad (15)$$

Again, equation (15) is greater than zero as in the case where constraints apply. The effect of capital on loans is positive. However, in equation (15), the impact depends on e_1 and b_{1i}. While e_1 captures the sensitivity of the loan demand to a rise in the interest rate on loans above the market rate and is not of any particular interest, b_{1i} reflects the sensitivity of uninsured deposits to changes in the rates offered by banks. As stated in equation (4), b_{1i} is a function of bank characteristics.

Hence, the conclusion for the case where no constraints apply is that the response of the loan supply depends on certain bank characteristics. Which of these, then, deserve consideration? The characteristics postulated to have an impact on the supply of loans are the ones shown in figure 6.2 and discussed in chapters 4, 5 and 6. These bank characteristics are explicitly incorporated in the empirical model in the section that follows.

7.3.2. Introduction of the empirical model

Having derived the model and established the link to bank characteristics, this section presents the model that is used for the hypotheses tests.

The empirical model that is actually estimated has been used in a comparable fashion in a number of publications.[80] This implies that its empirical specification is well established and has been approved by many successful predecessors.

The model is designed to capture the impact of certain bank characteristics on the supply of bank loans. It is modified to allow for a structural change in the period of the

[80] Among many others there are Kashyap and Stein (2000), Kishan and Opiela (2000) and Kishan and Opiela (2006), Ehrmann et al. (2003), Gambacorta and Mistrulli (2004), Gambacorta (2005), Ashcraft (2006), Gambacorta and Marques-Ibanez (2011), and Altunbas et al. (2009).

recent financial crisis. In its baseline specification, it is expressed by the following equation:[81]

$$\Delta \log(loans)_{it} = a_i + \sum_{j=1}^{J} \beta_j \, \Delta \log(loans)_{it-j} + NC \sum_{k=1}^{K} \gamma_k x_{ikt-1} + C * \sum_{k=1}^{K} \delta_k x_{ikt-1} + \rho y_t + \theta \Delta MP_t + \varepsilon_{it} \quad (16)$$

with $i = 1, \dots, N$, $t = 1, \dots, T$, $j = 1, \dots, J$, and $k = 1, \dots, K$, where N is the number of banks in the sample, T denotes the final year, J stands for the number of lags and K denotes the number of different bank characteristics.

In equation (16), the growth rate of the natural logarithm of bank loans, $\Delta \log(loans)$, is regressed on a vector of fixed effect a_i,[82] on lagged values of the dependent variable, and on k different bank characteristics – represented by x_k – that are interacted with a crisis dummy, C, that assumes the value one in the period from 2008 to 2009 and the value zero at all other times. It is also regressed on bank characteristics that are interacted with a non-crisis dummy, NC, that takes the value of zero in the period from 2008 to 2009 and one at all other times.[83] It must be noted that this does not lead to the introduction of perfect collinearity (a dummy variable trap).[84] As outlined in detail in the section on the estimation methodology (section 7.5), this is because all variables are transformed by applying orthogonal deviations in order to remove bank-specific fixed effects. Comparison of the non-interacted parameters with the parameters of the interaction terms (of the crisis dummy with the bank characteristics) and inspection of statistical significance in each case is intended to reveal any difference in the impact of the economic situation (normal times versus crises) on the effect of the different bank characteristics on bank loans.

Among all the bank characteristics in the standard specification are variables such as the size of an institution, a measure of the amount of liquid assets, the share of funding via customer deposits, a measure of the capitalization of a bank and other

[81] Additional specifications (augmentations of the baseline specification, specifications for sub-samples, robustness checks etc.) are reported further below together with the results.

[82] A motivation of for this fixed effect and the approach to dealing with it, especially against the background of a lagged endogenous variable which is also present here, is given in the section on the estimation method (section 7.5).

[83] The exact definition of the crisis period relevant in this context is motivated in section 7.4.3.2.

[84] See also the explanation in footnote 120.

factors. Precisely which variables are used, how they are constructed and from which sources they originate is presented in detail in the data section (section 7.4.) and shown in table 7.1 and table 7.2. Anticipating objections that may be justified with regard to the problem that certain right-hand-side variables (apart from loans) might not be entirely endogenous, all bank characteristics enter the estimated equation with one lag. An additional measure to fix the endogeneity issue is to apply the generalized method of moments methodology which is described in detail in section 7.5.

Proceeding with the remaining explanatory variables, the growth rate in the natural logarithm of bank loans is regressed on changes in the monetary policy indicator, ΔMP, on variables to control for loan demand effects, y, such as nominal GDP, on the inflation rate and on a more direct measure of loan demand provided by the euro area bank lending survey.[85] Since the only figure that can be observed is the amount of loans on banks' balance sheets, which is the outcome of the settlement of *both* loan supply *and* loan demand, it is crucial to disentangle the two. Otherwise, changes in the amount of loans observed might be attributed to the supply side while the loan demand side is the actual driver.[86] The error term is given by ε.

It is assumed that a linear relationship exists between bank loans and the parameters of the explanatory variables.

7.4. Data

7.4.1. Data sources

The model introduced above is fed with data from different sources (see table 7.1). The data spans the period from 1999 to 2011 and is based on an annual frequency. The year 1999 was chosen because it marks the beginning of stage three of European Economic and Monetary Union when a common monetary policy under the authority of the ECB took effect and the euro became a real currency. It has been

[85] Details of the construction of the variable based on the euro area bank lending survey are given in the next section (section 7.4.1).

[86] See section 7.4.3.1 for a detailed discussion of the disentanglement of loan supply and loan demand effects.

argued (in chapter 4) that three events taken together – the advancing integration of financial markets, developments in the field of financial innovation and the concurrent launch of the common European monetary policy – may have changed the relationship between bank characteristics and lending, especially with respect to other funding opportunities that have become available. To avoid any exposure to structural breaks caused by these events, it therefore seems reasonable to choose 1999 as the beginning of the sample. An overview of the variables used, and the construction/transformation in each case is given in table 7.2.[87]

	Variable	Period	Source
Bank characteristics	Loans	1999-2011	Bankscope
	Size (total assets)	1999-2011	Bankscope
	Capital: Equity capital ratio	1999-2011	Bankscope
	Capital: Tangible common equity ratio	1999-2011	Bankscope
	Capital: Tier 1 ratio	1999-2011	Bankscope
	Capital surplus	1999-2011	Own calculations based on Bankcope data
	Liquidity	1999-2011	Bankscope
	Deposit funding ratio	1999-2011	Bankscope
	Deposit overhang	1999-2011	Own calculations based on Bankcope data
	Dummy deposit overhang	1999-2011	Own calculations based on Bankcope data
	Dummy no deposit overhang	1999-2011	Own calculations based on Bankcope data
	Short-term funding ratio	1999-2011	Bankscope
	Share of non-interest income	1999-2011	Bankscope
	Share of mark-to-market securities	1999-2011	Bankscope
Monetary policy variables	EURIBOR	1999-2011	ECB (originally from Thompson Reuters)
	EONIA	1999-2011	ECB
	EURIBOR-OIS spread	1999-2011	Own calculations based on ECB data
	Non-standard measures	1999-2011	Own calculations based on ECB / Eurostat data
Macro-economic variables	GDP (euro area)	1999-2011	Eurostat
	GDP deflator (euro area)	1999-2011	Eurostat
	GDP (Germany)	1999-2011	Eurostat
	GDP deflator (Germany)	1999-2011	Eurostat
	GDP (Italy)	1999-2011	Eurostat
	GDP deflator (Italy)	1999-2011	Eurostat
	GDP (France)	1999-2011	Eurostat
	GDP deflator (France)	1999-2011	Eurostat
	GDP (Spain)	1999-2011	Eurostat
	GDP deflator (Spain)	1999-2011	Eurostat
	Lending survey	2003-2011	ECB
Other variables	Crisis dummy	1999-2011	Own calculations
	Non-crisis dummy	1999-2011	Own calculations

Table 7.1: Sources of the variables used

[87] All variables have been tested for unit roots. Each time tests suggested the presence of a unit-root in the original times series, the respective variable was first-differenced.

Bank characteristics

All the bank characteristics used in the model which make up the bulk of the data are taken from Bankscope. Bankscope, a commercial database maintained by the Bureau van Dijk in cooperation with Fitch Solutions, provides standardized data at the micro-level on banks' financial statements. It is the most comprehensive cdatabase in terms of geographical coverage (the number of countries) and coverage within a country (the number of banks within a country), and is widely used by academic and non-academic researchers for studies and policymaking. There is no better publicly or commercially available database of banks' financial statements

	Variable (short title)	**Construction/transformation** (as used in estimation)	**Symbol** (for transformed variable as used in estimation)
Bank charac-teristics	Loans	First differences of natural logarithm of loans; normalized with respect to average	ΔLOG(LOANS)
	Size (total assets)	Natural logarithm of total assets; normalized w.r.t. average	SIZE
	Capital: Equity capital ratio	Total equity over total assets; normalized w.r.t. average	CAP
	Capital: Tangible common equity ratio	Tangible common equity over tangible assets; normalized w.r.t. average	CAP_TCE_TCA
	Capital: Tier 1 ratio	Tier 1 regulatory capital ratio; normalized w.r.t. average	TIER_ONE
	Capital surplus	Capital surplus variable constructed as outlined in section 7.4.1	CAPSUR
	Liquidity	Cash and due from banks over total assets; normalized w.r.t. average	LIQ
	Deposit funding ratio	Total customer deposits over total assets; normalized w.r.t. average	DEP
	Deposit overhang	Loans over total customer deposits minus one	OVERHANG
	Dummy deposit overhang	Dummy variable: 1 if total customer deposits exceed volume of loans exceeds, 0 otherwise	DUMMY_OVERHANG
	Dummy no deposit overhang	Dummy variable: 0 if total customer deposits exceed volume of loans exceeds, 1 otherwise	DUMMY_NO_OVERHANG
	Short-term funding ratio	Deposits plus short term funding minus total customer deposits over total assets; normalized w.r.t. average	STF
	Share of non-interest income	Total non-interest operating income over the sum of net interest income and total non-interest operating income; normalized w.r.t. average	NII
	Share of mark-to-market securities	Available for sale securities over total assets; normalized w.r.t. average	AFS
Monetary policy variables	EURIBOR	3 month Euro Interbank Offered Rate	EURIBOR
	EONIA	Euro OverNight Index Average	EONIA
	EURIBOR-OIS spread	3 month EURIBOR-OIS spread	EURIBOR_OIS
	Non-standard measures	Assets on ECB's balance sheet over euro area GDP; first differences	Δ(NSM)
Macro-economic variables	GDP (euro area)	First differences of natural logarithm of first difference of euro area's nominal GDP	ΔLOG(GDP)
	GDP deflator (euro area)	GDP deflator for the euro area	GDP_DEFLATOR
	GDP (Germany)	First differences of natural logarithm of first difference of Germany's nominal GDP	ΔLOG(GDP)
	GDP deflator (Germany)	GDP deflator for Germany	GDP_DEFLATOR
	GDP (Italy)	First differences of natural logarithm of first difference of Italy's nominal GDP	ΔLOG(GDP)
	GDP deflator (Italy)	GDP deflator for Italy	GDP_DEFLATOR
	GDP (France)	First differences of natural logarithm of first difference of France's nominal GDP	ΔLOG(GDP)
	GDP deflator (France)	GDP deflator for France	GDP_DEFLATOR
	GDP (Spain)	First differences of natural logarithm of first difference of Spain's nominal GDP	ΔLOG(GDP)
	GDP deflator (Spain)	GDP deflator for Spain	GDP_DEFLATOR
	Lending survey	Weighted net percentage (tightened-eased) of overall answers to question 4 (demand for loans or credit lines to enterprises) of bank lending survey; first differences	Δ(LEND_SURV)
Other variables	Crisis dummy	Dummy variable: 1 for the years 2008-2009; 0 otherwise	CRISIS
	Non-crisis dummy	Dummy variable: 0 for the years 2008-2009; 1 otherwise	NC

Table 7.2: Description and construction of variables used in the regression

The annual frequency of the data corresponds to the frequency with which Bankscope provides it. As an alternative, one could employ data taken from Bloomberg, a US-based financial data provider. However, since Bloomberg data only comprises listed companies, using it would be a major drawback in terms of coverage of the banking population. Most likely, this would result in a sampling bias overweighting large banks (in terms of assets). This is because listed banks are bigger on average than non-listed companies.

In addition, several studies compare quarterly and annual data with respect to the conclusions that follow from the different frequencies. In a contribution based on US Call reports,[88] Ashcraft (2006) reports similar results for both frequencies. In a study of Italian banks, Gambacorta (2005) resorts to both data from non-publicly available Italian supervisory reports and Bankscope data. Their approach has been to pick those banks that are part of the Bankscope sample. They then look up the data for these banks in Italian supervisory reports and transform this data into a quarterly frequency and into an annual frequency. Comparison of the results based on this procedure yields no substantial differences between the two frequencies.

This leads to the conclusion that the annual frequency is sufficient, and that data with a quarterly frequency does not seem to contain additional relevant information in this context. There is therefore no justification for the disadvantages that come with employing quarterly data taken from the available sources, i.e. the limited coverage and a sampling bias toward large banks.

The sample includes banks from all countries that have been part of stage three of the European Economic and Monetary Union right from the beginning in 1999. These countries are Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, the Netherlands, Portugal and Spain. In addition, banks from Greece (which joined the euro area in 2001) are also part of the sample. Countries that have joined the euro area since then are not included.

With regard to the bank characteristics included in the model, *loans*, which are measured using the natural logarithm of gross loans, are the dependent variable. In addition, *loans* in lags are used as explanatory variables.

[88] In the US, banks are required to give answers as demanded by the Consolidated Report of Condition and Income (in short: Call report) every quarter. The Call reports are administered by the Federal Financial Institutions Examination Council (FFIEC). This data is publically available.

One of the characteristics included in x_k in equation (16) is the size of a bank, which is the natural logarithm of its total assets.

To capture the capitalization of a bank, the use of various measures creates the opportunity to perform robustness checks regarding the different concepts of capitalization. The standard capitalization variable is constructed by taking total equity over total assets. Total equity includes common equity, non-controlling interest, revaluation reserves for securities, foreign exchange instruments and fixed assets, as well as other accumulated comprehensive income.

A second measure of capitalization is tangible common equity divided by tangible assets. Construction involves taking total equity and total assets and subtracting goodwill, other intangibles and deferred tax from both. This is a relatively conservative measure of loss-absorbing capacity. It is especially interesting to a bank's investors, because it does not include the preferred stocks with which a number of banks were bailed out by national or federal state governments or other government institutions during the financial crisis.[89]

A third measure of capitalization is the Tier 1 capital ratio, which is geared to regulatory capital requirements and may, therefore, not be of primarily relevance for providers of uninsured funding. In addition, it is a relatively new concept (although it was first defined in the Basel I framework as far back as 1988), which is probably why many observations on this item are missing especially from the earlier years of the sample. It is nevertheless useful as a robustness check.

Another capital-related variable is the capital surplus or shortfall relative to a bank-specific target. The exact methodology of the construction of the capital surplus variable is presented in the following section (section 7.4.2). Basically, the construction involves two main steps: First, the bank-specific capital target is estimated, and then the actual capital endowment is subtracted from this target, producing either a surplus or a shortfall. As stated, a detailed explanation and discussion follows in the next section.

The measure of the liquidity of a bank is a variable made up of cash and receivables from banks over total assets.

[89] See e.g. Fratianni and Marchionne (2010) for an account of interventions or Congleton (2009) for a more general discussion of public interventions.

To examine the funding situation of a bank, two variables are used that are geared to the share of insured and uninsured funding. Insured funding is captured by the share of customer deposits and expressed as total customer deposits – including current, savings and term deposits – divided by total assets. Uninsured funding is measured by the sum of all deposits and short-term funding, from which total customer deposits are subtracted. The result is divided by total assets.

The extent to which a bank's securities are subject to market movements is given by the volume of available-for-sale securities over total assets. This is believed to hold true especially in crisis periods, making banks particularly vulnerable at such times.

A further variable quantifies the share of non-interest income as opposed to income from interest-bearing business. It is constructed by taking total non-interest operating income over the sum of net interest income and total non-interest operating income.

All bank characteristics, apart from the capital surplus variable, are normalized with respect to their averages across all banks, which yields indicators that add up to zero across all observations. The resultant parameters may be interpreted directly as the loan response of an average bank. This is the approach taken by e.g. Ehrmann et al. (2003), Gambacorta (2005), Altunbas et al. (2009) and many others.

Besides bank characteristics, the model also includes macroeconomic and monetary policy variables. Data on these variables also covers the period from 1999 to 2011. Like the data on bank characteristics, the frequency is annual and the data comprises the same countries, i.e. those that constituted the euro area in 1999 and complemented by Greece, which joined in 2001.

Macroeconomic variables

Among the macroeconomic variables included in the model to control for loan demand factors influencing the observable loan volumes on banks' balance sheets,[90] there is nominal GDP and inflation, which is proxied by the GDP deflator and, alternatively, by the harmonized index of consumer prices (HICP). The data is provided by Eurostat, the statistical office of the European Union.

[90] The question of how to disentangle loan supply and loan demand factors are thoroughly considered in section 7.4.3.1.

A new and innovative approach in this study is the utilization of data from the so called euro area bank lending survey. As part of this survey, senior loan officers at banks are asked quantitative questions on past and expected future developments in the loan markets four times a year. The data is collected by the ECB. A detailed discussion is provided in Berg et al. (2005).

The survey was announced in 2002 (see European Central Bank (21 November, 2002)) and first introduced by the ECB in 2003 to obtain further information about credit markets and the business cycle, and to assess the effects of monetary policy on the credit-related aspect of the transmission mechanism. The survey is addressed to about 90 senior loan officers in all euro area countries. Generally speaking, the questions distinguish between enterprises and households and relate to both past and expected future developments. One section covers the supply of loans and is geared to credit conditions (e.g. interest rate levels, collateral requirements, maturities) and credit standards (e.g. the factors that influence the tightening/easing of loan granting). In the other section, which includes the questions that are of interest to this study, respondents are asked whether demand for loans from different debtors, for different purposes and with different maturities has increased or decreased in recent months.

The data on the bank lending survey is of good quality in the sense that the answers are a reliable predictor of real GDP growth, as supported by the findings in De Bondt et al. (2010). In addition, the ECB, which carries out the survey, has the opportunity to cross-check the answers against the "hard" information it receives from banks as part of a regular and compulsory reporting program. This further validates the reliability of the survey.

For the purpose of this study, the answers to questions on the demand for loans have been evaluated. In particular, the weighted net percentage is calculated from the five possible answers to the question how the demand for loans and credit lines (to enterprises) has changed over the past three months over and above normal seasonal fluctuations.[91] To calculate an index for the euro area, all answers from loan officers in the individual countries are aggregated in accordance with the share of

[91] Answers are assigned values ranging from -2 (demand "decreased considerably") to +2 (demand "increased considerably").

national lending aggregates in the sum of euro area lending aggregates (see Berg et al. (2005)).

Because annual data is used in this study, the results for the four quarters – the answers refer to a three-month period in each case – are aggregated to deliver a single observation.[92] This time series is then used in the regression to control for loan demand effects that impact the loan volume.

To date, only very few studies have tried to make use of the euro area bank lending survey; and those that have done so all investigate different questions. The study by Ciccarelli et al. (2010) relies exclusively on the answers to the bank lending survey to evaluate how monetary policy shocks influence loan demand and loan supply (albeit without using data on bank characteristics). Focusing on those Italian banks that take part in the survey, Del Giovane et al. (2011) use the survey data to cross-check the developments condensed from banks' balance sheets. Maddaloni and Peydro (2011) reveal that monetary policy rates affect credit standards, as reflected in the answers to the survey questions. With the exception of these studies, however, the lending survey has been largely ignored by academic papers. In particular, it has not been used to capture loan demand in a euro area context.

Although one loses observations at the beginning of the sample as the survey only started in 2003, it is still a useful instrument to complement other macroeconomic variables.

The monetary policy variable and non-standard monetary policy measures

Different approaches are adopted with regard to the monetary policy variable, whose purpose is to capture the stance of monetary policy. The monetary policy stance is a measure of whether a central bank's monetary policy contributes to the economic, financial and monetary developments in a way that is in accordance with its goals – which, in the case of the ECB and the euro area, is ultimately the goal of achieving

[92] To be absolutely precise: The results published, say, in April refer to the preceding three months (January to March). Therefore, the results for April, July and October of year t_0 and January of t_1 are aggregated to form one observation for the year t_0.

price stability.[93] A measure of the stance is included in the empirical model because the fact of whether it is accommodative, neutral or restrictive should be closely reflected in the banks' funding conditions and their lending reactions.

There seems to be no generally accepted measure.[94] However, most studies dealing with bank lending and the bank lending channel in a European context use a short-term interbank rate to proxy banks' funding conditions. In this study, three different approaches are adopted to ensure the robustness of the results with regard to variations in the measurement of the monetary policy stance.

Since the ECB sets key interest rates with the aim of steering short-term money market interest rates (see European Central Bank (2011b), p. 93), it seems reasonable to use these rates as monetary policy rates. Two variables of this kind are the 3-month Euribor (Euro InterBank Offered Rate) and the Eonia rate (Euro OverNight Index Average), both of which are rates for relatively short-term time horizons at which banks in the euro area are willing to lend unsecured funds to each other. As shown in figure 7.2, the 3-month Euribor shows somewhat more fluctuation from mid-2007 onward, which is likely be due to other disruptions and is probably not a reflection of changes in the stance of monetary policy.[95] This finding might be considered as a cautious argument in favor of the Eonia rate as the superior measure.

However, strong demand for liquidity in connection with the dysfunction of interbank markets during the crisis led to sharp increases in both the overnight and 3-month interbank rates. As stated in the discussion of Gambacorta and Marques-Ibanez (2011), these rates thus do not appropriately represent banks' funding conditions during large parts of the crisis, especially against the background of the drying up of interbank markets and the sharp associated rate hikes that have been observable since the summer 2007 (see figure 7.2).

---

[93] For details of the monetary policy stance of the ECB during the recent crisis, see European Central Bank (2010b), p. 63 et seq.

[94] For an overview of different approaches, see e.g. Oliner and Rudebusch (1996a) or the survey provided in Khan and Qayyum (2007).

[95] Reasons for these fluctuations included tensions on the interbank markets. This issue is further discussed in section 7.4.3.2.

In practice, a meaningful indicator of banks' funding conditions should abstract from the banks' tendency to hoard liquidity during the crisis. This was the case when tensions in the financial markets in general and the interbank market in particular began to unfold because banks feared they might not be able to raise the amount necessary to meet reserve requirements in the latter. The resultant shortage of liquidity contributed to a sharp rise in interbank interest rates (liquidity premium), obviously in connection with increased risk premiums. To better capture the risk associated with lending by banks to each other, it is worthwhile considering the Euribor-OIS spread.

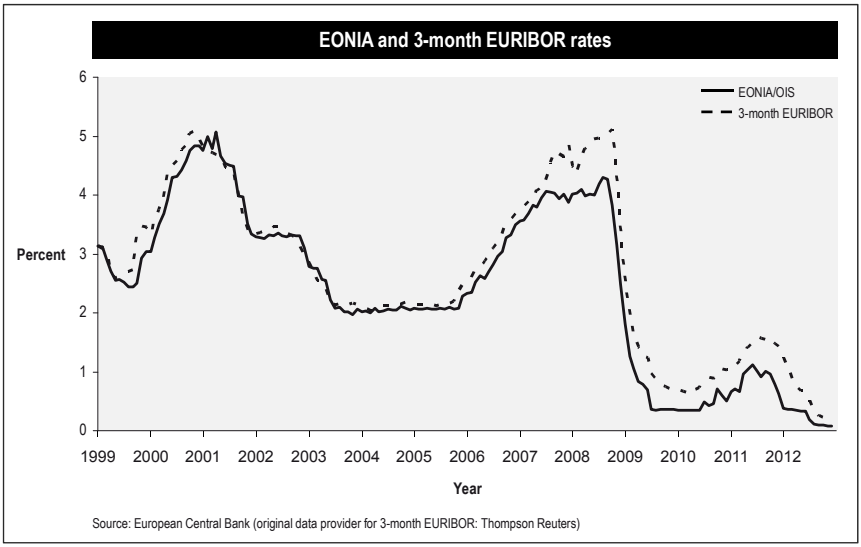


Figure 7.2: Eonia and 3-month Euribor rates

The OIS (overnight index swap) rate is the rate on a derivative contract in the course of which the geometric average of overnight interest rates is exchanged against the term OIS rate over the maturity of the contract. The difference is settled in cash. In this respect the OIS rate is a reflection of financial markets' *expectations* regarding the overnight rate (Eonia in the euro area) over the maturity of the contract (see Thornton (2009)). Because no exchange of principal is involved, there is very little default risk associated with OIS contracts.

The Euribor indicates the rate at which banks are willing to lend to each over the term of the Euribor contract. It includes *both* their *expectations* about how interest rates

will evolve over the term of the contract *and the risk* that is associated with lending to other banks.

Taking the spread between the 3-month Euribor and the OIS excludes – or effectively subtracts – these expectations about the development of interest rates (that are included in the OIS). This exercise thus yields a measure of the risk that is involved when banks lend to other banks.[96] This should be a much better reflection of the funding conditions than "pure" overnight or Euribor rates (see figure 7.3 for the evolution of the Euribor-OIS spread).

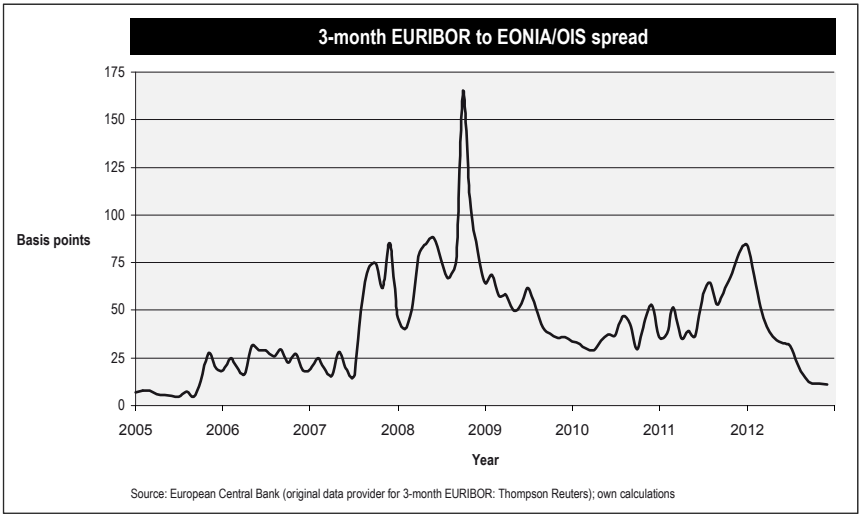


Figure 7.3: 3-month Euribor-OIS spread

Therefore, one innovation in this study compared to others dealing with the period of the financial crisis is that the 3-month Euribor-OIS spread is used as an indicator of banks' funding conditions in addition to the Eonia rate and the 3-month Euribor.

The data on the 3-month Euribor is taken from the European Central Bank. Eonia data is also taken from the ECB, while the original data provider is Thompson Reuters. The Euribor-OIS spread is a derivative of the two other variables and is based on the author's own calculations.

[96] Putting it simply, the idea can be expressed as: Euribor (expectations + risk) - OIS (expectations only) = Euribor-OIS (risk).

A special category of data reflects the implementation of non-standard monetary policy measures. In response to the shortage of liquidity in the wake of dysfunctional interbank markets, the European Central Bank took a number of unconventional steps. The ECB responded, first, by injecting additional liquidity through large-scale overnight fine-tuning and additional longer-term refinancing operations. Then, from September 2008 onward, its most important measure was adopting the fixed-rate full allotment policy and relaxing collateral requirements (see Trichet (2010), European Central Bank (2009) and Lenza et al. (2010)[97]).

These measures had a significant alleviating impact on interbank rates and thus influenced banks' funding conditions during the time of financial turmoil. Restoring the functioning of the short-term funding markets was indeed the *primary goal* of the ECB's unconventional measures (see Trichet (2010) and González-Páramo (2011)).

To account for the impact of these measures on bank lending, this study followed the approach adopted by Gambacorta and Marques-Ibanez (2011) and Brei et al. (2013). They form the quotient of the central bank's assets in relation to nominal GDP and use it in the estimation as a proxy for the ECB's non-standard measures. This measure is especially designed to capture the growth of the ECB's balance sheet caused by the extra liquidity provided.

From a theoretical point of view, however, it is not completely convincing to let the ratio of the central bank's assets to nominal GDP influence lending *directly* (see discussion of Gambacorta and Marques-Ibanez (2011)). As stated above, the unconventional measures sought to restore the short-term interbank markets to proper working order. Consequently, these measures may be already reflected in the monetary policy variables (the Eonia, Euribor or Euribor-OIS spread, respectively) which are in any case included in the estimated equation. To shed light on the question of whether this is actually the case is one of the results the use of the non-standard-measures variable is expected to give.

[97] Other measures taken by the ECB from September 2008 include the extension of the maturity of refinancing operations (LTROs), the provision of liquidity in US dollars, and the purchase of euro-denominated covered bonds. For a review see Trichet (2010), Lenza et al. (2010), European Central Bank (2009) or Mercier (2009).

To construct the quotient of assets in relation to nominal GDP, the total assets of the Eurosystem as provided by the ECB, are taken. Nominal GDP, as stated above, originates from Eurostat.

7.4.2. Target capital estimation

Using a variable that measures a capital surplus or shortfall, as briefly touched on in the previous section, is a relative novelty in the context of literature on bank lending. This approach involves estimating bank-specific capital targets.

Considerations regarding target capital ratios can be traced back to the capital structure puzzle put forward by Myers (1984). The basic question is how firms choose their capital structures, which, in itself implies a departure from the capital irrelevance proposition formulated by Modigliani and Miller (1958). This question has produced a very large body of literature in the field of corporate finance; and without revisiting this discussion in detail, some studies are worth noting in the context of this study. One of them is Flannery and Rangan (2006), who conclude that non-financial firms *do* target capital ratios. After a target has been missed firms do not fully but partially adjust in the subsequent period. Lemmon et al. (2008) add to this finding by observing that, despite the explanatory power of certain firm characteristics, the majority of the variation in non-financial firms' leverage ratios can be explained by time-invariant fixed effects. As debatable as this result may be, a related idea applied to banks has recently started to gain popularity.

The general idea that banks, too, follow target ratios and that this has an impact on their lending behavior was first expressed by Hancock and Wilcox (1994). In this and a subsequent study (Hancock and Wilcox (1998)), they employ variables for capital shortfalls or surpluses in a bank lending context. However, the shortfalls are measured relative to regulatory standards, not self-imposed ones. The authors report a significant lending reaction on the part of banks in response to shortfalls relative to unweighted capital ratio standards.

Borrowing from corporate finance literature and following the methodology already applied to the capital structures of non-financial firms, Gropp and Heider (2010) find that banks, like non-financial corporations, target individual capital ratios. These can largely be explained by bank-fixed effects, which are supplemented by bank characteristics as further explanatory variables. The individual nature of the capital

targets implies that there is no common capital target, such as the regulatory minimum capital ratios stated in the various Basel accords. The same line of thought is pursued by Berrospide and Edge (2010) and Francis and Osborne (2009), who model banks' target capital ratios as a function of a fixed effect and of certain bank characteristics.

All three authors who concern themselves with banks' capital structures (Francis and Osborne, Berrospide and Edge, Gropp and Heider) confirm that, where capital targets are missed, a partial adjustment process can be observed. According to this process, only a part of the gap between actual and targeted capital endowment, but not the entire gap, is closed in the subsequent period.

How exactly does the process of estimating the capital target ratio and of constructing the capital surplus/shortfall variable work? The process involves two stages: The first stage is to estimate bank-specific target capital ratios. In the second stage, estimated target capital ratios are put into relation with actual capital ratios. A positive deviation stands for a capital surplus, while a negative deviation represents a shortfall.

For the first stage, the equity capital target for each bank i at time t, cap^*_{it}, is modeled as dependent on a constant η_i (representing the individual fixed effect), the lagged capital ratio, $cap_{it\text{-}1}$, and a vector of N different bank characteristics:

$$cap^*_{it} = \eta_i + cap_{it-1} + \sum_{n=1}^{N} \theta_n \chi_{nit}. \quad (17)$$

The variables included in X_n broadly follow those that are used in the cited adjacent literature: They are size, the share of non-interest income, the share of short-term funding and the share of liquid assets. All these variables are constructed as explained in section 7.4.1.

The size of a bank, measured in logs of total assets, is believed to have an impact on the targeted capital ratio because, as stated above, size can be perceived as a proxy for the professionalism and transparency of a bank. This should have an impact on the equity capital buffer demanded by the providers of external finance[98] and, therefore, on the target ratio that a bank deems adequate, optimal or "right".

[98] Or, vice versa, given a certain equity capital endowment the external finance premium should be lower for bigger banks than for smaller banks.

A bank with a larger share of non-interest income might prefer to operate at higher levels of capital, because this form of income is more volatile than interest income.

A higher share of short-term funding can be interpreted as a reflection of a rather risky business or funding model, since it is typically associated with significant maturity mismatches between the assets and the liabilities side of the balance sheet. Accordingly, banks characterized by large proportions of short-term funding will probably tend to have more capital.

The thinking behind the share of liquid assets is that liquid assets act as a buffer to shield the bank from unforeseen funding problems. If raising funding is difficult for whatever reason, a bank can then respond by selling securities at short notice without being forced to reduce other, less liquid assets at higher cost, or even at a loss. Relatively liquid banks might therefore be comfortable with a lower level of capital.

Obviously, equation (17) cannot be estimated since values for the target ratios, cap^*_{it}, are missing. Hence, a further step is necessary: The assumption is that banks *partially adjust* in line with their capital targets after a deviation. This is expressed as

$$cap_{it} - cap_{it-1} = \lambda(cap^*_{it-1} - cap_{it-1}) + \varepsilon_{it}, \tag{18}$$

where cap_{it} is the actual capital ratio at time t, λ is the speed of adjustment and ε_{it} is an error term. The missing step is now to substitute (17) into (18). Rearranging this yields:

$$cap_{it} = (1-\lambda) * cap_{it-1} + \lambda(\eta_i + \sum_{n=1}^{N} \theta_n \chi_{nit}) + \varepsilon_{it}, \tag{19}$$

Equation (19) implies that all banks adjust toward their targets at the same speed. Flannery and Rangan (2006) once modeled λ as a function of firm characteristics, but reported no significant improvements by doing so. It further implied that the long-run impact of the bank characteristics in X_n on capital are given by the estimated parameters, θ_n, divided by $(1-\lambda)$.

Equation (19) can now be estimated with OLS. The coefficients obtained are plugged into equation (17). Together with the respective representations of the variables of the individual banks, this yields individual and time-variant capital targets for each bank in the sample.

All that remains to be done to construct the surplus variable is to calculate the difference between cap_{it} and cap^*_{it} for each bank in every period. The difference is

then divided by the capital target. This is necessary to make the surplus or shortfall proportional to the target ratio. Otherwise, a shortfall of, say, one percentage point would be equally "bad" irrespective of whether the target ratio is five per cent or 25 per cent.[99]

Constructed in this way, this variable is used as an additional bank characteristic in the empirical model (equation (16)).

7.4.3. Special challenges

Having presented the sources of the data and the construction of the variables in detail in the sections above, the present study now addresses to two further data-related topics. Both represent special challenges and therefore merit separate treatment. The first issue concerns itself with the question how it is possible to effectively control for factors that drive loan demand. This is necessary because the amount of loans observed on banks' balance sheets is merely the outcome of the settlement of supply and demand. The second issue deals with the length of the crisis period and the line of argument based on which the crisis period relevant to this research enterprise can be correctly identified.

7.4.3.1. Disentangling loan supply and loan demand

One well-known problem in the context of the bank lending channel – and a major empirical challenge when trying to identify the impact of bank characteristics on lending – is the disentanglement of supply and demand factors. Theoretically, an observed change in the volume of loans recorded on banks' balance sheets could be attributed either to shifts in the supply or in the demand of loans or to a combination of the two. The correlation between loan demand and loan supply or, more precisely, between demand and certain *factors* that have an impact on the supply of loans, can work through variations in the course of the business cycle and follows two main patterns (see e.g. the discussion of Berrospide and Edge (2010).

According to the first pattern, deteriorating investment opportunities and subdued economic prospects in an economic downturn lead to a decline in demand for loans

[99] In the first case the deviation from the target would be 20%, in the second case it would be only 4%.

from potential borrowers. At the same time, in the downturn credit defaults require banks to write off loans, which has a negative impact on the bank's capital position with the known adverse consequences for lending. Moreover, insofar as the economic downturn translates into a decline in the value of securities, the liquidity positions of banks too are affected. In addition, both aspects lead to a shrinkage of the balance sheet, such that the size of a bank as a factor potentially impacting the supply of loans also declines.

Deposits serve as an additional example (see Loutskina and Strahan (2009)): A large amount of insured deposits available to a bank is supposed to have a positive impact on the supply of loans. However, strong *demand* for loans, e.g. in a boom phase, might cause banks to intensify their efforts to attract insured retail deposits. This could induce a correlation between demand for loans and deposits which, when regressed, suggests that deposits drive the loan supply (because both observed loans and deposits rise), when in fact deposits might equally have been driven by loan demand. These examples reveal a first pattern from which a business-cycle related correlation between supply and demand can arise.

According to the second pattern, the quality of borrowers declines in an economic downturn, making them more risky. Simultaneously, a downward shift in the quality of the borrower pool results in higher risk weights and necessitates higher equity capital holdings than before for the same credit portfolio, such that less capital is available to expand the credit supply. This effect thus has two implications: One is a direct decrease in the (risk-weighted) capital ratio and the other is that the bank will come closer to being bound by regulatory or self-imposed capital constraints. This is the second example of a correlation between demand-related and supply-related factors that have an impact on the observable amount of loans. Since, in fact, capital does not drive loans in this example, but both capital and loans are driven by deteriorating economic conditions this correlation will lead to conclude that the effect of capital on loans is stronger than it really is if one fails to account for this factor.

In addressing these issues, the most common approach is to use macroeconomic variables such as GDP and inflation-related variables in the regressions. The GDP variable is an outright measure of aggregate demand and has a direct, demand-driven interpretation regarding loan growth. The inflation variable reflects the positive impact of price level changes on nominal loan growth.

The standard assumption is that these variables effectively capture the demand effects on the observed volume of loans, such that the partial effects of bank characteristics on bank loans that remain have a causal interpretation rather than representing mere correlations.

In addition, this study follows a new and innovative approach in disentangling loan supply from loan demand by using data taken from the euro area bank lending survey, as explained in section 7.4.1. In particular, answers to the question of how demand for loans and credit lines (to enterprises) has changed over the past three months above and beyond normal seasonal fluctuations are evaluated and included as a supplementary variable intended to capture the demand for credit.

The demand-related responses to the bank lending survey may be superior to the use of GDP measures, because they are directly geared to loan demand. In addition, it is theoretically possible that a causality between GDP and loans might exist that works in the opposite direction: A shock to the supply of loans (a "credit crunch"), for example, could cause GDP to contract. From a theoretical perspective, there is therefore much to suggest that using data obtained from the euro area bank lending survey is a fruitful option indeed.

7.4.3.2. Determining the relevant crisis period

One central concern of this study is to clarify the role of those bank characteristics that drive bank lending and, especially, to identify their impact during the recent crisis. Although the term "crisis" has already been used several times in this study, a definition has not yet been provided. According to conventional wisdom one can distinguish between different stages or emphasize different aspects of the crisis (subprime lending crisis, banking crisis, global financial crisis, sovereign debt crisis, etc.). Some of these stages or aspects of the crisis are still ongoing.

This section serves to answer the question which aspect of the crisis is relevant in the context of bank lending and what is the distinctive feature that characterizes this aspect. On the basis of this definition, the length of the crisis period is determined, which in turn determines the crisis dummy to be used in the empirical model.

The starting point for these considerations is to ask in what respect or by what events banks have been affected in the conduct of their business. The first event to be mentioned is the financial turmoil that started in August 2007. Around this date,

overnight money market rates rose to higher levels and were accompanied by greater volatility in the money market (see figure 7.4). The ECB responded by providing overnight credit of EUR 95 billion at the main refinancing rate in exchange for collateral (see e.g. Trichet (2010)). This measure helped to relieve some of the tension on the money market, although spreads[100] and the volatility of money market rates, especially at longer maturities, remained significantly higher than before.

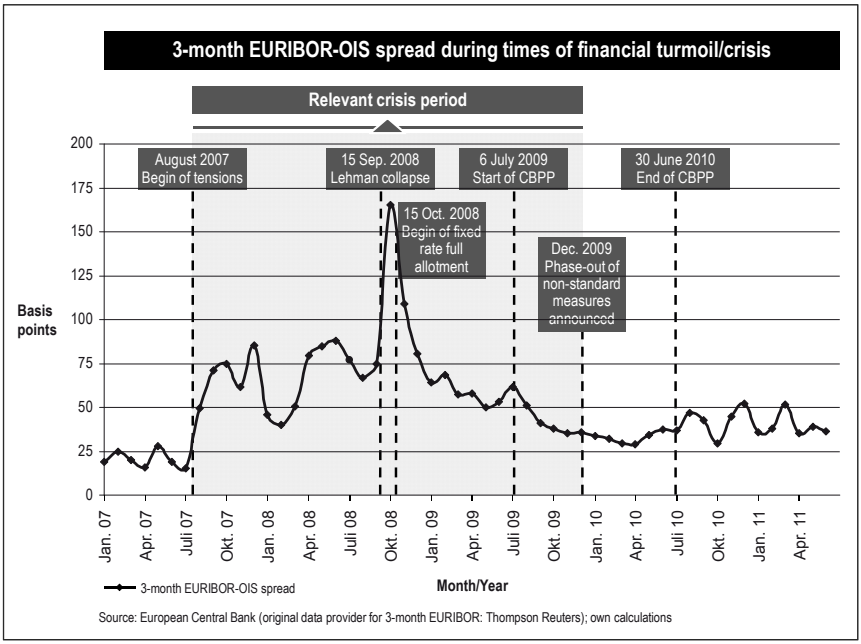


Figure 7.4: The impact of selected events on the evolution of the 3-month Euribor-OIS spread during times of financial turmoil/crisis

To understand how this negatively affected the funding conditions for banks, one must be mindful of the role of the money market (market for reserves/monetary base) in this context: The monetary base that the ECB provides corresponds to the aggregate need of the euro area banking system. It is determined on the one hand by the reserve ratio, which is the share of deposits (subject to reserve requirements)

[100] For example, the 3-month Euribor-OIS spread and the spreads between the overnight index swap rate and Euribor rates of other maturities. These spreads can be interpreted as a measure of counterparty risk. See section 7.4.1 for details.

that have to be held in the form of reserves with the ECB.[101] On the other hand, the need for central bank liquidity is determined by the volume of deposits itself which, in turn, depends on the amount of loans that the banking system grants on aggregate to non-financial corporations.[102] Since banks regularly report all relevant loan and deposit positions to the ECB, it knows exactly how much liquidity it must provide to the banking system on aggregate. A necessary condition for the functioning of the interbank market is that banks actively lend to each other so that the liquidity the central bank provides is effectively exchanged among the participants.

In the event that some banks' access to the required liquidity via interbank markets is compromised – as was the case in the period starting in August 2007 – this is associated with a rise in money market rates which, in the period in question, reflected some banks' desire to hoard liquidity. These rates are then translated into rates on, first, short-term and, then, longer-term loans and are reflected in the price of external funding. This has an impact on banks' overall funding costs and their ability to grant credit.

When Lehman Brothers collapsed on 15 September 2008, the tension immediately escalated into a financial and economic crisis. Money market rates increased sharply from already high levels (see figure 7.4) and exacerbated the funding problems of banks caused by a breakdown of the interbank money markets. The ECB responded by taking non-standard measures in order to restore the functioning of the money markets as a key element in the transmission of monetary policy. These measures included the unlimited provision of central bank money at a fixed rate (“full-allotment” policy) and expansion of the scope of accepted securities to serve as collateral.[103] While the ECB's deposit facility had been hardly used until then, a significant increase in the use of the deposit facility was observable in the wake of the full allotment policy and long-term tenders (see European Central Bank (2011a)),

[101] For details of the fractional reserve system, see European Central Bank (2011b), p. 101 et seq. or Bofinger (2001), p. 343 et seq.

[102] Note that the link between a loan and a deposit is given by the fact that the granting of a loan is associated with the creation of a deposit of equal value to the account of the beneficiary. This deposit is then subject to reserve requirements.

[103] An overview of additional measures taken by the ECB can be found e.g in Trichet (2010) or in European Central Bank (2011a).

highlighting the mood of uncertainty and the failure of the money market to effectively distribute liquidity among the participants. Another important element to improve the funding conditions of banks was the "covered bond purchase programme" (CBPP), which was announced in May 2009 and included outright purchases of covered bonds in issue during the 12-month period beginning in July 2009 (see European Central Bank (2011a)).[104] The launch of this program further underlines the funding problems that banks were facing due to the fact that the money market was no longer working properly.

Together with a reduction in the key interest rates, the measures taken by the ECB succeeded in reducing money market rates to normal levels[105] and improving banks' funding conditions. Because non-standard measures such as those undertaken in the preceding months were no longer necessary, the ECB was able to announce the gradual phase-out of these measures in December 2009.

In a nutshell, the *dysfunction of the money market* in conjunction with higher rates translated into higher funding costs for banks even though the bank characteristics had not necessarily changed. In the course of these developments, negative feedback loops such as those described in chapter 5 were set in motion, with all the externalities that then significantly contributed to the propagation of the crisis within the financial system. This is the key rationale for the hypothesis that, during the crisis, some bank characteristics played a different role in determining bank lending.

It follows that the period of unusually high money market rates shown in figure 7.4 is the crisis period of relevance to this study. It spans the years 2008 and 2009. The crisis dummy used in the estimation of equation (16) is constructed accordingly.[106]

[104] For an (ECB in-house) assessment of the CBPP see Beirne et al. (2011).

[105] "Normal" levels can probably be described as not being influenced by liquidity shortages and as characterized by the absence of unusual high volatility.

[106] This choice is in line with other studies that explicitly consider the crisis period, e.g. Gambacorta and Marques-Ibanez (2011). Based on quarterly data, the latter define the relevant crisis period as extending from the third quarter of 2007 to the fourth quarter of 2009.

7.4.4. Purging the data

This section describes in detail the steps necessary to prepare the data for empirical analysis and without which meaningful results would not be possible. The steps involve excluding banks that have only marginal lending business, correcting for mergers and acquisitions, eliminating banks with missing values for capitalization, deposits and liquid assets, and removing outliers. An overview of the steps is given in figure 7.5.

Exclusion of banks that have only marginal lending business

In line with e.g. Favero et al. (1999) and to avoid distortions in the results stemming from banks for which lending is only a marginal business, all institutions whose ratio of loans to total assets is less than five per cent are eliminated.[107] This group of banks consists mainly of specialized institutions such as guarantee banks, trust companies, securities banks etc., for which it can be assumed that loan business follows patterns that differ from those under scrutiny in this study – those that operate significant client loan business.

	Rationale	Approach/procedure
1	> Exclusion of banks with a **marginal lending business** (mainly securities banks, guarantee banks, trust companies)	> Eliminiation of banks with a share of *loans over total assets* smaller than 5%
2	> Correction for **mergers & acquisitions**	> Elimination of banks who show an asset growth of greater than 67% in at least one year of the sample period
3	> Elimination of banks with **missing values for capitalization** – otherwise no meaningful analysis possible (capitalization key driver of lending)	> Elimination of banks without any values for *total equity/total assets*
4	> Elimination of banks with **missing values for deposits and liquidity** – otherwise no meaningful analysis (e.g. also concerning short-term funding, deposit overhang) possible	> Elimination of banks without any values for *customer deposits* and *cash and due from banks over total assets*
5	> Elimination of **outliers** for – *Loans* – *Total equity over total assets* – *Cash and due from banks over total assets*	> Elimination of banks with annual growth rates for the respective variables within the 1st or above the 99th percentile in at least one year of the sample period

Figure 7.5: Overview of steps in purging and cleansing the data

[107] The five per cent threshold is calculated as an average of the available values over the sample period (1999-2011).

Elimination of banks with no reported values for capital, deposits and liquidity

A number of the hypotheses to be tested (see section 7.1) are directly geared to capital, deposit and liquidity variables. Banks that do not report *any* values for these variables cannot contribute at all to exploitation of the differences in these variables for the purpose of explaining lending since, given all that we know from the available literature, these variables have considerable explanatory power regarding the lending behavior of banks. Worse still, including these banks could contribute to biased estimators, because the time-series variation in loans for these banks might in part be attributed to other variables for which observations are available that are loosely correlated with capitalization, deposit or liquidity variables. Hence, in order to obviate the omitted variable problem, these banks are completely eliminated from the sample.

Treatment of mergers and acquisitions

Another issue regards the treatment of mergers and acquisitions. Several approaches are pursued in the relevant literature. The most important of these are the complete exclusion of banks that were involved in a merger or acquisition during the sample period, and the synthetic aggregation of merging banks for the years before the merger actually took place. The latter approach includes the assumption that the merger in question took place in t_0, i.e. at the beginning of the sample period.

In a study in which the robustness of results was explicitly tested with regard to alternative ways of handling mergers, Worms (2001) finds only minor qualitative and quantitative differences. Moreover, even where a study does not control for mergers at all, the broad picture does not change more than marginally. Similar results have been obtained by Kishan and Opiela (2000) and Ehrmann et al. (2003). This suggests that the treatment of mergers and acquisitions is of little relevance to the results.

However, to account for mergers in this study, the general approach adopted by Favero et al. (1999), Worms (2001) and Alper et al. (2012), for example, was applied. Accordingly, banks that are affected by mergers are excluded from the sample. For

this purpose, all banks whose total assets grow by more than 67% in any of the years in the sample period are excluded.[108]

Elimination of outliers

An important issue with outliers – which are probably attributable to measurement errors, input errors or one-time events, for example – is that they have the potential to significantly bias estimation results in a panel regression. This holds true especially where the first-difference estimator method is used in the context of dynamic panels (see Wooldridge (2002), chapter 11, Griliches and Hausman (1986) and Solon (1985)). It is therefore advisable to eliminate these outliers.[109] The risk of removing "regular" observations with the method used to detect outliers is justifiable in light of the danger of obtaining biased results (see e.g. Worms (2001)).

Therefore, following the general approach of Worms (2001), Ehrmann et al. (2003) and Gambacorta (2005), for example, an observation is defined as an outlier if its first difference is in the top or bottom percentile of the given distribution. This applies to *capitalization, loans* and *liquidity* as the most relevant variables with respect to the hypotheses tested in this study. Every bank that has at least one outlier is removed from the sample entirely.

7.5. Estimation method

Having introduced the model to be estimated and the data to be used, the question of the appropriate estimation method arises. This section motivates the choice especially of the generalized method of moments (GMM) methodology and certain features of the estimation, including a discussion of the reasons why these methods are advantageous in the context of the current research undertaking.

The starting point is the observation that the model estimated in equation (16) has a lagged endogenous variable as regressor and a time-invariant but bank-specific

[108] An alternative approach along the same lines is to refer to a database of mergers and acquisitions, and then to manually identify and eliminate all relevant banks. Unfortunately, no such database was available.

[109] The first-difference estimator method and the GMM methodology are discussed in detail in connection with the estimation method in section 7.5.

factor (a_i). This factor is often called *fixed effect* because it does not change over time. Why is it likely to encounter a fixed effect, i.e. why is incorporation of this factor justified?

In the context of the determinants of bank lending, there may be unobserved factors that could, for example, emanate from business stances such as risk aversion, managerial/employer quality, the organizational structure of a bank and/or the "quality" of its processes. Hence, one could conceivably encounter a situation in which different levels of loans exist even if all *observed* variables take the same values. Ultimately, therefore, one cannot rule out the possibility that (observable or unobserved) factors exist which also impact bank lending.

Because the fixed effect is unobserved, it would normally be covered by the error term, along with the time-variant, idiosyncratic error. However, a problem now arises in connection with the presence of the lagged endogenous explanatory variable: As Nickell (1981) shows, the lagged endogenous regressor is correlated with the fixed-effect proportion in the error term, which violates one of the key conditions under which OLS produces unbiased estimators. Using OLS thus results in the famous "dynamic panel bias".

However, the panel structure of the data offers several solutions to deal with fixed effects. In addition to the alternative methods – dummy variable regression, time-demeaning/within transformation or random effects model, all of which are inappropriate for specific reasons,[110] – two popular alternatives are the method of first-differencing and orthogonal transformation. They are designed to capture the

[110] In a dummy variable regression, one dummy is included for every "individual", with the disadvantage that this regression quickly becomes unmanageable when the number of cross-sections is large, as it is in this case (see Wooldridge (2002), p. 272 et seq.).

The procedure of time-demeaning, also known as within transformation, involves writing the equation to be estimated in averages of the time for each cross section. In the averaged equation, the fixed effect is also present. If one subtracts the averaged equation from the original one, the fixed effect drops out (see Wooldridge (2002), p. 265 et seq.). Unfortunately, as Nickell (1981) and Bond (2002) confirm, this approach addresses the fixed effect but does not eliminate the dynamic panel bias.

The random effects model requires that the unobserved effect be uncorrelated to all explanatory variables in all periods (see Wooldridge (2002), p. 272 et seq.). This assumption is hard to justify in this case.

fixed-effect part of the information otherwise contained in the error, while the time-variant (idiosyncratic) components remain in the error term.[111]

How does first-differencing work? Without going into too much detail regarding formalization the basic idea is easy to explain: The equation to be estimated is expressed as representing a certain point in time (for example at $t = 1$). In the next step, the equation is expressed as representing the next available point in time (e.g. $t = 2$). By subtracting the equation at $t = 2$ from the equation at $t = 1$, the intercept that captures the individual effect missed by observed variables is canceled out since it is time-invariant. Thus, by subtracting the observations of all explanatory variables at $t = 2$ from the relevant previous ones, one obtains a first-differenced equation in which the individual unobserved effect drops out. According to Roodman (2009b), the weakness of the method of first-differencing is that, when a data point is missing at a certain point in time, one loses not just one observation but also the adjacent observation due to the differencing procedure .

This shortcoming is cured by the orthogonal deviations procedure (Arellano and Bover (1995)), which involves subtracting the average of all future *available* observations of a variable from the contemporaneous observation of this variable. In doing so, one only loses the last observation instead of many more in the event of data gaps. Given a fully balanced panel in which no observations are missing, both approaches yield the same result.

The orthogonal deviations procedure is generally used in connection with the GMM estimator (see explanation further below), whereas the method of first-differencing is also applied in when estimating with OLS. Why not applying first-differences and perform the estimation using OLS? Besides the issue of data losses, this leads to another problem: Estimation with OLS results in an unbiased and consistent estimators only under certain conditions. The crucial assumption is the exogeneity of the explanatory variables. When employing first-differencing, the least strict formulation of the exogeneity condition amounts to $E(\Delta\varepsilon_{it}|x_{ikt}) = 0$, $t = 2,\ldots,T$, which means that the difference in the error term is uncorrelated to the bank-specific

[111] See Wooldridge (2002), p. 248 et seq. for a general treatment of unobserved effects panel data models, and also for the assumptions underlying difference GMM estimations.

explanatory variables (see Wooldridge (2002), p. 317 et seq.). Unfortunately, the exogeneity requirement is likely to be violated.

The nature of the model estimated in equation (16) and the relationships between the variables therein suggest that the problem of endogenous explanatory variables could well be relevant. When certain bank characteristics are strongly correlated to bank loans, it is not easy to clearly determine whether *only* these bank characteristics drive loans, or whether the volume of loans might *also* drive certain bank characteristics. To give an example: While the economic theory referred to in previous chapters suggests that the capitalization of bank has a positive impact on bank lending for a number of reasons – i.e. allowing easier access to uninsured sources of funding by mitigating the moral hazard problem associated with asymmetric information or acting as a buffer against possible losses – an increase in the volume of loans also demands an increase in capital. Thus, the direction of causality cannot readily be established in every case.

Another obvious and harmful example is the size of a bank measured in terms of total assets or some derivative thereof. According to the standard hypothesis, size matters for the supply of bank credit because it is assumed to reduce informational friction, especially when a bank tries to tap alternative sources of funding. Large banks thus benefit from more favorable funding conditions which they can pass on to borrowers, and which should be reflected in the size of the loan portfolio. The thing is that, when a bank grants credit, the amount of assets increases by exactly the amount of the loan at the same moment. This shows that causality works in the opposite direction as well – a direction that logically derives from the mere fact that loans are a subset of total assets. Hence, it is not in the least surprising that a statistical connection between size and loans can easily be found. However, interpreting this observation as being in line with the hypothesis stated above might be premature if one does not take into account that size measured in terms of total assets (or in logs or differences of total assets) is endogenous to the amount of loans. Unfortunately, it appears that not all scholars have paid particular attention to this issue.

To sum up: The issue with fixed effects can be resolved using the first-differencing method. However, the problem of endogenous explanatory variables means that the

OLS estimator cannot be used as it produces biased and inconsistent estimators. This speaks for the orthogonal deviations procedure.

When the data has a panel structure the GMM framework is especially suitable.[112] The GMM estimator proposed by Arellano and Bond (1991), called difference GMM estimator,[113] is particularly popular in the context of bank lending and bank lending literature. It has certain properties (see figure 7.6) that do not only help to tackle the issue with fixed effects but also that of the endogeneity of explanatory variables.

	Properties of difference GMM	Rationale for applicability for this study	
1	> Especially suitable for panels with small *T* and large *N* > Power of GMM increases with growing *N* compared with alternatives (e.g. direct bias corrected estimates by Hansen (2001))	> Sample period comprises years 1999-2011 > More than 3.000 banks enter estimations (after purging)	☑
2	> Linear functional relationship	> Loans depend linearly on explanatory variables	☑
3	> Dynamic left-hand-side variable that depends on its own past realizations	> Lags of loans used as explanatory variable	☑
4	> Presence of individual fixed effects	> Presence of fixed individual effects cannot be ruled out > Emanating from managerial/employer quality, organizational structure, "quality" of processes or risk aversion	☑
5	> Presence of endogenous explanatory variables	> Strict exogeneity cannot be warranted for all explanatory variables	☑
6	> Only available instruments are internal/ based on lags of instrumented variable	> Other, external and valid instruments not available	☑
7	> Heteroskedasticity and autocorrelation may be present within individuals but not across them	> Here, idiosyncratic disturbances (those apart from fixed effects) may have individual-specific patterns of heteroskedasticity and serial correlation > Not likely that these patterns are present across individuals, especially if it is controlled for demand factors	☑

Source: Figure according to Roodman (2009b)

Figure 7.6: Properties of the difference GMM estimator and their applicability

[112] See e.g. Newey and McFadden (1994) and Harris and Matyas (1999) for a general treatment of the GMM estimator, or Hansen (1982) for the original source.

[113] It is called difference GMM, because in its original form the authors used the first-differencing approach (not the orthogonal deviations method). However, the difference GMM estimator allows for both methods to remove individual fixed effects – first differencing and the orthogonal deviations method.

As one element to counter the endogeneity issue the GMM methodology involves the instrumental variable procedure.[114] It produces consistent estimates, provided that two conditions hold true: The first is that the instrumental variable used by the endogenous explanatory variable must be *uncorrelated to the error term* or, equivalently, be exogenous. Formally, it can be expressed as $Cov(z, \varepsilon) = 0$, where z is the instrumental variable and ε is the error. This makes perfect sense: Without this condition, the same problem of endogeneity which, as stated above, causes the OLS estimator to be unsuitable would exist and nothing would be won.

The second condition is that the instrumental variable must be *correlated with the endogenous explanatory variable*. Formally, this can be expressed as $Cov(z, x) \neq 0$, where x stands for an explanatory variable that is suspected of being exogenous. Because the condition demands some form of relationship between the endogenous explanatory variable and the instrument, it is referred to as the *instrumental relevance*.

To estimate the parameters consistently, at least as many instrumental variables as endogenous explanatory variables are required. Otherwise, the equation remains unidentified. If there are more instruments available than required, the equation is said to be *overidentified*. This implies that there are more moment conditions available than parameters to be estimated, which allows the additional moment conditions to be used in a test for overidentifying restrictions. The J-test – also known as the Sargan or Hansen test – is a specification test that sheds light on the validity of instruments (see Newey and McFadden (1994) for formalization and a detailed derivation). If the J-statistic suggests rejecting the null hypothesis of valid instruments, the instrumental variables are poor.

According to Arellano and Bond (1991), another property of the difference GMM estimator is that it is especially suitable in situations where only internal instruments are available, meaning that all instruments are based on lags of the instrumented variables, which is the case in the present study. With regard to individual fixed

[114] As already stated, a second element in tackling the endogeneity issue, alongside application of the GMM methodology, is to use bank characteristics as explanatory variables that are all lagged once. The basic idea – in the case of size, for example – is that *lagged* values of size are not influenced by *current* changes in the amount of loans, such that the coefficients on the lags are more suitable to be interpreted in line with the hypothesis that size impacts lending.

effects, lagged dependent variables and endogenous explanatory variables, their procedure produces unbiased and consistent estimators provided that the errors in the model are not subject to serial correlation of order two.

This methodology has been further developed by Arellano and Bover (1995) and Blundell and Bond (1998) toward what is referred to as the system GMM estimator.[115, 116] System GMM is motivated by one weakness of difference GMM. It is relative inefficient in the presence of weak instruments. To overcome this shortcoming, they suggest making use of the information contained in the levels of the instruments that disappear by transforming the variables into first differences. Consequently, they advise to take lags in levels as instruments for those right-hand side variables that are suspected of not being strictly exogenous. The authors report significant performance gains by exploiting the additional moment conditions. The power of this approach in a dynamic panel environment is further underscored by the results of Behr (2003).

Bun and Windmeijer (2010) show that the system GMM is particularly advantageous when the underlying time series are persistent. As becomes clear in the course of the discussion of the results of the empirical analysis, however, this is not the case here. Accordingly, this study follows the lead given by Arellano and Bond (1991) and uses the difference GMM estimator.

One crucial point (for difference GMM and system GMM) is that invalid instruments can induce a substantial bias for the estimators. The validity of the instruments used is regularly tested with the Sargan test. If the respective J-statistics show satisfactory results, researchers usually accept the validity of the instruments. However, an important caveat in this context, as rigorously set out by Roodman (2009a), is the weakness of such tests when the number of instruments grows large. This can easily be the case if one uses *all* available lags as instruments, such that the number of instruments explodes as the sample period increases. The consequence is that the test suggests that the instruments are valid – on the basis of which, together with

[115] The original reference is Arellano and Bover (1995) while Blundell and Bond (1998) have made explicit the assumptions under which the new-style instruments (see below) are valid. This has resulted in the nomination of Blundell and Bond as the authors of system GMM.

[116] The properties presented in figure 7.6 also apply to system GMM.

other necessary assumptions, one concludes that the estimated coefficients are unbiased – although in fact they are not.

To avoid this pitfall, this study follows Roodman (2009a), who suggests limiting the number of instruments by only using certain lags, e.g. the first lag for all bank characteristics (apart from loans) instead of all available lags. This limitation restores the power of tests for the validity of the instruments. In practical terms, this means that the endogenous explanatory variables are instrumented by the third and fourth lag of loans in levels. In addition, the first lag of the bank characteristics and the interaction terms of the bank characteristics with the crisis dummy used in the equation serve as instruments.[117] The macro variable(s) and the monetary policy variable are regarded as completely exogenous and instrumented by themselves.

To sum up: The validity of the instruments, in addition to the absence of serial correlation of order two in the errors, shows that the GMM estimator is consistent, efficient and asymptotically normally distributed.

For the present study the instruments are chosen in accordance with Arellano and Bond (1991). The validity of the (limited number of) instruments is tested with the Sargan test. The respective J-statistic and the number of instruments used are reported together with the results. Moreover, because of gaps in the data, orthogonal deviation is preferred over first-differencing. The estimations are carried out within the difference GMM framework. It is the estimator which is the one most widely used and best established in the relevant literature – a further reason that argues for it.

[117] The exact choice of instruments is reported together with the corresponding estimation results, since it is sensitive to the exact specification of the estimated equation.

8. Empirical analysis – results

Having clarified the author's approach to empirical analysis in the previous chapter, the scene is set to dedicate this chapter to the results as one important centerpiece of the entire study.

The chapter on results can be divided into two parts: The first part deals with the results for the euro area as a whole. For the second part, subsamples of the four major euro area countries – Germany, Italy, France and Spain – are constructed. These subsamples are analyzed separately.

To make it easy to follow the results, this chapter has a clear structure: The results for the euro area as a whole include the descriptive statistics and correlations as well as the results of the empirical analysis (see figure 8.1 for the structure of the empirical estimations).

The empirical analysis comprises the baseline analysis consisting of a standard specification and a considerable number of robustness checks. This is followed by two groups of analyses, the first of which focuses on the capital surplus and the second of which focuses on the deposit overhang. Again, each analysis consists of a standard specification and various robustness checks.

That is followed by a presentation of the results for the four individual countries. To allow for comparison, a standardized, unvarying approach to the estimations is chosen: Three types of estimations are carried out for each country: The first type is the baseline model. The second is designed to test the impact of a capital surplus or overhang, and the third focuses on deposit overhangs. Each type includes several specifications to check for the robustness of the results.

8.1. Results for the euro area

The results of the baseline analysis are presented first. These results already reflect answers to many of the hypotheses to be tested. After that, two groups of analyses – the first one focused on a capital surplus/shortfall relative to a bank-specific target and the second one focused on the impact of a deposit overhang – complement the analysis and yield complete picture regarding derived hypotheses. A summary of

H. Brinkmeyer, *Drivers of Bank Lending,* Schriften zum europäischen Management,
DOI 10.1007/978-3-658-07175-2_8, © Springer Fachmedien Wiesbaden 2015

tested hypotheses which are based on the euro area sample is given in figure 8.2 below.

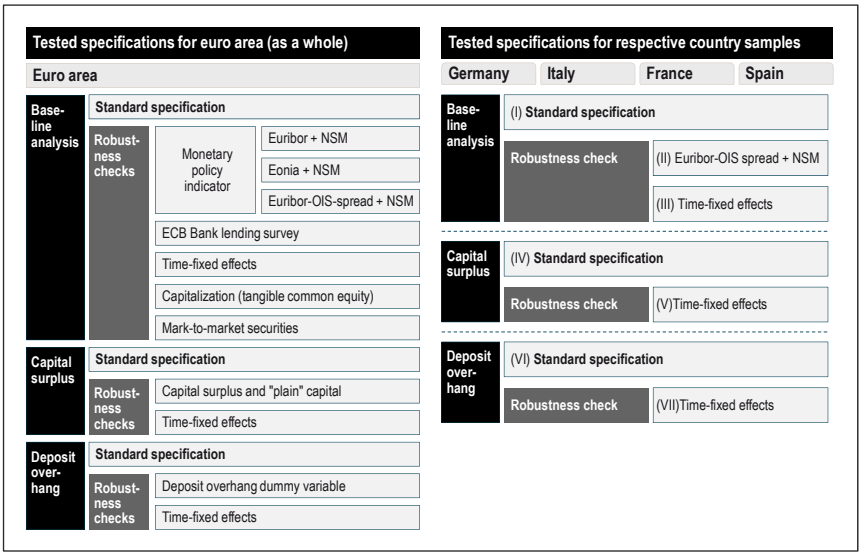


Figure 8.1: Structure of the empirical estimations

For all three groups of estimations, a generally similar approach is chosen: The first estimation is given by a standard specification. This is followed by a number of robustness checks to determine whether the results stand up to changes in the relevant specifications. One important type of robustness check is the estimation using time fixed effects, which involves the addition of time dummies for each year of the estimation period. This design is intended to capture the full cross-sectional impact of the explanatory variables.

The results are contrasted with those produced by studies of the euro area, where available. Where relevant studies of the euro area are not available, also studies that focus on the US are consulted.[118]

[118] In this case it has to be borne differences in results can be due to generally different economic, institutional and financial circumstances.

		Hypotheses	Tested using euro area sample
General hypo-theses	H1	A shortfall in capital relative to a targeted ratio leads to a reduction of the loan portfolio	✓
	H2	For banks that do not face a deposit overhang, lending depends on	
		> H2a: The share of uninsured short-term funding	✓
		> H2b: The share of non-interest income	✓
		> H2c: The share of securities that must be marked to market	✗
Hypo-theses involving crisis context	H3	During a crisis, the capital ratio has a more positive impact on lending than it does at normal times	✓
	H4	During a crisis, the impact of a pronounced maturity mismatch (evidenced by a large proportion of short-term funding) on lending is lower (in terms of the value of the coefficient) compared to normal times	✓
	H5	During a crisis, the impact of a large proportion of non-interest income on lending is lower (in terms of the value of the coefficient) compared to normal times	✓
	H6	During a crisis, the size of a bank has a more positive impact on lending than it does at normal times	✓
	H7	During a crisis, the impact of a large proportion of marked-to-market securities on lending is lower (in terms of the value of the coefficient) compared to normal times	✓
	H8	During a crisis, a large proportion of deposit funding has a positive impact on lending	✓
	H9	During a crisis, a deposit overhang has a positive impact on lending	✓

✓ Hypothesis tested ✗ Hypothesis not tested (refer to text for further remarks)

Figure 8.2: Tested hypotheses based on euro area sample

8.1.1. Descriptive statistics and correlations

An overview of descriptive statistics on euro area data and the correlation matrix are given in table 8.1 and table 8.2.

Descriptive statistics are notable with respect to the number of observations of certain variables: Data on securities that need to be marked to market (*AFS*) is scarce compared to other bank characteristics. This poses limitations to *AFS*-related estimations as is discussed further below. The lending survey variable (*LEND_SURV*) is the second variable for which the number of observations is relatively low. This reflects that the survey was not started by the ECB before 2003. In addition, all bank characteristics are normalized with respect to their respective averages (apart from capital surplus and deposit overhang as described in section 7.4). This results in a zero mean. A further implication of the normalization procedure is that minimal values

are negative which as such has no economic interpretation but is technical or mathematical result. Negative values for the median are sign of a distribution which is skewed toward large values. Since the distances from the median values to zero are relatively small in terms of standard deviations this is not considered to have a relevant impact on the results.

EURO AREA						
Variable name/symbol	**Number of observations**	**Mean**	**Median**	**Minimum**	**Maximum**	**Std. Dev.**
Dependent variable						
ΔLOG(LOANS)	20,313	0.046	0.032	-0.642	0.693	0.088
Independent variables						
Bank characteristics						
CAP	23,799	0.000	-0.014	-0.076	0.924	0.062
CAP_TCE_TCA	23,799	0.000	-0.013	-0.076	0.925	0.061
CAPSUR	23,799	0.001	0.010	-0.950	0.210	0.065
SIZE	22,967	0.000	-0.151	-7.511	8.052	1.579
DEP	22,750	0.000	0.044	-0.659	0.337	0.180
OVERHANG	22,744	0.205	0.112	-1.000	33.077	0.777
LIQ	22,846	0.000	0.000	-0.018	0.375	0.013
STF	22,750	0.000	-0.028	-0.168	0.805	0.145
NII	22,834	0.000	-0.006	-2.957	2.405	0.148
AFS	8,485	0.000	-0.040	-0.069	0.830	0.092
Monetary policy variables						
EURIBOR	35,100	3.022	3.078	0.814	4.644	1.245
EONIA	30,420	2.583	2.736	0.438	4.387	1.276
EURIBOR_OIS	30,420	0.263	0.245	-0.121	0.774	0.242
Δ(NSM)	30,420	0.013	0.005	-0.011	0.072	0.024
Macroeconomic variables						
ΔLOG(GDP)	32,760	0.032	0.036	-0.035	0.052	0.021
GDP_DEFLATOR	35,100	1.580	1.800	-0.300	2.500	0.715
Δ(LEND_SURV)	18,720	-0.813	6.125	-133.500	73.500	68.590

Table 8.1: Descriptive statistics for the euro area sample

The correlation matrix for the euro area sample reveals some interesting patterns. The clearly negative correlation between size and the capital ratio of a bank means that on average smaller banks have a higher capital ratio. This is consistent with the conjecture that shareholders of large institutes demand higher returns on their invested equity and that a higher leverage is a possibility to enhance profitability. It is also consistent with the notion that bigger institutions are more robust to business cycle fluctuations and, therefore, need less capital to reduce the asymmetric information and moral hazard problem toward providers of uninsured funds.

Table 8.2: Correlation matrix for the euro area

Correlation matrix - Euro area

	ΔLOG(LOANS)	CAP	CAP_TCE_TCA	CAPSUR	SIZE	DEP	OVERHANG	DUMMY_OVERHANG	LIQ	STF	NII	AFS	EURIBOR	EONIA	EURIBOR_OIS	Δ(NSM)	ΔLOG(GDP)	GDP_DEFLATOR	Δ(LEND_SURV)	CRISIS
ΔLOG(LOANS)	1.000																			

CAP	0.048	1.000																		
	0.000	-----																		
CAP_TCE_TCA	0.042	0.997	1.000																	
	0.000	*0.000*	----																	
CAPSUR	0.074	-0.005	-0.008	1.000																
	0.000	*0.422*	*0.253*	----																
SIZE	0.052	-0.203	-0.214	0.147	1.000															
	0.000	*0.000*	*0.000*	*0.000*	-----															
DEP	-0.124	-0.311	-0.302	-0.058	-0.353	1.000														
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	-----														
OVERHANG	-0.111	-0.109	-0.109	-0.015	-0.144	0.519	1.000													
	0.000	*0.000*	*0.000*	*0.031*	*0.000*	*0.000*	----													
DUMMY_OVERHANG	-0.159	-0.173	-0.166	-0.034	-0.232	0.673	0.485	1.000												
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	----												
LIQ	-0.150	-0.103	-0.098	-0.018	-0.072	0.331	0.180	0.258	1.000											
	0.000	*0.000*	*0.000*	*0.010*	*0.000*	*0.000*	*0.000*	*0.000*	-----											
STF	-0.024	-0.137	-0.135	0.011	0.349	-0.619	-0.332	-0.363	-0.104	1.000										
	0.001	*0.000*	*0.000*	*0.108*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	----										
NII	-0.014	0.131	0.121	0.026	0.066	-0.154	0.041	-0.051	0.045	0.140	1.000									
	0.046	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	-----									
AFS	0.148	0.304	0.299	0.018	-0.151	-0.137	0.048	-0.102	-0.191	-0.288	-0.098	1.000								
	0.000	*0.000*	*0.000*	*0.098*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	----								
EURIBOR	0.067	-0.047	-0.045	0.031	-0.029	-0.008	-0.014	-0.015	0.052	0.029	0.003	0.105	1.000							
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.266*	*0.052*	*0.033*	*0.000*	*0.000*	*0.643*	*0.000*	-----							
EONIA	0.061	-0.063	-0.060	0.034	-0.030	-0.003	-0.015	-0.013	0.064	0.043	-0.007	0.128	0.982	1.000						
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.718*	*0.027*	*0.071*	*0.000*	*0.000*	*0.347*	*0.000*	*0.000*	----						
EURIBOR_OIS	0.030	0.089	0.085	-0.022	0.005	-0.028	0.009	-0.012	-0.059	-0.071	0.051	-0.123	-0.034	-0.223	1.000					
	0.000	*0.000*	*0.000*	*0.001*	*0.508*	*0.000*	*0.179*	*0.082*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	-----					
Δ(NSM)	0.035	0.073	0.071	-0.040	-0.007	-0.023	0.001	-0.018	-0.028	-0.064	0.041	0.050	0.052	-0.078	0.677	1.000				
	0.000	*0.000*	*0.000*	*0.000*	*0.306*	*0.001*	*0.893*	*0.011*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	----				
ΔLOG(GDP)	0.071	-0.045	-0.042	0.015	-0.026	0.014	-0.017	-0.009	0.029	0.029	0.010	0.171	0.518	0.582	-0.404	0.068	1.000			
	0.000	*0.000*	*0.000*	*0.021*	*0.000*	*0.053*	*0.017*	*0.206*	*0.000*	*0.000*	*0.141*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	-----			
GDP_DEFLATOR	-0.015	-0.054	-0.051	0.034	-0.018	0.008	-0.007	0.000	0.066	0.028	-0.021	0.172	0.633	0.719	-0.534	-0.128	0.469	1.000		
	0.033	*0.000*	*0.000*	*0.000*	*0.011*	*0.271*	*0.296*	*0.966*	*0.000*	*0.000*	*0.003*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	-----		
Δ(LEND_SURV)	-0.055	-0.005	-0.006	0.005	0.006	0.015	0.006	0.013	-0.029	0.005	-0.018	-0.048	-0.832	-0.763	-0.581	-0.742	-0.333	-0.562	1.000	
	0.000	*0.491*	*0.423*	*0.567*	*0.510*	*0.081*	*0.506*	*0.116*	*0.001*	*0.584*	*0.035*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	-----	
CRISIS	-0.027	0.042	0.039	0.006	0.011	-0.023	0.014	-0.001	-0.025	-0.041	0.011	-0.146	0.029	-0.098	0.670	0.160	-0.764	-0.257	-0.246	1.000
	0.000	*0.000*	*0.000*	*0.339*	*0.101*	*0.001*	*0.042*	*0.920*	*0.000*	*0.000*	*0.116*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	----

The sample period goes from 1999 to 2011. *P*-values in italics. Pairwise samples (pairwise missing values deletion).

In this picture fits also that there is a positive correlation between size and the amount of short-term funding (+0.349). This suggests that bigger banks can more easily tap wholesale funding markets. It also suggests that smaller banks can meet their funding needs by resorting to insured customer deposits (negative correlation between *SIZE* and *DEP*; -0,353). For the negative correlation between capital and deposits it is hard to find an obvious explanation. Because smaller banks tend to have higher capital ratios and because smaller banks tend to have a higher proportion of deposits one could expect a positive correlation. It might be that, *ceteris paribus*, for a bank that has better access to deposits it is less important to lower costs for external finance by means of providing a large capital buffer since it is less dependent on external finance.

With regard to the possible issue of endogeneity of explanatory variables an interesting observation can be made: One could argue that the growth of the loan portfolio implies a reduction of the share of non-interest income because the granting of credit directly generates interest income. This would make the variable *NII* endogenous to loans and would probably compromise estimated coefficients. If that were the case one would be able to observe a relatively high negative correlation between loans and the share of non-interest income. This is not the case. The correlation coefficient of -0.014 is very small and certainly much smaller than one would expect given possible endogeneity concerns of *NII*. This leads to the conclusion that endogeneity of *NII* is not a serious problem in the sample used. To further reduce possible endogeneity issues all bank characteristics enter the regressions with one lag.

8.1.2. Baseline analysis

8.1.2.1. Results of the standard specification

Specification

The baseline analysis gives an answer to the majority of the hypotheses stated in section 7.1. To this end, there is not only one standard specification that is tested. Rather, the analysis is augmented by further specifications that serve as extensions of the standard specification and as robustness checks. The tests for those hypotheses that involve a capital surplus or deposit overhang are described in the

following sections. The reason for this special focus is that their use marks an innovation compared to the referenced literature on bank lending.

The standard setup begins with one lag of the first difference of the natural logarithm of loans. Next, to ensure instant comparability between the estimated coefficients stemming from the crisis and from outside the crisis, the following approach is chosen: All bank characteristics except for loans (i.e. capitalization, size, the share of deposits, liquidity, the short-term funding ratio and the share of non-interest income; all lagged once) enter the equation interacted once with the non-crisis dummy ("*nc*") and once with the crisis dummy ("*crisis*").[119] This non-crisis dummy exactly mirrors the crisis dummy, meaning that it takes on the value of 1 in all “normal” years, when the crisis dummy is zero, and vice versa. Comparison of the absolute coefficient values thus gives an immediate picture regarding the extent to which certain bank characteristics gain or lose importance during and outside a crisis. As stated in section 7.3.2, to remove cross-sectional fixed effects, all interaction terms are transformed using orthogonal deviations within the difference GMM framework. That is why there is no perfect collinearity between the respective crisis and the non-crisis interaction terms and, consequently, no dummy variable trap.[120]

The monetary policy indicator is given by the Euribor. To control for demand factors in this first specification, GDP enters the equation in the form of its first difference of the natural logarithm. Furthermore, price effects are controlled for by means of the inclusion of inflation, represented by the GDP deflator for the euro area. The inclusion of the crisis dummy variable in the regression allows for possible general shifts in loan behavior during the crisis that are not accounted for by the bank characteristics or other control variables.

Validity

The use of lags entails an adjusted sample period ranging from 2001 to 2011. 2,153 cross-sections and 14,061 (unbalanced) observations enter the regression.

---

[119] This is done in order to remedy the problem of endogeneity (in connection with the instrumental variable procedure within the GMM framework). Recall section 7.5 for details.

[120] In fact, if one only uses the crisis dummy and not the dummy variable for the no-crisis period (for example, only *SIZE*CRISIS* and *SIZE*), one will have to add the value of the crisis interaction to the value of the non-interacted term (the value of SIZE*CRISIS to the value of SIZE) to obtain exactly the same result. T-statistics are also identical.

The endogenous explanatory loan variable is instrumented by the dynamic instruments proposed by Arellano and Bond (1991), i.e. in this case the second and third lags of the natural logarithm of loans in first differences. All other bank characteristics are instrumented by the second lags of the respective (non-crisis and crisis) interactions with the bank characteristics. The GDP variable, the monetary policy indicator and inflation are assumed to be truly exogenous and are instrumented by themselves. The p-value of the Sargan test is 0.35, which hints at the validity of the overidentifying assumptions.

Estimation results

The results of the standard specification are summarized in table 8.3 (see figure 8.2 above for an overview of hypotheses tested using the euro area sample) and can be regarded as the benchmark against which the results of the other estimations are to be judged. It comprises all basic bank characteristics. As stated above, the impact of those bank characteristics that are not commonly used in adjacent literature – such as measures of the capital surplus or of a deposit overhang – is covered in the subsequent sections in connection with estimations that are especially geared to the various hypotheses.

Looking at the growth rate for the lagged value of the natural logarithm of loans, one can see not only that it is significantly different to zero, but also – what is more interesting – that it is significantly below one. If the latter had not been the case, this would have seriously compromised the validity of the estimations: A value of greater than one would have implied a self-accelerating, non-stationary process regarding the growth rate of loans. A value of one or at least close to one would have pointed to the weakness of the use of lagged variables as instruments.[121]

The coefficients for capital outside and during a crisis are both statistically significant at the one per cent level. The crisis coefficient for capital is a little higher than the non-crisis one. However, the difference is of little economic significance, as the point estimates differ only slightly. The conjecture that capital might be more relevant to bank lending during the crisis (hypothesis H3) is only weakly supported on the basis of this result.

[121] See Roodman (2009a) and the literature cited therein for a mathematical perspective on the issue of non-stationarity.

The estimated parameter for size outside the crisis is a little lower than the crisis parameter. In addition, the crisis parameter is statistically significant at the one per cent level, while the non-crisis parameter is not. This can be interpreted as support for the notion that bigger banks' loan portfolios are more robust in turbulent times (hypothesis H6).

Variable	Expected relationship	Actual relationship	Coefficient	Std. error	Prob.
ΔLOG(LOANS(-1))	+	+ ***	0.59	(0.08)	0.000
CAP(-1)*NC	+	+ ***	0.46	(0.15)	0.002
CAP(-1)*CRISIS	+	+ ***	0.48	(0.17)	0.004
SIZE(-1)*NC	+	+	0.14	(0.09)	0.114
SIZE(-1)*CRISIS	+	+ ***	0.23	(0.09)	0.007
DEP(-1)*NC	+	+	0.10	(0.08)	0.223
DEP(-1)*CRISIS	+	+	0.14	(0.09)	0.127
LIQ(-1)*NC	+	+	0.11	(0.36)	0.769
LIQ(-1)*CRISIS	+	+	0.37	(0.53)	0.487
STF(-1)*NC	+	+ ***	0.45	(0.12)	0.000
STF(-1)*CRISIS	<STF*NC (+/-)	+	0.18	(0.26)	0.498
NII(-1)*NC	+	+ *	0.21	(0.12)	0.083
NII(-1)*CRISIS	<NII*NC (+/-)	+ *	0.08	(0.04)	0.068
ΔLOG(GDP)	+	+ ***	0.21	(0.03)	0.000
EURIBOR	-	- **	-0.00	(0.00)	0.041
GDP_DEFLATOR	+/-	-	-0.00	(0.00)	0.637
CRISIS	-	-	-0.00	(0.00)	0.857

Regression properties

Sample (adjusted):	2001 - 2011	Instrument rank	28
Periods included:	11	Sargan test (p-value):	0.35
Cross-sections included:	2,153		
Total panel (unbalanced) observations:	14,061	Year fixed effects	no

The estimated model is given by equation (16). *CRISIS* is a dummy variable that is 1 in the years 2008 and 2009 and 0 in all other years. *NC* is the non-crisis dummy. It takes on the value of zero in 2008 and 2009 and 1 in all other years of the sample period. The model allows for fixed effects across banks realized by orthogonal deviations. It is estimated using difference GMM, 2-step estimator, White period robust standard errors. ***, ** and * indicate statistical significance on the 1%, 5% and 10% level respectively.

Table 8.3: Results of standard specification

An above-average volume of deposits seems to have a positive impact on lending both during (hypothesis H8) and outside a crisis, although neither coefficient is statistically significant. However, the standard error for the crisis coefficients is only slightly above the ten per cent significance level; and, as the robustness checks show, it is significant at the ten or even five per cent level most of the time.

The picture regarding holdings of liquid assets is not very conclusive. In standard literature on the bank lending channel, the impact of liquid asset holdings is usually motivated by buffer-stock considerations in connection with changes in the monetary policy rate.[122] However, even if one disregards the monetary policy indicator, liquid assets may be beneficial in a crisis when funding is difficult to obtain: In this case, the relatively easy reduction of liquid assets reduces the amount of funding needed. However, this does not seem to be the case. On the basis of this picture, it is hard to draw any further conclusions.

With respect to the volume of short-term funding, higher-than-average values is beneficial at normal times. This points to the positive effect of good access to market funding, such that a bank can take lending opportunities because it can resort to a broad funding base. In times of crisis, the effect is clearly moderated: As expected, the coefficient on the crisis term of *STF* is much smaller than during normal periods. This supports hypothesis H4, according to which a large share of market funding is disadvantageous because it is usually accompanied by a more pronounced maturity mismatch between the asset side and the liabilities side of the balance sheet. In a crisis, the drying-up of funding markets makes it difficult to roll over the volume of debt needed to fund loans and other assets. As a consequence, this leads to a reduced loan growth.

A comparable picture, albeit differently motivated, is obtained from the share of non-interest-income. At normal times, banks with a higher-than-average share of non-interest income are usually more profitable, thereby exhibiting a higher chance of being able to repay debt to investors. However, this positive impact is dampened in times of crisis. This supports hypothesis H5, which implies that the stronger volatility of the business from which non-interest income is generated could be perceived as a sign of heightened risk in turbulent times, thereby negatively affecting both funding conditions and also lending growth in times of crisis.

The control variables in the baseline regression are inconspicuous insofar as they show the expected sign: GDP is positive and highly significant, and the coefficient for Euribor is negative and small in absolute terms but significant at the five per cent

[122] The interaction of bank characteristics with the monetary policy indicator is not in the focus of this study.

level. The crisis dummy is negative, as expected, but – like the GDP deflator – is not significant.

8.1.2.2. Robustness checks

The results of the standard specification follow several robustness checks. They comprise the use of different monetary policy indicators, a different approach to capture demand effects, an alternative way to model the capitalization of a bank and the use of time fixed effect.

Variable	Expected relationship	Actual relationship	Coefficient	Std. error	Prob.
ΔLOG(LOANS(-1))	+	+ ***	0.61	(0.13)	0.000
CAP(-1)*NC	+	+ ***	0.47	(0.14)	0.001
CAP(-1)*CRISIS	+	+ ***	0.50	(0.16)	0.002
SIZE(-1)*NC	+	+	0.28	(0.19)	0.147
SIZE(-1)*CRISIS	+	+ ***	0.27	(0.10)	0.007
DEP(-1)*NC	+	+	0.08	(0.05)	0.116
DEP(-1)*CRISIS	+	+ *	0.08	(0.05)	0.091
LIQ(-1)*NC	+	+	0.13	(0.36)	0.709
LIQ(-1)*CRISIS	+	+	0.33	(0.52)	0.524
STF(-1)*NC	+	+ *	0.24	(0.15)	0.095
STF(-1)*CRISIS	<STF*NC (+/-)	+	0.18	(0.16)	0.276
NII(-1)*NC	+	+ **	0.14	(0.06)	0.031
NII(-1)*CRISIS	<NII*NC (+/-)	+ **	0.07	(0.03)	0.030
ΔLOG(GDP)	+	+ *	0.20	(0.11)	0.067
EURIBOR	-	- *	-0.00	(0.00)	0.087
GDP_DEFLATOR	+/-	- ***	-0.01	(0.00)	0.000
Δ(NSM)	+	+ *	0.14	(0.07)	0.057
CRISIS	-	-	-0.00	(0.01)	0.735

Regression properties

Sample (adjusted):	2001 - 2011	Instrument rank	28
Periods included:	11	Sargan test (p-value):	0.36
Cross-sections included:	2,153		
Total panel (unbalanced) observations:	14,061	Year fixed effects	no

The estimated model is given by equation (16). *CRISIS* is a dummy variable that is 1 in the years 2008 and 2009 and 0 in all other years. *NC* is the non-crisis dummy. It takes on the value of zero in 2008 and 2009 and 1 in all other years of the sample period. The model allows for fixed effects across banks realized by orthogonal deviations. It is estimated using difference GMM, 2-step estimator, White period robust standard errors. ***, ** and * indicate statistical significance on the 1%, 5% and 10% level respectively.

Table 8.4: Integration of non-standard monetary policy measures

Monetary policy indicators

A first series of robustness checks involves different ways to model the impact of monetary policy on loans and to see what influence this has on the results. In the first robustness check, the *NSM* (non-standard policy measures) variable is used. The *NSM* variable is constructed by taking the size of the ECB's balance sheet over total euro area GDP. It reflects the effect of the ECB's liquidity injections on the lending behavior of banks. It enters the estimated equation in first differences.

The results are given in table 8.4. The *NSM* variable is positive and significant at the ten per cent level. While one would generally expect this behavior, it is nonetheless, worthy of comment: It seems as if the ECB's full allotment policy, which has been primarily responsible for the growth of its assets, has had an impact on bank lending over above its alleviating effect on monetary interest rates.[123] This points to the effectiveness of this measure for the functioning of the loan supply.

Compared with the baseline regression, the overall picture of the bank characteristics does not change much. On a detailed level, this estimation produces significant results (at the ten per cent level) for the coefficient for deposits during the crisis and positive but not significant results for the coefficient outside the crisis. This supports the importance of a solid deposit base as a main element of the funding mix for the size of the loan portfolio. Overall, hypothesis H8, according to which the relevance of a large proportion of deposit funding should be more beneficial during the crisis than at normal times, is supported.

With regard to the impact of the share of non-interest income, significant results at the five per cent level are obtained for both *NII* coefficients. (In the baseline specification they are significant on the ten per cent level.) This is consistent with the results from the standard specification and with hypothesis H5.

Results are also consistent with the standard specification regarding the coefficients on *STF* which lends additional support in favor of hypothesis H4.

Two further robustness checks concern the representation of the monetary policy indicator. In the first of the two approaches, the Euribor variable is replaced by the Eonia variable. From a theoretical point of view, the differences should not be large in

[123] The alleviating impact of non-standard measures on the monetary policy rates is already reflected by the monetary policy variable itself.

light of the high degree of co-movement of the two (see figure 7.3). According to the second approach, the Euribor is replaced by the 3-month Euribor-OIS spread as motivated in section 7.4.3.2. The results are shown in table 8.5 and table 8.6 respectively.

Variable	Expected relationship	Actual relationship	Coefficient	Std. error	Prob.
ΔLOG(LOANS(-1))	+	+ ***	0.59	(0.12)	0.000
CAP(-1)*NC	+	+ ***	0.46	(0.15)	0.002
CAP(-1)*CRISIS	+	+ ***	0.48	(0.17)	0.004
SIZE(-1)*NC	+	+	0.24	(0.20)	0.231
SIZE(-1)*CRISIS	+	+ **	0.25	(0.10)	0.012
DEP(-1)*NC	+	+ *	0.09	(0.05)	0.062
DEP(-1)*CRISIS	+	+ **	0.10	(0.05)	0.047
LIQ(-1)*NC	+	+	0.11	(0.36)	0.769
LIQ(-1)*CRISIS	+	+	0.37	(0.53)	0.487
STF(-1)*NC	+	+ **	0.32	(0.15)	0.034
STF(-1)*CRISIS	<STF*NC (+/-)	+	0.19	(0.14)	0.197
NII(-1)*NC	+	+ *	0.11	(0.06)	0.077
NII(-1)*CRISIS	<NII*NC (+/-)	+ **	0.06	(0.02)	0.020
ΔLOG(GDP)	+	+ **	0.22	(0.11)	0.044
EONIA	-	- **	-0.00	(0.00)	0.011
GDP_DEFLATOR	+/-	- ***	-0.01	(0.00)	0.000
Δ(NSM)	+	+	0.14	(0.10)	0.165
CRISIS	-	-	-0.00	(0.01)	0.857

Regression properties

Sample (adjusted):	2001 - 2011	Instrument rank	28
Periods included:	11	Sargan test (p-value):	0.27
Cross-sections included:	2,153		
Total panel (unbalanced) observations:	14,061	Year fixed effects	no

The estimated model is given by equation (16). *CRISIS* is a dummy variable that is 1 in the years 2008 and 2009 and 0 in all other years. *NC* is the non-crisis dummy. It takes on the value of zero in 2008 and 2009 and 1 in all other years of the sample period. The model allows for fixed effects across banks realized by orthogonal deviations. It is estimated using difference GMM, 2-step estimator, White period robust standard errors. ***, ** and * indicate statistical significance on the 1%, 5% and 10% level respectively.

Table 8.5: Eonia as a monetary policy indicator

As can be seen, the general results are relatively robust regarding the way changes in the monetary policy stance are modeled. There are no major coefficient shifts among the bank characteristics. In both cases, the coefficients for capitalization, deposits, and non-interest income are significant, as is the non-crisis coefficient for short-term funding.

Variable	Expected relationship	Actual relationship	Coefficient	Std. error	Prob.
ΔLOG(LOANS(-1))	+	+ ***	0.59	(0.12)	0.000
CAP(-1)*NC	+	+ ***	0.49	(0.15)	0.001
CAP(-1)*CRISIS	+	+ ***	0.52	(0.17)	0.002
SIZE(-1)*NC	+	+	0.15	(0.14)	0.254
SIZE(-1)*CRISIS	+	+	0.16	(0.10)	0.111
DEP(-1)*NC	+	+ *	0.09	(0.05)	0.063
DEP(-1)*CRISIS	+	+ **	0.10	(0.05)	0.047
LIQ(-1)*NC	+	+	0.15	(0.34)	0.658
LIQ(-1)*CRISIS	+	+	0.44	(0.51)	0.391
STF(-1)*NC	+	+ **	0.27	(0.11)	0.016
STF(-1)*CRISIS	<STF*NC (+/-)	+	0.18	(0.17)	0.304
NII(-1)*NC	+	+ *	0.15	(0.08)	0.050
NII(-1)*CRISIS	<NII*NC (+/-)	+ *	0.05	(0.02)	0.054
ΔLOG(GDP)	+	+	0.08	(0.09)	0.395
EURIBOR_OIS	-	- **	-0.01	(0.00)	0.045
GDP_DEFLATOR	+/-	- ***	-0.01	(0.00)	0.000
Δ(NSM)	+	+ ***	0.30	(0.09)	0.001
CRISIS	-	-	-0.01	(0.00)	0.300

Regression properties

Sample (adjusted):	2001 - 2011	Instrument rank	28
Periods included:	11	Sargan test (p-value):	0.33
Cross-sections included:	2,153		
Total panel (unbalanced) observations:	14,061	Year fixed effects	no

The estimated model is given by equation (16). *CRISIS* is a dummy variable that is 1 in the years 2008 and 2009 and 0 in all other years. *NC* is the non-crisis dummy. It takes on the value of zero in 2008 and 2009 and 1 in all other years of the sample period. The model allows for fixed effects across banks realized by orthogonal deviations. It is estimated using difference GMM, 2-step estimator, White period robust standard errors. ***, ** and * indicate statistical significance on the 1%, 5% and 10% level respectively.

Table 8.6: The 3-month Euribor-OIS spread as a monetary policy indicator

One difference concerns the observation that the crisis coefficient for size is a little lower and insignificant when using the Euribor-OIS spread. It is hard to think of an explanation why there should be a connection. Since this is the only occurrence, not too much importance has been attached to this phenomenon.

Alternative approach to capture loan demand factors

The next robustness check is geared to the way in which loan demand is represented. As outlined in section 7.4.3.1, the results of the euro area bank lending survey are used as a proxy for loan demand and enter the regression in first differences. The results are shown in table 8.7.

One important thing to note is that, compared to the standard specification, one loses one third of all observations. This is due to the reduction in the number of periods included, as a consequence of the fact that the bank lending survey was first carried out in 2003. A further observation concerns the validity of the overidentifying restrictions: The p-value of the Sargan test is only 0.23, which is not completely satisfying (see Roodman (2009a)).

Variable	Expected relationship	Actual relationship	Coefficient	Std. error	Prob.
ΔLOG(LOANS(-1))	+	+ ***	0.63	(0.16)	0.000
CAP(-1)*NC	+	+ **	0.72	(0.31)	0.020
CAP(-1)*CRISIS	+	+ **	0.70	(0.31)	0.023
SIZE(-1)*NC	+	+	0.28	(0.30)	0.344
SIZE(-1)*CRISIS	+	+ **	0.22	(0.11)	0.042
DEP(-1)*NC	+	+ **	0.19	(0.08)	0.024
DEP(-1)*CRISIS	+	+ **	0.20	(0.08)	0.012
LIQ(-1)*NC	+	+	0.08	(0.36)	0.814
LIQ(-1)*CRISIS	+	+	0.36	(0.50)	0.472
STF(-1)*NC	+	+ **	0.21	(0.09)	0.019
STF(-1)*CRISIS	<STF*NC (+/-)	+ *	0.18	(0.10)	0.080
NII(-1)*NC	+	+	0.10	(0.07)	0.165
NII(-1)*CRISIS	<NII*NC (+/-)	+ *	0.03	(0.02)	0.067
EURIBOR	-	-	-0.00	(0.00)	0.396
GDP_DEFLATOR	+/-	- **	-0.03	(0.01)	0.035
Δ(LEND_SURV)	+	- *	-0.00	(0.00)	0.057
Δ(NSM)	+	+ **	0.39	(0.15)	0.011
CRISIS	-	- ***	-0.01	(0.00)	0.001

Regression properties

Sample (adjusted):	2005 - 2011	Instrument rank	28
Periods included:	7	Sargan test (p-value):	0.23
Cross-sections included:	2,118		
Total panel (unbalanced) observations:	9,357	Year fixed effects	no

The estimated model is given by equation (16). *CRISIS* is a dummy variable that is 1 in the years 2008 and 2009 and 0 in all other years. *NC* is the non-crisis dummy. It takes on the value of zero in 2008 and 2009 and 1 in all other years of the sample period. The model allows for fixed effects across banks realized by orthogonal deviations. It is estimated using difference GMM, 2-step estimator, White period robust standard errors. ***, ** and * indicate statistical significance on the 1%, 5% and 10% level respectively.

Table 8.7: Loan demand proxied by results of the ECB bank lending survey

Despite the theoretical soundness of the idea of using the data from the bank lending survey, the practical behavior of the variable hints at certain problems. While there is little change regarding the point estimates and the standard errors for the bank

characteristics, the estimated parameter for the lending survey variable is negative – contrary to expectations – and is significant at the ten per cent level. Moreover, the absolute value is very small and much smaller than the value of the coefficient for GDP. This general picture remains even when different specifications are used.[124]

Why is this the case? One obvious explanation could be due to the loss of observations. Given that the loss is mainly due to the shorter sample period and not due to a loss in cross-sections and, moreover, that there is little change in the estimates of the bank characteristics, it is rather questionable whether a longer time series on the bank lending survey would have produced different results.

Another possible explanation may be that the 90 banks participating in the survey is not a large enough number to draw a representative picture of loan demand in the entire euro area. It could also be the case that the loan officers' answers tend to exhibit procyclical behavior. In "good" times, for example, slightly favorable developments may already be overstated as a sign of an upcoming boom. This could lead to overly optimistic answers with which actual demand is unable to keep up.

Furthermore, the fact that the composition of the euro area has changed over the years might also induce a bias (of unknown direction), because the countries from which the surveyed loan officers originate are not exactly the same countries that are part of the sample.

A further reason might emerge from the following insight: The lending survey is carried out on a quarterly basis and the answers distinguish between the different customer groups that demand loans (i.e. enterprise loans, consumer credit and housing loans). The construction of a single lending survey variable thus requires some form of data compilation to make it applicable and to match it to the annual structure of the data. It is possible that the optimal compilation procedure has not yet been found, although, as stated above, different emphases in the loan demand groups have been tested, each with unsatisfactory results.

[124] Unreported analyses in which both variables (GDP and lending survey) are included do not produce more convincing results. The same applies to the use of the lending survey variable in levels (unit root tests lead to a rejection of the hypothesis that a unit root is present in the levels of this variable) instead of first differences or the use of lags.

Whatever explanation there may be, the bottom line is that, although the use of the lending survey variable does not seem to improve the results, the coefficients for the bank characteristics remain fairly stable – which is not a bad result at all.[125]

Another robustness check related to the control for demand factors takes a different approach, allowing for period fixed effects. Technically speaking, a dummy variable is introduced for each year in the sample period. In case one is not convinced to succeed in capturing all relevant factors that affect the demand for loans by observable proxies such as by GDP and the GDP deflator, using time fixed effects is a way to address this issue. In doing so, the estimated coefficients should be a representation of the full cross-sectional impact of the bank characteristics on loans (see Peydro (2010)).

The estimation with time fixed effects produces the results shown in table 8.8. One initial observation concerns the macro control variables and the variables that capture monetary policy actions (Euribor and NSM): None of these are significantly different from zero (at the 30 per cent level). This is not surprising, since these variables do not change by cross-sections but over time, and since the variation over the years is to a large extent reflected in the dummy variables for the different years. With regard to the instrumentation of the variables in this estimation, it can be noted

[125] A further (unreported) robustness check concers the use of the harmonized index of consumer prices (HICP) as an alternative measure of inflation. The result is that the GDP deflator performs consistently better than the HICP. From a theoretical perspective, a possible explanation is that the GDP deflator is the more convincing concept compared to the HICP when trying to capture the effects of price increases on the volume of loans. While the HICP is explicitly geared to consumer prices, it does not capture increases in asset prices ("asset price inflation"). For example, a rise in real estate prices may lead to increases in loan volumes on banks' balance sheets that are not reflected in the HICP as long as real estate prices do not feed through into consumer prices via the various possible channels. This feed-through into consumer prices could, for example, work via rents. In the case of rents for residential real estate, the HICP is directly affected because housing rents are part of the basket based on which the HICP is calculated. In the case of commercial properties, rent increases might affect sales prices, which are then passed on until they enter consumer prices. Either way, given that prices are sticky, e.g. due to menu costs, it is most realistic to assume that it takes some time before (at least parts of the) asset price changes have fed-through into consumer prices.

that the p-value of 0.58 in the Sargan test suggests that the instruments behave well in this case.

Variable	Expected relationship	Actual relationship	Coefficient	Std. error	Prob.
ΔLOG(LOANS(-1))	+	+ ***	0.68	(0.11)	0.000
CAP(-1)*NC	+	+ ***	0.38	(0.14)	0.006
CAP(-1)*CRISIS	+	+ **	0.40	(0.16)	0.014
SIZE(-1)*NC	+	+	0.11	(0.07)	0.134
SIZE(-1)*CRISIS	+	+ *	0.14	(0.08)	0.080
DEP(-1)*NC	+	+	0.07	(0.05)	0.145
DEP(-1)*CRISIS	+	+ *	0.08	(0.05)	0.094
LIQ(-1)*NC	+	-	-0.00	(0.43)	0.995
LIQ(-1)*CRISIS	+	+	0.22	(0.58)	0.705
STF(-1)*NC	+	+ ***	0.32	(0.12)	0.008
STF(-1)*CRISIS	<STF*NC (+/-)	+	0.15	(0.15)	0.314
NII(-1)*NC	+	+ *	0.12	(0.06)	0.069
NII(-1)*CRISIS	<NII*NC (+/-)	+ **	0.06	(0.03)	0.042
ΔLOG(GDP)	+	+	0.42	(0.42)	0.320
EURIBOR	-	+	0.00	(0.00)	0.445
GDP_DEFLATOR	+/-	+	0.00	(0.01)	0.974
Δ(NSM)	+	+	0.15	(0.32)	0.645

Regression properties

Sample (adjusted):	2001 - 2011	Instrument rank	38
Periods included:	11	Sargan test (p-value):	0.58
Cross-sections included:	2,153		
Total panel (unbalanced) observations:	14,061	Year fixed effects	yes

The estimated model is given by equation (16). *CRISIS* is a dummy variable that is 1 in the years 2008 and 2009 and 0 in all other years. *NC* is the non-crisis dummy. It takes on the value of zero in 2008 and 2009 and 1 in all other years of the sample period. The model allows for fixed effects across banks realized by orthogonal deviations. It is estimated using difference GMM, 2-step estimator, White period robust standard errors. ***, ** and * indicate statistical significance on the 1%, 5% and 10% level respectively.

Table 8.8: Estimation with time fixed effects

Looking at the point estimates of the bank characteristics, it is apparent that most of them are slightly lower than the standard specifications or indeed many of the other specifications. This can be interpreted as supporting the assumption that some of the cross-sectional variation in the supply of loans might be due to demand factors that are not completely captured by the variables for GDP and prices. However, since the difference in the point estimates is, as already stated, relatively small, this observation does not raise serious concerns about the general validity and accuracy of the other estimates. Moreover, the estimated signs of all bank characteristics

remain unchanged (with the exception of liquidity) and the estimated standard errors are also comparable to the standard specification, for example. The latter observations imply that the significance of the estimates does not change to a large extent either.

Variable	Expected relationship	Actual relationship	Coefficient	Std. error	Prob.
ΔLOG(LOANS(-1))	+	+ ***	0.59	(0.12)	0.000
CAP_TCE_TCA(-1)*NC	+	+ ***	0.46	(0.15)	0.002
CAP_TCE_TCA(-1)*CRISIS	+	+ ***	0.48	(0.17)	0.004
SIZE(-1)*NC	+	+	0.16	(0.10)	0.102
SIZE(-1)*CRISIS	+	+ ***	0.23	(0.08)	0.006
DEP(-1)*NC	+	+ *	0.09	(0.05)	0.065
DEP(-1)*CRISIS	+	+ **	0.09	(0.05)	0.049
LIQ(-1)*NC	+	+	0.10	(0.36)	0.786
LIQ(-1)*CRISIS	+	+	0.36	(0.53)	0.497
STF(-1)*NC	+	+ ***	0.37	(0.13)	0.004
STF(-1)*CRISIS	<STF*NC (+/-)	+	0.15	(0.24)	0.531
NII(-1)*NC	+	+ *	0.18	(0.10)	0.071
NII(-1)*CRISIS	<NII*NC (+/-)	+ **	0.08	(0.04)	0.044
ΔLOG(GDP)	+	+ **	0.22	(0.11)	0.043
EONIA	-	- **	-0.00	(0.00)	0.010
GDP_DEFLATOR	+/-	- ***	-0.01	(0.00)	0.000
Δ(NSM)	+	+	0.14	(0.10)	0.165
CRISIS	-	-	-0.00	(0.01)	0.858

Regression properties

Sample (adjusted):	2001 - 2011	Instrument rank	28
Periods included:	11	Sargan test (p-value):	0.25
Cross-sections included:	2,153		
Total panel (unbalanced) observations:	14,061	Year fixed effects	no

The estimated model is given by equation (16). *CRISIS* is a dummy variable that is 1 in the years 2008 and 2009 and 0 in all other years. *NC* is the non-crisis dummy. It takes on the value of zero in 2008 and 2009 and 1 in all other years of the sample period. The model allows for fixed effects across banks realized by orthogonal deviations. It is estimated using difference GMM, 2-step estimator, White period robust standard errors. ***, ** and * indicate statistical significance on the 1%, 5% and 10% level respectively.

Table 8.9: Capitalization measured in terms of tangible common equity over tangible common assets

Taking all the above into account, the conclusion is that the robustness of the results shows that controlling for loan demand effects by means of variables for GDP and prices is successful. Concerns about a (supposedly) insufficient account of the demand side are unfounded.

Capitalization measures

To check the robustness of the results with respect to the choice of a different capitalization variable, the ratio of total equity capital to total assets is replaced by the ratio of tangible common equity to tangible common assets (see table 8.9 for the results).

As expected on the basis of the strong correlation between the two measures, the results are very robust with respect to the choice of capitalization variable. The estimates of the capitalization variables in particular differ only as of the second decimal place. Regarding the coefficients for some other variables (e.g. the deposit variables), the equation with tangible common equity shows a higher level of significance.

Another possible robustness check regarding different measures of capitalization concerns the use of the Tier 1 ratio, which takes on a regulatory perspective on capital. [126] Unfortunately, data availability is poor, which is reflected by the loss of almost 90 per cent of all observations. In part, this is due to the fact that the concept of the Tier 1 ratio only recently gained widespread attention. Longer time series are therefore unavailable. The consequence for the estimation is poor behavior by the coefficients and results that are unsatisfactory.[127]

The overall conclusion regarding the use of different capitalization measures is that results are quite robust to these kind of variations.

Securities that must be marked to market

According to hypothesis H7, situations in which a large share of securities have to be marked to market (over total assets) should have a dampening impact on a bank's propensity to lend during a crisis. This is tested by incorporating the corresponding crisis and non-crisis variable (*AFS*) in the equation to be estimated. Beyond this, the

[126] See Basel Committee on Banking Supervision (1998) for details of the instruments eligible for inclusion in the Tier 1 capital ratio.

[127] Another robustness check is carried out to further strengthen our understanding of capital: In order to control for probable cyclical patterns in capital endowment, the idea is to interact GDP with capital. The (unreported) result is that the coefficient for the interaction term of GDP with capital is negative but clearly insignificant. The coefficients for the capital variables do change marginally. This picture does not change if one introduces the distinction between the interaction of GDP and capital during and outside of a crisis.

same bank characteristics enter the regression as in the standard specification. The monetary policy indicator is the Eonia and the macro controls are GDP (first difference of logs) and deflation. Instruments are chosen in the same way as in the standard specification; only the appropriate instruments for *AFS* are added.

Variable	Expected relationship	Actual relationship	Coefficient	Std. error	Prob.
ΔLOG(LOANS(-1))	+	+ ***	0.79	(0.23)	0.001
CAP(-1)*NC	+	+ *	0.85	(0.47)	0.070
CAP(-1)*CRISIS	+	+ **	0.92	(0.41)	0.027
SIZE(-1)*NC	+	+	0.30	(0.28)	0.279
SIZE(-1)*CRISIS	+	+	0.25	(0.31)	0.424
DEP(-1)*NC	+	+	0.18	(0.17)	0.307
DEP(-1)*CRISIS	+	- *	-0.13	(0.08)	0.099
LIQ(-1)*NC	+	+	1.75	(1.32)	0.186
LIQ(-1)*CRISIS	+	+	2.29	(1.66)	0.167
STF(-1)*NC	+	+ *	0.34	(0.20)	0.089
STF(-1)*CRISIS	<STF*NC (+/-)	+	0.13	(0.19)	0.486
NII(-1)*NC	+	+	0.06	(0.49)	0.897
NII(-1)*CRISIS	<NII*NC (+/-)	+	0.02	(0.07)	0.735
AFS(-1)*NC	+/-	+ *	0.22	(0.12)	0.075
AFS(-1)*CRISIS	<AFS*NC (+/-)	+	0.19	(0.15)	0.209
ΔLOG(GDP)	+	+ **	0.57	(0.28)	0.041
EONIA	-	- ***	-0.01	(0.00)	0.008
GDP_DEFLATOR	+/-	-	-0.01	(0.01)	0.238
CRISIS	-	- *	-0.01	(0.00)	0.092

Regression properties

Sample (adjusted):	2001 - 2011	Instrument rank	30
Periods included:	11	Sargan test (p-value):	0.17
Cross-sections included:	806		
Total panel (unbalanced) observations:	3,131	Year fixed effects	no

The estimated model is given by equation (16). *CRISIS* is a dummy variable that is 1 in the years 2008 and 2009 and 0 in all other years. *NC* is the non-crisis dummy. It takes on the value of zero in 2008 and 2009 and 1 in all other years of the sample period. The model allows for fixed effects across banks realized by orthogonal deviations. It is estimated using difference GMM, 2-step estimator, White period robust standard errors. ***, ** and * indicate statistical significance on the 1%, 5% and 10% level respectively.

Table 8.10: Estimation including the share of mark-to-market securities

Unfortunately, the main item needed to construct this variable, "available-for-sale securities", is missing in many periods for many banks. Compared to the standard specification, 78% per cent of total panel observations are lost, resulting in the inclusion of only 806 cross-sections. With a p-value of 0.17, the Sargan test is only just satisfactory.

The main variables of interest in this equation are the two *AFS* variables. The result for the non-crisis is that the coefficient is positive and significant at the five per cent level (see table 8.10).

The crisis coefficient for *AFS* is positive and lower than for the non-crisis coefficient. However, it is not significant at conventional significance levels. This results is too weak to be able to conclude the validity of hypothesis H7. It is likely that the massive loss of observations leads to flawed estimations. This impression is confirmed by estimates for the other coefficients: Although they do not differ too greatly from the previous estimations (standard specification and robustness checks), they appear to be less reliable, as can be seen by higher standard error values, for example.

As a result, hypothesis H7, which states that a large proportion of securities that have to be marked to market has a negative impact on bank lending, cannot be confirmed. Nevertheless this result should be handled with caution, given the possibility that these results could be caused by a lack of observations and other factors.

8.1.2.3. Summary of main results and relationship to existing literature

What are the main results from the regressions conducted so far, and how do these results relate to the evidence provided in existing literature?

Starting with the bank characteristics, one important outcome is that "pure" capital is important both at normal times and during a crisis. The magnitude of both coefficients is always positive, significant and higher than for the other characteristics, underscoring its special role. Moreover, it is interesting to note that, in most specifications, there is a small difference in absolute terms, suggesting that capital is a little more important during a crisis than it is at normal times, in accordance with hypothesis H3.

Regarding comparison with the available literature, it can be noted that the positive impact of capital in a crisis in particular is also supported by Gambacorta and Marques-Ibanez (2011), while the evidence concerning the non-crisis effect depends on the specification.

A further robust outcome of the estimations carried out is that the size of a bank has a positive and significant impact in most cases during times of crisis and a positive but insignificant impact at normal times. This result is consistent with existing literature: While the generally positive impact of size in the US has been confirmed

by e.g. Kashyap and Stein (1995) euro area results obtained for the time before the crisis by, among others, Ehrmann et al. (2003), Ehrmann and Worms (2004) and Worms (2003) have not found a significant influence. However, for the period of the recent crisis, Gambacorta and Marques-Ibanez (2011) also detected a positive and significant effect of size on lending thus size seems to be relevant in a crisis because it can reduce informational asymmetries. It must be borne in mind, however, that their sample also includes banks in the US and the UK. Moreover, a connection between size and lending can be established if one considers that the bigger the institute, the more diversified its client base and its income sources are likely to be with respect to industries, geography, client size, etc. Consequently, investors should "trust" bigger banks to a higher degree regarding their ability to meet their repayment obligations, especially when this ability is called in question during a crisis. In addition, a bigger size might also imply a higher degree of professionalism regarding reporting structures, risk management, etc. Taken together, the evidence provided lends support to hypothesis H6.

In the case of deposits, one focus is on the effect of a deposit overhang on lending. This relationship is discussed in detail in section 8.1.4. However, the result regarding the impact of the pure volume of deposits is also interesting, since a larger share of deposit funding is, according to hypothesis H8, assumed to influence lending positively during a crisis. This hypothesis can be confirmed on the basis of the empirical results. The estimated crisis coefficient is positive and, in most of the specifications, significant at the ten or five per cent level. This supports the view that banks with a strong base of insured deposits are less prone to being subject to credit constraints by having too little funding available when the financial markets are in turmoil.

In the literature, the effect of a broad (insured) deposit funding base has not yet been debated intensively.[128] However, this picture is shared by Ivashina and Scharfstein (2010) for the US and Gambacorta and Marques-Ibanez (2011) for a mixed sample consisting of banks from the euro area, the US and UK.

With respect to the share of short-term funding, the following pattern can be observed: The crisis coefficient is positive and lower than the non-crisis coefficient

[128] One reason for this might be the negative correlation between deposit funding and alternative/market funding.

but generally not significant, while the non-crisis estimate is positive and significant in most cases. This can be viewed as supporting hypothesis H4, according to which it becomes harder for banks to obtain funding during a crisis. This effect seems to be more pronounced for banks that rely on market funding to a large extent.

The effect of the funding structure and the role of the ease of access to market funding has attracted particular attention against the background of the recent crisis. The results in this study are consistent with the findings of Gambacorta and Marques-Ibanez (2011) as far as the negative impact during the crisis is concerned. However, the results contrast with those of Brei et al. (2013), who do not observe clear results regarding the direction of the impact of short-term funding during the crisis and who observe negative coefficients outside of the crisis. It should be noted that their approach is not entirely comparable insofar as they distinguish between banks that have been subject to some sort of rescue measure and those they have not, and that they employ a different estimation methodology in some areas.[129]

The results of this study are also consistent with hypothesis H5: A higher-than-average proportion of non-interest income seems to be positive for the supply of bank loans at normal times, while the impact is much less positive in a crisis. According to theory, this relative negative influence is due to the higher volatility of the business that generates non-interest income, while interest income is a more stable source. This increases the risk premium on funding and results in a smaller loan portfolio. The estimated coefficients are significant in many of the specifications. So far, the impact of the proportion of non-interest income has not been regarded at all in the relevant literature although this concept is sound from a theoretical point of view as it fits well in the framework presented in section 4.2.

The only bank characteristic that does not behave as expected is liquidity. The estimated coefficients are usually positive but associated with a high standard error, which makes them unreliable. Even in interaction with monetary policy indicators, the results are not much clearer. However, the positive sign on liquidity is generally consistent with Ehrmann et al. (2003), Gambacorta (2005) and Gambacorta and Marques-Ibanez (2011), for example.

[129] Alongside the GMM estimator, they also use OLS. Whether the use of OLS is justified in this context is debatable, as discussed in section 7.5.

The main results are robust to changes in the specification regarding the implementation of monetary policy measures, the measurement of loan demand factors, the use of different capitalization measures and other specifications.

Taken together, the hypotheses that have been developed from the respective appropriate theoretical context are confirmed in large part by the baseline analysis.

The next two sections are devoted to two questions of particular interest to this study: The first examines the effect of a capital surplus or shortfall relative to a self-imposed target, and the second concerns the role a deposit overhang plays in the propensity to lend.

8.1.3. Capital surplus

An innovative approach to the character and role of capital in the context of bank lending – and one of the most interesting questions in the course of this research – is the one regarding the impact of a capital surplus or shortfall relative to a self-chosen target. While a shortfall implies a (binding) capital constraint, a surplus should give a bank the opportunity to extend its loan supply (hypothesis H1). To shed light on this issue, three different specifications are tested. In the first one, the "plain" capital measure is replaced by the capital surplus variable, which is constructed as explained in section 7.4.2. In the second one, robustness is checked by the use of both "pure" capital and the capital surplus variable. In the third specification, time fixed effects emphasize the true cross-sectional effects.

8.1.3.1. Results of the standard specification

Specification

Hypothesis H1 – that a shortfall of capital relative to a target leads to a reduction in the loan supply – is first tested by means of a standard specification. In this specification, the capital surplus variable, interacted once with the non-crisis dummy and once with the crisis dummy, is used. Furthermore, the bank characteristics size, deposits, liquidity, short-term funding and non-interest income are part of both regressions. All bank characteristics are lagged once to remedy the problem of endogeneity (in connection with the instrumental variable procedure). GDP, Euribor,

the GDP deflator, the non-standard monetary policy measures variable (*NSM*) and the crisis dummy act as control variables.

Validity

Due to the lagged regressors and the choice of instruments, the sample period is adjusted and includes the years from 2001 to 2011. The incorporation of 2,150 cross-sections leads to a total of 14,050 panel observations (unbalanced). To instrument the endogenous explanatory variable, dynamic instruments along the lines of Arellano and Bond (1991) are used, i.e. the second and third lags of the first-differenced natural logarithm of loans. All other bank characteristics, or rather their interactions with the non-crisis and crisis dummies that are used in the regressions, are instrumented by the second lags of the relevant (non-crisis and crisis) interactions with the bank characteristics. The variables measuring GDP, monetary policy and inflation are assumed to be truly exogenous and are instrumented by themselves. As a result, the instrument rank is 28. Sargan's J-statistics yield a value that translates into a probability of almost 0.3 (0.29), which exceeds conventional significance levels. This is a sign of the validity of the overidentifying restrictions and hints at a proper specification.

Estimation results

Table 8.11 shows the results for the standard estimation containing capital surplus as the only capitalization measure. The coefficients for the non-crisis and the crisis variable are both statistically significant at the 10 per cent level. The point estimate is 0.17 for the non-crisis surplus variable and almost twice as high (0.30) for the crisis version. It should be noted, however, that the standard error for the crisis coefficient is also almost twice as large, which calls into question whether the difference between the two is economically significant. Either way, the results support the view that a capital surplus or, equivalently, the deviation from an individual capital target does indeed play a role in explaining the lending response of banks.

What can be said about the other variables included in the regressions under discussion? The parameters for size are significant during times of crisis at the ten per cent level, and the point estimates are in a similar range to the specifications in the baseline analysis. At normal times, however, the coefficient for size is positive but not statistically significant.

The estimates for deposits are positive but not significantly different to zero.

An observation that is similar to the baseline analysis is the one that the coefficients for liquidity are far removed from conventional significance levels. The only pattern that seems to persist across the different specifications is that the non-crisis estimates of liquidity are positive, while the crisis coefficients are all negative. However, whether this pattern is real or has to be ascribed to pure chance is not clear.

Variable	Expected relationship	Actual relationship	Coefficient	Std. error	Prob.
ΔLOG(LOANS(-1))	+	+ ***	0.46	(0.09)	0.000
CAPSUR(-1)*NC	+	+ *	0.17	(0.09)	0.061
CAPSUR(-1)*CRISIS	+	+ *	0.30	(0.17)	0.077
SIZE(-1)*NC	+	+	0.09	(0.07)	0.153
SIZE(-1)*CRISIS	+	+ *	0.22	(0.11)	0.051
DEP(-1)*NC	+	+	0.05	(0.07)	0.509
DEP(-1)*CRISIS	+	+	0.06	(0.08)	0.409
LIQ(-1)*NC	+	+	0.17	(0.46)	0.708
LIQ(-1)*CRISIS	+	-	-0.43	(0.56)	0.446
STF(-1)*NC	+	+ ***	0.31	(0.11)	0.004
STF(-1)*CRISIS	<STF*NC (+/-)	+	0.13	(0.08)	0.127
NII(-1)*NC	+	+ ***	0.25	(0.08)	0.002
NII(-1)*CRISIS	<NII*NC (+/-)	+ ***	0.07	(0.03)	0.003
ΔLOG(GDP)	+	+ ***	0.25	(0.07)	0.000
EURIBOR	-	- **	-0.00	(0.00)	0.040
GDP_DEFLATOR	+/-	-	-0.00	(0.00)	0.316
Δ(NSM)	+	+ ***	0.26	(0.10)	0.009
CRISIS	-	-	-0.01	(0.01)	0.294

Regression properties

Sample (adjusted):	2001 - 2011	Instrument rank	28
Periods included:	11	Sargan test (p-value):	0.29
Cross-sections included:	2,150		
Total panel (unbalanced) observations:	14,050	Year fixed effects	no

The estimated model is given by equation (16). *CRISIS* is a dummy variable that is 1 in the years 2008 and 2009 and 0 in all other years. *NC* is the non-crisis dummy. It takes on the value of zero in 2008 and 2009 and 1 in all other years of the sample period. The model allows for fixed effects across banks realized by orthogonal deviations. It is estimated using difference GMM, 2-step estimator, White period robust standard errors. ***, ** and * indicate statistical significance on the 1%, 5% and 10% level respectively.

Table 8.11: Results of estimations including capital surplus only

The coefficient for short-term funding is positive, as expected, and highly significant outside a crisis (p-values <0.01), which lends further support to the view that the ability to access alternative forms of funding has a positive impact on the volume of

the loan portfolio. In the recent crisis, though, the relationship vanishes, indicated by estimates that are not significant. The sign is less positive than the one the crisis parameter, however, being broadly in line with the baseline analysis. Handled with caution, this could be an additional indication that reliance on short-term funding causes problems when it becomes harder to roll over debt during a crisis which is the core consideration underlying hypothesis H4.

One interesting result is obtained regarding the share of non-interest income, which is positive outside of a crisis and negative in relative terms during a crisis. These results are statistically significant at the one per cent level and consistent with the baseline analysis. According to the theoretical foundation of hypothesis H5, in a crisis, the higher volatility of non-interest income leads investors to suspect higher risks and demand a higher risk premium for uninsured market funding. This, in turn, increases banks' difficulties in funding their loan portfolio. Why is this pattern reversed compared to normal times? The evidence supports the view that, at normal times, a higher share of non-interest income is associated with higher profitability, since no equity capital has to be provided for these kinds of business (e.g. investment banking business, derivatives, transaction banking, securities business, etc.). Under these circumstances, higher profitability thus reduces the risk of default. This relationship is reversed in a crisis, however, due to a change in the revenue potential of the underlying business.

The control variables behave as expected, with a positive sign for GDP, a negative sign for the monetary policy indicator (both significant) and a positive but insignificant coefficient for deflation. The magnitude of GDP is in the same range as the coefficient for the baseline analysis, which hints at the robustness of this variable relative to different specifications. The same holds for Euribor as the monetary policy indicator. Moreover, as expected, the estimate for *NSM* is positive and significant.

Hereafter, the robustness of these results, especially regarding the capital surplus variable, is tested by means of two additional specifications.

8.1.3.2. Robustness checks

"Plain" capital in addition to capital surplus

According to this specification, in addition to the capital surplus variable, "plain" capital enters the estimated equation (both non-crisis and crisis interacted). As in the

standard specification above, the bank characteristics size, deposits, liquidity, short-term funding and non-interest income are part of the regression. Further controls are GDP, Euribor, the GDP deflator, NSM and the crisis dummy.

Variable	Expected relationship	Actual relationship	Coefficient	Std. error	Prob.
ΔLOG(LOANS(-1))	+	+ ***	0.56	(0.08)	0.000
CAP(-1)*NC	+	+ ***	0.72	(0.23)	0.001
CAP(-1)*CRISIS	+	+ ***	0.81	(0.24)	0.001
CAPSUR(-1)*NC	+	+	0.14	(0.16)	0.400
CAPSUR(-1)*CRISIS	+	+ *	0.16	(0.09)	0.087
SIZE(-1)*NC	+	+	0.18	(0.37)	0.618
SIZE(-1)*CRISIS	+	+ ***	0.27	(0.08)	0.001
DEP(-1)*NC	+	+	0.13	(0.09)	0.139
DEP(-1)*CRISIS	+	+ *	0.16	(0.10)	0.094
LIQ(-1)*NC	+	+	0.12	(0.61)	0.847
LIQ(-1)*CRISIS	+	-	-0.35	(0.64)	0.590
STF(-1)*NC	+	+ ***	0.39	(0.11)	0.000
STF(-1)*CRISIS	<STF*NC (+/-)	+ *	0.11	(0.06)	0.090
NII(-1)*NC	+	+ ***	0.20	(0.05)	0.000
NII(-1)*CRISIS	<NII*NC (+/-)	+ ***	0.08	(0.02)	0.000
ΔLOG(GDP)	+	+ ***	0.21	(0.03)	0.000
EURIBOR	-	-	-0.00	(0.00)	0.114
GDP_DEFLATOR	+/-	+	0.00	(0.00)	0.881
Δ(NSM)	+	+ **	0.25	(0.10)	0.011
CRISIS	-	-	-0.01	(0.01)	0.328

Regression properties

Sample (adjusted):	2001 - 2011	Instrument rank	30
Periods included:	11	Sargan test (p-value):	0.31
Cross-sections included:	2,150		
Total panel (unbalanced) observations:	14,050	Year fixed effects	no

The estimated model is given by equation (16). *CRISIS* is a dummy variable that is 1 in the years 2008 and 2009 and 0 in all other years. *NC* is the non-crisis dummy. It takes on the value of zero in 2008 and 2009 and 1 in all other years of the sample period. The model allows for fixed effects across banks realized by orthogonal deviations. It is estimated using difference GMM, 2-step estimator, White period robust standard errors. ***, ** and * indicate statistical significance on the 1%, 5% and 10% level respectively.

Table 8.12: Results of estimations including capital surplus and capital

The choice of instruments is also analogous to the standard specification (apart from the additional instruments for the "plain" capital variables), yielding a p-value of 0.31 for the Sargan test statistic. The estimation is based on an equal number of observations compared to the standard specification.

The main result is that the importance of a capital surplus variable for bank lending is cautiously encouraged by this specification. (All results are displayed in table 8.12.) The estimated coefficient of 0.14 is very close to that of the standard specification. Unfortunately, the standard error is relatively high, leading to an insignificant coefficient (at conventional levels). However, the crisis coefficient is significantly different from zero at the ten per cent level (p-value: 0.087). The coefficient of 0.16 is close to the non-crisis coefficient and also to those of the standard specification, which includes capital surplus only. It should be remembered that constructing the capital surplus variable involves the estimation procedure outlined in section 7.4.2. It is therefore reasonable not to expect the same level of accuracy as for variables/items that can be deducted more or less directly from items on the balance sheet or income statement. In light of these results, there is reason to conclude that the estimation of the capital surplus variable was successful or, at least, that the results do not provide any arguments to the contrary.

As a further result, the coefficients for "plain capital" are both highly significant (at the one per cent level) and less than one standard deviation away from the values of the baseline analysis. Taken together, the overall picture is that the departure from a capital target helps explain the banks' lending response. Furthermore, there is some evidence to support the view that whether a target is missed during a crisis or at normal times is of no relevance to the loan supply.

Regarding the other bank characteristics in the estimation, there are no serious deviations compared to the standard estimation. One minor exception is that the crisis coefficient for deposits is significant at the 10 per cent level. Apart from this, the coefficients are in a similar dimension. Moreover, the control variables behave as expected.

Estimation with time fixed effects

To analyze the true cross-sectional impact of the bank characteristics, the standard specification is augmented by dummies for the years in the sample period, thereby capturing time fixed effects. With the exception of the time dummies, the specification is identical to standard estimation. Accordingly, the choice of instruments too is analogous, yielding a p-value of 0.57 for the Sargan test with an instrument rank of 38.

As a result (see table 8.13), the coefficients for the capital surplus variables are both positive and significantly different to zero at the ten per cent level. In terms of absolute values, the coefficients are close to the estimates of the two preceding specifications. This is additional evidence for the fact that the capital endowment relative to a self-chosen target helps explain the banks' lending responses. Also consistent with the results obtained previously with regard to capital surplus is the observation that, although there is a difference between the crisis and the non-crisis coefficient, the magnitude of the standard errors is such that one cannot clearly conclude that the difference is economically significant.

Variable	Expected relationship	Actual relationship	Coefficient	Std. error	Prob.
ΔLOG(LOANS(-1))	+	+ ***	0.60	(0.12)	0.000
CAPSUR(-1)*NC	+	+ *	0.19	(0.10)	0.064
CAPSUR(-1)*CRISIS	+	+ *	0.20	(0.12)	0.097
SIZE(-1)*NC	+	+ *	0.09	(0.05)	0.056
SIZE(-1)*CRISIS	+	+ **	0.09	(0.05)	0.050
DEP(-1)*NC	+	+ *	0.09	(0.05)	0.094
DEP(-1)*CRISIS	+	+ **	0.10	(0.05)	0.049
LIQ(-1)*NC	+	+	0.05	(0.43)	0.912
LIQ(-1)*CRISIS	+	+	0.28	(0.58)	0.625
STF(-1)*NC	+	+	0.25	(0.21)	0.232
STF(-1)*CRISIS	<STF*NC (+/-)	+ *	0.07	(0.04)	0.088
NII(-1)*NC	+	+	0.12	(0.08)	0.106
NII(-1)*CRISIS	<NII*NC (+/-)	+	0.06	(0.04)	0.149
ΔLOG(GDP)	+	+	0.85	(0.65)	0.192
EURIBOR	-	+	0.00	(0.00)	0.489
GDP_DEFLATOR	+/-	+	0.01	(0.01)	0.635
Δ(NSM)	+	-	-0.10	(0.35)	0.777

Regression properties

Sample (adjusted):	2001 - 2011	Instrument rank	38
Periods included:	11	Sargan test (p-value):	0.57
Cross-sections included:	2,150		
Total panel (unbalanced) observations:	14,050	Year fixed effects	yes

The estimated model is given by equation (16). *CRISIS* is a dummy variable that is 1 in the years 2008 and 2009 and 0 in all other years. *NC* is the non-crisis dummy. It takes on the value of zero in 2008 and 2009 and 1 in all other years of the sample period. The model allows for fixed effects across banks realized by orthogonal deviations. It is estimated using difference GMM, 2-step estimator, White period robust standard errors. ***, ** and * indicate statistical significance on the 1%, 5% and 10% level respectively.

Table 8.13: Capital surplus estimation with time fixed effects

The parameters for the other bank characteristics are broadly in line with the estimates in the preceding specifications and also with those in the baseline analysis.

Inspecting the control variables it is noticeable that they are not significantly different from zero and, in the case of NSM and Euribor, have the "wrong" sign. This is not surprising, however, since much of the variation of the controls is captured by the time dummies.

8.1.3.3. Summary of main results and relationship to existing literature

What are the main results from the preceding regressions? One robust result is that a surplus of capital relative to a self-chosen target has a positive impact on bank lending both during a crisis and outside of a crisis. The difference between the coefficients is relatively small in all cases. The stability of this result across the different specifications leads to the conclusion that, ceteris paribus, missing a capital target has a similar or at least comparable effect on a bank's supply of loans, irrespective of whether the said target is missed during a crisis or at normal times. It should be noted that, given a causal interpretation, the positive sign on the capital surplus variable implies that a shortfall in capital relative to a target leads to a reduction of the supply of bank loans. This can be attributed to the fact that a shortfall relative to a target – even if the target is "only" self-chosen – has the effect of a capital constraint.

Taken together, this outcome is consistent with hypothesis H1. Moreover, the results also lend support to the hypotheses H8 (the role of deposits in a crisis), H6 (size being relevant in a crisis), H3 ("plain" capital of greater importance during a crisis, indicated by higher absolute values than at normal times), H4 (a large proportion of short-term funding is negative in relative terms in a crisis) and H5 (a large proportion of *NII* is negative in relative terms in a crisis).

How do the results, especially the one for the capital surplus, fit in with the existing literature? One first strand of literature concerned with bank lending and capital constraints tackles the subject in the context of the credit crunch in the early 1990s in the US. Despite the fact the focus of authors such as Bernanke and Lown (1991), Peek and Rosengren (1995b), Peek and Rosengren (1995c) and Hancock and Wilcox (1994) is clearly on a capital constraint induced by *regulatory* considerations, their general conclusion is consistent with the findings regarding a surplus or shortfall

relative to *self-chosen* targets in this study. Any constraint, however motivated, has a negative effect on bank lending.

More recently, on the basis of estimated individual capital ratios, Francis and Osborne (2009) show a modest but positive effect of a capital surplus on bank lending in the UK and Berrospide and Edge (2010) do so for the US.

To the knowledge of the author, there is as yet no study that is specially geared to individual capital targets and their impact on lending for banks in the euro area and against the background of the recent financial crisis.[130] The results presented herein thus constitute an innovation, linking the target capital estimation technique with the crisis in the context of bank lending.

8.1.4. Deposit overhang

A further innovation in this study concerns the function of a deposit overhang – when the amount of insured deposits is higher than the amount of loans – for the supply of bank loans. According to hypothesis H9, an overhang of deposits should, in the recent crisis, generally have supported the lending capacity of banks, since those banks had less need to resort to the dysfunctional wholesale funding markets than banks without a deposit overhang.

In addition, hypotheses H2a to H2c state that, if a bank *does* have a deposit overhang, the impact of a higher-than-average share of market funding, of non-interest income and of securities that need to be marked to market should be significant compared to those banks that do *not* have a deposit overhang. These relationships are postulated to be valid irrespective of the economic conditions, i.e. during a crisis or outside of a crisis. The expected result is that a significant relationship exists for those banks that do not have a deposit overhang. In fact, given that one result of the baseline analysis is that *STF* has a positive impact outside of a crisis and a negative one in relative terms during a crisis, and given that there are

[130] There are, however, studies of the cyclicality of capital regulation, of the countercyclicality of capital buffers in the context of lending and the crisis (see e.g. Drehmann and Gambacorta (2012) or Repullo and Suarez (2013)) and on other related issues. These studies usually adopt a regulatory perspective.

only two crisis years, the overall sign for *STF* is expected to be positive and closer to the non-crisis impact. The same holds for *NII*.

The case of the share of securities that need to be marked to market is difficult. As already stated in the context of the baseline analysis, the loss in the number of observations is relatively severe. As a consequence, the tests carried out in this section involving the *AFS* variable produce neither stable nor meaningful results. Hence, unfortunately, hypothesis H2c can neither be validated nor rejected.

To test hypotheses H2a and H2b, the deposit overhang-related variables are of particular interest. A distinction can be drawn between two ways of constructing these variables:

As outlined in section 7.4.1, the first way involves constructing the variable *OVERHANG*. This is built by subtracting one from the result of dividing customer deposits by loans. Any value above zero means that a bank has a deposit overhang.

The second way uses two dummy variables: *DUMMY_OVERHANG* assumes the value of one whenever the amount of insured deposits exceeds the amount of loans and is otherwise zero. The counterpart is the variable *DUMMY_NO_OVERHANG*, which is one if a bank does not have a deposit overhang and is otherwise zero. Both dummy variables are interacted with *STF* and *NII* to test hypotheses H2a and H2b.[131] This procedure allows for a direct comparison of the two different groups – banks with and without a deposit overhang – with a focus on the crisis period.

Three different specifications are used. In the first one, the overhang variable is used alongside the "normal" deposit variable. The overhang dummy variables are used in the second specification. In the third one, this specification is checked for robustness by including time fixed effects.

[131] Again, due to the orthogonal deviations procedure, this does not induce perfect collinearity and does not lead to the dummy variable trap. See also section 7.3.2 and footnote 120.

8.1.4.1. Results of the standard specification

Specification

As already mentioned, in the standard specification the focus of the analysis is on the *OVERHANG* variable in order to test hypothesis H9. The variable is interacted with the non-crisis and the crisis dummy. In addition, the bank characteristics capitalization, size, liquidity, deposits, short-term funding and non-interest income enter the estimated equation. All bank characteristics are lagged once to further reduce the problem of endogeneity (together with the instrumental variable procedure). GDP, Euribor, the GDP deflator, the non-standard monetary policy measures variable (*NSM*) and the crisis dummy serve as control variables.

Validity

As a consequence of the lags used in the regression and the choice of instrumental variables, the sample period is adjusted to the years 2001 to 2011. A total of 2,153 cross-sections are included, leading to 14,061 (unbalanced) observations.

Due to the use of endogenous explanatory variables, dynamic instruments are chosen in accordance with Arellano and Bond (1991). This means that the second and third lags of the natural logarithm of the growth rate of loans act as instruments. Other bank characteristics and their interactions with the non-crisis and crisis dummies are instrumented by the second lags of the (non-crisis and crisis) interaction terms. The variables for GDP, monetary policy and inflation are assumed to be truly exogenous and are instrumented by themselves. This results in a p-value of 0.33 for the Sargan test at an instrument rank of 30. The p-value is satisfactory as an indication of the validity of the overidentifying restrictions.

Estimation results

The results of the standard specification are summarized in table 8.14. The main variables of interest, i.e. the *OVERHANG* variables, are both positive and significant at the ten per cent level. With regard to a deposit overhang in normal times it was not clear *a priori* which sign to expect. During times of crisis, however, the sign should be positive in line with the theoretical underpinnings of hypothesis H9, according to which access to an amount of insured deposits which at least equals the size of the loan portfolio helps to shield the loan portfolio from the negative consequences of the disruption of the wholesale funding markets. Hence, although the absolute value of

the coefficient is not excessively high (0.04), the result is consistent with hypothesis H9.

One interesting observation concerns the coefficients for both "normal" deposit variables. In the presence of the overhang variables, they turn clearly insignificant (p-values of 0.76 and 0.96). On the one hand this has to do with the correlation between the two variables. On the other hand this leads to the conclusion that it is not necessarily the share of deposits over total assets that matters for the lending reaction of banks, but that (the degree of) a deposit overhang is what matters most.

Variable	Expected relationship	Actual relationship	Coefficient	Std. error	Prob.
ΔLOG(LOANS(-1))	+	+ ***	0.45	(0.15)	0.003
CAP(-1)*NC	+	+ ***	0.46	(0.16)	0.004
CAP(-1)*CRISIS	+	+ ***	0.49	(0.18)	0.005
SIZE(-1)*NC	+	+ **	0.08	(0.04)	0.044
SIZE(-1)*CRISIS	+	+ *	0.15	(0.08)	0.065
LIQ(-1)*NC	+	+	0.03	(0.34)	0.924
LIQ(-1)*CRISIS	+	+	0.12	(0.53)	0.828
DEP(-1)*NC	+	-	-0.02	(0.08)	0.763
DEP(-1)*CRISIS	+	-	-0.00	(0.07)	0.963
OVERHANG(-1)*NC	+/-	+ *	0.05	(0.03)	0.061
OVERHANG(-1)*CRISIS	+	+ *	0.04	(0.02)	0.083
STF(-1)*NC	+	+	0.14	(0.08)	0.107
STF(-1)*CRISIS	<STF*NC (+/-)	+	0.08	(0.06)	0.138
NII(-1)*NC	+	+	0.16	(0.13)	0.230
NII(-1)*CRISIS	<NII*NC (+/-)	+ *	0.10	(0.06)	0.097
ΔLOG(GDP)	+	+ **	0.26	(0.11)	0.015
EURIBOR	-	- ***	-0.00	(0.00)	0.002
GDP_DEFLATOR	+/-	- ***	-0.01	(0.00)	0.000
Δ(NSM)	+	+	0.11	(0.10)	0.271
CRISIS	-	+	0.00	(0.01)	0.611

Regression properties

Sample (adjusted):	2001 - 2011	Instrument rank	30
Periods included:	11	Sargan test (p-value):	0.33
Cross-sections included:	2,153		
Total panel (unbalanced) observations:	14,061	Year fixed effects	no

The estimated model is given by equation (16). *CRISIS* is a dummy variable that is 1 in the years 2008 and 2009 and 0 in all other years. *NC* is the non-crisis dummy. It takes on the value of zero in 2008 and 2009 and 1 in all other years of the sample period. The model allows for fixed effects across banks realized by orthogonal deviations. It is estimated using difference GMM, 2-step estimator, White period robust standard errors. ***, ** and * indicate statistical significance on the 1%, 5% and 10% level respectively.

Table 8.14: Results of estimations including the deposit overhang variable

Regarding the other bank characteristics included in the estimation, capitalization is, as in all other specifications, positive and significant at the one per cent level while

the crisis coefficient is a little higher than the non-crisis one (consistent with hypothesis H3). Familiar patterns also apply to size: Not only are both size coefficients positive and significant at the five and ten per cent levels, but the crisis coefficient is also higher than the non-crisis one in absolute terms. This provides additional support for hypothesis H6.

As in most of the previous specifications, the estimates for liquidity are positive but insignificant.

The coefficients for *STF* are positive for the non-crisis period and positive but lower for the years of the crisis. Although they marginally miss the ten per cent significance level, these results are consistent with the ones obtained by the previous specifications.

A similar observation is shared for *NII*, which is positive outside of the crisis and positive but smaller and significant at the ten per cent level during the crisis.

The results for *STF* and *NII* can be viewed as lending further support for the hypotheses H4 and H5.

The results for the control variables are in line with expectations, including a positive and significant result for the GDP variable and a negative and significant result (albeit small in absolute terms) for Euribor and inflation.

In the following section, the robustness of the result obtained in this section – the relevance of a deposit overhang – is tested by means of two additional specifications.

8.1.4.2. Robustness checks

Deposit overhang dummy variable

According to the first of the alternative specifications that are designed to check the robustness of the importance of a deposit overhang for the loan supply, an overhang is captured by a dummy variable (*DUMMY_OVERHANG*) which assumes the value of one whenever the amount of insured customer deposits exceeds the size of the loan portfolio. A second dummy variable (*DUMMY_NO_OVERHANG*), which is the

exact mirror, assumes the value of zero in the event of a deposit overhang and one otherwise.[132] This setup allows for a direct comparison of the two groups of banks.

According to the hypotheses H2a and H2b, a higher-than-average share of short-term funding and non-interest income for banks that have no overhang of deposits should have a significant effect compared to banks that do have an overhang. Hence, both overhang dummies (*DUMMY_OVERHANG) and (DUMMY_NO_OVERHANG*) are interacted with the short-term funding variable and the non-interest income variables. As a result, the coefficients for *STF* and *NII* are expected to be significant for banks with no overhang in deposits and insignificant for banks with a deposit overhang.

In addition, the bank characteristics capitalization, size, liquidity, non-interest income and short-term funding are part of the regression. GDP, Euribor, the GDP deflator, NSM and the crisis dummy serve as further control variables.

The choice of instruments is analogous to the standard specification, yielding a p-value of 0.27 for the Sargan test statistic. The estimation is based on 14,030 (unbalanced) observations, including 2,144 cross-sections.

The results of the estimation (see table 8.15) are consistent with hypotheses H2a and H2b. Indeed, the coefficients for *STF* and *NII* for banks that have no deposit overhang are significantly different from zero at the five and ten per cent level respectively, while the corresponding coefficients for banks that do have a deposit overhang are insignificant. As expected, the signs on the no-overhang dummies are lower than on the overhang dummies for this analysis.

Interestingly, inclusion of the "normal" *STF* and *NII* variables (interacted with the crisis and non-crisis dummy) yields insignificant results throughout. This could be interpreted to indicate that a deposit overhang (or the absence of it) is a main trigger for the importance of *STF* and *NII*.

The parameters for the other bank characteristics are in line with those of the previous estimations. Coefficients are positive and significant for capital, size and deposits, whereas the results for liquidity are of no use.

[132] Note that, due to the orthogonal deviations procedure (which removes cross-sectional fixed effects), this induces neither perfect multicollinearity nor a dummy variable trap.

The results for the control variables are also as expected. In particular, demand for loans seems to be well captured by the GDP variable, as indicated by highly significant values. Moreover, the point estimate is in the range of earlier estimations.

Variable	Expected relationship	Actual relationship	Coefficient	Std. error	Prob.
ΔLOG(LOANS(-1))	+	+ ***	0.68	(0.11)	0.000
CAP(-1)*NC	+	+ **	0.42	(0.18)	0.018
CAP(-1)*CRISIS	+	+ **	0.45	(0.18)	0.013
SIZE(-1)*NC	+	+	0.14	(0.09)	0.139
SIZE(-1)*CRISIS	+	+ *	0.14	(0.08)	0.085
DEP(-1)*NC	+	+ **	0.10	(0.05)	0.044
DEP(-1)*CRISIS	+	+ **	0.11	(0.05)	0.030
LIQ(-1)*NC	+	+	0.00	(0.39)	0.990
LIQ(-1)*CRISIS	+	+	0.27	(0.56)	0.629
DUMMY_OVERHANG*STF(-1)	+	+	0.13	(0.12)	0.285
DUMMY_NO_OVERHANG*STF(-1)	+/-	+ **	0.05	(0.02)	0.011
DUMMY_OVERHANG*NII(-1)	+	+	0.02	(0.03)	0.488
DUMMY_NO_OVERHANG*NII(-1)	+/-	+ *	0.00	(0.00)	0.075
STF(-1)*NC	+	+	0.10	(0.08)	0.198
STF(-1)*CRISIS	<STF*NC (+/-)	+	0.09	(0.06)	0.145
NII(-1)*NC	+	-	-0.06	(0.07)	0.417
NII(-1)*CRISIS	<NII*NC (+/-)	-	-0.06	(0.08)	0.419
ΔLOG(GDP)	+	+ ***	0.56	(0.17)	0.001
EURIBOR	-	-	-0.00	(0.00)	0.177
GDP_DEFLATOR	+/-	- **	-0.00	(0.00)	0.015
Δ(NSM)	+	-	-0.12	(0.09)	0.177
CRISIS	-	- **	-0.02	(0.01)	0.040

Regression properties

Sample (adjusted):	2001 - 2011	Instrument rank	32
Periods included:	11	Sargan test (p-value):	0.27
Cross-sections included:	2,144		
Total panel (unbalanced) observations:	14,030	Year fixed effects	no

The estimated model is given by equation (16). *CRISIS* is a dummy variable that is 1 in the years 2008 and 2009 and 0 in all other years. *NC* is the non-crisis dummy. It takes on the value of zero in 2008 and 2009 and 1 in all other years of the sample period. The model allows for fixed effects across banks realized by orthogonal deviations. It is estimated using difference GMM, 2-step estimator, White period robust standard errors. ***, ** and * indicate statistical significance on the 1%, 5% and 10% level respectively.

Table 8.15: Estimation including a deposit overhang dummy variable

Deposit overhang dummy variable and time fixed effects

An additional robustness check repeats the preceding specification, with the difference that it is estimated with a time fixed effect to underscore the cross-

sectional effects of the bank characteristics. Time dummies are thus included for each year of the sample period.[133]

The instruments are chosen analogous to the preceding estimation, yielding a satisfying p-value of 0.53 for the Sargan test. 2,144 cross-sections enter the estimation with 14,030 (unbalanced) observations.

Variable	Expected relationship	Actual relationship	Coefficient	Std. error	Prob.
ΔLOG(LOANS(-1))	+	+ ***	0.71	(0.11)	0.000
CAP(-1)*NC	+	+ *	0.45	(0.24)	0.062
CAP(-1)*CRISIS	+	+ **	0.49	(0.25)	0.050
SIZE(-1)*NC	+	+	0.14	(0.09)	0.117
SIZE(-1)*CRISIS	+	+	0.14	(0.09)	0.104
DEP(-1)*NC	+	+	0.08	(0.05)	0.141
DEP(-1)*CRISIS	+	+ *	0.09	(0.05)	0.082
LIQ(-1)*NC	+	-	-0.02	(0.43)	0.970
LIQ(-1)*CRISIS	+	+	0.14	(0.58)	0.806
DUMMY_OVERHANG*STF(-1)	+	+	0.13	(0.13)	0.306
DUMMY_NO_OVERHANG*STF(-1)	+/-	+ *	0.06	(0.03)	0.074
DUMMY_OVERHANG*NII(-1)	+	+	0.02	(0.03)	0.401
DUMMY_NO_OVERHANG*NII(-1)	+/-	+ *	0.00	(0.00)	0.069
STF(-1)*NC	+	+	0.08	(0.07)	0.225
STF(-1)*CRISIS	<STF*NC (+/-)	+	0.07	(0.07)	0.304
NII(-1)*NC	+	-	-0.06	(0.07)	0.381
NII(-1)*CRISIS	<NII*NC (+/-)	-	-0.06	(0.07)	0.427
ΔLOG(GDP)	+	+	0.61	(0.59)	0.299
EURIBOR	-	-	-0.01	(0.01)	0.256
GDP_DEFLATOR	+/-	+	0.00	(0.00)	0.108
Δ(NSM)	+	+	0.39	(0.27)	0.144

Regression properties

Sample (adjusted):	2001 - 2011	Instrument rank	42
Periods included:	11	Sargan test (p-value):	0.53
Cross-sections included:	2,144		
Total panel (unbalanced) observations:	14,030	Year fixed effects	yes

The estimated model is given by equation (16). *CRISIS* is a dummy variable that is 1 in the years 2008 and 2009 and 0 in all other years. *NC* is the non-crisis dummy. It takes on the value of zero in 2008 and 2009 and 1 in all other years of the sample period. The model allows for fixed effects across banks realized by orthogonal deviations. It is estimated using difference GMM, 2-step estimator, White period robust standard errors. ***, ** and * indicate statistical significance on the 1%, 5% and 10% level respectively.

Table 8.16: Deposit overhang dummy variable and time fixed effects

The results (table 8.16) confirm the conclusions reached earlier: Again, the coefficients for *STF* and *NII* for banks with no deposit overhang are significant at the

[133] The only difference to the preceding specification is that the crisis dummy is omitted here, since the shift in the offset for the crisis years is already captured by relevant the time dummies.

ten per cent level and lower as expected, while the results for banks with an overhang are not significant. Absolute values and standard error change only marginally.

The robustness of the results for the other bank characteristics is relatively high. All coefficients are in the same dimension and differ only slightly, pointing to the overall validity of the results obtained.

8.1.4.3. Summary of main results and relationship to existing literature.

What can be concluded concerning the main results of the estimations for a deposit overhang? The first result is that a deposit overhang has a positive impact on bank lending during a crisis. In the presence of a deposit overhang variable, the "normal" deposit variable becomes insignificant. This points to the conclusion that the fact that a bank has an overhang of deposits marks a threshold from which its dependence on wholesale funding is considerably lower. This "jump" seems to dominate the impact of normal deposits to a certain extent.

A second result is that, if a bank has a deposit overhang, a higher-than-average share of short-term funding and non-interest income places a burden on the loan portfolio. Hypotheses H2a and H2b suggest that this is due to the lower relevance of the asymmetric information issue, since a deposit overhang is a sign of a reduced need of wholesale funding.

Taken together, the results highlight the fact that a deposit overhang helps to explain the loan supply behavior of banks, thereby lending support to hypotheses H2a, H2b and H9. Moreover, the results for the other bank characteristics are consistent with hypotheses H3 (impact of capital during the crisis) and H6 (size being relevant in a crisis).

How do the results compare to the related literature? Up to now, the effect of a deposit overhang has scarcely been debated. The few available studies on the subject focus on the role of deposits rather than on the impact of an overhang. As mentioned in the context of the baseline analysis, there are two studies that refer to deposits in a crisis context: One is Ivashina and Scharfstein (2010), who find that banks with low deposits experienced the sharpest decline in their loan portfolios in the US. They conclude that this can be attributed to the less acute need to roll over debt and raise alternative market funding. This notion is broadly supported by

Gambacorta and Marques-Ibanez (2011) for a sample of banks in the euro area, the US and the UK during the recent crisis. To the knowledge of the author, no further studies are available that deal explicitly with deposits in a crisis context or with deposit overhangs.

8.2. Results for major euro area countries

To ascertain whether the main results from the preceding section are also valid for individual euro area countries or whether they only hold for the euro area as a whole, the four most important euro area countries – Germany, France, Italy and Spain – are analyzed in more detail. Another question regards the differences between the individual countries which is also addressed.

		Hypotheses	Tested using country samples
General hypo-theses	H1	A shortfall in capital relative to a targeted ratio leads to a reduction of the loan portfolio	✓
	H2	For banks that do not face a deposit overhang, lending depends on	
		> H2a: The share of uninsured short-term funding	✗
		> H2b: The share of non-interest income	✗
		> H2c: The share of securities that must be marked to market	✗
Hypo-theses involving crisis context	H3	During a crisis, the capital ratio has a more positive impact on lending than it does at normal times	✓
	H4	During a crisis, the impact of a pronounced maturity mismatch (evidenced by a large proportion of short-term funding) on lending is lower (in terms of the value of the coefficient) compared to normal times	✓
	H5	During a crisis, the impact of a large proportion of non-interest income on lending is lower (in terms of the value of the coefficient) compared to normal times	✓
	H6	During a crisis, the size of a bank has a more positive impact on lending than it does at normal times	✓
	H7	During a crisis, the impact of a large proportion of marked-to-market securities on lending is lower (in terms of the value of the coefficient) compared to normal times	✗
	H8	During a crisis, a large proportion of deposit funding has a positive impact on lending	✓
	H9	During a crisis, a deposit overhang has a positive impact on lending	✓

✓ Hypothesis tested ✗ Hypothesis not tested (refer to text for further remarks)

Figure 8.3: Tested hypotheses based on individual country samples

The country analyses follow a standardized procedure according to which three types of regressions are run for each of the countries under scrutiny: The first is the baseline model, the second one focuses on the impact of a capital surplus, and the third one deals with the effect of a deposit overhang on bank lending. Each of these three types of regressions is accompanied by several robustness checks, such that a total of seven specifications are tested for each of the countries. A summary of tested hypotheses which are based on individual country samples is given in figure 8.3 above.

The subsequent sections are organized as follows: First, the composition of the country samples and the exact specifications to be tested are described. The results of the country analyses are then presented with a focus on the hypotheses-related results.[134] The subsequent section is devoted to the differences between the individual countries and their underlying causes.

8.2.1. Composition of the country samples and tested specifications

The composition of the country samples is straightforward: The basis for the data is given by the euro area sample after applying the purging steps described in section 7.4.4 (and figure 7.5), from which the data on the banks in each of the four countries is extracted.

This procedure ensures the generation of true subsamples. This is desirable in the case in point in order to compare the results for the individual countries with the overall euro area outcomes. If all purging steps had been applied to the country samples individually, this would have implied that a number of the banks represented in the euro area sample would not be included in the individual country samples which could have an impact on the results.

Accordingly, all variables based on bank characteristics are constructed in exactly the same way as for the euro area, as outlined in section 7.4. The only difference is that normalization of the bank characteristics regarding their respective averages

[134] Because the analysis is basically carried out in the same way as for the euro area as a whole, large parts of the more technical considerations (number of cross-sections and observations, variables used etc.) are not repeated in this section. This includes the summary statistics and the correlation tables can be found in the appendix.

(across all banks in a country)[135] is applied to the country samples individually. This yields indicators that add up to zero across all observations, meaning that the estimated parameters can be directly interpreted as the loan response of an average bank.

In case of the macroeconomic control variables GDP and the GDP deflator, the respective country variables are used (German GDP and GDP deflator for Germany, French GDP for France, etc.). Since individual country data from the euro area bank lending survey is not available, the data from the lending survey is not included in the country samples.

The monetary policy indicators are euro area-wide figures, because monetary policy indicators for individual countries are neither available nor would they be appropriate. For all countries, the Euribor and the Euribor-OIS spread are used. Moreover, the variable that captures non-standard monetary policy measures (*NSM*) is incorporated in some of the specifications.

As stated above, three types of regressions are run, leading to seven different specifications that are tested for each country. The specifications are briefly explained below and can also be inferred from the information shown in table 8.17 to table 8.24.

The first group of estimations is the one for the baseline specifications. In the first model (I), based on equation (16), the first difference of the natural logarithm of loans is regressed against its first lag, against the bank characteristics capital, size, deposits, liquidity, short-term funding and non-interest income, and against the control variables GDP, the GDP deflator, Euribor and the crisis dummy.[136] Liquidity is used only in interaction with Euribor as the monetary policy indicator. On the one hand, this takes account of the buffer stock motive for liquidity holdings in the case of adverse monetary policy changes, as stated by bank lending channel theory. On the other hand, it is also in accordance with the findings from the euro area that liquidity holdings themselves do not add much explanatory power regarding the lending response of banks at conventional significance levels.

[135] The only bank characteristics that are not normalized with respect to their averages are loans and the variables related to a capital surplus and a deposit overhang.

[136] The exact construction of the variables is explained in section 7.4 and table 7.2.

In the second model (II), the robustness of the results is checked with respect to changes in the way monetary policy measures are integrated. The Euribor is replaced by the Euribor-OIS spread and the non-standard monetary policy measures variable is used.

The third specification (III) is the baseline model estimated using time fixed effects and including *NSM*.

The second group of estimations focuses on the effect of a capital surplus or shortfall relative to an individual capital target on the supply of bank loans. To this end, the capital surplus variables enter the model (IV) in the interacted form (interacted with the crisis dummy and the non-crisis dummy) in addition to the "pure" capital variables. In a robustness check (V), the same specification is estimated with time fixed effects.

The third group is geared to testing the impact of a deposit overhang. Accordingly, the two (interacted) deposit overhang variables enter the equation (VI). Again, robustness is checked by estimating the same specification with time fixed effects (VII).

These seven specifications for each country allow all the hypotheses stated in section 7.1 to be tested, with the exception of hypotheses H2 and H7. Hypotheses H2a to H2c are the only ones that are not related to comparing the crisis to normal periods and are therefore less in focus for the country samples.[137] Moreover, Hypotheses H2c and H7 both concern the impact of securities that have to be marked to market (*AFS*). As discussed in connection with the hypothesis tests for the euro area as a whole, the number of available data points is relatively low. Dividing the euro area sample into country subsamples thus further aggravates the issue of the poor availability of *AFS*-related data. As a result, no meaningful hypothesis tests are possible, such that the effect of securities that have to be marked to market on lending on an individual country basis is not analyzed.

Having explained the various specifications, the more technical details of the estimation should not be overlooked. The estimation method is exactly the same as the one used for the euro area. This includes the GMM methodology, the removal of individual fixed effects by orthogonal deviations and the choice of instruments. As in

[137] Hypotheses H1 in its formulation is also not specifically related the crisis period but, first, this distinction is accounted for in the empirical design of the respective estimations and, second, the impact of a capital surplus on lending is of distinct interest to this study.

all other regressions, loans serving as the endogenous explanatory variable are instrumented by the dynamic instruments proposed by Arellano and Bond (1991), i.e. the second and third lags of the natural logarithm of loans in first differences. All other bank characteristics are instrumented by the second lags of (non-crisis and crisis) interactions with the bank characteristics. GDP, the GDP deflator variable, the monetary policy indicator and inflation are assumed to be truly exogenous and are instrumented by themselves.

While this approach to the estimation is an important element to deal with the possible problem of endogenous or predetermined regressors, a second step to address this issue is the inclusion of bank characteristics that are all lagged once.[138]

The descriptive statistics and a correlation matrix for each of the four countries can be found in the appendix.

The following sections are devoted to the main results from the four countries under scrutiny, with a focus on those aspects that are directly linked to the hypotheses.

8.2.2. Main results for Germany

Before coming to the results, it is worth noting that, with more than 1,200 cross-sections and almost 10,000 observations included in the regressions, Germany is the country that provides the richest amount of data. The regression outcomes can therefore be viewed as reliable and resilient in the sense that there is no reason to believe they suffer from an insufficiently broad set of data.

What are the main insights from the baseline regressions (I-III) with regard to the hypotheses to be tested? (See figure 8.3 for an overview of hypotheses tested using the individual country sample for Germany and figure 8.6 in section 8.3 for a summary of the results.)

The results (see table 8.17) are consistent with hypothesis H3: In all specifications, the crisis coefficient for capitalization is higher than the non-crisis coefficient.

The estimation outcome also supports hypothesis H4, according to which a larger[139] share of short-term funding has a negative impact in relative terms on lending, i.e.

[138] This issue of possible endogeneity is discussed in section 7.5. See also footnote 114 on page 120.

compared to the non-crisis coefficient, during a crisis. The result is statistically significant at the ten per cent level in most of the cases. In addition, a persistent pattern is that the effect of short-term funding is consistently more positive outside of a crisis.

GERMANY	(I) Baseline model		(II) Baseline with Euribor_OIS and non-standard measures		(III) Baseline model with time-fixed effects	
Dependent variable: ΔLOG(LOANS)	Coeff.	Std. Error	Coeff.	Std. Error	Coeff.	Std. Error
ΔLOG(LOANS(-1))	0.56 ***	(0.10)	0.52 ***	(0.10)	0.52 ***	(0.10)
CAP(-1)*NC	0.45 **	(0.21)	0.57 ***	(0.20)	0.45 **	(0.19)
CAP(-1)*CRISIS	0.46 ***	(0.17)	0.60 ***	(0.16)	0.51 ***	(0.18)
CAPSUR(-1)*NC						
CAPSUR(-1)*CRISIS						
SIZE(-1)*NC	0.06	(0.04)	0.06	(0.04)	0.05 *	(0.03)
SIZE(-1)*CRISIS	0.06 **	(0.03)	0.08 **	(0.04)	0.07 **	(0.03)
DEP(-1)*NC	0.00	(0.04)	0.02	(0.04)	0.00	(0.05)
DEP(-1)*CRISIS	0.06 *	(0.03)	0.07 *	(0.04)	0.05	(0.03)
OVERHANG(-1)*NC						
OVERHANG(-1)*CRISIS						
LIQ(-1)*EURIBOR*NC	0.31	(0.21)	0.17 *	(0.10)	0.05	(0.11)
LIQ(-1)*EURIBOR*CRISIS	0.29	(0.28)	0.17	(0.15)	0.03	(0.17)
STF(-1)*NC	0.19 *	(0.10)	0.18 *	(0.10)	0.16	(0.13)
STF(-1)*CRISIS	0.06 *	(0.03)	0.06 *	(0.03)	0.05	(0.03)
NII(-1)*NC	0.03	(0.10)	0.08	(1.76)	0.08	(0.09)
NII(-1)*CRISIS	0.01	(0.09)	0.03	(0.05)	0.03	(0.10)
ΔLOG(GDP)	0.24 *	(0.13)	0.13 *	(0.07)	0.45	(0.30)
EURIBOR	0.00 ***	(0.00)			0.00	(0.00)
EURIBOR_OIS			-0.03 ***	(0.01)		
GDP_DEFLATOR	-0.01 ***	(0.00)	0.00	(0.00)	0.00	(0.00)
Δ(NSM)			0.36 **	(0.17)	-0.11	(0.39)
CRISIS	-0.01	(0.01)	-0.01 **	(0.00)		
Time dummies:	NO		NO		YES	
Sample period (adjusted):	2001-2011		2001-2011		2001-2011	
Cross-sections included:	1,241		1,241		1,241	
Total (unbalanced) obs.:	9,974		9,974		9,974	
Instrument rank:	27		28		38	
Sargan test (p-value):	0.59		0.68		0.72	

The estimated model is given by equation (16). CRISIS is a dummy variable that is 1 in the years 2008 and 2009 and 0 in all other years. NC is the non-crisis dummy. It takes on the value of 0 in 2008 and 2009 and 1 in all other years of the sample period. The model allows for fixed effects across banks realized by orthogonal deviations. It is estimated using difference GMM, 2-step estimator, White period robust standard errors. ***, ** and * indicate statistical significance on the 1%, 5% and 10% level respectively.

Table 8.17: Baseline results for Germany

[139] Because all bank characteristics (except for loans, capital surplus and deposit overhang) are normalized with respect to their respective averages, "larger" means a larger share than that of an average (German) bank.

A similar observation can be made with respect to the impact of non-interest income and hypothesis H5: It is positive at normal times but, relative to that, negative in times of crisis. The difference is, however, that the estimated coefficients miss the ten per cent significance level in most cases.

GERMANY	(IV) Capital surplus		(V) Capital surplus and time-fixed effects		(VI) Deposit overhang		(VII) Deposit overhang and time-fixed effects	
Dependent variable: ΔLOG(LOANS)	Coeff.	Std. Error	Coeff.	Std. Error	Coeff.	Std. Error	Coeff.	Std. Error
ΔLOG(LOANS(-1))	0.54 ***	(0.10)	0.52 ***	(0.10)	0.48 ***	(0.12)	0.44 ***	(0.12)
CAP(-1)*NC	0.53 ***	(0.16)	0.48 ***	(0.13)	0.45 **	(0.19)	0.47 ***	(0.18)
CAP(-1)*CRISIS	0.76 **	(0.32)	0.74 ***	(0.26)	0.46 ***	(0.17)	0.54 ***	(0.19)
CAPSUR(-1)*NC	0.06 ***	(0.02)	0.06 ***	(0.02)				
CAPSUR(-1)*CRISIS	0.05 *	(0.03)	0.06 **	(0.03)				
SIZE(-1)*NC	0.05 *	(0.03)	0.05	(0.03)	0.06	(0.05)	0.08 *	(0.04)
SIZE(-1)*CRISIS	0.07 **	(0.03)	0.08 **	(0.04)	0.08 **	(0.04)	0.10 ***	(0.03)
DEP(-1)*NC	-0.03	(0.05)	-0.03	(0.05)	-0.04	(0.05)	-0.04 **	(0.02)
DEP(-1)*CRISIS	0.03	(0.04)	0.01	(0.05)	0.03	(0.04)	0.03	(0.02)
OVERHANG(-1)*NC					0.06 ***	(0.01)	0.06 ***	(0.01)
OVERHANG(-1)*CRISIS					0.08 ***	(0.02)	0.05 ***	(0.01)
LIQ(-1)*EURIBOR*NC	0.42 **	(0.21)	0.20	(0.21)	0.26 *	(0.15)	0.06	(0.10)
LIQ(-1)*EURIBOR*CRISIS	0.39 *	(0.21)	0.18	(0.26)	0.28	(0.22)	0.05	(0.16)
STF(-1)*NC	0.23 **	(0.10)	0.21 *	(0.12)	0.17	(0.12)	0.14	(0.19)
STF(-1)*CRISIS	0.10 *	(0.05)	0.10 *	(0.06)	0.04 *	(0.02)	0.03	(0.02)
NII(-1)*NC	0.05	(0.45)	0.11	(0.22)	0.06	(1.09)	0.14	(0.13)
NII(-1)*CRISIS	0.03	(0.08)	0.05 *	(0.03)	0.01	(0.09)	0.04	(0.05)
ΔLOG(GDP)	0.33 **	(0.13)	0.06	(0.42)	0.38 ***	(0.13)	0.17	(0.40)
EURIBOR	0.00 ***	(0.00)	0.00	(0.00)	0.00 ***	(0.00)	0.00	(0.00)
EURIBOR_OIS								
GDP_DEFLATOR	-0.01 ***	(0.00)	-0.01	(0.01)	-0.01 ***	(0.00)	0.00	(0.00)
Δ(NSM)	-0.06	(0.10)	-0.08	(0.42)	-0.10	(0.09)	0.29	(0.37)
CRISIS	0.00	(0.01)			-0.01	(0.02)		
Time dummies:	NO		YES		NO		YES	
Sample period (adjusted):	2001-2011		2001-2011		2001-2011		2001-2011	
Cross-sections included:	1,238		1,238		1,241		1,241	
Total (unbalanced) obs.:	9,939		9,939		9,974		9,974	
Instrument rank:	30		40		30		40	
Sargan test (p-value):	0.60		0.72		0.54		0.65	

The estimated model is given by equation (16). CRISIS is a dummy variable that is 1 in the years 2008 and 2009 and 0 in all other years. NC is the non-crisis dummy. It takes on the value of 0 in 2008 and 2009 and 1 in all other years of the sample period. The model allows for fixed effects across banks realized by orthogonal deviations. It is estimated using difference GMM, 2-step estimator, White period robust standard errors. ***, ** and * indicate statistical significance on the 1%, 5% and 10% level respectively.

Table 8.18: Capital surplus and deposit overhang results for Germany

Regarding hypothesis H6, the role of the size of a bank is positive and significant at the five per cent level in all specifications during the crisis, which is consistent with what the hypothesis claims. Nevertheless, it should be noted that, although the crisis

coefficient is consistently higher, the difference between the crisis and the non-crisis estimate is relatively small.

The parameters for deposits are consistent with hypothesis H8 in the sense that a higher-than-average share of deposits has a positive impact during the crisis.

Turning to the regressions that center around the capital surplus variable, the fact that a capital surplus helps to explain the lending response of banks can be recorded as a key result (table 8.18). The crisis and non-crisis parameters are significant at the ten and one per cent levels respectively in both of the tested specifications (IV and V). It is worth noting that they are positive even in the presence of the "pure" capital variables, whose coefficients also show the expected positive sign and are statistically significant at the five and one per cent levels. All in all, the capital surplus variables seem to work well for Germany and the results very strongly support hypothesis H1.

The last two specifications (VI and VII) are devoted to the role that a deposit overhang plays in the supply of bank loans. The result for the German sample is, first, that the overhang parameters are positive and significant, particularly in times of crisis (but also during normal times) in both specifications. In this sense, the coefficients are as expected and consistent with hypothesis H9. A second result is that, in presence of the deposit overhang variables, the coefficients on normal deposits turn negative for the non-crisis parameter while they stay positive for the crisis version. Although not statistically significant at conventional levels, this can be seen as further supporting the positive impact of normal deposits on the loan supply during a crisis.

To sum up the results for Germany: The results are consistent with the formulated hypotheses to a large extent. Support for hypothesis H5 (non-interest income) alone seems slightly vague, which can be attributed to a lack of statistically significant results and not to unexpected deflections for the parameters. In particular, the hypotheses regarding the impact of a capital surplus or a deposit overhang are supported by the data.

8.2.3. Main results for Italy

ITALY	(I) Baseline model		(II) Baseline with Euribor_OIS and non-standard measures		(III) Baseline model with time-fixed effects	
Dependent variable: ΔLOG(LOANS)	Coeff.	Std. Error	Coeff.	Std. Error	Coeff.	Std. Error
ΔLOG(LOANS(-1))	0.07 **	(0.04)	0.05	(0.05)	0.05	(0.05)
CAP(-1)*NC	1.19	(0.74)	1.20 **	(0.59)	1.12	(0.82)
CAP(-1)*CRISIS	1.16 *	(0.61)	1.09 *	(0.65)	1.11	(0.89)
CAPSUR(-1)*NC						
CAPSUR(-1)*CRISIS						
SIZE(-1)*NC	0.13 ***	(0.04)	0.07 *	(0.04)	0.24 ***	(0.06)
SIZE(-1)*CRISIS	0.35 **	(0.14)	0.06	(0.04)	0.23 ***	(0.06)
DEP(-1)*NC	0.45 **	(0.21)	0.58 ***	(0.17)	0.44 **	(0.20)
DEP(-1)*CRISIS	0.48 **	(0.21)	0.64 ***	(0.18)	0.47 **	(0.21)
OVERHANG(-1)*NC						
OVERHANG(-1)*CRISIS						
LIQ(-1)*EURIBOR*NC	0.18	(0.30)	0.08	(0.24)	0.05	(0.27)
LIQ(-1)*EURIBOR*CRISIS	0.14	(0.24)	0.08	(0.22)	0.07	(0.22)
STF(-1)*NC	0.21	(0.19)	0.07	(0.30)	0.07	(0.27)
STF(-1)*CRISIS	0.11	(0.19)	0.04	(0.19)	0.04	(0.27)
NII(-1)*NC	0.22	(1.26)	0.13	(0.52)	0.16 **	(0.07)
NII(-1)*CRISIS	0.02 *	(0.01)	0.03 *	(0.02)	0.08	(0.07)
ΔLOG(GDP)	0.47 **	(0.20)	0.30	(0.40)	0.16	(0.18)
EURIBOR	-0.01 ***	(0.00)			-0.01	(0.02)
EURIBOR_OIS			-0.01	(0.02)		
GDP_DEFLATOR	0.02 ***	(0.00)	0.00	(0.01)	-0.06	(0.05)
Δ(NSM)			-0.06	(0.26)	-0.18	(1.28)
CRISIS	-0.03 ***	(0.01)	-0.02	(0.02)		
Time dummies:	NO		NO		YES	
Sample period (adjusted):	2001-2011		2001-2011		2001-2011	
Cross-sections included:	494		494		494	
Total (unbalanced) obs.:	1,594		1,594		1,594	
Instrument rank:	26		27		36	
Sargan test (p-value):	0.21		0.23		0.35	

The estimated model is given by equation (16). CRISIS is a dummy variable that is 1 in the years 2008 and 2009 and 0 in all other years. NC is the non-crisis dummy. It takes on the value of 0 in 2008 and 2009 and 1 in all other years of the sample period. The model allows for fixed effects across banks realized by orthogonal deviations. It is estimated using difference GMM, 2-step estimator, White period robust standard errors. ***, ** and * indicate statistical significance on the 1%, 5% and 10% level respectively.

Table 8.19: Baseline results for Italy

The second biggest euro area country in terms of the number of banks in the sample is Italy. With less than 500 banks and about 1,600 observations, however, the Italian sample includes only 40 per cent of the banks and only 15 per cent of the observations compared to Germany. Especially the comparison of the number of observations leads to the conclusion that, in the Italian sample, on average the number of observations per bank is available to a lesser extent than for Germany.

Nevertheless, the number of observations should still be large enough to produce meaningful results.

ITALY	(IV) Capital surplus		(V) Capital surplus and time-fixed effects		(VI) Deposit overhang		(VII) Deposit overhang and time-fixed effects	
Dependent variable: ΔLOG(LOANS)	Coeff.	Std. Error	Coeff.	Std. Error	Coeff.	Std. Error	Coeff.	Std. Error
ΔLOG(LOANS(-1))	0.09 **	(0.03)	0.06	(0.04)	0.34	(0.24)	0.04	(0.03)
CAP(-1)*NC	0.26	(1.27)	0.67 *	(0.38)	0.92 *	(0.51)	0.89	(0.65)
CAP(-1)*CRISIS	0.39	(1.38)	0.92 *	(0.50)	1.05 *	(0.56)	0.84	(0.69)
CAPSUR(-1)*NC	0.18 **	(0.07)	0.10	(0.06)				
CAPSUR(-1)*CRISIS	0.14 *	(0.08)	0.12 *	(0.07)				
SIZE(-1)*NC	0.27 ***	(0.05)	0.27 ***	(0.05)	0.31 ***	(0.06)	0.32 ***	(0.05)
SIZE(-1)*CRISIS	0.25 ***	(0.05)	0.25 ***	(0.05)	0.30 ***	(0.06)	0.31 ***	(0.04)
DEP(-1)*NC	0.59 ***	(0.14)	0.35 **	(0.16)	0.52 *	(0.29)	0.24	(0.15)
DEP(-1)*CRISIS	0.57 ***	(0.15)	0.34 **	(0.17)	0.58 *	(0.32)	0.26 *	(0.16)
OVERHANG(-1)*NC					0.22 *	(0.12)	0.12 ***	(0.02)
OVERHANG(-1)*CRISIS					0.20 *	(0.12)	0.12 ***	(0.03)
LIQ(-1)*EURIBOR*NC	0.25	(0.30)	0.13	(0.28)	0.14	(0.34)	0.11	(0.28)
LIQ(-1)*EURIBOR*CRISIS	0.15	(0.24)	0.10	(0.22)	0.10	(0.30)	0.06	(0.20)
STF(-1)*NC	0.24	(0.22)	0.16	(0.18)	0.42	(0.33)	0.17	(0.51)
STF(-1)*CRISIS	0.06	(0.04)	0.04	(0.18)	0.19	(0.15)	0.08	(0.21)
NII(-1)*NC	0.18	(0.59)	0.20	(0.19)	0.74 *	(0.40)	0.24 *	(0.13)
NII(-1)*CRISIS	0.04	(0.02)	0.07	(0.07)	0.47 **	(0.20)	0.16	(0.20)
ΔLOG(GDP)	1.03 ***	(0.31)	1.29	(2.29)	1.97 ***	(0.62)	0.09	(1.40)
EURIBOR	-0.02 ***	(0.00)	-0.06 *	(0.03)	-0.03 ***	(0.01)	0.00	(0.01)
EURIBOR_OIS								
GDP_DEFLATOR	0.02 ***	(0.01)	0.10 **	(0.04)	0.04 ***	(0.01)	-0.04	(0.03)
Δ(NSM)	-0.20	(0.19)	-0.16	(0.14)	-0.68 *	(0.35)	-0.02	(0.96)
CRISIS	-0.01	(0.02)			-0.03	(0.02)		
Time dummies:	NO		YES		NO		YES	
Sample period (adjusted):	2001-2011		2001-2011		2001-2011		2001-2011	
Cross-sections included:	494		494		494		494	
Total (unbalanced) obs.:	1,594		1,594		1,594		1,594	
Instrument rank:	29		37		27		37	
Sargan test (p-value):	0.23		0.40		0.22		0.43	

The estimated model is given by equation (16). CRISIS is a dummy variable that is 1 in the years 2008 and 2009 and 0 in all other years. NC is the non-crisis dummy. It takes on the value of 0 in 2008 and 2009 and 1 in all other years of the sample period. The model allows for fixed effects across banks realized by orthogonal deviations. It is estimated using difference GMM, 2-step estimator, White period robust standard errors. ***, ** and * indicate statistical significance on the 1%, 5% and 10% level respectively.

Table 8.20: Capital surplus and deposit overhang results for Italy

Starting with the results from the baseline specifications (I-III; see table 8.19), it can be observed that the role of the share of non-interest income is supported in accordance with hypothesis H5. (See figure 8.3 on page 170 for an overview of hypotheses tested using the individual country sample for Italy and figure 8.6 in section 8.3 for a summary of the results.) The estimated coefficients for the crisis version have are lower, as expected, and are significant in the majority of cases.

Regarding the impact of short-term funding (hypothesis H4), it must be noted that the estimates produce the expected lower coefficients for the crisis (and positive but higher ones for normal times), but the results are not statistically significant at the ten per cent level. Despite this, the results can still be interpreted as supporting hypothesis H4 at least weakly.

The impact of size, particularly in the crisis, is positive and significant at the five per cent level. One exception is the second specification, in which the estimate of size is not significant and is considerably smaller in absolute terms. Hypothesis H6 is not supported, however, since the coefficient on size in a crisis is not higher than outside of a crisis.

Hypothesis H3 is also not supported by the data. The estimates for the crisis version of the capital variable are not consistently higher than for the non-crisis one (but only in roughly half of the cases). Still, the effect of capital on lending is generally positive.

For Italy, the notion that a larger-than-average amount of deposits is beneficial during a crisis regarding the size of the loan portfolio (hypothesis H8) is well confirmed, although the difference between the crisis and the non-crisis coefficients is not very large.

Turning to the evidence provided by tests of specifications IV and V on the capital surplus (table 8.20), the estimated parameters are significant at the ten per cent level for interaction with the crisis dummy. For non-crisis interaction, the sign is also positive but the significance is not robust for the specification using time fixed effects (p-value: 0.12). Nevertheless, taking all factors into account, the results are consistent with hypothesis H1.

The last two regressions focus on the role of a deposit overhang. According to theory and to hypothesis H9, an overhang in deposits in crisis years should largely shield banks from turmoil on the wholesale funding markets. On the basis of the data, this assumption can be confirmed with significantly positive results throughout all specifications.

To sum up: Hypotheses H3 and H6 ("pure capital" and size) are not supported by the data. The evidence in favor of hypothesis H5 (non-interest income) is relatively weak. However, this hypothesis is not contradicted by the data as measured by the expected difference between the crisis and the non-crisis coefficients. The other

hypotheses, H1, H4, H8 and H9, are well supported, especially the one regarding the impact of a deposit overhang.

8.2.4. Main results for France

The third biggest country in the sample is France. 120 cross-sections (banks) are included in the sample, producing almost 900 observations. On average, coverage in terms of the number of observations for each bank is clearly better than in the Italian sample. The total number of observations is still satisfactory.

This better coverage of French banks is reflected in the consistency and robustness of the results across different specifications as far as the signs and absolute values are concerned (I-III; see table 8.21). (See figure 8.3 on page 170 for an overview of hypotheses tested using the individual country sample for France and figure 8.6 in section 8.3 for a summary of the results.)

This does not mean, however, that all hypotheses are supported by the data. : An interesting observation that can be made given the baseline analysis in specifications I to III is that the parameter for capital is consistently higher at normal times than during the crisis. This contrasts with the results for the euro area as a whole, the other countries individually (apart from Italy) and the prediction of hypothesis H3.

Regarding hypotheses H4 and H5 the results for the share of short-term funding and the share of non-interest income line up with expectations regarding the direction and difference of the impacts, especially during the crisis. It must yet be noted that they are not statistically significant. Accordingly, the evidence in favor of hypotheses H4 and H5 is relatively weak.

As a further result, the coefficients for size are positive both during and outside of a crisis and are statistically significant at least at the ten per cent level in most cases. In particular, the crisis coefficients are higher in absolute terms than the non-crisis ones, although the difference in absolute terms is small. Altogether, this is still consistent with hypothesis H6 which is weakly supported.

Regarding the role of "pure" deposits during the crisis (hypothesis H8), the evidence is somewhat unconvincing. Though the sign is positive and the absolute value for the crisis coefficient is consistently higher than for the non-crisis one, the difference between the non-crisis and crisis estimates is very small and the coefficients are not statistically significant in specifications I to III.

FRANCE	(I) Baseline model		(II) Baseline with Euribor_OIS and non-standard measures		(III) Baseline model with time-fixed effects	
Dependent variable: ΔLOG(LOANS)	Coeff.	Std. Error	Coeff.	Std. Error	Coeff.	Std. Error
ΔLOG(LOANS(-1))	0.26 ***	(0.06)	0.18 ***	(0.06)	0.15 ***	(0.05)
CAP(-1)*NC	0.82 ***	(0.23)	0.46 ***	(0.14)	0.45 ***	(0.13)
CAP(-1)*CRISIS	0.55 **	(0.23)	0.17 *	(0.10)	0.16 *	(0.10)
CAPSUR(-1)*NC						
CAPSUR(-1)*CRISIS						
SIZE(-1)*NC	0.02 *	(0.01)	0.07 **	(0.03)	0.12 ***	(0.03)
SIZE(-1)*CRISIS	0.03 **	(0.01)	0.08 **	(0.03)	0.13 ***	(0.03)
DEP(-1)*NC	0.01	(0.09)	0.02	(0.06)	0.12	(0.12)
DEP(-1)*CRISIS	0.11	(0.12)	0.06	(0.08)	0.16	(0.11)
OVERHANG(-1)*NC						
OVERHANG(-1)*CRISIS						
LIQ(-1)*EURIBOR*NC	0.54 **	(0.22)	0.22	(0.15)	0.50	(0.32)
LIQ(-1)*EURIBOR*CRISIS	0.35 **	(0.15)	0.22 *	(0.12)	0.29	(0.18)
STF(-1)*NC	0.10	(0.11)	0.09	(0.61)	0.26	(0.52)
STF(-1)*CRISIS	0.01	(0.08)	0.07	(0.08)	0.11	(0.10)
NII(-1)*NC	0.02	(0.03)	0.03	(0.12)	0.02	(0.03)
NII(-1)*CRISIS	0.00	(0.00)	0.03	(0.02)	0.01	(0.02)
ΔLOG(GDP)	0.64 ***	(0.19)	0.32 **	(0.14)	0.56	(1.07)
EURIBOR	0.00	(0.00)			0.00	(0.02)
EURIBOR_OIS			-0.05 *	(0.03)		
GDP_DEFLATOR	-0.01 *	(0.00)	-0.05 *	(0.03)	-0.01	(0.02)
Δ(NSM)			0.99 ***	(0.20)	0.35	(0.36)
CRISIS	-0.01	(0.01)	-0.01	(0.01)		
Time dummies:	NO		NO		YES	
Sample period (adjusted):	2001-2011		2001-2011		2001-2011	
Cross-sections included:	120		120		120	
Total (unbalanced) obs.:	896		896		896	
Instrument rank:	26		26		37	
Sargan test (p-value):	0.21		0.37		0.21	

The estimated model is given by equation (16). CRISIS is a dummy variable that is 1 in the years 2008 and 2009 and 0 in all other years. NC is the non-crisis dummy. It takes on the value of 0 in 2008 and 2009 and 1 in all other years of the sample period. The model allows for fixed effects across banks realized by orthogonal deviations. It is estimated using difference GMM, 2-step estimator, White period robust standard errors. ***, ** and * indicate statistical significance on the 1%, 5% and 10% level respectively.

Table 8.21: Baseline results for France

Interestingly, this picture changes in specifications VI and VII in the presence of the deposit overhang variables. In these specifications, the estimated parameters for deposits are both negative and significant, whereas those for the overhang variables are positive and significant. This peculiarity of the French data supports hypothesis H9 well but is only very weakly consistent with hypothesis H8 based on specifications VI and VII.

The results for the capital surplus variables are consistent with hypothesis H1. Both during and outside of the crisis, a capital surplus has a positive impact on bank

lending. It is worth noting that the impact of "pure" capital is stronger in absolute terms compared to the other specifications without the surplus variables.

FRANCE	(IV) Capital surplus		(V) Capital surplus and time-fixed effects		(VI) Deposit overhang		(VII) Deposit overhang and time-fixed effects	
Dependent variable: ΔLOG(LOANS)	Coeff.	Std. Error	Coeff.	Std. Error	Coeff.	Std. Error	Coeff.	Std. Error
ΔLOG(LOANS(-1))	0.13 *	(0.07)	0.13 *	(0.08)	0.41 ***	(0.04)	0.04 ***	(0.01)
CAP(-1)*NC	1.56 **	(0.61)	1.81 ***	(0.57)	0.57 ***	(0.22)	0.47 ***	(0.16)
CAP(-1)*CRISIS	1.69 **	(0.71)	1.93 ***	(0.46)	0.29	(0.22)	0.15	(0.17)
CAPSUR(-1)*NC	0.05 *	(0.03)	0.08 ***	(0.02)				
CAPSUR(-1)*CRISIS	0.07 **	(0.03)	0.08 ***	(0.03)				
SIZE(-1)*NC	0.06 ***	(0.02)	0.10 ***	(0.01)	0.03 *	(0.02)	0.10 ***	(0.03)
SIZE(-1)*CRISIS	0.06 ***	(0.02)	0.11 ***	(0.01)	0.04 **	(0.02)	0.10 ***	(0.03)
DEP(-1)*NC	0.13	(0.09)	0.01	(0.06)	-0.12 *	(0.06)	-0.22 *	(0.13)
DEP(-1)*CRISIS	0.16 *	(0.08)	0.07	(0.05)	-0.11 *	(0.07)	-0.18 *	(0.10)
OVERHANG(-1)*NC					0.05 ***	(0.02)	0.07 *	(0.04)
OVERHANG(-1)*CRISIS					0.07 ***	(0.01)	0.07 **	(0.03)
LIQ(-1)*EURIBOR*NC	0.66 ***	(0.23)	0.50 ***	(0.18)	0.26	(0.16)	0.57 *	(0.34)
LIQ(-1)*EURIBOR*CRISIS	0.32 **	(0.15)	0.35 ***	(0.13)	0.31 **	(0.12)	0.36 *	(0.19)
STF(-1)*NC	0.26 **	(0.12)	0.12	(0.35)	0.11	(0.74)	0.27	(0.19)
STF(-1)*CRISIS	0.11	(0.09)	0.10 *	(0.05)	0.06	(0.05)	0.13	(0.13)
NII(-1)*NC	0.02	(0.02)	0.03	(0.03)	0.10	(0.07)	0.04 ***	(0.01)
NII(-1)*CRISIS	0.01	(0.02)	0.01	(0.02)	0.05 ***	(0.02)	0.02	(0.01)
ΔLOG(GDP)	0.43 *	(0.24)	1.48 **	(0.62)	0.24	(0.19)	0.68	(1.00)
EURIBOR	-0.03 ***	(0.00)	-0.03 ***	(0.01)	-0.01 ***	(0.00)	0.00	(0.01)
EURIBOR_OIS								
GDP_DEFLATOR	-0.04 ***	(0.01)	-0.03 **	(0.01)	-0.03 ***	(0.00)	-0.03	(0.02)
Δ(NSM)	0.44 ***	(0.14)	1.16 **	(0.47)	1.18 ***	(0.17)	0.76	(0.73)
CRISIS	-0.01	(0.01)			-0.01	(0.01)		
Time dummies:	NO		YES		NO		YES	
Sample period (adjusted):	2001-2011		2001-2011		2001-2011		2001-2011	
Cross-sections included:	120		120		120		120	
Total (unbalanced) obs.:	896		896		896		896	
Instrument rank:	50		40		49		69	
Sargan test (p-value):	0.23		0.32		0.29		0.32	

The estimated model is given by equation (16). CRISIS is a dummy variable that is 1 in the years 2008 and 2009 and 0 in all other years. NC is the non-crisis dummy. It takes on the value of 0 in 2008 and 2009 and 1 in all other years of the sample period. The model allows for fixed effects across banks realized by orthogonal deviations. It is estimated using difference GMM, 2-step estimator, White period robust standard errors. ***, ** and * indicate statistical significance on the 1%, 5% and 10% level respectively.

Table 8.22: Capital surplus and deposit overhang results for France

To sum up: The estimates based on the sample for France produce the strongest evidence in favor of hypotheses H1 and H9 (capital surplus and deposit overhang). Weak support is provided for hypotheses H4 H5 and H6 (*STF*, *NII* and *SIZE*), while

hypotheses H3 and H8 (capital and deposits) are not consistently backed up by the data.[140]

8.2.5. Main results for Spain

Of the four individual countries examined, Spain is the one with the least number of cross-sections and observations in its country sample. Each of the specifications I to VII contains 74 cross-sections and about 220 observations. This is still marginally satisfactory.

What are the main results for the Spanish sample (see table 8.23 and table 8.24)? (See figure 8.3 on page 170 for an overview of hypotheses tested using the individual country sample for Spain and figure 8.6 in section 8.3 for a summary of the results.) Regarding the impact of capital during the crisis (hypothesis H3), the coefficient is consistently higher than the one outside of a crisis. Although the crisis coefficient is not statistically significant in all cases, it nevertheless speaks well for the validity of hypothesis H3.

Regarding the share of short-term funding and non-interest income, the pattern observable in France is repeated here: For both variables, the crisis and non-crisis coefficients show the anticipated difference but are not statistically significant (at the ten per cent level) in most cases. Accordingly, hypotheses H4 and H5 once again receive only weak support from the data.

The impact of size on lending (hypothesis H6) is not clear for Spain. Although the impact is positive in most cases, the results are not significant. Moreover, the crisis coefficient is not higher than the non-crisis one. Altogether, the results do not substantiate the hypothesis.

The estimated coefficients for deposits during the crisis (hypothesis H8) are positive and statistically significant. In addition, the absolute values are consistently higher than those for the non-crisis coefficients, which suggests that deposits are more important during the crisis.

---

[140] The case of pure deposits (H8) may be considered as borderline, since specifications IV to VII support hypothesis H8 at least weakly. Nevertheless, in an overall assessment and applying strict standards, results are interpreted as not supporting H8.

SPAIN	(I) Baseline model		(II) Baseline with Euribor_OIS and non-standard measures		(III) Baseline model with time-fixed effects	
Dependent variable: ΔLOG(LOANS)	Coeff.	Std. Error	Coeff.	Std. Error	Coeff.	Std. Error
ΔLOG(LOANS(-1))	0.12 *	(0.06)	0.21 **	(0.09)	0.10	(0.12)
CAP(-1)*NC	1.10 ***	(0.29)	0.77	(0.51)	0.31	(0.75)
CAP(-1)*CRISIS	1.33 **	(0.53)	1.08	(0.66)	1.09	(0.75)
CAPSUR(-1)*NC						
CAPSUR(-1)*CRISIS						
SIZE(-1)*NC	0.03	(0.06)	0.00	(0.07)	0.09	(0.24)
SIZE(-1)*CRISIS	0.02	(0.06)	-0.01	(0.08)	0.09	(0.24)
DEP(-1)*NC	0.39 ***	(0.11)	0.08	(0.10)	0.33 *	(0.19)
DEP(-1)*CRISIS	0.75 ***	(0.20)	0.41 *	(0.22)	0.60 **	(0.28)
OVERHANG(-1)*NC						
OVERHANG(-1)*CRISIS						
LIQ(-1)*EURIBOR*NC	0.38 ***	(0.06)	0.26 ***	(0.07)	0.25 **	(0.12)
LIQ(-1)*EURIBOR*CRISIS	0.47	(0.34)	0.53	(0.34)	0.05	(0.33)
STF(-1)*NC	0.43 ***	(0.09)	0.39	(0.26)	0.35	(0.22)
STF(-1)*CRISIS	0.22	(0.30)	0.17	(0.13)	0.01	(0.14)
NII(-1)*NC	0.27	(0.17)	0.35 *	(0.20)	0.33	(0.57)
NII(-1)*CRISIS	0.07	(0.10)	0.08	(0.17)	0.16	(0.13)
ΔLOG(GDP)	0.67 ***	(0.19)	1.51 ***	(0.42)	0.59	(0.73)
EURIBOR	-0.02 ***	(0.00)			0.00	(0.02)
EURIBOR_OIS			-0.03 *	(0.02)		
GDP_DEFLATOR	-0.02 ***	(0.00)	0.00	(0.00)	-0.01	(0.02)
Δ(NSM)			-0.73 **	(0.32)	-0.23	(1.67)
CRISIS	-0.03 ***	(0.01)	-0.05 **	(0.02)		
Time dummies:	NO		NO		YES	
Sample period (adjusted):	2001-2011		2001-2011		2001-2011	
Cross-sections included:	74		74		74	
Total (unbalanced) obs.:	222		222		222	
Instrument rank:	41		42		44	
Sargan test (p-value):	0.32		0.38		0.24	

The estimated model is given by equation (16). CRISIS is a dummy variable that is 1 in the years 2008 and 2009 and 0 in all other years. NC is the non-crisis dummy. It takes on the value of 0 in 2008 and 2009 and 1 in all other years of the sample period. The model allows for fixed effects across banks realized by orthogonal deviations. It is estimated using difference GMM, 2-step estimator, White period robust standard errors. ***, ** and * indicate statistical significance on the 1%, 5% and 10% level respectively.

Table 8.23: Baseline results for Spain

This picture is confirmed by specifications VII and VIII. When the deposit overhang variables are integrated in the equations, "plain" deposits remain significant during the crisis and the parameters are higher than the non-crisis ones. The coefficients for the overhang variables are also positive and significant at least at the five per cent level and are higher during the crisis than at normal times. This further underlines the importance not only of deposits, but also of a deposit overhang for Spain during the crisis (hypotheses H8 and H9).

SPAIN	(IV) Capital surplus		(V) Capital surplus and time-fixed effects		(VI) Deposit overhang		(VII) Deposit overhang and time-fixed effects	
Dependent variable: ΔLOG(LOANS)	Coeff.	Std. Error	Coeff.	Std. Error	Coeff.	Std. Error	Coeff.	Std. Error
ΔLOG(LOANS(-1))	0.08	(0.08)	0.03	(0.10)	0.24 ***	(0.07)	0.39 **	(0.17)
CAP(-1)*NC	0.24	(0.69)	0.78	(1.72)	1.06 *	(0.55)	1.00	(0.65)
CAP(-1)*CRISIS	0.69	(0.93)	1.06	(2.07)	1.65 **	(0.69)	1.65 **	(0.64)
CAPSUR(-1)*NC	0.12 **	(0.06)	0.02	(0.05)				
CAPSUR(-1)*CRISIS	0.18 **	(0.08)	0.08	(0.08)				
SIZE(-1)*NC	0.03	(0.06)	0.07	(0.08)	0.10	(0.07)	0.25 ***	(0.09)
SIZE(-1)*CRISIS	0.01	(0.07)	0.10	(0.08)	0.10	(0.07)	0.26 ***	(0.09)
DEP(-1)*NC	0.34 **	(0.17)	0.26	(0.25)	0.07	(0.23)	0.26	(0.33)
DEP(-1)*CRISIS	0.81 **	(0.37)	0.61 **	(0.30)	0.60 *	(0.33)	0.60 **	(0.26)
OVERHANG(-1)*NC					0.17 **	(0.08)	0.50 ***	(0.13)
OVERHANG(-1)*CRISIS					0.22 ***	(0.08)	0.55 ***	(0.13)
LIQ(-1)*EURIBOR*NC	0.40 **	(0.18)	0.22 **	(0.10)	0.45 *	(0.25)	0.42 ***	(0.14)
LIQ(-1)*EURIBOR*CRISIS	0.63 *	(0.37)	0.45	(0.38)	0.60 *	(0.33)	0.56 **	(0.27)
STF(-1)*NC	0.42 *	(0.23)	0.31	(0.35)	0.39 ***	(0.13)	0.30	(0.21)
STF(-1)*CRISIS	0.19	(0.15)	0.18 *	(0.10)	0.16	(0.15)	0.13	(0.10)
NII(-1)*NC	0.32 **	(0.15)	0.45 **	(0.20)	0.20	(0.18)	0.29	(0.18)
NII(-1)*CRISIS	0.10 **	(0.05)	0.09	(0.15)	0.02	(0.12)	0.01	(0.15)
ΔLOG(GDP)	1.83 ***	(0.50)	1.73 **	(0.78)	0.31	(0.54)	1.90 **	(0.76)
EURIBOR	-0.01 **	(0.01)	-0.02	(0.03)	0.00	(0.00)	0.00	(0.01)
EURIBOR_OIS								
GDP_DEFLATOR	-0.01 **	(0.00)	0.02	(0.02)	0.05 ***	(0.01)	0.00	(0.01)
Δ(NSM)	-1.11 ***	(0.40)	0.63	(1.76)	-0.38 *	(0.22)	0.18	(0.29)
CRISIS	-0.05 **	(0.02)			0.02	(0.02)		
Time dummies:	NO		YES		NO		YES	
Sample period (adjusted):	2001-2011		2001-2011		2001-2011		2001-2011	
Cross-sections included:	74		74		74		74	
Total (unbalanced) obs.:	222		222		222		222	
Instrument rank:	44		46		44		47	
Sargan test (p-value):	0.41		0.45		0.54		0.23	

The estimated model is given by equation (16). CRISIS is a dummy variable that is 1 in the years 2008 and 2009 and 0 in all other years. NC is the non-crisis dummy. It takes on the value of 0 in 2008 and 2009 and 1 in all other years of the sample period. The model allows for fixed effects across banks realized by orthogonal deviations. It is estimated using difference GMM, 2-step estimator, White period robust standard errors. ***, ** and * indicate statistical significance on the 1%, 5% and 10% level respectively.

Table 8.24: Capital surplus and deposit overhang results for Spain

The estimates for a capital surplus produce somewhat mixed results. All parameters are positive as expected. In the presence of time fixed effects, however, they lose their significance and are a little smaller in absolute terms. On the basis of this observation, hypothesis H1 still receives support.

To sum up the results for Spain: It must be noted that the deposit-related and deposit overhang-related hypotheses are most strongly reflected in the data. Strong support is given to the hypothesis that capital is more important during a crisis than at normal times. The anticipated impacts of a capital surplus relative to a bank-specific target,

the share of short-term funding and non-interest income are only weakly backed up by the sample. Size does not seem to be important to Spanish banks during the crisis.

8.2.6. Discussion of inter-country differences and differences between countries and the euro area

Having examined the results for the individual countries, it makes sense to put them in a broader context. The differences between the individual countries themselves and between the countries and the euro area as a whole are therefore discussed in this section.

Generally speaking, most of the patterns seen for the euro area sample are also present in the individual country samples. However, the few notable exceptions are worth highlighting: They are not merely identified in this section, but are also attributed to differences in the countries' economic situations and the institutional setups of the various financial systems. In this respect, this section has an explorative character.

To facilitate comparison, the results of the three specification with time fixed effects (specifications III, V and VII) are reproduced in the appendix, juxtaposing the four countries in tabular form. Another summary of the results is given in figure 8.6 in the following section.

One general reason for the differences between the results for the euro area as a whole and the individual countries and for the different behavior of important variables might be that it is harder to properly filter out demand effects at the country level. Significant elements of the demand companies face in euro area countries are driven not only by domestic factors. Rather, they also receive demand from many other European countries (and other countries around the world). For this reason, focusing only on domestic demand-related variables may be a too narrow approach to capture all the factors that drive loan demand in a given country.[141] This possibility cannot be ruled out entirely.

[141] One could be tempted to propose testing the inclusion of the euro area GDP variable in addition or as a substitute to the domestic GDP variables in order to capture broader demand factors. Unreported results, however, suggest that this does not improve the estimates.

A further general reason could be the size of the (sub)samples. Especially in the case of Spain, the number of results that are not statistically significant may be due to the relatively low number of cross-sections and observations included in the sample. In connection with lower average coverage in terms of observations per bank included in the sample, this may not allow for sufficient variation in the data. To some extent, this also applies to the Italian sample, for which coverage per bank is also relatively low. The difference to Spain is that the overall number of observations is much higher.

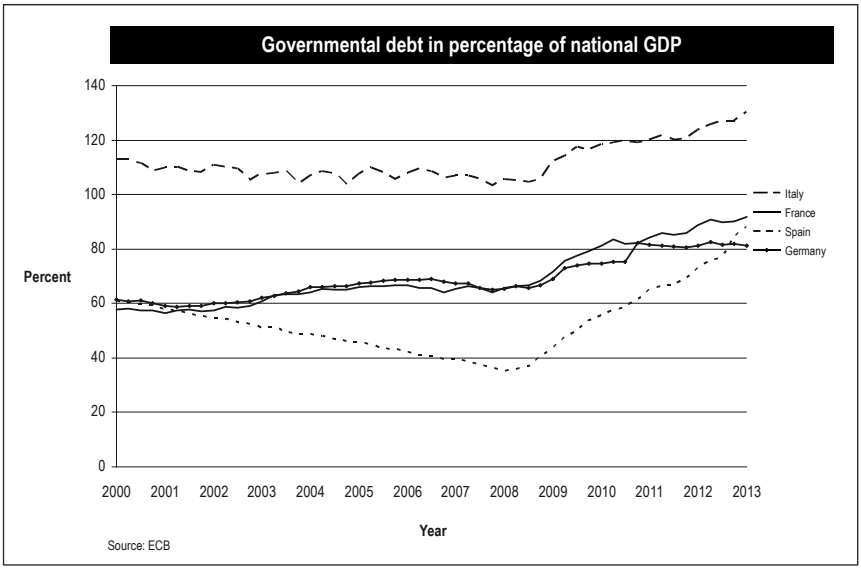


Figure 8.4: Government debt as a percentage of national GDP

One interesting observation is that in Italy and Spain deposits seem to be more relevant to banks' lending response than in other countries. Another is that the absolute values on deposits are consistently higher in the two countries. The cause of this peculiarity can probably be found in the fact that the level of government debt in Italy has been consistently higher during the entire sample period than in the other countries in the crisis years, as shown in figure 8.4. In Spain, it was the public deficit that grew more rapidly compared to the other countries (figure 8.5). The imbalances in public accounts and the dwindling creditworthiness of these states may also have negatively impacted domestic banks' ability to raise uninsured funding on the

wholesale funding markets, since domestic banks are the most important providers of public debt. Consequently, the availability of deposits gained importance to the extent that access to uninsured sources of funding became more difficult.

Interestingly, the same effect is also observable for the deposit overhang. For both countries, Italy and Spain, the absolute values are higher than for the other countries and for the euro area sample; the results are also statistically significant. This can be taken as further evidence of the increased economic significance of deposits in the two countries, especially during a crisis.

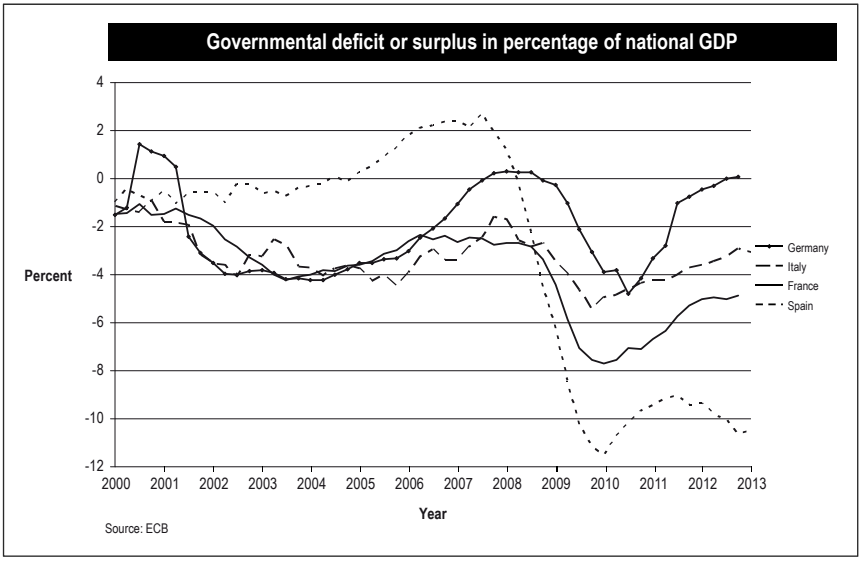


Figure 8.5: Government deficit or surplus as a percentage of national GDP

The same type of consideration may be responsible for the observation that "pure" capital, measured in terms of the magnitude of absolute values, is more important in Spain and Italy. These values are higher than in other countries and in the euro area, not only but especially so in the crisis. As a result, providers of uninsured funding perceive that substantial holdings of public debt add risk to a bank's portfolio – a factor that banks try to outweigh by higher equity capital ratios.

In the case of Spain, the situation was exacerbated by the overvaluation of house prices and the crash of the Spanish real estate market during the crisis (see Barrel and Davis (2008), for example). An explanation consistent with the results of the

estimations is that these economically harmful developments may to some extent have been anticipated by informed market participants. In this was the case, they may have provided funds only on condition of an ample capital endowment in order to cover possible futures losses.

Taken together, these considerations lead to the conjecture that this Spanish singularity among the analyzed countries led to a structural shift in the importance of capital during the crisis, an assertion reflected in the higher absolute values for the coefficients of the capital variable.

Furthermore, this factor could also have overshadowed the impact of size on lending in Spain. Compared to the euro area sample and to the other countries, the size of a bank seems to be generally less important (apart from Italy).

A further observation concerns the impact of the share of short-term funding during the crisis. As pointed out above, a higher-than-average share of short-term funding is usually associated with a relatively pronounced maturity mismatch. During a crisis, this can be particularly disadvantageous to banks when it becomes harder to raise the necessary amounts of uninsured funding on dysfunctional funding markets in order to maintain the loan portfolio. For Italy, however, the estimated coefficients are lower (in absolute terms) than for the euro area as a whole, as well as being lower than in most of the other countries.[142] Furthermore, the difference between the crisis impact and the non-crisis impact is smaller compared to other countries. How can this be? The solution is probably given by a characteristic of the Italian financial system: Traditionally, as reported by Ehrmann et al. (2003) (and originally by Borio (1996)), the proportion of short-term loans is high in Italy.[143] This means that even when it is not easy to borrow on the wholesale funding markets, Italian banks are not impacted as severely as banks in other countries because, *due to shorter maturities*, it is easier to adjust their lending portfolios downward until they match the amount of funding available at acceptable rates. Hence, the low economic significance of short-term funding in the crisis for Italian banks may not be overly surprising against the background of this country's maturity structure for bank loans.

[142] The only exception is Germany for which the estimated coefficients are similarly low.

[143] According to Ehrmann et al. (2003) this is different for Germany, France and Spain.

8.3. Conclusion – Main research hypotheses confirmed

Before discussing all the implications of the results in the next chapter, this section provides a concise summary of the results. It briefly outlines whether the hypotheses geared to the euro area as a whole and to the four major euro area countries are verified on the basis of the empirical analysis.

	Hypotheses	Verified for euro area sample	Verified for country samples			
			Germany	Italy	France	Spain
H1	A shortfall in capital relative to a targeted ratio leads to a reduction of the loan portfolio	++	+++	++	+++	+
H2	For banks that do not face a deposit overhang, lending depends on		n.a.			
	> H2a: The share of uninsured short-term funding	++				
	> H2b: The share of non-interest income	+				
	> H2c: The share of securities that must be marked to market	n.a.				
H3	During a crisis, the capital ratio has a more positive impact on lending than it does at normal times	+	+++	–	–	++
H4	During a crisis, the impact of a pronounced maturity mismatch (evidenced by a large proportion of short-term funding) on lending is lower (in terms of the value of the coefficient) compared to normal times	+	++	+	+	+
H5	During a crisis, the impact of a large proportion of non-interest income on lending is lower (in terms of the value of the coefficient) compared to normal times	++	+	++	+	+
H6	During a crisis, the size of a bank has a more positive impact on lending than it does at normal times	++	+	–	+	–
H7	During a crisis, the impact of a large proportion of marked-to-market securities on lending is lower (in terms of the value of the coefficient) compared to normal times	–	n.a.			
H8	During a crisis, a large proportion of deposit funding has a positive impact on lending	++	+	++	–	+++
H9	During a crisis, a deposit overhang has a positive impact on lending	++	+++	++	+++	+++

+++ Hypothesis very strongly supported
++ Hypothesis strongly supported
+ Hypothesis weakly supported
– Hypothesis not supported
n.a. Hypothesis not tested / no indication possible

Figure 8.6: Summary of the results of the hypothesis test

Figure 8.6 provides a graphical overview of the results. Each hypothesis is assessed for the euro area and for each of the four individual countries on basis of the sign of the coefficients measured against the expected sign and the statistical significance. In case of each hypothesis, the strength of validation is indicated by the number of plus signs, where three plus signs stand for very strong evidence, two plus signs stand for strong evidence and one plus sign stands for weak evidence. Whenever a hypothesis is not supported by the data, this indicated by a minus sign.

The assessment of the degree of support that the hypotheses receive (and the assignment of plus signs or minus signs in figure 8.6 respectively) is not limited to the results of the standard specifications or specifications used within the context of the baseline analyses. In fact, the results of *all* estimated specifications are taken into account. In case of the euro area sample results of 14 estimated specifications are included in the assessment. In case of the individual country samples results of seven estimated specifications are accounted for.[144]

For the euro area, only hypotheses H2c and H7, both of which involve the share of securities that have to be marked to market (*AFS*), are either not verified or not tested due to data issues. All other hypotheses are supported or strongly supported by the results of the estimates. This includes, in particular, the role of a surplus or shortfall relative to a bank-specific, self-imposed target – a concept that has not been studied in the context of bank lending in the euro area so far. The surplus or shortfall has an impact on the loan supply, irrespective of the economic circumstances (normality or crisis).

The hypotheses that test whether certain characteristics have a different impact on lending in the crisis compared to normal periods, hypotheses H3 to H6 and H8 to H9 can be validated on basis of the estimations. The claim that there is a difference under crisis conditions is thus generally supported for the recent crisis. Among these characteristics are the capitalization of a bank, the share of short-term funding, the share of non-interest income, the size of a bank, the share of deposit funding and the fact of whether or not a bank has an overhang in deposits (over the amount of loans).

Compared with the euro area, the overall picture in the individual countries is quite similar. As figure 8.6 shows, all hypotheses are (at least weakly) supported for the four countries analyzed individually, except from H3 and H6. The collective evidence for H5 for the German sample is a borderline case.[145] The support is particularly strong for hypotheses H1 and H9, capital surplus and deposit overhang. For most hypotheses there are only subtle differences across countries. Where bigger

[144] See figure 8.1 for an overview of all tested specifications for the euro area sample as well for the individual country samples.

[145] Despite missing significance of the coefficients on defined levels in most cases the crisis coefficient is consistently lower. Based on this, the assessment "weakly supported" seems to be just warrantable.

differences exist between the countries, this has been discussed in the previous section.

This summary concludes the empirical part of the study and opens the way for the final discussion.

9. Final discussion and implications

9.1. Overall summary of results

The results of this study imply that the economic significance of certain bank characteristics in determining the loan supply changed during the recent crisis. Some characteristics that are less important at normal times gained economic significance during the crisis, while the impact of other characteristics on lending was amplified or even reversed.

Figure 4.4 and figure 6.2 provide a framework within which the relevance of certain bank characteristics can be identified. It was developed by referring to literature on the bank lending channel and to the theoretical foundations of the loss spiral and the liquidity spiral. It has been adapted to the bank-centric view of this study. Rigorous reference to a theoretical framework provides the basis on which the exact effect of the analyzed bank characteristics on lending has been determined empirically. Consideration of the crisis period in this context means that this study is, to date, one of the few that explicitly deals with the determinants of lending during the crisis in the euro area, thereby contributing to the understanding of the impact and its implications.

The detailed findings of this study for the euro area and for most of the four individual countries are as follows:[146] As discussed in detail above, almost all financial institutions target a certain level of equity capital which they judge to be adequate for a number of reasons. One finding of this study is that a downward deviation from these self-chosen capital targets has a negative effect on the supply of loans (cf. hypothesis H1). Its quantitative importance does not depend on whether a target is missed at normal times or during a crisis. The explanation for this behavior is that falling short of the self-chosen target implies a capital constraint, in which case a bank is reluctant to expand its lending and will instead constrain the granting of credit. The concept of a bank-specific capital target and its use in the context of bank lending in the euro area is a novelty in the relevant literature landscape.

[146] The results for the four countries (Germany, Italy, Spain and France) analyzed individually differ only slightly from those for the euro area as a whole, as shown in figure 8.6.

H. Brinkmeyer, *Drivers of Bank Lending,* Schriften zum europäischen Management,
DOI 10.1007/978-3-658-07175-2_9, © Springer Fachmedien Wiesbaden 2015

Banks that need to avail themselves of (uninsured) wholesale funding – a need indicated by the fact that they have no overhang in deposits – generally (i.e. irrespective of the economic situation) find that their lending is impacted significantly and negatively by their volume of short-term funding (cf. hypothesis H2a). The likely reason is that a large proportion of short-term funding is perceived by providers of uninsured market funding as a sign of a greater risk, because a larger share of short-term funding is accompanied by a greater maturity mismatch. A maturity mismatch becomes a pressing problem when wholesale funding markets dry out and when the yield curve is inverted.

A generally heightened perceived riskiness from providers' of uninsured funding point of view is also likely to be responsible for the significant and negative impact on credit granting of a higher-than-average share of non-interest income for those banks that do not have an overhang in deposits (cf. hypothesis H2b). The business that generates non-interest income is more vulnerable to variations relating to the business cycle. In an economic downturn, this leads to a steeper decline in income compared to banks with a more stable business model. By consequence, investors demand a higher risk premium, which banks pass on in the form of higher lending rates. This upward shift in the supply curve for bank loans in turn leads to a reduced growth of the loan portfolio.

One main objective of this study is a better understanding of the recent crisis and how and in what ways it affected bank lending. Only a very small number of studies on this issue have been published to date. Hence, the results of empirical analyses that focus on the crisis period are all the more valuable and can be summarized as follows: A higher-than-average capital ratio has a more positive impact on lending during a crisis than at normal times (cf. hypothesis H3). According to the theoretical foundation for the loss spiral and the margin spiral, the adverse consequences of these two mechanisms are aggravated by high leverage. A higher capital ratio thus has the ability to cushion this effect at least to some extent. It is clear that more capital does not only provide buffer against losses stemming from these two effects but also against losses resulting from other events. Accordingly, higher capital ratios have the quality to generally increase the confidence in an institution which is all the more important during a crisis ("flight to quality").

The issue of the share of short-term funding, which is an indication for a maturity mismatch, is exacerbated during a crisis when the associated risk materializes (cf. hypothesis H4): When investors withdraw their funds and funding markets begin to dry out, rolling over short-term debt becomes much more difficult. This increases the risk that a bank may need to liquidate long-term assets at short notice and on unfavorable terms. In such a situation, it is very difficult to expand lending.

A related mechanism is likely to be responsible for the negative impact in relative terms of a higher-than-average share of non-interest income during the crisis as opposed to at normal times (cf. hypothesis H5): The greater vulnerability of non-interest income generating business is no longer a "theoretical" risk, but consequences – in the form of income losses – become real and apparent. The banks hit by the resultant income losses are forced to pay higher risk premiums on wholesale funding markets, which they then pass on to their borrowers. This results in a slower growth of the loan portfolio compared to banks with a higher share of more stable interest income.

During the crisis, larger banks, measured in terms of total assets, reduced their loan portfolio to a lesser extent (cf. hypothesis H6). In accordance with the theoretical framework, the likely cause is that bigger banks generally have more advanced controlling and reporting procedures in place. For providers of uninsured funding, this results in a greater degree of transparency. In addition, a bank's size is likely to be correlated with the degree of diversification of income sources and professionalism (with regard to management capacity and process quality, for example). This should contribute to a lower risk and a higher probability that the bank can repay borrowed funds. Both factors are especially important during a crisis, when investment decisions are all the more challenging. Accordingly, the lower risk premium demanded by investors allows a bank to borrow at lower interest rates. Logically, the bank can then lend money on more attractive terms to their clients and will also have a bigger loan portfolio.

A higher-than-average share of deposits has a positive impact on the loan portfolio (cf. hypothesis H8). The explanation for this is simply that good access to insured deposits as a source of funding makes it less necessary to resort to borrowing on wholesale funding markets which lowers overall funding costs. As a consequence,

the overall funding costs of a bank are lower, so the bank can lend money at lower rates. This in turn leads to a bigger loan portfolio.

In addition, a very much similar logic applies to banks that have an overhang in deposits over the amount of loans (cf. hypothesis H9). The deposit overhang acts as a proxy for the point from which independence of wholesale funding markets is theoretically possible.[147] It is therefore a more accentuated measure than "pure" deposits. The results suggest that the overhang dominates the effect of "pure" deposits to some extent which hints at the notion that independence of uninsured funding is better captured by the deposit overhang.

The question of what overriding theoretical contribution and practical implications these results imply is addressed in the following sections.

9.2. Theoretical contributions

The contribution that these results make to literature, especially with regard to the role of the bank characteristics at normal times and in times of crisis, have already been discussed in the context of the results of the empirical analysis. This section therefore summarizes the main contributions and distinguishes between those that concern the role of bank characteristics and those that relate to literature on the bank lending channel.

9.2.1. Contributions to research regarding the determinants of bank lending

One important finding concerns the setting of bank-specific capital targets and the consequences of missing or overshooting these self-imposed thresholds. The idea of bank-specific capital targets is rooted in a connection between two different research streams.

The first stream deals with the capital structures of non-financial firms and builds on the work of Flannery and Rangan (2006), who finds that non-financial firms target capital ratios to which they partially adjust if they are missed, and the study by Lemmon et al. (2008), who add that, besides the explanatory power of certain firm

[147] Even if an overhang does not mean that a bank needs no wholesale funding at all – apart from loans, there are other assets that also have to be funded – the necessary amount should, nevertheless be significantly reduced.

characteristics, the bulk of the variation in non-financial firms' leverage ratios can be explained by time-invariant fixed effects.

The second stream addresses target capital ratios for banks, albeit in the form of minimum capital ratios with reference to a *regulatory* capital requirement. Hancock and Wilcox (1994) and Hancock and Wilcox (1998) use capital shortfall or surplus variables measured relative to regulatory – not self-chosen – standards.

In connecting these two streams, Gropp and Heider (2010) find that, like non-financial corporations, banks too target individual capital ratios. These can be explained by bank-specific fixed effects and by the variation in certain bank characteristics. Along the same lines, Berrospide and Edge (2010) and Francis and Osborne (2009) model bank target capital ratios for the US and the UK respectively.

For the euro area and context of bank lending, however, this has not yet been done. In this respect, using the concept of a capital shortfall relative to a bank-specific target and finding that this has an impact on a bank's credit growth allows this study to contribute to the related body of literature. In addition, the result can be interpreted as general confirmation of the notion that banks target individual capital ratios that are usually well above regulatory minimum rates.

Another important strand of findings in this study is related to the impact of certain bank characteristics especially during the recent banking crisis as opposed to normal times. To date, only the work of Gambacorta and Marques-Ibanez (2011) is remotely comparable although it is not exclusively geared to the euro area but to banks from a broader set of European countries, the UK and the US.[148] Without repeating the detailed overall summary of results given in the previous section, many of the effects found by Gambacorta and Marques-Ibanez are confirmed by this study, while others – such as the impact of a deposit overhang on lending – are put forward for the first time in the present study.

In addition, this study contributes to literature by separately analyzing the four biggest euro area countries, namely Germany, Italy, France and Spain. As demonstrated above, subtle differences exist with respect to the effect of some bank characteristics

[148] Other euro area studies that deal with bank lending in the crisis context either have a narrowed geographical scope (e.g. Albertazzi and Marchetti (2010) or Bonaccorsi di Patti and Sette (2012) analyze the situation in Italy only) or a different topical focus (e.g. Brei et al. (2013) concentrate on the effect of rescue packages on bank lending.

on lending during the crisis. These differences can be attributed to the specific economic situations in these countries during the crisis, or to the respective institutional contexts.

A further contribution with respect to possible ways in which a bank's capitalization can be measured is that the difference between the tested options is only marginal. Given the strong correlation, it is not surprising that the results are very similar irrespective of whether total equity or tangible common equity is used. Subject to certain limitations, this also applies to the Tier 1 capital ratio: Since the available time series on the Tier 1 ratio is limited because it is a relatively new concept, it was not possible to test this matter exhaustively in the empirical analyses. However, strong correlation to the two other capital measures suggests that the difference in the overall results is, again, not substantial.

9.2.2. Contributions to bank lending channel-related research

9.2.2.1. General contributions

In addition to the analysis of the impact of certain bank characteristics on bank lending, which is the focus of this study, it also contributes to literature relating to the bank lending channel, from which important aspects of the theoretical background have been derived.

In chapter 4, the traditional theoretical justification for a bank lending channel is reconsidered in light of developments regarding the integration of financial markets and the importance of financial innovation. According to the traditional view, the central bank exerts control over the volume and terms of available reserves by changing key interest rates. In so doing, it affects the creation of deposits and, at the same time, banks' ability to grant loans. This view has been criticized for not adequately reflecting modern central banks' operational framework and for omitting the importance of wholesale funding markets as the marginal funding source today: The ECB, for example, supplies *any* amount of reserves demanded by the banking system, not just some amount that the ECB itself determines in advance. It follows that the direction of causality between reserves and bank lending has not been established correctly.

Instead, according to the new view on the bank lending channel, the ECB changes key interest rates in order to affect the terms and availability of uninsured forms of funding, which have evolved into an economically significant pillar of banks' funding strategies. In this way, the ECB impacts the overall funding costs/terms for banks, which are then reflected in banks' own lending rates and the growth of their credit portfolio.

Having already been put forward by Disyatat (2011), these considerations are consolidated in this study and brought into a single framework that, to date, has never been explicitly expressed. This framework, captured in figure 4.4 and figure 6.2, may not be complete and will probably be extended in future. However, it provides a benchmark framework into which bank characteristics that have not yet been considered can be integrated. It connects the volume of required funding and its cost to the other conditions that must be met in order for the bank lending channel to exist.

As this study has proven, the underlying framework is valid and applicable even in the context of a crisis.

9.2.2.2. Monetary policy indicator

A further contribution this study makes with respect to literature on the bank lending channel concerns the way in which the monetary policy indicator is modeled. The general aim is to find a representation for the impact that monetary policy measures have on bank lending (monetary policy stance). The most widespread and best-established approach is to use the Eonia or the 3-month Euribor rate. The results confirm the adequacy of these two measures.

Mindful of the turbulence on interbank markets during the recent crisis, which raised questions about the significance of the Eonia or Euribor for this period, a novel approach has been adopted: Its main element is the use of the Euribor-OIS spread. As explained in section 7.4.1, the approach focuses on reflecting the risk that is involved when banks lend to other banks. It should therefore be a very important measure for banks' credit supply without being blurred by the turbulence on financial markets. A second element of the novel approach is the inclusion of a measure that captures the non-standard monetary policy measures adopted by the ECB during the crisis, as suggested by Gambacorta and Marques-Ibanez (2011). The non-standard measures have also been of relevance to the supply of loans, because they helped

overcome the shortage in central bank reserves that was caused by the dysfunction of interbank markets. The non-standard measures are represented by the ECB's assets as a share of nominal GDP.

The results show that both measures are relevant to the explanation of banks' loan supply. Accordingly, this study contributes by proposing the Euribor-OIS spread as a novel and theoretically sound concept that has proven to work well in practice. Moreover, the significance of the use of non-standard measures and its positive impact on lending is confirmed.

9.2.2.3. Disentanglement of loan supply and loan demand

One important issue in the context of bank lending – and a major empirical challenge when trying to identify the impact of bank characteristics on lending – is the disentanglement of supply and demand factors. Theoretically, an observed change in the volume of loans recorded on banks' balance sheets could be attributed to shifts in either the loan supply or demand for loans. This problem occurs whenever changes in demand factors coincide with changes in the bank characteristics that are postulated to affect the supply of loans. As outlined in section 7.4.3.1, the correlation between loan demand and the factors that have an impact on the supply of loans works through two main patterns that are linked to business cycle fluctuations.

In this study, two main approaches are made to address this issue: Following the majority of related studies, the first approach consists of a combination of GDP and the GDP deflator as the variable that captures inflation. Furthermore, all major specifications are also tested using time fixed effects in addition. The use of time fixed effects involves the use of time dummies for each year of the sample period and helps to capture demand effects that might not have been accounted for with the GDP and inflation variables. However, as the results show, the difference between the estimates with and without time fixed effects is relatively small. This holds for the euro area sample as well as for the country subsamples. Taken together, this is a strong indication that loan demand effects are already well captured by the combination of GDP and inflation.

The second approach involves using the results of the euro area bank lending survey, in the course of which senior loan officers at selected euro area banks are, for example, asked about past and expected future developments in loan demand. In

theory, this is a very sound concept, because it gathers information directly at the point where demand for loans should be most apparent: at the banks themselves. Unfortunately, however, in practice the use of a variable based on the answers to the lending survey does not work well: The sign for the lending survey variable is not as expected, and the results are generally unsatisfactory.

As discussed above, a combination of reasons may be responsible for this finding. First, the ECB carried out the bank lending survey for the first time in 2003. This leads to a loss of observations that might in some way negatively impact the results, although an obvious rationale is not easy to establish. Second, the set of 90 participating banks might not be large enough to draw a representative picture of loan demand for the entire euro area. Third, the fact that the composition of the euro area has changed might induce a small bias, because the countries from which the surveyed loan officers originate are not exactly the same countries that are part of the sample. Fourth, it could be the case that the loan officers' answers tend to exhibit procyclical behavior. In "good" times, for example, slightly favorable developments may already be overstated as a sign of an upcoming boom. This could lead to overly optimistic answers compared to actual loan demand. Fifth, the lending survey is carried out on a quarterly basis and the answers distinguish between the different customer groups that demand loans (i.e. enterprise loans, consumer credit and housing loans). The construction of a single lending survey variable thus requires some form of data compilation to make it applicable and to match it to the annual structure of the data. It is possible that there is a superior compilation procedure, although different approaches have been made and tested, each with unsatisfactory results.

Taking everything into account, the conclusion, in confirmation of the approach adopted by the majority of related studies, is that using a combination of GDP and inflation together with time fixed effects works well in capturing demand for loans. Moreover, although theoretically sound, the use of a variable based on the euro area bank lending survey does not work well in practice.

9.3. Implications for bank management

The findings of this dissertation have several implications for the management of banks. Since the lending business is banks' strongest pillar overall and the most

reliable source of income for banks, having an understanding of the factors that determine it is an important piece of knowledge. In particular with regard to the recent crisis, some aspects that have not been accounted for in the past are worth considering.

The first aspect is the share of uninsured short-term funding in the overall funding mix. Broad access to wholesale funding markets may look attractive at first sight. In fact, however, banks with a large proportion of short-term funding run a higher business risk, because this practice is associated with maturity mismatches. The greater the mismatch between maturities on the asset and liabilities sides, the greater the risk premium that investors demand – especially in a crisis. This is because investors anticipate the higher risk that a bank may be unable to roll over its debt when turbulence hits the funding markets, causing them to tend to dry out. In the worst case, a bank might not only be forced to constrain its lending but also to sell assets under fire-sale conditions at prices considerably below their book value. This could lead to a situation in which a bank finds itself plunged into the loss and the margin spiral. The bottom line is that a bank is well advised not to "play the yield curve" too hard, and to be aware of the risks that such a business model entails.[149]

This leads to another funding-related implication of the results: Good access to insured retail deposits turned out to be most valuable during the crisis. Banks that have a large share of deposit funding might look "boring", like many savings and cooperative banks. Nevertheless, this kind of bank managed to master the crisis better than other banks for which higher lending growth was a clear sign. On this basis, bank managers should consider strengthening the acquisition of retail deposits, because this is cheap on the one hand and helps a bank to avoid being hit too hard by adverse developments on the wholesale funding markets in a crisis on the other hand.

In addition, a large share of non-interest income has turned out to negatively impact the credit supply of a bank. While it seems attractive to tap non-interest related sources of income because no capital is required for this kind of business, which

[149] German bank Hypo Real Estate provides a striking example – in a negative sense – of the risks inherent in a business model based on the transformation of maturities (see Dettmer and Weiland (2009) and Siemers (2009)): After it was bailed out in October 2008, the bank was completely taken over by the German Financial Markets Stabilisation Fund (SoFFin) in April 2009.

strengthens the profitability of an institution under normal business circumstances, this practice had a negative effect during the crisis. Because these income sources are more prone to business cycle fluctuations and because non-interest income declined significantly, investors that lent funds to these banks demanded a higher risk premium. This results in higher interest rates for the banks' borrowers and, consequently, less credit growth. What is more, it usually causes high expenses for personnel and materials (especially IT expenses) to serve the business that generates non-interest income. When this business declines, capacity is left unused, leaving banks with a hefty cost block that is hard to reduce quickly. Bank managers should therefore carefully rethink the balance between interest and non-interest income, even if some consultants never tire of advising them to go for a larger share of the latter.

The observation that size has a positive impact on the loan portfolio does not necessarily equate with a call for internal or external growth. A more general interpretation, according to which size is a proxy for transparency and business risk, is needed: The more transparent a bank's controlling and reporting procedures are the more "trust" investors will place in a bank and the lower the risk premium they will demand by way of compensation. The implication for bank managers is therefore that investors should explicitly be targeted with company communication to give them as transparent a picture as possible. A similar logic applies to the size of a bank as a proxy for the degree of income sources and professionalism (e.g. regarding process quality handling of risk management etc.). The higher the degree of diversification, the better the quality of processes and the better staff is trained the more positive should this impact the risk perception of a bank from an investor's point of view. Bank managers should therefore evaluate room for improvement particularly in these areas. This is especially important against the background of a crisis.

Last but not least, one probably obvious piece of advice is for a bank to strengthen its equity capital ratio in order to support its lending business. More capital has a positive effect both outside of a crisis and during a crisis, with a slightly stronger effect in the latter case. Due to the design of the empirical analysis, this is clearly the impact that capital has on lending, and not the effect that more lending requires more

capital.[150] Higher capital ratios send a signal to investors that the problem of moral hazard and asymmetric information is reduced. They also serve as a buffer against losses. This is positively reflected in the risk premium that investors demand.

9.4. Implications for monetary policymakers

This study does not have implications only for the management of banks, but also for monetary policymakers. Although references to monetary policy are not the focus of the empirical analyses, two main points are worth mentioning.

The first regards the non-standard measures taken by the ECB during the recent financial crisis. In light of the risk that some banks could lose their access to the interbank markets – which would have resulted in substantially higher rates for these banks and generally higher money market rates – the ECB responded in particular by providing an unlimited supply of central bank money at a fixed rate ("full-allotment" policy), and by expanding the scope of securities that are accepted as collateral. If the risks had materialized during a protracted period and the ECB had not done anything about it, this would not only have impaired the efficiency of monetary policy (by muting the bank lending channel), but would also have had serious negative consequences for the ability of banks to grant credit, not to mention the effects for the real economy.

As the results of the empirical analysis show, the ECB's non-standard measures had a positive impact on bank lending and were effective in countering the threats stemming in particular from distortions in the interbank market. The implication for monetary policymakers is thus that, in a comparable situation in future, it seems likely that these measures would again be successful.

The second implication concerns the importance of non-bank financial intermediaries and their possible consequences for the effectiveness of monetary policy. In particular, it has been argued that the importance of the bank lending channel may have been eroded by the emergence and substantial growth of non-bank financial

[150] See 7.5 for the respective details on the estimation method. The endogeneity issue not only of capital but also of other variables is addressed by using lagged values of the explanatory variables in all estimations and by the employment of the GMM methodology that involves an instrumental variable procedure.

intermediaries. These thoughts have, at least, been suggested by Kashyap and Stein (1994) and Ashcraft (2006). Such a view relies very much on the "traditional view" of the bank lending channel, according to which the central bank influences lending by exercising control over the terms and availability of reserves. Non-bank financial intermediaries do not resort to insured retail deposits at all and are not part of reserve requirements schemes. Apparently, however, they have gained importance in terms of their capacity to provide non-bank credit and in terms of total assets. This has led some scholars to conclude that the influence of monetary policy on the real economy via banks has declined.

Although this contention is not tested empirically in the current study, the theoretical framework provided in the context of the "new view" of the bank lending channel strongly indicates that this conclusion is premature. The new view focuses on wholesale funding, which has taken the place of insured retail deposits as a main funding source. There is hardly any reason to believe that the mechanism according to which monetary policy can affect the terms on which wholesale funding is available should not also apply to non-bank financial intermediaries. Non-banks too have to raise funds on the funding markets, and the cost depends on their overall financial condition, their riskiness as perceived by investors, and so on. These costs will then be passed on to borrowers. Ultimately, there is good reason to assume that the theoretical framework outlined in section 4.2 is helpful in explaining how funding costs are determined not only for banks, but also for non-bank financial intermediaries.

For monetary policymakers, the implication is that the bank lending channel has not lost its significance. On the contrary, the likely applicability of the theoretical framework to also non-banks may actually have increased its significance.

9.5. Implications for the discussion of banking supervision

Although the present study is not geared toward contributing to the ongoing debate surrounding banking regulation and macroprudential supervision, there is one result in particular that has implications for this field. The aim of macroprudential supervision is to strengthen the robustness of the financial and banking system as a whole in its role as a provider of credit by going beyond the perspective of the

individual bank and instead considering the economy-wide effects of regulatory and supervisory measures.[151]

In this context, many instruments and tools have been proposed (see Hannoun (2010), for example). Two of the more prominent ones are limiting leverage and achieving higher capital ratios, depending to some extent on the business cycle ("counter-cyclical capital buffers)".

One important result of this study is the indication that banks expand their lending only if their capital endowment is above their self-chosen capital target. Consequently, when higher capital requirements are introduced too abruptly this might lead to the situation that banks are instantly constrained by their own capital targets. This calls for a very careful introduction of new capitalization rules because banks will only continue to grant credit as long as banks' capital endowments are sufficiently strong.

9.6. Limitations and outlook

This last section provides a summary of issues that could not be considered in this study, as well as pointing out suggestions and possible directions for future research.

One first issue regards the Bankscope database maintained by the Bureau van Dijk in cooperation with Fitch Solutions as the data source. Bankscope covers a smaller number of banks than the number claimed by the ECB.[152] However, as already noted, the studies that compare the results obtained on the basis of a sample from Bankscope with results based on a sample from national banking authorities or Eurosystem datasets report neither systematic nor substantial differences. There is therefore no reason to conclude that the choice of Bankscope data leads to any bias.

A second issue has to do with the question whether capitalization (understood as an economic concept) is adequately proxied. There are different ways to measure a bank's capital (adopting a regulatory focus, for example, or using a broader approach that also considers generally liable equity capital). Due to the fact that regulation-

[151] For a literature review on macroprudential supervision, see Galati and Moessner (2012). Bianchi and Mendoza (2011) provide a study that shows how positive externalities can emerge by adopting a macroprudential perspective.

[152] A constantly updated record of the number of monetary financial institutions is provided by the ECB online at http://sdw.ecb.europa.eu.

inspired measures such as the Tier 1 capital ratio are relatively new and that, hence, the data availability is not yet sufficient, these measures could not be compared and contrasted with the total equity or common tangible equity in the course of this study. Accordingly, the question of whether using the Tier 1 capital ratio would have made a greater difference cannot be answered.

Another measurement issue regards construction of the capital surplus variable. The use of a variable that is the result of an estimation is associated with a higher level of uncertainty concerning the accuracy of the variable. Despite the careful selection of variables that have explanatory power for the capital target, one could think of other variables that might improve this accuracy. Although using the surplus variable does not involve any conspicuously negative results, some residual doubt remains whether all banks' capital targets are estimated as accurately as possible.

A further limitation of this study is the fact that, due to the poor availability of data about securities that must be marked to market, their influence on lending could not be clarified empirically. It is hoped that more light will be shed on this issue in future as soon as enough data becomes available.

A related issue is the impact on lending of a bank's affiliation to a wider bank network. A number of studies report a difference between banks that are thus affiliated and those that are not. Unfortunately, due to the structure of the data, this information was not available for the present study.

Worthy of additional consideration could be the fact that the non-standard monetary policy measures adopted by the ECB during the crisis might not be fully captured by the ratio of the ECB's assets to total euro area GDP. There is no question that other, qualitative measures exist too, one example being the acceptance of a broader range of assets that serve as collateral. Although this places a limitation on the interpretation of the corresponding coefficient, it must be noted that the qualitative measures coincided to a large extent with the more quantitative measures. Hence, one could conclude that the non-standard measures as a whole might not be too badly proxied by the *NSM* variable.

A number of suggestions for future research emerge from this study. What has not been addressed is the impact of bank characteristics on different loan classes (e.g. mortgage loans, consumer credit and enterprise loans), as this distinction is only available when drawing on data collected via national banking authorities. Especially

for the US, a number of studies differentiate between the loan groups, e.g. Kashyap and Stein (2000), Kishan and Opiela (2000) and Kishan and Opiela (2006). However, this makes the task of disentangling loan supply and loan demand even more difficult. For example, levels of monetary interest rates that are perceived as relatively low compared to historical standards lead to a temporary boom in, say, real estate investments and the corresponding loan classes. When trying to filter this demand-side effect for certain asset classes using only broad measures of aggregate demand, the results must necessarily be weak. In addition, when the trigger for this demand-side effect (low interest rates in this example) coincides with changes in the loan supply (e.g. due to the better availability of uninsured funding), the identification problem becomes even more challenging. Altogether, analyzing the different loan classes is an interesting field for further research. The identification of a bank lending channel, though, is even more challenging and has yet to be completed satisfactorily.

A different possible avenue for further research could focus even more closely on the differences between individual countries. Probably due to the integration of Europe's financial markets, the fact that differences in the characteristics of individual euro-area countries might well cause the same bank characteristics to have a dissimilar impact on lending seems to have fallen into oblivion. Some studies, such as that of Gambacorta and Marques-Ibanez (2011), control for these factors by using country dummies. However, the present study suggests that country-specific differences can be attributed to economic particularities or to institutional circumstances in the individual countries. A more thorough understanding of the exact causes of the differences could enable better forecasts of the impact of monetary policy in the individual countries, or indeed in the euro area as a whole.

A very interesting research enterprise would be to empirically validate the notion that the significance of the bank lending channel has not been eroded by financial innovation, the integration of financial markets and the rapid growth of non-bank financial intermediaries, as has been argued above on theoretical grounds. Unfortunately, poor data availability regarding this largely unregulated aspect of the financial system still imposes limits on this kind of project.

Finally, the question whether the findings in this study regarding the *recent* crisis also apply to other historical banking crises would be worth answering in future. This might contribute to more universal recommendations for bank managers, monetary

policymakers and banking regulators/supervisors, helping them to equip themselves better for – and avoid the most damaging consequences of – the next crisis.

References

Adrian, Tobias; Shin, Hyun Song (2008a): "Financial intermediaries, financial stability, and monetary policy", Staff Reports 346, *Federal Reserve Bank of New York*.

Adrian, Tobias; Shin, Hyun Song (2008b): "Liquidity, monetary policy, and financial cycles", *Current Issues in Economics and Finance,* 14 (1), 1–7.

Adrian, Tobias; Shin, Hyun Song (2010a): "Liquidity and leverage", *Journal of Financial Intermediation,* 19 (3), 418–437.

Adrian, Tobias; Shin, Hyun Song (2010b): "The Changing Nature of Financial Intermediation and the Financial Crisis of 2007–2009", *Annual Review of Economics,* 2 (1), 603–618.

Albertazzi, Ugo; Marchetti, Domenico J. (2010): "Credit supply, flight to quality and evergreening: an analysis of bank-firm relationships after Lehman", Temi di discussione (Working papers) 756, *Banca d'Italia*.

Alper, Koray; Hülagü, Timur; Keles, Gürsu (2012): "An Empirical Study on Liquidity and Bank Lending", Working Paper 12/04, *Central Bank of the Republic of Turkey*.

Altunbas, Yener; De Bondt, Gabe; Marques-Ibanez, David (2004): "Bank capital, bank lending and monetary policy in the euro area", *Kredit und Kapital,* 37 (4), 443–464.

Altunbas, Yener; Fazylov, Otabek; Molyneux, Philip (2002): "Evidence on the bank lending channel in Europe", *Journal of Banking & Finance,* 26 (11), 2093–2110.

Altunbas, Yener; Gambacorta, Leonardo; Marques-Ibanez, David (2009): "Securitisation and the bank lending channel", *European Economic Review,* 53 (8), 996–1009.

Altunbas, Yener; Gambacorta, Leonardo; Marques-Ibanez, David (2010): "Bank risk and monetary policy", *Journal of Financial Stability,* 6 (3), 121–129.

Angeloni, Ignazio; Kashyap, Anil K.; Mojon, Benoit; Terlizzese, Daniele (2003): "Monetary Transmission in the Euro Area: Does the Interest Rate Channel Explain it All?", NBER Working Papers 9984, *National Bureau of Economic Research*.

Arellano, Manuel; Bond, Stephen (1991): "Some Tests of Specification for Panel Data", *Review of Economic Studies,* 58 (2), 277–297.

Arellano, Manuel; Bover, Olympia (1995): "Another look at the instrumental variable estimation of error-components models", *Journal of Econometrics,* 68 (1), 29–51.

Ashcraft, Adam B. (2006): "New Evidence on the Lending Channel", *Journal of Money, Credit and Banking,* 38 (3), 751–775.

Barrel, Ray; Davis, E. Philip (2008): "The Evolution of the Financial Crisis of 2007-8", National Institute Economic Review 206, *National Institute of Economic and Social Research (UK)*.

Basel Committee on Banking Supervision (October 27, 1998): *Instruments eligible for inclusion in Tier 1 capital (press release).* Basel.

Basel Committee on Banking Supervision (September 12, 2012): *Group of Governors and Heads of Supervision announces higher global minimum capital standards (press release).* Basel.

H. Brinkmeyer, *Drivers of Bank Lending,* Schriften zum europäischen Management,
DOI 10.1007/978-3-658-07175-2, © Springer Fachmedien Wiesbaden 2015

Behr, Andreas (2003): “A comparison of dynamic panel data estimators: Monte Carlo evidence and an application to the investment function”, Discussion paper 05/03, *Deutsche Bundesbank*.

Beirne, John; Dalitz, Lars; Ejsing, Jacob; Grothe, Magdalena; Manganelli, Simone; Monar, Fernando; Sahel, Benjamin; Sušec, Matjaž; Tapking, Jens; Vong, Tana (2011): “The impact of the Eurosystem's covered bond purchase programme on the primary and secondary markets”, Occasional Paper Series 122, *European Central Bank*.

Berger, Allen N.; DeYoung, Robert; Flannery, Mark J.; Lee, David; Öztekin, Özde (2008): “How Do Large Banking Organizations Manage Their Capital Ratios?”, *Journal of Financial Services Research,* 34 (2), 123–149.

Berger, Allen N.; Udell, Gregory F. (1994): “Do Risk-Based Capital Allocate Bank Credit and Cause a "Credit Crunch"' in the United States?”, *Journal of Money, Credit and Banking,* 26 (3), 585–628.

Berg, Japser; van Rixtel, Adrian; Ferrando, Annalisa; De Bondt, Gabe; Scopel, Silvia (2005): “The bank lending survey for the euro area”, Occasional Paper Series 23, *European Central Bank*.

Bernanke, Ben S. (1983): “Nonmonetary Effects of the Financial Crisis in Propagation of the Great Depression”, *American Economic Review,* 73 (3), 257–276.

Bernanke, Ben S. (2007): “The financial accelerator and the credit channel”, *Speech given at the 'The Credit Channel of Monetary Policy in the Twenty-first Century' conference, Federal Reserve Bank of Atlanta, Atlanta, Georgia, June 15, 2007*.

Bernanke, Ben S.; Blinder, Alan S. (1988): “Credit, Money, and Aggregate Demand”, *American Economic Review,* 78 (2), 435–439.

Bernanke, Ben S.; Blinder, Alan S. (1992): “The Federal Funds Rate and the Channels of Monetary Transmission”, *American Economic Review,* 82 (4), 901–921.

Bernanke, Ben S.; Gertler, Mark (1989): “Agency Costs, Net Worth, and Business Fluctuations”, *American Economic Review,* 79 (1), 14–31.

Bernanke, Ben S.; Gertler, Mark (1995): “Inside the Black Box”, *Journal of Economic Perspectives,* 9 (4), 27–48.

Bernanke, Ben S.; Gertler, Mark; Gilchrist, Simon (1996): “The Financial Accelerator and the Flight to Quality”, *The Review of Economics and Statistics,* 78 (1), 1–15.

Bernanke, Ben S.; Gertler, Mark; Gilchrist, Simon (1999): “The financial accelerator in a quantitative business cycle framework”, in: *Handbook of Macroeconomics,* ed. by Taylor, John B.; Woodford, Michael. Amsterdam: Elsevier, 1341–1393.

Bernanke, Ben S.; Lown, Cara S. (1991): “The Credit Crunch”, *Brookings Papers on Economic Activity,* 22 (2), 205–248.

Berrospide, Jose M.; Edge, Rochelle M. (2010): “The Effects of Bank Capital on Lending: What Do We Know, and What Does It Mean?”, *International Journal of Central Banking,* 6 (34), 5–54.

Bhattacharya, Sudipto; Nyborg, Kjell G. (2010): “Bank Bailout Menus”, CEPR Discussion Papers 7906, *Centre for Economic Policy Research*.

Bianchi, Javier; Mendoza, Enrique G. (2011): “Overborrowing, Financial Crises and 'Macro-prudential' Policy?”, IMF Working Papers 11/24, *International Monetary Fund*.

Blinder, Alan S. (1984): “Notes on the Comparative Statics of a Stiglitz-Weiss Bank”, Mimeo.

Blinder, Alan S. (1987): “Credit Rationing and Effective Supply Failures”, *The Economic Journal,* 97 (386), 327–52.

Blundell, Richard; Bond, Stephen (1998): “Initial conditions and moment restrictions in dynamic panel data models”, *Journal of Econometrics,* 87 (1), 115–143.

Bofinger, Peter (2001): *Monetary Policy: Goals, Institutions, Strategies, and Instruments.* New York: Oxford University Press.

Bonaccorsi di Patti, Emilia; Sette, Enrico (2012): “Bank balance sheets and the transmission of financial shocks to borrowers: evidence from the 2007-2008 crisis”, Temi di discussione (Working papers) 848, *Banca d'Italia*.

Bond, Stephen (2002): “Dynamic panel data models: a guide to micro data methods and practice”, *Portuguese Economic Journal,* 1 (1), 141–162.

Borio, Claudio (1996): “Credit Characteristics and the Monetary Policy Transmission Mechanism in Fourteen Industrial Countries: Facts, Conjectures and Some Econometric Evidence”, in: *Monetary Policy in a Converging Europe,* ed. by Alders, Koos J.; Koedijk, Kees K.; Kool, Clemens C.; Winder, Carlo C. Dordrecht, Netherlands: Kluwer Academic Publishers, 77-115.

Borio, Claudio; Disyatat, Piti (2010): “Unconventional Monetary Policies: An Appraisal”, *The Manchester School,* 78 (s1), 53–89.

Borio, Claudio; Zhu, Haibin (2012): “Capital regulation, risk-taking and monetary policy: a missing link in the transmission mechanism?”, *Journal of Financial Stability,* 8 (4), 236–251.

Börner, Christoph J.; Grichnik, Dietmar; Reize, Frank (2010): “Finanzierungsentscheidungen mittelständischer Unternehmen - Einflussfaktoren auf die Kapitalstruktur deutscher KMU”, *Zeitschrift für betriebswirtschaftliche Forschung,* 62 (3), 227–250.

Brei, Michael; Gambacorta, Leonardo; Peter, Goetz von (2013): “Rescue packages and bank lending”, *Journal of Banking & Finance,* 37 (2), 490–505.

Brunnermeier, Markus K. (2009a): “Deciphering the Liquidity and Credit Crunch 2007-2008”, *Journal of Economic Perspectives,* 23 (1), 77–100.

Brunnermeier, Markus K. (2009b): “Financial Crises: Mechanisms, Prevention and Management”, in: *Macroeconomic stability and financial regulation: Key issues for the G20,* ed. by Dewatripont, Mathias; Freixas, Xavier; Portes, Richard. London: Centre for Economic Policy Research, 91–103.

Brunnermeier, Markus K.; Pedersen, Lasse Heje (2009): “Market Liquidity and Funding Liquidity”, *Review of Financial Studies,* 22 (6), 2201–2238.

Bun, Maurice J.G.; Windmeijer, Frank (2010): “The weak instrument problem of the system GMM estimator in dynamic panel data models”, *Econometrics Journal,* 13 (1), 95–126.

Campello, Murillo (2002): “Internal Capital Markets in Financial Conglomerates”, *Journal of Finance,* 57 (6), 2773–2805.

Carlson, Mark; Shan, Hui; Warusawitharana, Missaka (2013): “Capital ratios and bank lending: a matched bank approach”, *Journal of Financial Intermediation,* 22 (4), 663–687.

Carlstrom, Charles T.; Fuerst, Timothy S. (2001): “Monetary policy in a world without perfect capital markets”, Working Paper 01-15, *Federal Reserve Bank of Cleveland*.

Cecchetti, Stephen G. (1995): “Distinguishing theories of the monetary transmission mechanism”, *Federal Reserve Bank of St. Louis Review* (May/June), 83–97.

Ciccarelli, Matteo; Maddaloni, Angela; Peydro, Jose-Luis (2010): “Trusting the bankers: a new look at the credit channel of monetary policy”, Working Paper 1228, *European Central Bank*.

Congleton, Roger D. (2009): “On the political economy of the financial crisis and bailout of 2008–2009”, *Public Choice,* 140 (3), 287–317.

De Bondt, Gabe; Maddaloni, Angela; Peydro, Jose-Luis; Scopel, Silvia (2010): “The euro area Bank Lending Survey matters - empirical evidence for credit and output growth”, Working Paper 1160, *European Central Bank*.

Del Giovane, Paolo; Eramo, Ginette; Nobili, Andrea (2011): “Disentangling demand and supply in credit developments: A survey-based analysis for Italy”, *Journal of Banking & Finance,* 35 (10), 2719–2732.

Dell'Ariccia, Giovanni; Igan, Deniz; Laeven, Luc (2012): “Credit Booms and Lending Standards: Evidence from the Subprime Mortgage Market”, *Journal of Money, Credit and Banking,* 44 (3), 367–384.

Dettmer, Markus and Weiland, Severin (2009): “BaFin-Prüfbericht: Wie die HRE in die Katastrophe schlitterte”, *Spiegel Online,* http://www.spiegel.de/politik/deutschland/bafin-pruefbericht-wie-die-hre-in-die-katastrophe-schlitterte-a-627127.html. Accessed September 30, 2013.

Diamond, Douglas W.; Dybvig, Philip H. (1983): “Bank Runs, Deposit Insurance, and Liquidity”, *Journal of Political Economy,* 91 (3), 401–419.

Disyatat, Piti (2004): “Currency crises and the real economy: The role of banks”, *European Economic Review,* 48 (1), 75–90.

Disyatat, Piti (2011): “The Bank Lending Channel Revisited”, *Journal of Money, Credit and Banking,* 43 (4), 711–734.

Douglas, Diamond W.; Rajan, Raghuram G. (2001): “Liquidity Risk, Liquidity Creation, and Financial Fragility: A Theory of Banking”, *Journal of Political Economy,* 109 (2), 287–327.

Drehmann, Mathias; Gambacorta, Leonardo (2012): “The effects of countercyclical capital buffers on bank lending”, *Applied Economics Letters,* 19 (7), 603–608.

Ehrmann, Michael; Gambacorta, Leonardo; Martinez-Pages, Jorge; Sevestre, Patrick; Worms, Andreas (2003): “Financial systems and the role of banks in monetary policy transmission in the Euro area”, in: *Monetary policy transmission in the Euro area: A study by the Eurosystem Monetary Transmission Network,* ed. by Angeloni,

Ignazio; Kashyap, Anil K.; Mojon, Benoit. Cambridge: Cambridge University Press, 235–269.

Ehrmann, Michael; Worms, Andreas (2001): “Interbank lending and monetary policy transmission - evidence for Germany”, Working Paper 73, *European Central Bank*.

Ehrmann, Michael; Worms, Andreas (2004): “Bank Networks and Monetary Policy Transmission”, *Journal of the European Economic Association,* 2 (6), 1148–1171.

European Central Bank (21 November, 2002): *Bank lending survey for the euro area (press release).* Frankfurt am Main.

European Central Bank (2009): “Recent Developments in the Balance Sheets of the Eurosystem, the Federal Reserve System and the Bank of Japan”, *ECB Monthly Bulletin,* October (-), 81–94.

European Central Bank (2010a): *Financial Stability Review December 2010.* Frankfurt am Main: European Central Bank.

European Central Bank (2010b): “The ECB's monetary policy stance during the financial crisis”, *ECB Monthly Bulletin,* January (-), 63–71.

European Central Bank (2011a): “The ECB's non-standard measures - impact and phasing-out”, *ECB Monthly Bulletin,* July (-), 55–69.

European Central Bank (2011b): *The monetary policy of the ECB.* Frankfurt am Main: European Central Bank.

Favero, Carlo A.; Giavazzi, Francesco; Flabbi, Luca (1999): “The Transmission Mechanism of Monetary Policy in Europe: Evidence from Banks' Balance Sheets”, NBER Working Papers 7231, *National Bureau of Economic Research*.

Fiore, Fiorella de; Uhlig, Harald (2005): “Bank finance versus bond finance - what explains the differences between US and Europe?”, Working Paper 547, *European Central Bank*.

Fisher, Irving (1928): *Money illusion.* New York: Adelphi.

Fisher, Irving (1933): “The Debt-Deflation Theory of Great Depressions”, *Econometrica,* 1 (4), 337–357.

Flannery, Mark J.; Rangan, Kasturi P. (2006): “Partial adjustment toward target capital structures”, *Journal of Financial Economics,* 79 (3), 469–506.

Francis, William; Osborne, Matthew (2009): “Bank regulation, capital and credit supply: Measuring the Impact of Prudential Standards”, Occasional Paper Series 36, *UK Financial Services Authority*.

Fratianni, Michele; Marchionne, Francesco (2010): “The Banking Bailout of the Subprime Crisis: Size and Effects”, *PSL Quarterly Review,* 63 (254), 187–233.

Friedman, Milton (1960): *A Program for Monetary Stability.* New York: Fordham University Press.

Friedman, Milton (1968): “The Role of Monetary Policy”, *American Economic Review,* 58 (-), 1–17.

Friedman, Milton; Schwartz, Anna J. (1963): *A Monetary History of the United States, 1867-1960.* Princeton: Princeton University Press.

Furfine, Craig (2001): “Bank Portfolio Allocation: The Impact of Capital Requirements, Regulatory Monitoring, and Economic Conditions”, *Journal of Financial Services Research,* 20 (1), 33–56.

Galati, Gabriele; Moessner, Richhild (2012): “Macroprudential Policy – A Literature Review”, *Journal of Economic Surveys* (-).

Gambacorta, Leonardo (2005): “Inside the bank lending channel”, *European Economic Review,* 49 (7), 1737–1759.

Gambacorta, Leonardo; Marques-Ibanez, David (2011): “The bank lending channel: lessons from the crisis”, *Economic Policy,* 26 (66), 135–182.

Gambacorta, Leonardo; Mistrulli, Paolo E. (2004): “Does bank capital affect lending behavior?”, *Journal of Financial Intermediation,* 13 (4), 436–457.

Gambacorta, Leonardo; Rossi, Carlotta (2010): “Modelling bank lending in the euro area: a nonlinear approach”, *Applied Financial Economics,* 20 (14), 1099–1112.

Geanakoplos, John (2010): “The Leverage Cylce”, in: *NBER Macroeconomics Annual 2009,* ed. by Acemoglu, Daron; Rogoff, Kenneth S.; Woodford, Michael. Chicago: National Bureau of Economic Research, 1–65.

Gertler, Mark; Gilchrist, Simon (1993): “The Role of Credit Market Imperfections in the Monetary Transmission Mechanism: Arguments and Evidence”, *Scandinavian Journal of Economics,* 95 (1), 43–64.

González-Páramo, José Manuel (2011): “The ECB’s monetary policy during the crisis”, *Closing speech at the Tenth Economic Policy Conference, Málaga, October 21, 2011*.

Greenlaw, David; Hatzius, Jan; Kashyap, Anil K.; Shin, Hyun Song (2008): “Leveraged Losses: Lessons from the Mortgage Market Meltdown”, U.S. Monetary Policy Forum Report No. 2, *Rosenberg Institute, Brandeis International Business School and Initiative on Global Markets University of Chicago Graduate School of Business*.

Griliches, Zvi; Hausman, Jerry A. (1986): “Errors in variables in panel data”, *Journal of Econometrics,* 31 (1), 93–118.

Gropp, Reint; Heider, Florian (2010): “The Determinants of Bank Capital Structure”, *Review of Finance,* 14 (4), 587–622.

Hall, Brian J. (1993): “How Has the Basle Accord Affected Bank Portfolios?”, *Journal of the Japanese and International Economies,* 7 (4), 408–440.

Hancock, Diana; Wilcox, James A. (1993): “Has There Been a Capital Crunch in Banking? The Effects on Bank Lending of Real Estate Market Conditions and Bank Capital Shortfalls”, *Journal of Housing Economics,* 3 (1), 31–50.

Hancock, Diana; Wilcox, James A. (1994): “Bank Capital and the Credit Crunch: The Roles of Risk-Weighted and Unweighted Capital Regulations”, *Real Estate Economics,* 22 (1), 59–94.

Hancock, Diana; Wilcox, James A. (1998): “The "credit crunch" and the availability of credit to small business”, *Journal of Banking & Finance,* 22 (6-8), 983–1014.

Hannoun, Herve (2010): “Towards a global financial stability framework”, *Speech given at the 45th SEACEN Governors' Conference, Siem Reap province, Cambodia, February 26-27, 2010*.

Hansen, Lars P. (1982): “Large Sample Properties of Generalized Method of Moments Estimators”, *Econometrica,* 50 (4), 1029–54.

Hanson, Samuel G.; Kashyap, Anil K.; Stein, Jeremy C. (2011): “A Macroprudential Approach to Financial Regulation”, *Journal of Economic Perspectives,* 25 (1), 3–28.

Harris, David; Matyas, Laszlo (1999): “Introduction to the Generalized Method of Moments Estimation”, in: *Generalized Method of Moments Estimation,* ed. by Matyas, Laszlo. Cambridge: Cambridge University Press, 3–30.

Healy, Paul M.; Palepu, Krishna G. (2001): “Information asymmetry, corporate disclosure, and the capital markets: A review of the empirical disclosure literature”, *Journal of Accounting and Economics,* 31 (1-3), 405–440.

Holod, Dmytro; Peek, Joe (2007): “Asymmetric information and liquidity constraints”, *Journal of Banking & Finance,* 31 (8), 2425–2451.

Hubbard, Glenn R. (1995): “Is there a "credit channel" for monetary policy?”, *Federal Reserve Bank of St. Louis Review,* 77 (May/June), 63–77.

Iacoviello, Matteo (2005): “House Prices, Borrowing Constraints, and Monetary Policy in the Business Cycle”, *American Economic Review,* 95 (3), 739–764.

International Accounting Standards Board (October 2008): *IASB amendments permit reclassification of financial instruments (press release).* London.

Ivashina, Victoria; Scharfstein, David S. (2010): “Bank lending during the financial crisis of 2008”, *Journal of Financial Economics,* 97 (3), 319–338.

Jaffee, Dwight M.; Russell, Thomas (1976): “Imperfect Information, Uncertainty, and Credit Rationing”, *The Quarterly Journal of Economics,* 90 (4), 651–66.

Jarchow, Hans-Joachim (2003): *Theorie und Politik des Geldes.* Göttingen: Vandenhoeck und Ruprecht.

Jimenez, Gabriel; Ongena, Steven; Peydro, Jose-Luis; Saurina, Jesus (2008): “Hazardous times for monetary policy: What do twenty-three million bank loans say about the effects of monetary policy on credit risk-taking?”, Documentos de Trabajo (Working Paper) 0833, *Banco de Espana*.

Kashyap, Anil K.; Rajan, Raghuram G.; Stein, Jeremy C. (2002): “Banks as Liquidity Providers: An Explanation for the Coexistence of Lending and Deposit-Taking”, *Journal of Finance,* 57 (1), 33–73.

Kashyap, Anil K.; Stein, Jeremy C. (1994): “Monetary Policy and Bank Lending”, in: *Monetary Policy,* ed. by Mankiw, Gregory N. Chicago: The University of Chicago Press for NBER, 221–261.

Kashyap, Anil K.; Stein, Jeremy C. (1995): “The impact of monetary policy on bank balance sheets”, *Carnegie-Rochester Conference Series on Public Policy,* 42 (1), 151–195.

Kashyap, Anil K.; Stein, Jeremy C. (2000): “What Do a Million Observations on Banks Say about the Transmission of Monetary Policy?”, *American Economic Review,* 90 (3), 407–428.

Kashyap, Anil K.; Stein, Jeremy C.; Wilcox, David W. (1993): “Monetary Policy and Credit Conditions: Evidence from the Composition of External Finance”, *American Economic Review,* 83 (1), 78–98.

Keynes, John Maynard (1936): *The General Theory of Employment, Interest and Money.* London: Macmillan.

Keys, Benjamin J.; Mukherjee, Tanmoy; Seru, Amit; Vig, Vikrant (2010): "Did securitization lead to lax screening? Evidence from subprime loans", *The Quarterly Journal of Economics,* 125 (1), 307–362.

Khan, Sajawal; Qayyum, Abdul (2007): "Measures of Monetary Policy Stance", Macroeconomics Working Papers 22201, *East Asian Bureau of Economic Research*.

King, Stephen R. (1986): "Monetary Transmission: Through Bank Loans or Bank Liabilities?", *Journal of Money, Credit and Banking,* 18 (3), 290–303.

Kishan, Ruby P.; Opiela, Timothy P. (2000): "Bank Size, Bank Capital, and the Bank Lending Channel", *Journal of Money, Credit and Banking,* 32 (1), 121–141.

Kishan, Ruby P.; Opiela, Timothy P. (2006): "Bank capital and loan asymmetry in the transmission of monetary policy", *Journal of Banking & Finance,* 30 (1), 259–285.

Kiyotaki, Nobuhiro; Moore, John (1997): "Credit Cycles", *Journal of Political Economy,* 105 (2), 211–48.

Lemmon, Michael L.; Roberts, Michael R.; Zender, Jaime F. (2008): "Back to the Beginning: Persistence and the Cross-Section of Corporate Capital Structure", *Journal of Finance,* 63 (4), 1575–1608.

Lenza, Michele; Huw, Pill; Lucrezia, Reichlin (2010): "Monetary policy in exceptional times", *Economic Policy,* 25 (62), 295–339.

Loutskina, Elena; Strahan, Philip E. (2009): "Securitization and the Declining Impact of Bank Finance on Loan Supply: Evidence from Mortgage Originations", *Journal of Finance,* 64 (2), 861–889.

Ludvigson, Sydney (1998): "The Channel of Monetary Transmission to Demand: Evidence from the Market for Automobile Credit", *Journal of Money, Credit and Banking,* 30 (3), 365–383.

Maddaloni, Angela; Peydro, Jose-Luis (2011): "Bank Risk-taking, Securitization, Supervision, and Low Interest Rates: Evidence from the Euro-area and the U.S. Lending Standards", *Review of Financial Studies,* 24 (6), 2121–2165.

Marques-Ibanez, David (2009): "Banks, credit and the transmission mechanism of monetary policy", Research Bulletin 8, *European Central Bank*.

Marques-Ibanez, David; Scheicher, Martin (2010): "Securitisation: Instruments and Implications", in: *The Oxford Handbook of Banking,* ed. by Berger, Allen N.; Molyneux, Philip; Wilson, John. Oxford: Oxford University Press, 530–555.

Mayer, Colin (1990): "Financial Systems, Corporate Finance, and Economic Development", in: *Asymmetric Information, Corporate Finance, and Investment,* ed. by Hubbard, Glenn R. Chicago: University of Chicago Press, 307–332.

Mercier, Paul (2009): "The Liquidity Management of the Eurosystem during the Financial Turmoil (August 2007 to February 2009)", *Revue bancaire et financière,* 73 (2/3), 96–104.

Mishkin, Frederic S. (1995): "Symposium on the Monetary Transmission Mechanism", *Journal of Economic Perspectives,* 9 (4), 3–10.

Mishkin, Frederic S. (2010): *The economics of money, banking and financial markets.* Boston, MA: Pearson Education.

Modigliani, Franco (1971): "Monetary Policy and Consumption", in: *Consumer Spending and Monetary Policy - The Linkages,* ed. by Federal Reserve Bank of Boston: Federal Reserve Bank of Boston, 9–84.

Modigliani, Franco; Miller, Merton H. (1958): "The cost of capital, corporation finance and the theory of investment", *American Economic Review,* 48 (3), 261–297.

Mojon, Benoit (2000): "Financial structure and the interest rate channel of ECB monetary policy", Working Paper 40, *European Central Bank*.

Myers, Stewart C. (1977): "Determinants of corporate borrowing", *Journal of Financial Economics,* 5 (2), 147–175.

Myers, Stewart C. (1984): "The Capital Structure Puzzle", *Journal of Finance,* 39 (3), 575–92.

Myers, Stewart C.; Majluf, Nicholas (1984): "Corporate financing and investment decisions when firms have information that investors do not have", *Journal of Financial Economics,* 13 (2), 187–221.

Nakamura, Leonard (1984): "Bankruptcy and the Informational Problems of Commercial Bank Lending", Financial Research Center Memorandum 54, *Princeton University*.

Newey, Whitney K.; McFadden, Daniel (1994): "Large Sample Estimation and Hypothesis Testing", in: *Handbook of Econometrics,* ed. by Engle, Robert F.; McFadden, Daniel. Amsterdam: Elsevier, 2111–2245.

Nickell, Stephen J. (1981): "Biases in Dynamic Models with Fixed Effects", *Econometrica,* 49 (6), 1417–1426.

Oliner, Stephen D.; Rudebusch, Glenn D. (1996a): "Is there a broad credit channel for monetary policy?", *Economic Review* (), 3–13.

Oliner, Stephen D.; Rudebusch, Glenn D. (1996b): "Monetary Policy and Credit Conditions: Evidence from the Composition of External Finance: Comment", *American Economic Review,* 86 (1), 300–309.

Peek, Joe; Rosengren, Eric S. (1995a): "Bank lending and the transmission of monetary policy", in: *Is Bank Lending Important for the Transmission of Monetary Policy?,* ed. by Peek, Joe; Rosengren, Eric S.: Federal Reserve Bank of Boston Conference Proceedings No. 39, 47–68.

Peek, Joe; Rosengren, Eric S. (1995b): "Bank regulation and the credit crunch", *Journal of Banking & Finance,* 19 (3-4), 679–692.

Peek, Joe; Rosengren, Eric S. (1995c): "The Capital Crunch: Neither a Borrower nor a Lender Be", *Journal of Money, Credit and Banking,* 27 (3), 625–38.

Peek, Joe; Rosengren, Eric S. (1997): "The International Transmission of Financial Shocks: The Case of Japan", *American Economic Review,* 87 (4), 495–505.

Peek, Joe; Rosengren, Eric S. (2000): "Collateral Damage: Effects of the Japanese Bank Crisis on Real Activity in the United States", *American Economic Review,* 90 (1), 30–45.

Peek, Joe; Rosengren, Eric S. (2010): “The Role of Banks in the Transmission of Monetary Policy”, in: *The Oxford Handbook of Banking,* ed. by Berger, Allen N.; Molyneux, Philip; Wilson, John. Oxford: Oxford University Press, 257–278.

Peydro, Jose-Luis (2010): “Discussion of "The Effects of Bank Capital on Lending: What Do We Know, and What Does It Mean?"”, *International Journal of Central Banking,* 6 (34), 55–69.

Phelps, Edmond S. (1967): “Phillips Curves, Expectations of Inflation and Optimal Unemployment over Time”, *Economica,* 34 (-), 254–281.

Phillips, A. W. (1958): “The Relation Between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom, 1861-1957”, *Economica,* 25 (100), 283–299.

Rajan, Raghuram G. (1992): “Insiders and Outsiders: The Choice between Informed and Arm's-Length Debt”, *Journal of Finance,* 47 (4), 1367–1400.

Repullo, Rafael; Suarez, Javier (2013): “The Procyclical Effects of Bank Capital Regulation”, *Review of Financial Studies,* 26 (2), 452–490.

Romer, Christina D.; Romer, David H. (1990): “New Evidence on the Monetary Transmission Mechanism”, *Brookings Papers on Economic Activity,* 21 (1), 149–214.

Roodman, David (2009a): “A Note on the Theme of Too Many Instruments”, *Oxford Bulletin of Economics and Statistics,* 71 (1), 135–158.

Roodman, David (2009b): “How to do xtabond2: An introduction to difference and system GMM in Stata”, *Stata Journal,* 9 (1), 86–136.

Samuelson, P.A; Solow, R. M. (1960): “Problem of Achieving and Maintaining a Stable Price Level: Analytical Aspects of Anti-Inflation Policy”, *American Economic Review,* 50 (2), 177–194.

Sharpe, Steven A. (1990): “Asymmetric Information, Bank Lending, and Implicit Contracts: A Stylized Model of Customer Relationships”, *Journal of Finance,* 45 (4), 1069–87.

Shleifer, Andrei; Vishny, Robert W. (1992): “Liquidation Values and Debt Capacity: A Market Equilibrium Approach”, *Journal of Finance,* 47 (4), 1343–66.

Siemers, Ansgar (2009): “Hypo Real Estate: Die große Peer-Steinbrück-Show”, *Focus Online,* http://www.focus.de/finanzen/banken/hypo-real-estate-die-grosse-peer-steinbrueck-show_aid_428079.html. Accessed September 30, 2013.

Solon, Gary (1985): “Comment on ‘Benefits and Limitations of Panel Data’ by C. Hsiao”, *Econometric Reviews,* 4 (-), 183–186.

Standard & Poor's (2013): “S&P/Case-Shiller Home Price Indices Methodology”, *S&P Dow Jones Indices LLC*.

Stein, Jeremy C. (1998): “An Adverse-Selection Model of Bank Asset and Liability Management with Implications for the Transmission of Monetary Policy”, *RAND Journal of Economics,* 29 (3), 466–486.

Stein, Jeremy C. (2012): “Monetary Policy as Financial Stability Regulation”, *The Quarterly Journal of Economics,* 127 (1), 57–95.

Stiglitz, Joseph E.; Weiss, Andrew (1981): “Credit Rationing in Markets with Imperfect Information”, *American Economic Review,* 71 (3), 393–410.

Thornton, Daniel L. (2009): “What the Libor-OIS spread says”, *Economic Synopses,* 24 (-), 1–2.

Tobin, James (1969): “A General Equilibrium Approach to Monetary Theory”, *Journal of Money, Credit and Banking,* 1 (1), 15–29.

Tobin, James (1982): “The Commercial Banking Firm: A Simple Model”, *Scandinavian Journal of Economics,* 84 (4), 495–530.

Trichet, Jean-Claude (2010): “State of the Union: The Financial Crisis and the ECB's Response between 2007 and 2009”, *Journal of Common Market Studies,* 48 (s1), 7–19.

van Rixtel, Adrian; Gasperini, Gabriele (2013): “Financial crises and bank funding: recent experience in the euro area”, BIS Working Papers 406, *Bank for International Settlements*.

Weber, Axel A.; Gerke, Rafael; Worms, Andreas (2009): “Has the monetary transmission process in the euro area changed? Evidence vased on VAR estimates”, BIS Working Papers 276.

Wooldridge, Jeffrey M. (2002): *Econometric Analysis of Cross Section and Panel Data.* Cambridge, MA: MIT Press.

Worms, Andreas (2001): “Monetary Policy Effects on Bank Loans in Germany: A Panel-econometric Analysis”, Discussion paper 17/01, *Deutsche Bundesbank*.

Worms, Andreas (2003): “The reaction of bank lending to monetary policy measures in Germany”, in: *Monetary policy transmission in the Euro area: A study by the Eurosystem Monetary Transmission Network,* ed. by Angeloni, Ignazio; Kashyap, Anil K.; Mojon, Benoit. Cambridge: Cambridge University Press, 270–283.

Appendix

Descriptive statistics - GERMANY

Variable name/symbol	Number of observations	Mean	Median	Minimum	Maximum	Std. Dev.
Dependent variable						
ΔLOG(LOANS)	13,655	0.029	0.019	-0.593	0.683	0.076
Independent variables						
Bank characteristics						
CAP	15,486	0.000	-0.005	-0.061	0.939	0.037
CAPSUR	15,486	0.020	0.020	-0.950	0.120	0.041
SIZE	15,168	0.000	-0.063	-4.341	7.612	1.387
DEP	15,114	0.000	0.015	-0.715	0.281	0.118
OVERHANG	15,110	0.296	0.177	-1.000	11.025	0.589
LIQ	15,150	0.000	0.000	-0.022	0.372	0.010
STF	15,114	0.000	-0.015	-0.168	0.712	0.096
NII	15,132	0.000	-0.008	-1.221	1.726	0.098
Monetary policy variables						
EURIBOR	19,065	3.022	3.078	0.814	4.644	1.245
EURIBOR_OIS	16,523	0.263	0.245	-0.121	0.774	0.242
Δ(NSM)	16,523	0.013	0.005	-0.011	0.072	0.024
Macroeconomic variables						
ΔLOG(GDP)	17,794	0.022	0.023	-0.041	0.050	0.021
GDP_DEFLATOR	19,065	0.753	0.800	-0.700	1.600	0.554

Descriptive statistics - ITALY

Variable name/symbol	Number of observations	Mean	Median	Minimum	Maximum	Std. Dev.
Dependent variable						
ΔLOG(LOANS)	2,729	0.103	0.097	-0.517	0.693	0.088
Independent variables						
Bank characteristics						
CAP	3,580	0.000	-0.012	-0.099	0.870	0.071
CAPSUR	3,580	-0.053	-0.040	-0.920	0.060	0.071
SIZE	3,266	0.000	-0.195	-4.532	7.384	1.539
DEP	3,238	0.000	-0.008	-0.517	0.441	0.145
OVERHANG	3,238	-0.106	-0.269	-1.000	15.207	0.759
LIQ	3,261	0.000	-0.002	-0.010	0.099	0.008
STF	3,238	0.000	-0.046	-0.059	0.864	0.125
NII	3,266	0.000	-0.006	-1.064	1.114	0.132
Monetary policy variables						
EURIBOR	7,815	3.022	3.078	0.814	4.644	1.245
EURIBOR_OIS	6,773	0.263	0.245	-0.121	0.774	0.242
Δ(NSM)	6,773	0.013	0.005	-0.011	0.072	0.024
Macroeconomic variables						
ΔLOG(GDP)	7,294	0.029	0.035	-0.036	0.055	0.021
GDP_DEFLATOR	7,815	2.187	2.400	0.400	3.200	0.712

H. Brinkmeyer, *Drivers of Bank Lending,* Schriften zum europäischen Management,
DOI 10.1007/978-3-658-07175-2, © Springer Fachmedien Wiesbaden 2015

Descriptive statistics - FRANCE

Variable name/symbol	Number of observations	Mean	Median	Minimum	Maximum	Std. Dev.
Dependent variable						
ΔLOG(LOANS)	1,315	0.070	0.072	-0.547	0.675	0.245
Independent variables						
Bank characteristics						
CAP	1,508	0.000	-0.011	-0.080	0.802	1.649
CAPSUR	1,508	-0.039	-0.030	-0.820	0.050	4.193
SIZE	1,465	0.000	0.117	-5.130	6.294	0.068
DEP	1,437	0.000	-0.050	-0.410	0.498	0.057
OVERHANG	1,437	-0.242	-0.357	-1.000	12.056	0.011
LIQ	1,411	0.000	-0.002	-0.012	0.077	0.261
STF	1,437	0.000	-0.027	-0.403	0.512	0.836
NII	1,453	0.000	0.126	-159.273	4.615	0.024
Monetary policy variables						
EURIBOR	2,130	3.022	3.078	0.814	4.644	0.095
EURIBOR_OIS	1,846	0.263	0.245	-0.121	0.774	0.018
Δ(NSM)	1,846	0.013	0.005	-0.011	0.072	0.679
Macroeconomic variables						
ΔLOG(GDP)	1,988	0.033	0.038	-0.025	0.052	1.245
GDP_DEFLATOR	2,130	1.580	1.700	0.200	2.600	0.242

Descriptive statistics - SPAIN

Variable name/symbol	Number of observations	Mean	Median	Minimum	Maximum	Std. Dev.
Dependent variable						
ΔLOG(LOANS)	458	0.087	0.090	-0.542	0.594	0.126
Independent variables						
Bank characteristics						
CAP	639	0.000	-0.011	-0.080	0.461	0.058
CAPSUR	639	-0.024	-0.010	-0.490	0.210	0.057
SIZE	585	0.000	-0.126	-6.588	6.514	2.206
DEP	565	0.000	0.091	-0.711	0.217	0.224
OVERHANG	563	0.271	0.075	-1.000	33.077	1.854
LIQ	583	0.000	-0.007	-0.014	0.279	0.024
STF	565	0.000	-0.074	-0.131	0.729	0.193
NII	577	0.000	-0.031	-0.502	0.757	0.152
Monetary policy variables						
EURIBOR	1,590	3.022	3.078	0.814	4.644	1.245
EURIBOR_OIS	1,378	0.263	0.245	-0.121	0.774	0.242
Δ(NSM)	1,378	0.013	0.005	-0.011	0.072	0.024
Macroeconomic variables						
ΔLOG(GDP)	1,484	0.053	0.070	-0.037	0.083	0.035
GDP_DEFLATOR	1,590	2.887	3.300	0.100	4.400	1.393

Correlation matrix - GERMANY

	ΔLOG(LOANS)	CAP	CAPSUR	SIZE	DEP	OVERHANG	LIQ	STF	NII	EURIBOR	EURIBOR_OIS	Δ(NSM)	ΔLOG(GDP)	GDP_DEFLATOR	CRISIS
ΔLOG(LOANS)	1.000														

CAP	-0.013	1.000													
	0.157	-----													
CAPSUR	0.064	-0.005	1.000												
	0.000	*0.558*	-----												
SIZE	0.031	-0.192	0.097	1.000											
	0.001	*0.000*	*0.000*	-----											
DEP	-0.029	-0.044	-0.047	-0.376	1.000										
	0.001	*0.000*	*0.000*	*0.000*	-----										
OVERHANG	-0.087	-0.043	-0.013	-0.107	0.557	1.000									
	0.000	*0.000*	*0.147*	*0.000*	*0.000*	-----									
LIQ	-0.033	0.078	-0.024	-0.072	0.160	0.101	1.000								
	0.000	*0.000*	*0.006*	*0.000*	*0.000*	*0.000*	-----								
STF	0.051	-0.100	0.004	0.265	-0.837	-0.498	-0.173	1.000							
	0.000	*0.000*	*0.683*	*0.000*	*0.000*	*0.000*	*0.000*	-----							
NII	-0.070	0.074	-0.002	-0.087	0.025	0.040	0.140	-0.058	1.000						
	0.000	*0.000*	*0.848*	*0.000*	*0.004*	*0.000*	*0.000*	*0.000*	-----						
EURIBOR	0.021	-0.094	0.031	-0.023	-0.051	-0.049	0.039	0.038	0.070	1.000					
	0.018	*0.000*	*0.000*	*0.009*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	-----					
EURIBOR_OIS	0.007	0.137	-0.020	-0.020	0.040	0.082	-0.043	-0.058	0.154	-0.034	1.000				
	0.417	*0.000*	*0.014*	*0.023*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	-----				
Δ(NSM)	-0.032	0.129	-0.046	-0.023	0.023	0.043	-0.020	-0.058	0.152	0.052	0.677	1.000			
	0.000	*0.000*	*0.000*	*0.009*	*0.007*	*0.000*	*0.022*	*0.000*	*0.000*	*0.000*	*0.000*	-----			
ΔLOG(GDP)	0.031	0.034	-0.010	-0.015	0.004	-0.014	-0.002	-0.020	0.086	0.213	-0.019	0.373	1.000		
	0.000	*0.000*	*0.250*	*0.082*	*0.613*	*0.115*	*0.821*	*0.023*	*0.000*	*0.000*	*0.012*	*0.000*	-----		
GDP_DEFLATOR	-0.127	0.050	0.009	0.027	0.044	0.055	0.040	-0.061	-0.041	-0.188	-0.061	0.040	-0.127	1.000	
	0.000	*0.000*	*0.286*	*0.002*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	-----	
CRISIS	-0.028	0.048	0.006	-0.002	0.028	0.070	-0.005	-0.032	0.059	0.029	0.670	0.160	-0.639	0.148	1.000
	0.001	*0.000*	*0.459*	*0.841*	*0.001*	*0.000*	*0.576*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	-----

The sample period goes from 1999 to 2011. *P*-values in italics. Pairwise samples (pairwise missing values deletion).

Correlation matrix - ITALY

	ΔLOG(LOANS)	CAP	CAPSUR	SIZE	DEP	OVERHANG	LIQ	STF	NII	EURIBOR	EURIBOR_OIS	Δ(NSM)	ΔLOG(GDP)	GDP_DEFLATOR	CRISIS
ΔLOG(LOANS)	1.000														

CAP	-0.055	1.000													
	0.005	-----													
CAPSUR	0.053	-0.012	1.000												
	0.007	*0.464*	-----												
SIZE	-0.053	-0.310	0.158	1.000											
	0.007	*0.000*	*0.000*	-----											
DEP	0.107	-0.006	-0.034	-0.270	1.000										
	0.000	*0.731*	*0.057*	*0.000*	-----										
OVERHANG	0.086	0.101	-0.010	-0.168	0.511	1.000									
	0.000	*0.000*	*0.568*	*0.000*	*0.000*	-----									
LIQ	0.030	-0.109	-0.004	0.024	0.281	0.054	1.000								
	0.121	*0.000*	*0.824*	*0.183*	*0.000*	*0.003*	-----								
STF	0.013	-0.188	0.037	0.373	-0.550	-0.180	-0.193	1.000							
	0.500	*0.000*	*0.042*	*0.000*	*0.000*	*0.000*	*0.000*	-----							
NII	0.007	0.100	0.042	0.176	-0.064	0.090	-0.024	0.094	1.000						
	0.707	*0.000*	*0.019*	*0.000*	*0.000*	*0.000*	*0.189*	*0.000*	-----						
EURIBOR	0.175	0.081	0.019	-0.052	-0.012	0.032	0.073	0.007	-0.152	1.000					
	0.000	*0.000*	*0.252*	*0.004*	*0.523*	*0.073*	*0.000*	*0.689*	*0.000*	-----					
EURIBOR_OIS	-0.113	-0.066	-0.044	0.061	-0.023	-0.066	0.049	-0.102	-0.217	-0.034	1.000				
	0.000	*0.000*	*0.010*	*0.001*	*0.200*	*0.000*	*0.007*	*0.000*	*0.000*	*0.005*	-----				
Δ(NSM)	0.033	-0.057	-0.040	0.019	-0.005	-0.004	0.102	-0.075	-0.201	0.052	0.677	1.000			
	0.089	*0.001*	*0.019*	*0.287*	*0.773*	*0.834*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	-----			
ΔLOG(GDP)	0.216	0.060	0.016	-0.060	0.022	0.054	0.025	0.066	0.026	0.541	-0.550	-0.110	1.000		
	0.000	*0.000*	*0.337*	*0.001*	*0.215*	*0.003*	*0.171*	*0.000*	*0.153*	*0.000*	*0.000*	*0.000*	-----		
GDP_DEFLATOR	0.086	0.084	0.019	-0.042	-0.032	0.040	0.014	0.043	-0.065	0.539	-0.412	-0.261	0.170	1.000	
	0.000	*0.000*	*0.261*	*0.021*	*0.074*	*0.027*	*0.430*	*0.018*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	-----	
CRISIS	-0.135	-0.017	-0.003	0.043	-0.040	-0.049	-0.001	-0.063	-0.155	0.029	0.670	0.160	-0.777	0.107	1.000
	0.000	*0.327*	*0.854*	*0.017*	*0.027*	*0.007*	*0.961*	*0.000*	*0.000*	*0.016*	*0.000*	*0.000*	*0.000*	*0.000*	-----

The sample period goes from 1999 to 2011. *P*-values in italics. Pairwise samples (pairwise missing values deletion).

Correlation matrix - FRANCE

	ΔLOG(LOANS)	CAP	CAPSUR	SIZE	DEP	OVERHANG	LIQ	STF	NII	EURIBOR	EURIBOR_OIS	Δ(NSM)	ΔLOG(GDP)	GDP_DEFLATOR	CRISIS
ΔLOG(LOANS)	1.000														

CAP	-0.168	1.000													
	0.000	-----													
CAPSUR	0.114	-0.017	1.000												
	0.000	*0.515*	-----												
SIZE	0.070	-0.399	0.229	1.000											
	0.014	*0.000*	*0.000*	-----											
DEP	0.150	-0.275	-0.023	-0.114	1.000										
	0.000	*0.000*	*0.415*	*0.000*	-----										
OVERHANG	-0.021	-0.116	0.016	0.008	0.563	1.000									
	0.455	*0.000*	*0.574*	*0.763*	*0.000*	-----									
LIQ	-0.020	-0.055	0.025	-0.231	0.451	0.116	1.000								
	0.498	*0.052*	*0.372*	*0.000*	*0.000*	*0.000*	-----								
STF	-0.049	0.041	-0.059	0.158	-0.813	-0.513	-0.375	1.000							
	0.087	*0.148*	*0.035*	*0.000*	*0.000*	*0.000*	*0.000*	-----							
NII	0.002	0.023	0.003	0.017	0.044	0.034	0.025	-0.045	1.000						
	0.934	*0.399*	*0.910*	*0.534*	*0.112*	*0.219*	*0.371*	*0.102*	-----						
EURIBOR	0.108	-0.082	0.063	-0.057	0.006	0.039	0.011	0.012	0.010	1.000					
	0.000	*0.002*	*0.017*	*0.038*	*0.826*	*0.164*	*0.688*	*0.678*	*0.706*	-----					
EURIBOR_OIS	-0.028	0.084	-0.019	0.087	-0.072	-0.001	-0.038	0.036	0.037	-0.034	1.000				
	0.327	*0.001*	*0.480*	*0.002*	*0.010*	*0.984*	*0.175*	*0.191*	*0.177*	*0.141*	-----				
Δ(NSM)	0.079	0.067	-0.056	0.056	-0.046	0.019	-0.008	0.037	0.024	0.052	0.677	1.000			
	0.005	*0.011*	*0.034*	*0.042*	*0.094*	*0.496*	*0.782*	*0.181*	*0.393*	*0.026*	*0.000*	-----			
ΔLOG(GDP)	0.174	-0.056	0.021	-0.068	0.037	0.022	0.001	0.000	-0.001	0.501	-0.367	0.113	1.000		
	0.000	*0.034*	*0.416*	*0.013*	*0.180*	*0.428*	*0.974*	*0.989*	*0.962*	*0.000*	*0.000*	*0.000*	-----		
GDP_DEFLATOR	0.072	0.001	0.054	-0.005	-0.009	0.013	0.025	0.008	-0.010	0.592	-0.083	0.176	0.380	1.000	
	0.011	*0.976*	*0.040*	*0.849*	*0.745*	*0.632*	*0.368*	*0.780*	*0.712*	*0.000*	*0.000*	*0.000*	*0.000*	-----	
CRISIS	-0.120	0.035	0.030	0.067	-0.053	0.003	-0.006	0.016	0.019	0.029	0.670	0.160	-0.754	-0.048	1.000
	0.000	*0.188*	*0.262*	*0.015*	*0.055*	*0.913*	*0.817*	*0.559*	*0.483*	*0.208*	*0.000*	*0.000*	*0.000*	*0.038*	-----

The sample period goes from 1999 to 2011. *P*-values in italics. Pairwise samples (pairwise missing values deletion).

Correlation matrix - SPAIN

	ΔLOG(LOANS)	CAP	CAPSUR	SIZE	DEP	OVERHANG	LIQ	STF	NII	EURIBOR	EURIBOR_OIS	Δ(NSM)	ΔLOG(GDP)	GDP_DEFLATOR	CRISIS
ΔLOG(LOANS)	1.000														

CAP	-0.105	1.000													
	0.028	-----													
CAPSUR	0.148	-0.044	1.000												
	0.002	*0.269*	-----												
SIZE	0.144	-0.382	0.325	1.000											
	0.002	*0.000*	*0.000*	-----											
DEP	0.026	-0.167	-0.143	-0.318	1.000										
	0.586	*0.000*	*0.001*	*0.000*	-----										
OVERHANG	0.122	0.093	-0.026	-0.108	0.161	1.000									
	0.011	*0.032*	*0.553*	*0.012*	*0.000*	-----									
LIQ	0.053	0.401	0.008	0.070	-0.075	0.062	1.000								
	0.265	*0.000*	*0.856*	*0.098*	*0.081*	*0.150*	-----								
STF	-0.031	-0.040	0.038	0.211	-0.908	-0.177	-0.044	1.000							
	0.514	*0.358*	*0.378*	*0.000*	*0.000*	*0.000*	*0.309*	-----							
NII	0.078	0.120	0.149	0.332	-0.136	0.265	0.408	0.028	1.000						
	0.100	*0.005*	*0.000*	*0.000*	*0.002*	*0.000*	*0.000*	*0.510*	-----						
EURIBOR	0.394	0.010	0.026	-0.005	0.002	-0.067	0.039	-0.011	-0.145	1.000					
	0.000	*0.795*	*0.510*	*0.897*	*0.971*	*0.121*	*0.359*	*0.790*	*0.001*	-----					
EURIBOR_OIS	-0.259	-0.143	-0.062	-0.067	0.166	0.006	-0.152	-0.131	-0.096	-0.034	1.000				
	0.000	*0.000*	*0.119*	*0.110*	*0.000*	*0.883*	*0.000*	*0.002*	*0.023*	*0.203*	-----				
Δ(NSM)	0.106	-0.098	-0.076	-0.021	0.124	-0.053	-0.100	-0.122	-0.108	0.052	0.677	1.000			
	0.024	*0.014*	*0.056*	*0.616*	*0.004*	*0.222*	*0.018*	*0.004*	*0.010*	*0.055*	*0.000*	-----			
ΔLOG(GDP)	0.560	0.061	0.058	0.021	-0.062	-0.049	0.085	0.040	-0.016	0.591	-0.641	-0.204	1.000		
	0.000	*0.124*	*0.149*	*0.623*	*0.151*	*0.250*	*0.045*	*0.354*	*0.706*	*0.000*	*0.000*	*0.000*	-----		
GDP_DEFLATOR	0.554	0.074	0.069	0.009	-0.067	-0.038	0.069	0.050	-0.031	0.551	-0.707	-0.298	0.920	1.000	
	0.000	*0.062*	*0.082*	*0.835*	*0.116*	*0.383*	*0.101*	*0.242*	*0.471*	*0.000*	*0.000*	*0.000*	*0.000*	-----	
CRISIS	-0.282	-0.036	-0.006	-0.054	0.076	0.038	-0.079	-0.051	-0.085	0.029	0.670	0.160	-0.642	-0.489	1.000
	0.000	*0.373*	*0.888*	*0.199*	*0.078*	*0.372*	*0.062*	*0.232*	*0.046*	*0.276*	*0.000*	*0.000*	*0.000*	*0.000*	-----

The sample period goes from 1999 to 2011. *P*-values in italics. Pairwise samples (pairwise missing values deletion).

Juxtaposition of countries - specification III

(III) Baseline model with time-fixed effects	Germany		Italy		France		Spain	
Dependent variable: ΔLOG(LOANS)	Coeff.	Std. Error	Coeff.	Std. Error	Coeff.	Std. Error	Coeff.	Std. Error
ΔLOG(LOANS(-1))	0.52 ***	(0.10)	0.05	(0.05)	0.15 ***	(0.05)	0.10	(0.12)
CAP(-1)*NC	0.45 **	(0.19)	1.12	(0.82)	0.45 ***	(0.13)	0.31	(0.75)
CAP(-1)*CRISIS	0.51 ***	(0.18)	1.11	(0.89)	0.16 *	(0.10)	1.09	(0.75)
SIZE(-1)*NC	0.05 *	(0.03)	0.24 ***	(0.06)	0.12 ***	(0.03)	0.09	(0.24)
SIZE(-1)*CRISIS	0.07 **	(0.03)	0.23 ***	(0.06)	0.13 ***	(0.03)	0.09	(0.24)
DEP(-1)*NC	0.00	(0.05)	0.44 **	(0.20)	0.12	(0.12)	0.33 *	(0.19)
DEP(-1)*CRISIS	0.05	(0.03)	0.47 **	(0.21)	0.16	(0.11)	0.60 **	(0.28)
LIQ(-1)*EURIBOR*NC	0.05	(0.11)	0.05	(0.27)	0.50	(0.32)	0.25 **	(0.12)
LIQ(-1)*EURIBOR*CRISIS	0.03	(0.17)	0.07	(0.22)	0.29	(0.18)	0.05	(0.33)
STF(-1)*NC	0.16	(0.13)	0.07	(0.27)	0.26	(0.52)	0.35	(0.22)
STF(-1)*CRISIS	0.05	(0.03)	0.04	(0.27)	0.11	(0.10)	0.01	(0.14)
NII(-1)*NC	0.08	(0.09)	0.16 **	(0.07)	0.02	(0.03)	0.33	(0.57)
NII(-1)*CRISIS	0.03	(0.10)	0.08	(0.07)	0.01	(0.02)	0.16	(0.13)
ΔLOG(GDP)	0.45	(0.30)	0.16	(0.18)	0.56	(1.07)	0.59	(0.73)
EURIBOR	0.00	(0.00)	-0.01	(0.02)	0.00	(0.02)	0.00	(0.02)
EURIBOR_OIS								
GDP_DEFLATOR	0.00	(0.00)	-0.06	(0.05)	-0.01	(0.02)	-0.01	(0.02)
D(NSM)	-0.11	(0.39)	-0.18	(1.28)	0.35	(0.36)	-0.23	(1.67)
Time dummies:	YES		YES		YES		YES	
Sample period (adjusted):	2001-2011		2001-2011		2001-2011		2001-2011	
Cross-sections included:	1,241		494		120		74	
Total (unbalanced) obs.:	9,974		1,594		896		222	
Instrument rank:	38		36		37		44	
Sargan test (p-value):	0.72		0.35		0.21		0.24	

The estimated model is given by equation (16). CRISIS is a dummy variable that is 1 in the years 2008 and 2009 and 0 in all other years. NC is the non-crisis dummy. It takes on the value of 0 in 2008 and 2009 and 1 in all other years of the sample period. The model allows for fixed effects across banks realized by orthogonal deviations. It is estimated using difference GMM, 2-step estimator, White period robust standard errors. ***, ** and * indicate statistical significance on the 1%, 5% and 10% level respectively.

Juxtaposition of countries - specification V

(V) Capital surplus and time-fixed effects	Germany		Italy		France		Spain	
Dependent variable: ΔLOG(LOANS)	Coeff.	Std. Error	Coeff.	Std. Error	Coeff.	Std. Error	Coeff.	Std. Error
ΔLOG(LOANS(-1))	0.52 ***	(0.10)	0.06	(0.04)	0.13 *	(0.08)	0.03	(0.10)
CAP(-1)*NC	0.48 ***	(0.13)	0.67 *	(0.38)	1.81 ***	(0.57)	0.78	(1.72)
CAP(-1)*CRISIS	0.74 ***	(0.26)	0.92 *	(0.50)	1.93 ***	(0.46)	1.06	(2.07)
CAPSUR(-1)*NC	0.06 ***	(0.02)	0.10	(0.06)	0.08 ***	(0.02)	0.02	(0.05)
CAPSUR(-1)*CRISIS	0.06 **	(0.03)	0.12 *	(0.07)	0.08 ***	(0.03)	0.08	(0.08)
SIZE(-1)*NC	0.05	(0.03)	0.27 ***	(0.05)	0.10 ***	(0.01)	0.07	(0.08)
SIZE(-1)*CRISIS	0.08 **	(0.04)	0.25 ***	(0.05)	0.11 ***	(0.01)	0.10	(0.08)
DEP(-1)*NC	-0.03	(0.05)	0.35 **	(0.16)	0.01	(0.06)	0.26	(0.25)
DEP(-1)*CRISIS	0.01	(0.05)	0.34 **	(0.17)	0.07	(0.05)	0.61 **	(0.30)
LIQ(-1)*EURIBOR*NC	0.20	(0.21)	0.13	(0.28)	0.50 ***	(0.18)	0.22 **	(0.10)
LIQ(-1)*EURIBOR*CRISIS	0.18	(0.26)	0.10	(0.22)	0.35 ***	(0.13)	0.45	(0.38)
STF(-1)*NC	0.21 *	(0.12)	0.16	(0.18)	0.12	(0.35)	0.31	(0.35)
STF(-1)*CRISIS	0.10 *	(0.06)	0.04	(0.18)	0.10 *	(0.05)	0.18 *	(0.10)
NII(-1)*NC	0.11	(0.22)	0.20	(0.19)	0.03	(0.03)	0.45 **	(0.20)
NII(-1)*CRISIS	0.05 *	(0.03)	0.07	(0.07)	0.01	(0.02)	0.09	(0.15)
ΔLOG(GDP)	0.06	(0.42)	1.29	(2.29)	1.48 **	(0.62)	1.73 **	(0.78)
EURIBOR	0.00	(0.00)	-0.06 *	(0.03)	-0.03 ***	(0.01)	-0.02	(0.03)
GDP_DEFLATOR	-0.01	(0.01)	0.10 **	(0.04)	-0.03 **	(0.01)	0.02	(0.02)
D(NSM)	-0.08	(0.42)	-0.16	(0.14)	1.16 **	(0.47)	0.63	(1.76)
Time dummies:	YES		YES		YES		YES	
Sample period (adjusted):	2001-2011		2001-2011		2001-2011		2001-2011	
Cross-sections included:	1,238		494		120		74	
Total (unbalanced) obs.:	9,939		1,594		896		222	
Instrument rank:	40		37		40		46	
Sargan test (p-value):	0.72		0.40		0.32		0.45	

The estimated model is given by equation (16). CRISIS is a dummy variable that is 1 in the years 2008 and 2009 and 0 in all other years. NC is the non-crisis dummy. It takes on the value of 0 in 2008 and 2009 and 1 in all other years of the sample period. The model allows for fixed effects across banks realized by orthogonal deviations. It is estimated using difference GMM, 2-step estimator, White period robust standard errors. ***, ** and * indicate statistical significance on the 1%, 5% and 10% level respectively.

Juxtaposition of countries - specification VII

(VII) Deposit overhang and time-fixed effects	Germany		Italy		France		Spain	
Dependent variable: ΔLOG(LOANS)	Coeff.	Std. Error	Coeff.	Std. Error	Coeff.	Std. Error	Coeff.	Std. Error
ΔLOG(LOANS(-1))	0.44 ***	(0.12)	0.04	(0.03)	0.04 ***	(0.01)	0.39 **	(0.17)
CAP(-1)*NC	0.47 ***	(0.18)	0.89	(0.65)	0.47 ***	(0.16)	1.00	(0.65)
CAP(-1)*CRISIS	0.54 ***	(0.19)	0.84	(0.69)	0.15	(0.17)	1.65 **	(0.64)
SIZE(-1)*NC	0.08 *	(0.04)	0.32 ***	(0.05)	0.10 ***	(0.03)	0.25 ***	(0.09)
SIZE(-1)*CRISIS	0.10 ***	(0.03)	0.31 ***	(0.04)	0.10 ***	(0.03)	0.26 ***	(0.09)
DEP(-1)*NC	-0.04 **	(0.02)	0.24	(0.15)	-0.22 *	(0.13)	0.26	(0.33)
DEP(-1)*CRISIS	0.03	(0.02)	0.26 *	(0.16)	-0.18 *	(0.10)	0.60 **	(0.26)
OVERHANG(-1)*NC	0.06 ***	(0.01)	0.12 ***	(0.02)	0.07 *	(0.04)	0.50 ***	(0.13)
OVERHANG(-1)*CRISIS	0.05 ***	(0.01)	0.12 ***	(0.03)	0.07 **	(0.03)	0.55 ***	(0.13)
LIQ(-1)*EURIBOR*NC	0.06	(0.10)	0.11	(0.28)	0.57 *	(0.34)	0.42 ***	(0.14)
LIQ(-1)*EURIBOR*CRISIS	0.05	(0.16)	0.06	(0.20)	0.36 *	(0.19)	0.56 **	(0.27)
STF(-1)*NC	0.14	(0.19)	0.17	(0.51)	0.27	(0.19)	0.30	(0.21)
STF(-1)*CRISIS	0.03	(0.02)	0.08	(0.21)	0.13	(0.13)	0.13	(0.10)
NII(-1)*NC	0.14	(0.13)	0.24 *	(0.13)	0.04 ***	(0.01)	0.29	(0.18)
NII(-1)*CRISIS	0.04	(0.05)	0.16	(0.20)	0.02	(0.01)	0.01	(0.15)
ΔLOG(GDP)	0.17	(0.40)	0.09	(1.40)	0.68	(1.00)	1.90 **	(0.76)
EURIBOR	0.00	(0.00)	0.00	(0.01)	0.00	(0.01)	0.00	(0.01)
GDP_DEFLATOR	0.00	(0.00)	-0.04	(0.03)	-0.03	(0.02)	0.00	(0.01)
D(NSM)	0.29	(0.37)	-0.02	(0.96)	0.76	(0.73)	0.18	(0.29)
Time dummies:	YES		YES		YES		YES	
Sample period (adjusted):	2001-2011		2001-2011		2001-2011		2001-2011	
Cross-sections included:	1,241		494		120		74	
Total (unbalanced) obs.:	9,974		1,594		896		222	
Instrument rank:	40		37		69		47	
Sargan test (p-value):	0.65		0.43		0.32		0.23	

The estimated model is given by equation (16). CRISIS is a dummy variable that is 1 in the years 2008 and 2009 and 0 in all other years. NC is the non-crisis dummy. It takes on the value of 0 in 2008 and 2009 and 1 in all other years of the sample period. The model allows for fixed effects across banks realized by orthogonal deviations. It is estimated using difference GMM, 2-step estimator, White period robust standard errors. ***, ** and * indicate statistical significance on the 1%, 5% and 10% level respectively.