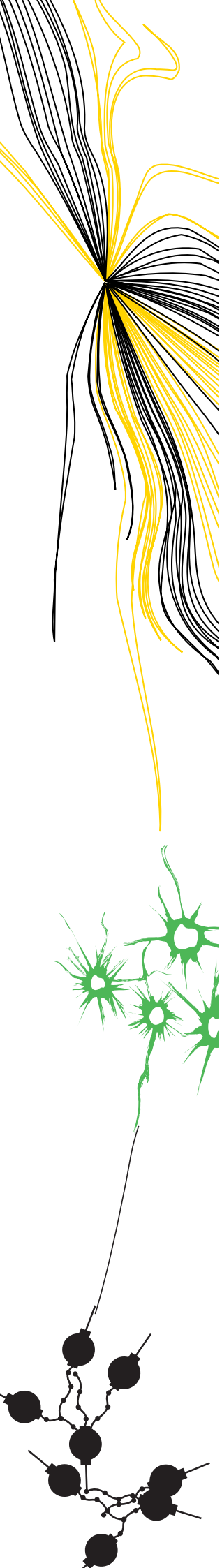

Master Thesis

Deposit Funding in the Euro Area

Determinants of deposit funding demand and supply: an explorative study on Euro Area bank deposit funding levels and Rabobank's prospects of increasing its Euro Area deposit funding.

Martijn Driesprong

$\mathcal{MD}r$

Utrecht, 2015

For your notes

Deposit Funding in the Euro Area

A thesis submitted in partial fulfilment of the requirements for the degree of

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by M. Driesprong

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Faculty	School of Management and Governance
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For your notes

SUMMARY

Developments in the Euro Area deposit funding markets, their driving factors and opportunities and difficulties for Rabobank in these markets are the three main topics of this study. We find evidence for a renewed post-crisis importance of deposits as an important bank funding source and conclude that banks have changed their perspective on deposits. Involvement in lending activities has proven an important determinant in banks' funding ability between 1999 and 2013. Pre-crisis bank lending activities preceded deposit funding while post-crisis banks attracted deposit funding first before granting new loans. This shift indicate higher reliance on deposit funding and a return to traditional banks activities. Moreover, this study shows that bank business models are important determinants for banks' deposit funding ability.

Research approach – Despite the importance of deposit funding for banks, the issue has received little attention in research. Based on a literature study, we identified potential determinants for bank deposit funding levels which we categorized by bank demand or deposit supply perspectives. We composed a dataset with country-level, regulatory bank balance sheet data (12 countries), a dataset with bank-level, accountancy bank balance sheet data (565 banks) between 1999-2013 and collected additional data on the potential deposit supply determinants. Time-dependent regressions were deployed to examine changes in deposit funding levels and associated determinants.

Main findings – We focussed our analysis on two main areas. First, we explored the dynamics of the deposit funding market and second we analysed relationships between deposit funding levels and the identified determinants. We found that Euro Area banks have increased their deposit funding levels in the between 1999 and 2013. This growth was time-invariant although the growth decreased post-crisis. Moreover, we found significant differences in deposit funding levels across countries and across bank business orientation. Banks in Northern Euro Area countries and investment-oriented banks have considerable higher deposit funding levels than their Southern Euro Area and retail-oriented counterparts.

Lending activities are an important factor for banks' deposit funding levels. The relationship between lending and deposit funding levels is consistent over time although differences in pre-crisis and post-crisis behaviour exist. In the short run, banks adjust their deposit funding levels after changes in loan levels but not the other way around; on the long run a reciprocal relationship is observed. Post-crisis the long run equilibrium relationship dissipated and banks focused primarily on increasing their deposit funding levels, regardless of their lending activities. Other important demand factors for deposit funding levels include deposit funding variability, bank risk, both negatively related, and bank size, positively related to deposit funding levels. Market power was not found influential on deposit funding levels. Important factors from a deposit supply perspective include national income (positive), housing prices (negative) and median age (positive). These findings extent classic money demand theory towards the demand of bank deposit services and hence deposit funding supply.

Recommendations – In answering our Research Question "What are Rabobank's difficulties and opportunities for increased deposit funding in the Euro Area" we made four main recommendations. First, Rabobank might benefit from stabilizing their deposit funding variability and bank risk profile. Deposit funding variability is significantly higher than banks in a Euro Area peer group and as a result of highly volatile return on assets, Rabobank report relative high levels of bank riskiness. Second, Rabobank might benefit from increased exploitation of the lending-deposit taking relationship. Post-crisis Euro Area banks have shifted their attention towards this core activity which resulted in a higher reliance and stronger demand for deposit funding. Third, Rabobank might benefit from maintained bank size. Euro Area banks have drastically decreased their bank size post-crisis while their deposit funding levels increased. Fourth, Rabobank might explore Spain and Portugal as sources for deposit funding. The relative higher ageing, lower housing prices and lower economic sentiments in these countries are favourable characteristics for higher levels of deposit funding.

For your notes

PREFACE

In 2006, I started my academic training in Civil Engineering at the University of Twente. Since then, I walked different paths in life and study. Now, exactly nine years later and with a second thesis on Innovation and Entrepreneurship on the way, I am writing the final words of my master thesis Financial Engineering & Management.

For this thesis, I have been engaged in a seven-month internship at the Special Projects team of Control Rabobank Group (CRG) in Utrecht. I am grateful to Carolien van Eggermond who has provided me with this opportunity. It has given me exactly what I was looking for: a glimpse into all major and minor details that keep a large bank afloat. A special acknowledgement goes out to Allard Bruinshoofd who allowed me to accompany him on his in-depth exploration of these major and minor details and provided me with excellent feedback and support during the development of this thesis. I would be remiss not to thank Annemarie, Himet, Jeroen, William and the CRG staff for their hospitality and time in their incredible busy schedule.

I also thank my supervisors from the University of Twente for their involvement. I admire how Berend Roorda develops, organizes and teaches the Financial Engineering & Management track while making time available for valuable feedback and debates. The thorough and elaborate feedback from Reinoud Joosten was invaluable to the completion of this thesis.

In Dutch fashion, I saved 'the best for last'. This thesis is not only my final deliverable for obtaining a Master of Science degree in Industrial Engineering & Management at the University of Twente, it also marks a long unwished-for, but now highly anticipated start of new paths. Laura, thank you for your patience and support and I am looking forward to our new paths together.

Martijn Driesprong

Utrecht, August 2015

"Other things may change us, but we start and end with family" (Anthony Brandt)

For your notes

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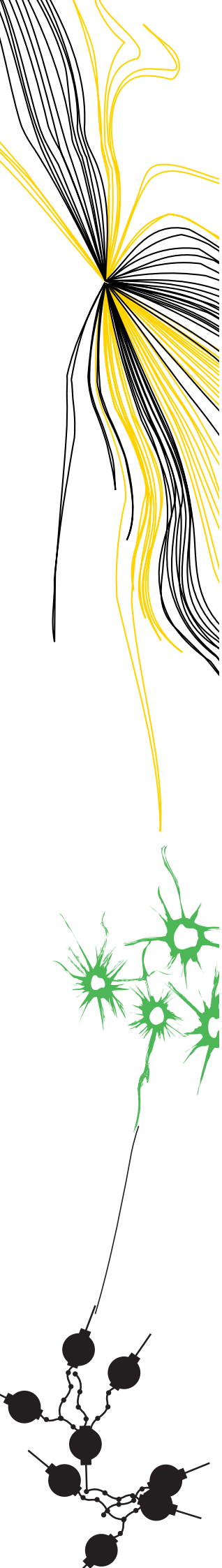


CHAPTER 1

RESEARCH DESIGN

1.1 Introduction

The aggregate balance sheet of the European Union and the Euro Area reflects the importance of deposit funding for banks (see Table 1.1.1). Within the European Union, non-MFI[1] deposits amount up to 38 per cent of monetary financial institution (MFI) funding which is approximately sufficient to fund outstanding non-MFI loans. For credit institutions[2] (CIs) the deposit and loan ratios are nearly identical to those of MFIs since credit institutions amount for 88 per cent of the number of MFIs in the European Union and 96 per cent in balance size (see Table 1.1.2). The balance sheet of the European Union and the Euro Area also show great similarity. The major differences in other assets and other liabilities are a result of a 6 per cent decrease in the share of external assets and external liabilities within the Euro Area. This reflects the integration financial markets within the Euro Area into one currency.[3]

Problem context – Deposit funding is regarded as an important means of stable funding by international institutions, legislators and regulators, rating agencies and academics.[4] This characteristic of deposit funding is especially important for deposit-funded banks which are more sensitive to decreasing deposit ratios than with large ratios of wholesale funding (Köhler, 2014, p. 212). Rabobank is one of those banks since 49 per cent of their total liabilities consists of funds entrusted of which 44 per cent are retail customer deposits (Rabobank, 2013a, p. 11).

Since the recent crisis, increased capital and bail-in requirements, additional liquidity ratios and the harmonization of deposit guarantee schemes forced banks to evaluate and improve the stability of their funding profiles and especially their deposit funding activities (European Parliament and Council, 2013c; European Commission, 2014b). Rabobank recently launched their strategic framework 2013-2016 which aims at a one billion Euro cost reduction through standardization and virtualization, slower growth of international wholesale, increased capitalization and a decrease of the loan to deposit ratio to 130 per cent through growth of international direct banking activities (Rabobank, 2013a, p. 19-22). Rabobank's department Control Rabobank Group (CRG) is responsible for monitoring changes in the bank's environment (e.g., regulation, behaviour of other competitors, customers and markets), translation of these developments in consequences and opportunities for the Rabobank and advising alternative measures to the bank's management. Hence, CRG is interested in the consequences of the recent developments in the deposit market on the bank's deposit funding ability. However, the factors influencing the deposit funding market are complex.

[1] Monetary financial institutions (MFIs) are central banks and organizations in the European Union that accept deposits from the public or offer notional protected savings accounts (e.g. money market funds). MFI deposits are generally referred to as interbank funding and therefore not included as deposit funding

[2] A credit institution is an organization which undertakes the business of which is to take deposits or other repayable funds from the public and to grant credits for its own account.

[3] External assets and liabilities are those assets and liabilities which are held and owed in foreign currencies.

[4] The IMF (2013, p. 106), BIS (2013, p. 67-68), European Parliament and Council (2013c, p. 251) include examples from legislation and regulation, Standard & Poors (2011, p. 35-36), Moodys Investor Service (2013, p. 21, 28-29), Fitch Ratings (2014, p. 28) emphasize on the importance from a rating agency's perspective and Van den End (2013, p. 16), Cecchetti, King, and Yetman (2011, p. 10) – amongst others – emphasize on the importance of deposits for stable funding from an academic perspective.

Assets	**MFI**		**CI**
	EA	*EU*	*EA*
Loans	38%	38%	39%
Securities	19%	17%	19%
Advances to banks	17%	16%	17%
Other assets	25%	30%	25%

Liabilities	**MFI**		**CI**
	EA	*EU*	*EA*
Capital	8%	8%	8%
Issued debt	16%	15%	14%
Interbank liabilities	18%	16%	19%
Deposit liabilities	36%	35%	37%
Other liabilities	22%	26%	21%

Table 1.1.1: Aggregate balance sheet of monetary financial institutions (MFIs) and credit institutions (CIs) in the European Union and Euro Area at the end of April 2014 (ECB, 2014).

	MFIs	CIs	MMFs	Other MFIs	CBs
Euro Area	6,717	5,846	814	39	18
European Union	8,746	7,727	943	47	29

Table 1.1.2: Number of monetary financial institutions (MFIs), stratified in credit institutions (CIs), money market funds (MMFs), central banks (CBs) and other MFIs in the European Union and Euro Area at the end of April 2014 (ECB, 2014).

1.2 Problem statement

The increased regulatory pressure and Rabobank's strategic framework towards 2016 underscore the importance of deposit funding for Rabobank. With this study, we examine the dynamics in the Euro Area deposit funding market and influencing factors and use the results to highlight opportunities for Rabobank in the Euro Area deposit funding market. The *research goal* is formulated accordingly:

> **Research goal** To assess, given Rabobank's strategic framework and recent developments in regulation, Rabobank's prospects of increasing its Euro Area deposit funding by obtaining insights in the main determinants of deposit funding and recent changes in the deposit funding market.

This goal is reflected in our *main research question* which is illustrated in Figure 1.2.1:

> **Research question** What are Rabobank's difficulties and opportunities for increased deposit funding in the Euro Area?

In order to answer this main research question, four sub-questions are specified guiding our analysis of the Euro Area Deposit funding market and supporting reflection on the main research question (see Table 1.2.1). Sub-Question 1 enables us to connect to existing literature. In conjunction with economic theory, we distinguish two points of view: the bank demand for deposits and customer supply of deposits. We review existing literature to identify and discuss potential determinants influencing deposit funding from both perspectives. Throughout the literature review, we develop hypothesis for the relationships between the identified determinants and deposit funding which provides a basis for a conceptual framework with determinants of deposit funding levels.

With Sub-Question 2, we focus on the context of the Euro Area deposit funding market. We construct a database with country-level and bank-level bank balance sheets and explore recent developments in Euro Area deposit funding market. This context provides background for our examination of the relationship between deposit funding and identified determinants (Sub-Question 3). We develop measures to test hypotheses, collect data and consequently execute the hypotheses tests. Finally, when the determinants, the relationship between the determinants and deposit funding and recent developments in the Euro Area deposit funding market are established, we reflect on these findings and highlight opportunities and difficulties for increased Euro Area deposit funding by Rabobank (Sub-Question 4).

Research Question	**What are Rabobank's difficulties and opportunities for increased deposit funding in the Euro Area?**	
Literature review	1.	What are the main determinants for Euro Area bank deposit funding levels?
Analysis	2.	What are the recent changes in Euro Area bank funding profiles?
	3.	How do the identified determinants relate to the Euro Area bank deposit funding levels?
Reflection	4.	How can Rabobank learn from our research and increase their Euro Area deposit funding level?

Table 1.2.1: Main research question and sub-questions.

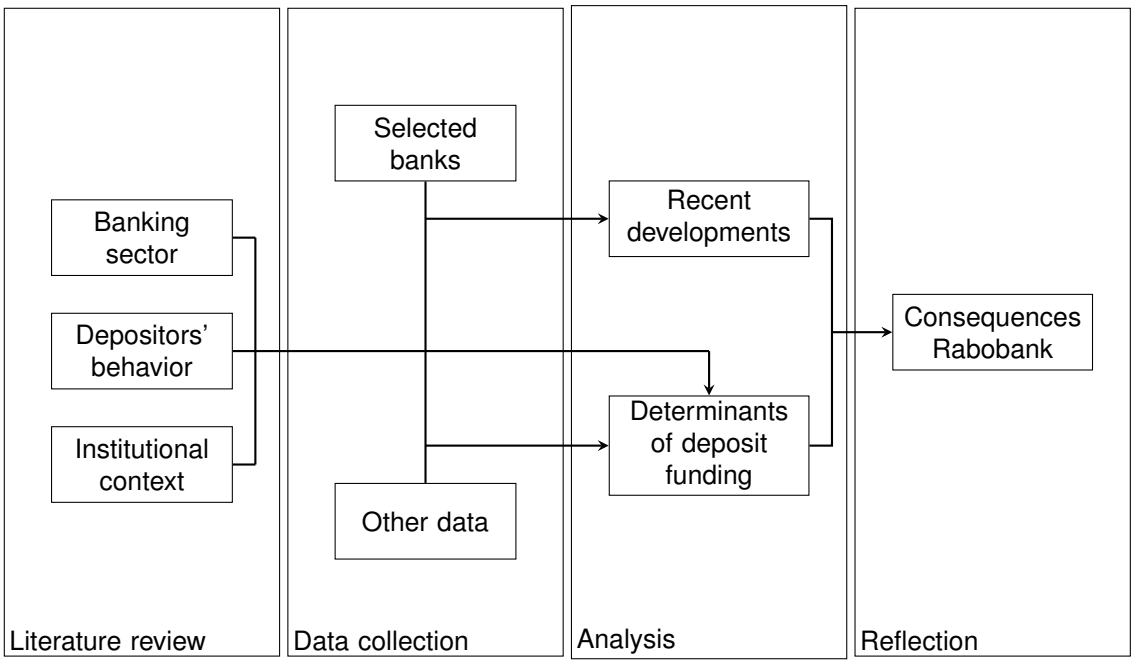


Figure 1.2.1: Research model (adapted from Verschuren & Doorewaard, 2004, p. 87).

1.3 Relevance

Knowledge gap – Research on the supply of money can be traced back to the development of the quantity theory of money which links the supply of money to the price level (i.e. see Newcomb, 1886; Keynes, 1936). Following the Keynesian school of thought, different scholars related money supply to capital – following Friedman's (1963) wealth spectrum approach – while more recent studies focus on the empirics of money demand model estimation (De Bondt, 2009, e.g., Arnold & Roelands, 2010). This stream of research, however, focusses on the macro-economic determinants and dynamics of monetary aggregates on a national level without implications for availability of deposits on a bank-level.

In more recent years, research on bank deposits focussed on the importance of deposit liabilities for bank stability (e.g., see Köhler, 2014; Beck, De Jonghe, & Schepens, 2013), customer protection (e.g., see Demirgüç-Kunt & Detragiache, 2002; Anginer, Demirguc-Kunt, & Zhu, 2014; Huizinga & Nicodème, 2006) and in relation to other funding sources (e.g., see Demirgüç-Kunt & Huizinga, 2010; Craig & Dinger, 2013). However, these studies disregard the impact of country and bank-specific factors on the availability of deposit funding levels.

Scientific contributions – In light of increased emphasis on deposit funding, the absence of a bank-level overview of factors influencing deposit funding is impeding our understanding of the dynamics in the deposit market. We examine potential determinants of deposit levels and address the implications for bank's funding ability. We focus on recent years and include the years since the recent financial crisis. This enables us to specifically include impact of further harmonization of deposit guarantee schemes on the retail operations of Euro Area banks.

Managerial contributions – Rabobank is with 83 per cent of its loans outstanding primarily exposed to the European market (Rabobank, 2013c, p. 34) which corresponds to its Euro Area deposit funding, i.e. 80 per cent of the funds entrusted are collected in the Netherlands and 45 per cent of the long-term bonds are issued in the Euro (Rabobank, 2013b, p. 77). Our examination of important determinants for deposit funding in the Euro Area enables the Rabobank to align their strategic objective of increased deposit funding with market dynamics.

1.4 Scope

As discussed in Chapter 4, we obtain our data through the ECB Statistical Datawarehouse (ECB, 2014) and Bureau van Dijk's Bankscope (2014) database. We are interested in Rabobank's ability to fund with Euro deposits with a special focus on recent developments. Hence, we focus on banks in countries that were member of the Euro Area at the beginning of the recent financial crisis: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal and Spain. Deposit funding is central to this study, hence we only include banks who report deposit funding levels in the subsequent years from 2008 to the last available year but gather all available data from 1999 onwards. This set-up increases the survivor bias but is in line with our aim to make useful comments on recent developments. Furthermore, we limit our analysis to banks with a balance sheet size of EUR 1.5 billion in order to limit the influence of outlier banks in our analysis. Different data sources are deployed to examine deposit funding from a bank-level (accounting) and country-level (regulatory) perspective.

1.5 Thesis outline

The thesis outline is structured as followed. First we identify potential determinants for bank deposit funding with use of a literature review. We base this review on scientific articles and discussion papers from the banking sector – mainly from regulators working in close cooperation with bank research departments – and report results in Chapter 2 and Chapter 3. In Chapter 4, methods for hypothesis testing, data collection and data treatment is discussed.

In Chapter 5, we focus on Sub-Question 2 and create an overview of the Euro Area deposit funding market and recent developments. In Chapter 6 we complement this overview with an empirical examination of potential determinants for deposit funding levels. By way of synthesis, Chapter 7 includes an overview of our main findings. We discuss the connection to existing literature, provide with directions for future research and reflect on the main research question with a discussion on managerial implications.

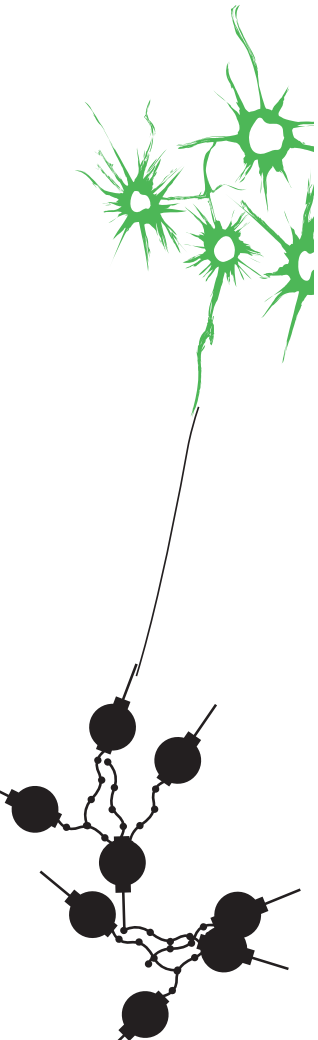
CHAPTER 2

BANKS' DEPOSIT DEMAND

This chapter is concerned with Sub-Question 1:

"What are the main determinants for Euro Area deposit funding?"

We discuss relevant literature on deposit funding and the main determinants from a bank demand perspective and develop hypotheses to answer the Research Question. The demand perspective directs our attention primarily to bank-level determinants.



2.1 How bank fund themselves

Banks are the only institutions permitted to attract deposit funding from the public in the Euro Area (European Parliament and Council, 2013a, p. 355). Consequently, bank funding consists of deposit liabilities but these are not their only funding source. Bank funding sources may be typified by maturity, risk profile and fund provider (see Figure 2.1.1); but a differentiation in funding by funds provider – including capital, wholesale funding and deposit funding – is most common. These types of funding also vary by loss-absorption and risk-bearing capacity, cost of funding, informedness of the fund providers and stability.

Capital – Capital is the residual value of the bank in the event of liquidation and is first in line for risk- and loss-absorption (ECB, 2012, p. 84). End of April 2014, capital and reserves amounted up to 8 per cent of the aggregate Euro Area bank liabilities.[1] Capital comprises the bank's equity, non-distributed funds and reserves for risks associated with the business activities and is the bank's primary source of risk-absorption. Providers of capital are financially informed decision makers and include shareholders, bank's own operations and some types of subordinated ('junior') risk-bearing debt. Although capital is a stable source of funding, it is also expensive since providers of capital demand higher returns for the associated higher risk.[2]

Wholesale funding – Wholesale funding is provided by informed institutional investors which include pension funds, insurers, money market funds and other banks. Wholesale funding includes interbank deposits, issued debt, trading liabilities and money market funds. In the Euro Area, wholesale funding provides in aggregate 54 per cent of bank funding needs and was regarded relatively stable prior to the recent financial crisis. Since then a large reliance on wholesale funding is considered hazardous as it increases the exposure to market shocks as investors have the ability to withdraw funds at the first negative market signals (Van Rixtel & Gasperini, 2013, p. 3). This altered perspective and the increased volatility of wholesale funding is mainly due to a change in risk perception as in some cases the legal obligation to repay wholesale funding was not met. This perspective was later formalized in Euro Area regulation on bank resolution (European Parliament and Council, 2013b).

The fleetingness of wholesale funding is also an attractive characteristic as it allows banks to manage the balance sheet size pro-cyclical and fills the funding gap.[3] As such, wholesale funding is used as an additional source for funding needs that exceed the relative stable capital, reserves and deposit funds. Reliance on wholesale funding is in general inevitable as the availability of other funding sources is limited by their costs and country-specific social structures.[4]Attracting wholesale funding involves expensive activities related to accountability, reporting, investor relations and maintaining an active dealer network for the issued debt to ensure a liquid market. These mainly fixed costs require a certain bank size for wholesale funding to become an attractive source of funding.

[1]Aggregated Euro Area bank balance sheets data obtained from Statistical Data Warehouse (ECB, 2014). Figure 2.1.2 shows increased capital levels in Euro Area bank funding profiles from 5.5 per cent in 2008 to 8 per cent in 2014.

[2]The financial informedness of providers refers to the providers' ability to assess the banks' riskiness and mitigate potential information asymmetries (Freixas & Rochet, 1997, p. 1).

[3]The funding gap refers to the inability of banks to fund outstanding loans with deposits. See for example Ayadi, Arbak, and De Groen (2011, p. 12), Le Leslé (2012, p. 9), Van den End (2013, p. 2).

[4]For example, the availability of deposit funding is lower in countries with large mandatory pension systems.

	Capital	**Wholesale funding**	**Deposit funding**
Provider's informedness	Informed	Informed	Uninformed
Risk- and loss-absorption	Full	Limited	None
Cost of funding	8–12%	6–10 %	0-3%
Stability	High	Intermediate to low	High
Volume	8%	54%	38%

Table 2.1.1: Key characteristics of funding sources.

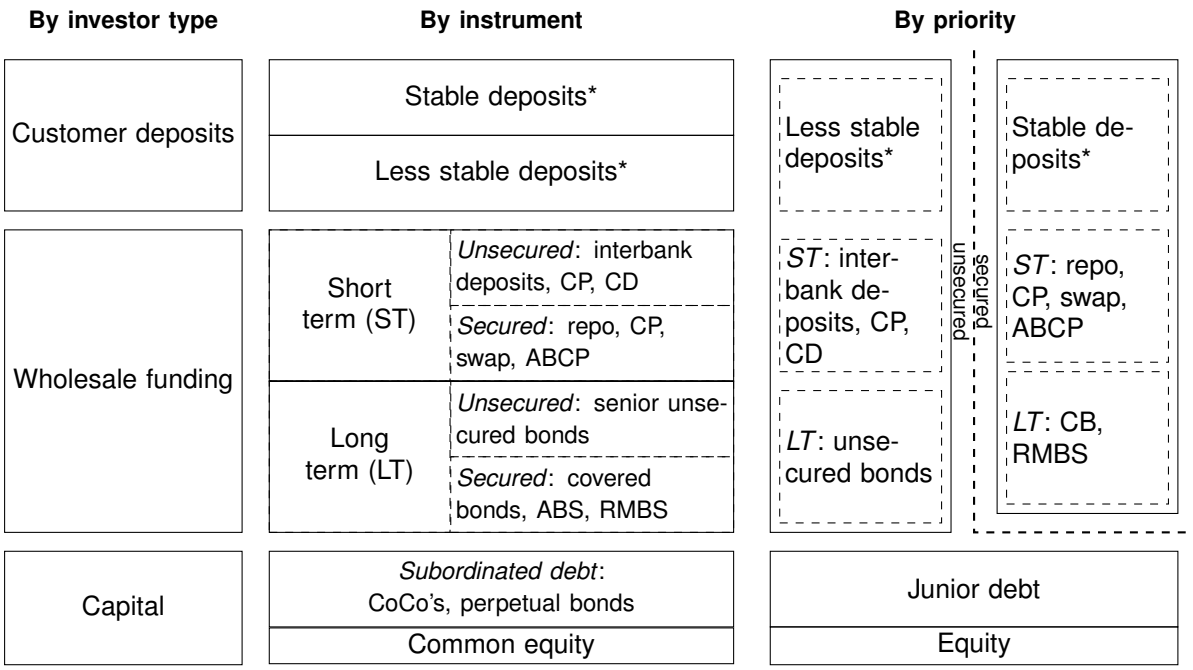


Figure 2.1.1: Breakdown of bank liabilities (adapted from IMF, 2013, p. 108). (*) Stable or secured deposits are those which are covered by deposit guarantee schemes (DGSs).

Deposit funding – Deposits are 'amounts which are owed to creditors (...) which are not negotiable [standardized products] and not marketable' (ECB, 2012, p. 66) and provided by uninformed decision makers, i.e. mainly households and small and medium enterprises.[5]The non-marketability of the deposit liabilities refers to restrictions on the transfer of legal ownership and accounts for the absence of an organized market for deposits and hence to a great extent the stability of deposit funds as banks are unable to trade these deposits (e.g., see BIS, 2013; BIS, 2014). Furthermore, deposits are largely exempt from loss-absorption by deposit guarantee schemes as it is assumed that providers of retail deposit funding make less informed financial decisions opposed to providers of other funding sources. However, stability of deposit funding increases while regulatory preferential treatment of deposits decreases depositors' incentives to monitor bank riskiness and ultimately to change banks' risk-taking behaviour.

In the Euro Area, deposits form the primary funding source of many banks with a median deposit level over total liabilities of 60% in the last 5 years. End of April 2014, the aggregate deposit volume in the Euro Area amounted 38 per cent of the banks' total liabilities.[6] A breakdown by maturities include overnight deposits (46%), deposits with an agreed maturity (28%) and deposits redeemable at notice (26%). In some instances repurchase agreements (repos) are also referred to as deposit funding; however we exclude repos from our definition of deposit funding as repurchase transactions are negotiable and often represent transferable liabilities.

Before the crisis, deposits proved an inexpensive source of funding with spreads of 300 basis points under one-year Euribor rates (ECB, 2014). Nowadays, the spreads have diminished to 10 basis points, mainly due to a drop in wholesale funding costs but also as a result of increased costs of attracting retail deposits.

[5]Corporations and other non-households may also hold deposits (23%). However, these deposits are less stable by nature since these often employ more sophisticated strategies to manage their cash positions which involve higher portions of wholesale funding and short-term deposit positions. Households hold twice as much of their deposits in long-term deposits and less in overnight deposits (41%) than corporations (66%).

[6]The difference between the median and aggregate measure of relative deposit funding levels is partly caused by different data sources – accounting and regulatory data respectively – and might be the result of differing dependence on deposit funding across bank sizes.

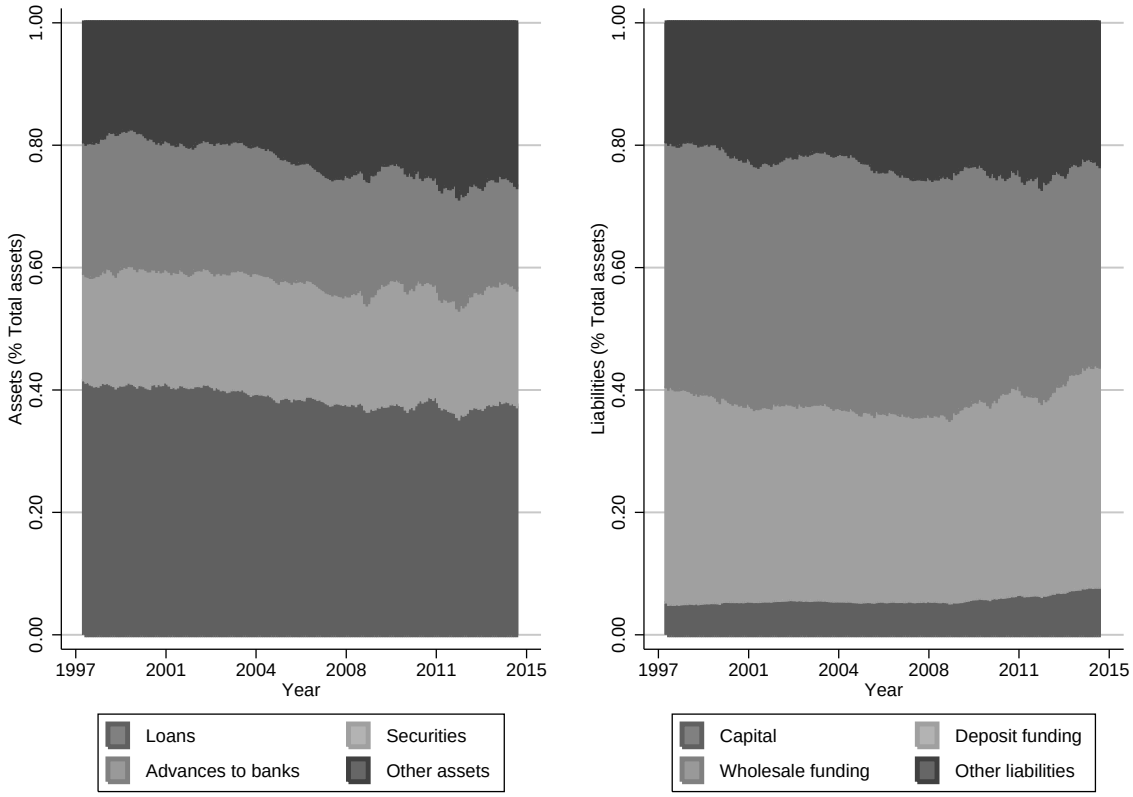


Figure 2.1.2: Asset and liabilities levels in Euro Area bank balance sheets between 1999-2014.

Conclusion – Banks fund with a wide variety of financial instruments which differ in risk-return characteristics, stability and their regulatory treatment. Capital is expensive, full risk- and loss-absorbing funding while wholesale funding provides limited loss-absorption against lower funding costs. Whereas capital providers are severely limited in their ability to withdraw their funding, wholesale funding is more flexible but also less reliable. Both capital and wholesale funding providers are considered informed financial decision makers and do not receive special regulatory protection. In contrast, depositors are considered uninformed and deposit funding receives regulatory preference in insolvency procedures. As a result, deposits are stable, generally not loss-absorbing and relatively inexpensive.

2.1.1 Changed funding patterns

Deposit funding levels in the Euro Area bank balance sheets increased from 5,064 to 11,076 billion euros between 1999 and 2014 while in the same period relative deposit funding grew from 34.1 % to 35.8 % of the total assets. This increase in absolute and relative deposit funding levels in Euro Area bank balance sheets might emanate from an increased regulatory emphasis on deposit funding as a source of funding, attractive risk-return characteristics of deposit funding – primarily resulting from depositor protection regimes – and the opportunities for cross-selling arising from deposit taking activities. In later sections we discuss potential determinants for deposit funding levels in more detail.

Regardless of the specific driving forces, there is a strong indication that deposit funding levels have grown. To formally test this presumption and to allow an examination of the underlying mechanisms for deposit funding level growth, we hypothesize that:

Hypothesis 1a Overall, bank deposit funding levels have increased since 1999.

Different scholars have argued that bank funding structures have changed in line with changes in their main business activities. After a movement towards investment banking activities in the 1980s (Elsas, Hackethal, & Holzhäuser, 2010, p. 1286; Llewellyn, 2012, pp. 45-46), banks moved again away from these activities after the recent crisis (Demirgüç-Kunt & Huizinga, 2010, p. 648; ECB, 2013, p. 24), resulting in a Euro Area aggregated reduction of wholesale funding from 44 to 38 per cent of total liabilities. The wholesale funding reduction was absorbed by an increase in equity (+ 2.5 per cent), secured debt and deposit funding (+ 3.5 per cent) in the period 2008-2013.[7]The shift towards other non-wholesale funding sources, indicate a stronger demand for deposit funding. Hence, we expect stronger growth of deposit funding levels in Euro Area bank balance sheets since the recent crisis:

Hypothesis 1b Growth of bank deposit funding levels in Euro Area bank balance sheets increased since the recent crisis.

We discuss bank business models and their impact on deposit funding levels in Section 2.2.3; here we focus on the presence of cross-sectional differences and their impact on deposit funding levels. In a recent study of bank funding patterns since the financial crisis, Mesquita (2010) found that banks "regard the geographical funding structure not as a choice variable, but as a consequence of their institution's history, which determines the overall business model, which in turn instils a corporate culture and risk attitude that ultimately translates into the funding approach" (Mesquita, 2010, p. 9). Hence, determinants of funding structures also include banks' country-specific history, geography and institutional context supporting our expectation of large differences in deposit funding levels not only across bank business orientations but also across countries:

Hypothesis 1c Bank deposit funding levels vary across countries.

Hypothesis 1d Bank deposit funding levels vary across bank business orientations.

Our indication of deposit funding level growth raises the question what the driving forces are behind deposit growth. Regulatory emphasis, attractive-risk return characteristics and bank business models – and hence competitive considerations – are mentioned as potential determinants. In the next sections, we highlight evidence that deposit funding demand is indeed driven by these factors; furthermore, we highlight bank's economic function in which deposit funding plays an important role.

2.2 Why banks fund with deposits

Euro Area banks fund with deposits as banks are by definition the only financial institutions that accept – and permitted to accept[8]– deposits from the public and grant credits for own account (European Parliament and Council, 2013c, p. 19). Hence, the basic function of banks is to transform deposits into loans. This transformation mechanism is an important starting point for our discussion of four explanatory themes for deposit funding levels from a bank perspective:[9]the *economic function*, *regulatory incentives*, *bank business models* and *competitive considerations*. First, the mechanism underscores banks' economic function as liquidity distributor in the Euro Area. Second, the mechanism shows the regulatory favouritism for banks in deposit taking activities and the need for regulatory involvement to foster financial stability and customer protection. Third, the extent to which banks are involved with this mechanism highlights the existence of different business models. Fourth, these business models position banks and their deposit funding ability differently in the Euro Area deposit funding market and hence result in different competitive considerations.

[7]The shift towards deposit funding is especially welcome since retail oriented banks have shown a high degree of stability and resilience to the recent crisis (Merck Martel, Van Rixtel, & Mota, 2012, p. 116). The shift to less volatile funding also results in increased funding costs but operating profits – and hence solvability – have remained stable (ECB, 2013, pp. 18, 19, 26).

[8]A permit to attract deposit funding from the public is a necessary condition to classify as a bank.

[9]Note that these themes are undoubtedly interrelated (cf. Barth, Caprio, & Levine, 2004, pp. 206, 245; Goddard, Molyneux, Wilson, & Tavakoli, 2007).

2.2.1 Economic function: the role of deposits in banks' main function

Although banks diversified their activities drastically in the last decades, banks' core business activities continued to include deposit taking from the public, offering deposit-linked payment services and lending for own account. This asset transformation mechanism allows banks to execute an important economical function, i.e. creation and distribution of temporal- and spatial-specific liquidity[10]between their customers. This economic function and the underlying mechanism is a major driver of banks' demand for deposit funding.

Liquidity distribution – Liquidity distribution is beneficial for economic growth as it ensures efficient allocation of liquidity to its most productive use and allows distribution of economic resources with varying size in uncertain environments (Merton, 1995, pp. 23-24). However, liquidity distribution is – especially in uncertain environments – also associated with transaction costs. Banks minimize the transaction costs – and hence create liquidity – through intermediation between customers, asset transformation, depositor and debtor monitoring, risk management, information processing and value transfers (Freixas & Rochet, 1997, pp. 1-2; Cavelaars & Passenier, 2012, pp. 4-5). In fact, "the raison d'être for [the banking] industry is the existence of transactions costs" (Scholes *et al.*, 1976, p. 215). This is because the presence of transaction costs enables banks to utilize economies of scope and scale, minimize the transaction costs for individual customers and create additional liquidity.

Economies of scale and scope – As platforms for liquidity distribution come with fixed costs, banks attract and grant large volumes of deposits and loans to minimize transaction costs. Providing the same platform to multiple customers results in scale advantages. Increased scale of operations allows depositors and borrowers to hold more diversified portfolios as a broader range of investment opportunities become available from large coalitions of depositors. These large coalitions are then able to invest in more illiquid investments while satisfying the liquidity needs of individual investors (Freixas & Rochet, 1997, p. 19; Diamond & Dybvig, 1983, p. 416). Moreover, scale advantages coincide with scope advantages as the distinct combination of deposit taking activities and lending are essentially two manifestations of the same function – providing of liquidity – and need similar risk analysis, monitoring and information processes (Kashyap, Rajan, & Stein, 2002, p. 65). Especially the information advantages resulting from simultaneous provisioning of loans and deposit services provide banks with large scope advantages.[11]As a result, banks are likely to adjust their deposit funding and loan levels simultaneously which indicates a strong interrelationship – or cointegrating relationship – between deposit funding and lending over time:

Hypothesis 2a Bank deposit funding and loan levels are dynamically related.

Although banks have the ability to fund loans with a wide array of sources, this relationship implies that loans are – at least on the long-run – funded with deposit funding. Hence, deposit funding and loan levels are not only dynamically related, there is likely a causal flow – or Granger causality – from deposit funding to loan levels which indicates that changes in deposit funding precede changes in loan levels:

Hypothesis 2b Changes in bank deposit funding levels lead to changes in bank loan levels.

Such a causal flow from deposit funding to loan levels is in line with prudential principles as banks attract funding with similar characteristics first before these are transformed and transferred in the form of loans.

Regulatory favouritism[12]**–** Required knowledge and capabilities to minimize transaction costs in liquidity provision is not unique to banks. However, deposit taking is restricted in practice to banks[13]as

[10]Assets which have the property of being transformed at minimal transaction costs are referred to as liquid assets (Scholes, Benston, & Smith, 1976, p. 219).

[11]These advantages include cross-selling potential. However, simultaneous involvement in deposit and loan activities may not only provide banks with information benefits but also increase information asymmetries which undermine depositors' ability to value bank assets and offerings correctly. These asymmetries enable banks to extract monopolistic rents which might lessen wealth creation (Benston & Kaufman, 1995, p. 18; Ayadi *et al.*, 2011, p. 9). This tension highlights regulatory involvement and emphasis on competition.

[12]The impact and motives of regulation on bank deposit demand are further discussed in Section 2.2.2.

banks benefit from regulatory favouritism. This restriction allows governments and regulators to monitor and influence economic development, financial stability and customer protection but limit competition-fuelled efficiency as the regulatory favouritism resulted in banking sectors characterized by monopolistic competition (Freixas & Rochet, 1997, p. 1; Goddard *et al.*, 2007, p. 1922).

Diversification – Diversification allows banks, in addition to cross-selling and cost-sharing, to minimize transaction costs further. Banks offer and use risk diversification through distribution of different risks from a variety of debtors over various investors and diversify their own risk profile similarly by diversification of activities. Diversification of bank activities increases the profitability but interestingly not necessarily the market value of banking conglomerate. This valuation-profitability paradox is most likely explained by the mediating effect of the banks' increased risk profiles which is especially true for European banks.[14] Large, diversified banks are considered 'too big to fail' (TBTF) and benefit from (implicit) government guarantees which might result in excessive risk taking[15]while smaller banks often lack the expertise to undertake different streams of business activities (Mercieca, Schaeck, & Wolfe, 2007, p. 1995). The impact of diversification and bank size on bank stability is also stressed by Bank of England director Andrew Haldane who argued that implicit and explicit state-support had distorted risk-return considerations in banking which led to different innovations, including new business line diversification. These diversifications resulted in increased systemic risk for the overall banking sector (Haldane, 2013, p. 3). Investors might discount banks' market value with the increased risk of the financial sector but this is not necessarily true for all banks. Banks with high reliance on one type of income might benefit from increased bank stability by income diversification and vice versa (Lepetit, Nys, Rous, & Tarazi, 2008, p. 1461; Stiroh & Rumble, 2006, p. 2158). Similar results are found for funding structures which indicates the U-shaped relationship of deposit funding and interest income on bank stability (Köhler, 2014, p. 208).

Although diversification is closely related to banks' asset transformation mechanism, the economic added value of bank diversification itself depends on the bank's specific business activities. The extent to which banks diversify their activities is of great significance for the bank's risk profiles, funding structures and hence for the importance of deposit funding in these structures.

Recent changes in banks' asset transformation mechanism – Since the start of the crisis many banks emphasised – again – on providing liquidity as their main activity. As a result, attention increased for the asset transformation mechanism and hence for deposit funding. However, this focus likely coincided with a change of the dynamic relationship between deposit funding and lending. Shortly after the fall of Lehman Brothers, banks world wide decreased their lending.[16] Similarly, European banks decreased the levels of lending as the uncertainty of European economies and their ability to repay loans continued (Howcroft, Kara, & Marques, 2014, p. 489). For a stable deposit-loan transformation mechanism, the decreased lending activities indicate decreased deposit funding activities.

Decreased deposit funding levels conflict with our hypotheses 1a and 1b. On the other hand, the relative stability of deposit funding levels, the rapid decrease of other funding sources and regulatory emphasis on deposit funding favour the premises of growing deposit levels (H1a-b) with decreasing loan levels. As a result, we hypothesize that the deposit–loan transformation mechanism has probably changed since the crisis:

> **Hypothesis 2c** The dynamic relationship between deposit funding and loan levels changed since the crisis.

Conclusion – Banks deploy their main asset transformation mechanism between deposits and loans,

[13] This restriction is true for all deposit taking activities and especially for deposits from households and SMEs, the majority of depositors in the Euro Area. Differences between Anglo-Saxon financial systems and mainland European financial systems exist where the former are less restrictive although in Anglo-Saxon systems deposit taking activities from uninformed decision makers also is reserved for licensed banks.

[14] See for a more broad discussion Stiroh and Rumble (2006, p. 2158), Baele, De Jonghe, and Vander Vennet (2007, p. 2020), Laeven and Levine (2007, p. 365), Elsas *et al.* (2010, p. 1286), Jonghe (2010, p. 415).

[15] Regulators have also argued that banks are too complex rather than too big to save as a result of the breath of activities. Disciplining these banks efficiently has proven a challenge for regulators which has enabled large banks to continue to extract monopolistic rents (Kane, 2000, p. 695; Stiroh & Rumble, 2006, p. 2159).

[16] Although banks with generous access to deposit funding showed lower decreases (Ivashina & Scharfstein, 2010, p. 335).

exploit scale and scope economies and support efficient liquidity allocation to its most productive use. Hence, banks' deposit demand is a direct result of their economic function: liquidity distribution at minimum transaction costs. This economic function suggests a strong interrelation between deposit funding and loans (H2a); moreover, it implies a causal flow from deposit funding to lending as loans are funded by deposits (H2b). Since the recent crisis, deposit funding levels have grown while lending activities decreased. Consequently, the transformation mechanism between deposit funding and loans has likely changed (H2c).

The economic function is supported by regulatory favouritism and influenced by scope advantages which might result in different business models. The influence of regulation and business models on banks' deposit demand are discussed in next sections.

2.2.2 Regulation: regulatory incentives for deposit preference

Regulators are involved with banks for numerous motives,[17] primarily to foster economic growth, financial stability and customer protection. Deposits play a special role for regulators as these provide both the rationale and means for regulatory interventions (Laeven & Levine, 2009, p. 260): from a customer protection perspective, depositors require a preferred position as they are considered uninformed decision makers (see Section 2.1 and Figure 2.1.1). However, depositor preference might result in reduced depositor market discipline which increases moral hazard and lead to excessive risk-taking. To counter these effects, regulators impose capital requirements which align the risk-taking incentives of a bank and its owners by forcing them to allocate more personal wealth at risk in the bank. The alignment of risk-taking incentives for the owners and depositors increases financial stability.[18]

Euro Area bank regulation – European Union member states have a long history of bank regulation which from the seventeenth century increasingly focused on deposit taking and lending (Benston, 2000, p. 185). In the last decades a number of regulatory initiatives aimed to integrate Euro Area bank regulations.[19] This resulted in the capital requirements regulation (CRR), capital requirement directive (CRD), bank recovery and recovery directive (BRRD) and deposit guarantee scheme directive (DGSD) nowadays in effect. These regulations all aim to increase financial stability and customer protection through restrictions on leverage, liquidity requirements and adjustment of priorities in insolvency claims. The CRR and CRD – generally referred to as the CRD IV package[20] – contain the Euro Area specific requirements for capital and liquidity and specifically designate retail deposits as stable funding. Outflows of deposits covered by a deposit guarantee scheme are expected not to exceed 5 per cent per annum and hence considered highly stable while other funding sources receive higher discounts and are considered significantly less stable (see European Parliament and Council, 2013c, article 421).

Banking union – The most recent edition of the CRD IV package, the DGSD and BRRD form the basis the EU initiatives to prevent future bank crises and are referred to as the banking union. The banking union is part of the efforts to create a fully integrated European banking market[21] and is based on three pillars (Goddard *et al.*, 2007, p. 1928; European Commission, 2014a, p. 1).

- *Single supervision* – by the ECB as central prudential supervisor of all financial institutions in the Euro Area. The largest banks are supervised by the ECB directly while supervision of smaller banks is mandated to the national supervisors.
- *Single resolution* – by the Single Resolution Board (SRB) and financed by the banking sector. The single resolution mechanism allows for orderly resolution of banks in the Euro Area at the minimal

[17] See for example Benston (2000) for a discussion on potential justifications for bank regulation.

[18] Laeven and Levine (2009), Forssbæck (2011) show however that the effects of increased depositor guarantees and capital requirements are highly bank-specific as these also may stimulate banks into excessive risk-taking when altered risk profiles induce bank owners to demand higher returns.

[19] See Goddard *et al.* (2007, p. 1915) for an overview of EU banking legislations between 1977 and 2008.

[20] These requirements are the transposition of the Basel agreements on stable funding and liquidity management. In essence, these aggreements focus on minimum leverage requirements of 3 per cent and a net stable funding ratio and a liquidity coverage ratio of at least 100 per cent (e.g., see BIS, 2013; BIS, 2014).

[21] Dermine (2006) already argued prior to the recent financial crisis that continuing European integration requires cross-boarder supervision and Euro-wide funded bail-out tools.

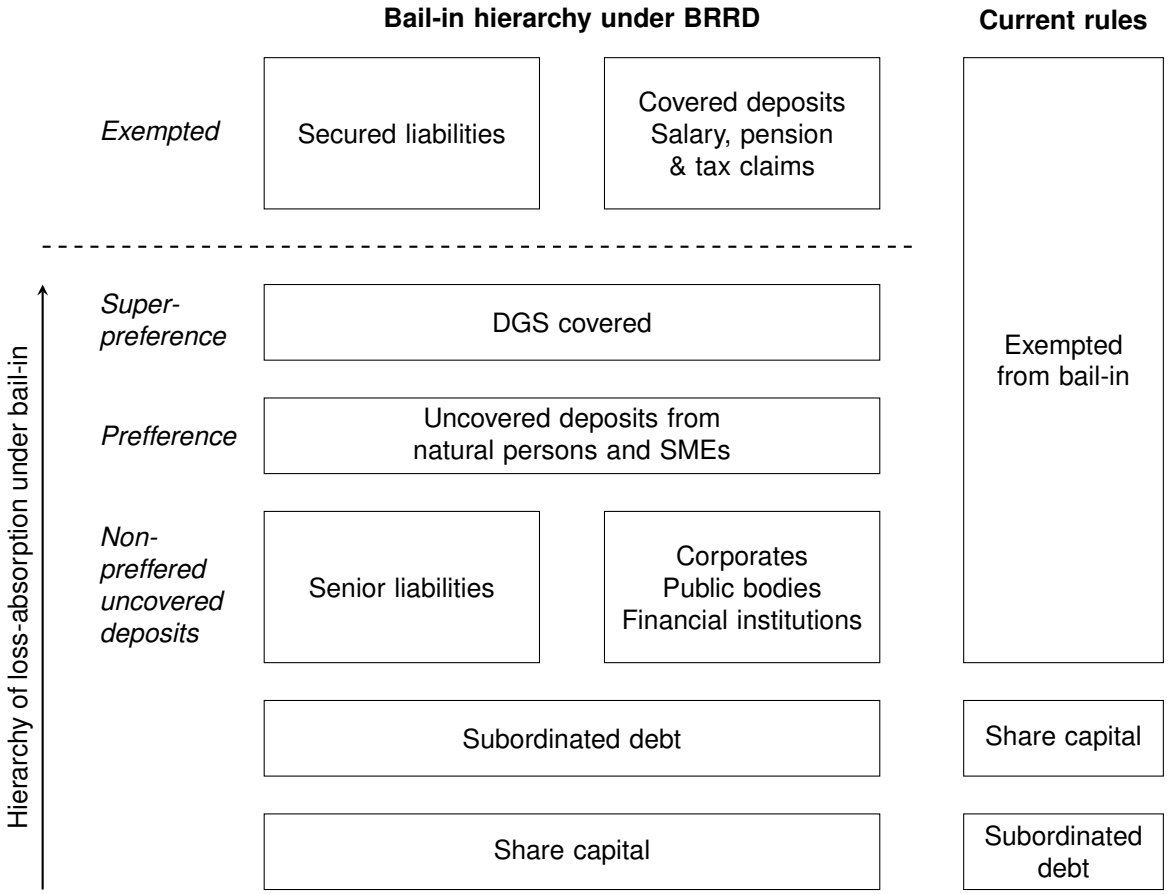


Figure 2.2.1: Bail-in waterfall (based on European Commission, 2013, p. 8; European Parliament and Council, 2013b, pp. 267-269).

costs for taxpayers. The contribution of large banks to the ex ante Single Resolution Fund (SRF) is based on the deposit volumes of banks.

- *Single rulebook* – for all banks active in the European Union. The rulebook includes the capital requirements (CRD IV package), designating supervision authority and recovery and resolution planning (BRRD) and the depositor preference (DGSD).

The impact of the banking union on banks' funding structures is multifold. The single supervision mechanism increases homogeneity of funding structure requirements and interrelations between bank fund providers in the Euro Area[22] while the single resolution mechanism forces banks to structure their activities upfront to minimize resolution costs. Increased homogeneity – more specifically, the limitation of diversification – of funding structures is also enforced by the hierarchy of loss-absorption under the BRRD which – in line with the DGSD – show super-preference to the majority of retail deposit funding (see Figure 2.2.1).

Depositor preference – Depositor preference in the European Union is since the 1994 directive on deposit guarantee schemes harmonized at a supra-national levels (European Parliament and Council, 1994) and aims to provide customer protection and financial stability by guaranteeing repayment of a covered level of funds deposited and by limiting the occurrence of bank runs (European Parliament and Council, 2014, p. 173). The harmonization of depositor preference required all banks to operate under a deposit guarantee scheme and provided with a uniform coverage level across the European Union.

[22] Especially the minimum capital requirements are influential for the bank funding structure; however, the risk weightings in CRD IV and BIS III create 'buckets' of risk categories, influencing the concentration of available risk-return profiles.

[23] Germany has a tiered DGS-system with statutory coverage of EUR 100.000 and voluntary additional coverage.

Country	#	Deposit guarantee schemes	Coverage
Austria	5	Einlagensicherung der Banken & Bankiers	100.000
		Hypo-Haftungsgesellschaft	100.000
		Österreichischer Raiffeisen-Einlagensicherung	100.000
		Schulze-Delitzsch-Haftungsgenossenschaft	100.000
		Österreichische Sparkassenverband	100.000
Belgium	1	Fonds de Protection des Dépôts et des Instruments Financiers	100.000
Cyprus	1	Deposit Protection and Resolution of Credit and Other Institutions Scheme	100.000
Estionia	1	Tagatisfond	100.000
Finland	1	Talletussuojarahasto	100.000
France	1	Fonds de Garantie des Dépôts	100.000
Germany[23]	5	Deposit Protection Fund	30% of assets
		Bundesverband Öffentlicher Banken Deutschlands	100.000
		Entschädigungseinrichtung deutscher Banken	100.000
		Bundesverband Öffentlicher Banken Deutschlands	unlimited
		Finanzgruppe Deutscher Sparkassen- und Giroverband	unlimited
		Bundesverband der Deutschen Volksbanken und Raiffeisen-banken	unlimited
Greece	1	Hellenic Deposit and Investment Guarantee Fund	100.000
Ireland	1	Irish Deposit Protection Scheme	100.000
Italy	3	Fondo di Garanzia degli Obbligazionisti	103.291
		Fondo di Garanzia dei Depositanti	100.000
		Fondo Interbancario di Tutela dei Depositi	100.000
Latvia	1	Financial and Capital Market commission of Latvia	100.000
Luxembourg	1	Association pour la Garantie des Dépôts Luxembourg	100.000
Malta	1	Depositor Compensation Scheme	100.000
Netherlands	1	Collective guarantee scheme of credit insitutions for repayable funds and portfolio investments	100.000
Portugal	2	Fundo de Garantia do Credito Agricola Mutuo	100.000
		Fundo de Garantia de Depósitos	100.000
Slovakia	1	Fond ochrany vkladov	100.000
Slovenia	1	Banka Slovenije	100.000
Spain	1	Fondo de Garantía de Depósitos de Entidades de Crédito	100.000

Table 2.2.1: Overview of deposit guarantee schemes in the Euro Area (data from DGS websites).

This form of customer protection resulted in lowered risk and price characteristics of deposit funding and decreased deposit fund variability since depositors' exerted market power reduced. Hence, deposit guarantee schemes form an important regulatory influence on deposit funding for banks.

The effects of deposit guarantee schemes on bank stability are evident:[24] depositor preference might prevent bank runs which have severe impact on the real economy (Diamond & Dybvig, 1983) and during the last financial crisis, systemic stability and bank risk proved lower in countries with depositor guarantee schemes (Anginer *et al.*, 2014, p. 9). Furthermore, the regulatory-induced under priced

[24] Although recent examples of bank runs in the United Kingdom (2007), Iceland (2008), the Netherlands (2009), Cyprus (2013) and Bulgaria (2014) show that deposit guarantee schemes can not prevent all bank runs.

risk characteristics of deposits increase attractiveness of deposit funding and result in reduced market discipline exerted by depositors (Demirgüç-Kunt & Detragiache, 2002, pp. 1402-1403). To counter these negative effects, regulators align the incentives of banks, depositors, creditors and owners with capital requirements and specific features in deposit guarantee scheme design.[25] This alignment is crucial since other market participants need to absorb the reduced market discipline of depositors.

Currently small differences exist between the number and coverage of deposit guarantee schemes of Euro Area countries (see Table 2.2.1). DGSD is based on minimum harmonization and allows for a broader application which enables Euro Area member states to tailor their schemes to country-specifics which is especially important for the German tiered-DGS system.[26]

Conclusion – Deposits play a central role for both the rationale and means of regulatory involvement with banks: to foster economic growth, financial stability and depositor preference, deposits are exempted from loss-absorption in bank insolvency procedures. As a result, banks experience reduced market discipline, depositors are less engaged with their bank and the banks benefit from higher levels of deposit funding stability. Recent initiatives are in line with the rationale to increase depositor protection and the stability of deposit funding. The regulatory focus on deposit funding invariability to increase bank stability and hence depositor protection is likely more influential and stringent for banks with high levels of deposit funding. Hence, we expect that deposit funding stability – or more exact, the invariability – positively relates to deposit funding levels.

> **Hypothesis 3a** Bank deposit funding levels are lower (higher) for banks with high (low) deposit funding variability.

Furthermore, the regulatory focus on stability has a broader sphere of influence than deposit funding stability. With recent initiatives which aim to limit overspills from non-retail activities to depositors (Table 2.2.4), regulatory incentives focus on separation of retail-activities – and hence deposit funding – from other more risky activities.[27] As a result, banks with higher risk profiles are likely to fund less with deposits:

> **Hypothesis 3b** Bank deposit funding levels are lower (higher) for banks with high (low) risk profiles.

Banks' demand for deposit funding is not only the result of its main economic function or regulatory incentives. As we discuss in the next sections, strategic choice and competitive considerations play also an important role.

2.2.3 Bank business model: deposits as a strategic funding choice

Bank demand for deposits and hence deposit funding is in addition to its primary economic function a result of banks' strategic choice explicated in their business model. Banks often exploit different business models simultaneously as banks have diversified drastically since the 1980s and nowadays engage in a wide array of activities[28] (Ayadi *et al.*, 2011, p. 10; Goddard *et al.*, 2007, p. 1918).

Elements of bank business models – In general, a business model expresses the business logic of a firm; hence it contains the value offering, customer definition and segmentation and value delivering

[25] For example, see Gropp and Vesala (2004, p. 27), Demirgüç-Kunt, Kane, and Laeven (2008, p. 435), Barth *et al.* (2004, pp. 207-210), Demirgüç-Kunt and Huizinga (2004, pp. 396-397), Forssbæck (2011, pp. 2677-2678), Angkinand and Wihlborg (2010, pp. 271-272). Benston (2000, p. 196) even argues that deposit guarantee schemes provide *the* rationale for public policy interventions through capital requirements since these schemes foster moral hazardous behaviour

[26] Minimum harmonization also allows member states to compete with their deposit guarantee schemes to attract additional deposit funding. However, Huizinga and Nicodème (2006, p. 985) show that adoption of schemes and changes in coverage level and eligible deposits influences non-significant deposit flows to the countries.

[26] Where potential incentives for excessive bank risk-taking are limited with capital requirements.

[27] For a further discussion of the different structural approaches to reform the banking sector see Gambacorta and Rixtel (2013).

[28] In the 2013 Directive on access to the activity of credit institutions and the prudential supervision of credit institutions and investment firms, a non-exhausitive list of banking activities is included and encompases deposit taking, lending, leasing, payment services, issuing monies, money-equivalencies, guarantees, commitments, trading for own account, participation in securities, advising in capital structures, money brokering, portfolio management, safekeeping of securities, credit reference services and safe custody services (European Parliament and Council, 2013a, p. 425).

Retail orientation		Universal orientation / Investment orientation
Products and services	*Retail*	Loans, deposits, payment services, insurance
	Investment	Asset management, custodian services, letters of credit, equity or bond issuance, structured finance, M&A, asset management, real estate development, operational care lease, proprietary trading
Customers	*Retail*	Households, SMEs, consumers
	Investment	Large corporations, other financial institutions, (local) governments
Distribution channel		Relationship banking, transaction banking, physical presence, online banking
Sources of profits	*Retail*	Interest income, fee income
	Investment	Trading income, fee income

Table 2.2.2: Elements of bank business models (Cavelaars & Passenier, 2012, p. 3).

mechanism.[29] Bank business models are best defined in terms of products and services, customer segments, distribution channels and sources of profits (see Table 2.2.2). Bank products and services vary distinctively: some are standardized and part of 'standard production' while others are tailored to specific needs of customers. The standardized homogeneous products are primarily designed to meet large homogeneous customer groups (e.g., households and individual consumers), generate mainly interest revenues and result from longer relationships between customers and the bank, increasingly provided through online banking. Profitability is enhanced by cross-selling to the same customer and other customers, exploiting both economies of scale and scope (Cavelaars & Passenier, 2012, p. 13). The tailored products and services are often provided to professional customer on a transaction-to-transaction basis (e.g., to corporates and institutional investors) and generate often volatile fee income. Additional bank activities include the provision of a wide array of products and services on the spectrum between homogeneous and ideosyncratic products and services. Furthermore, banks may be involved in trading activities for market making or for own account (e.g., proprietary trading).

Bank business model orientations – The wide variety and potential combinations of products, services, customer segments, distribution channels and sources of profit has resulted in numerous typologies of business models (see for some examples Table 2.2.3) which are – similar to the provider-based categorization of funding – generally categorized in two customer-oriented model classes:

- *Retail-orientation* – Retail-oriented banks focus on households, small and medium enterprises and private individuals and provide increasingly via on-line banking standardized products which generate interest income and are funded by retail deposit funding.
- *Investment-orientation* – Investment-oriented banks focus on financial institutions and large corporations and provide tailored, wholesale funded products and services resulting in fee income.

In practice, banks do not limit their activities to one customer-orientation which has resulted by a third predominant bank orientation class in literature: the universal bank. Universal banks deploy highly complex, diversified business models focussing on both retail and investment-oriented activities. However, definitions on universal banks[30] and their banking activities differ which in addition to the complexity of the business models hampers correct identification of universal business models. Instead, the retail- and investment-orientation should be viewed as two opposing ends in a continuum with differing customers, distribution channels, sources of profit bank and activity-configuration which shape the bank-specific business models (see Table 2.2.2).

[29] See for instance Osterwalder, Pigneur, and Tucci (2005, p. 10), Chesbrough (2010, p. 355), Teece (2010, p. 182) for a discussion on business models in general and see Ayadi *et al.* (2011), Cavelaars and Passenier (2012) for a discussion on bank business models.

Commercial banks	Mainly active in a combination of retail banking to individuals and SMEs, wholesale banking to large corporates and private banking and not belonging to groups of saving banks or co-operative banks
Savings banks	Mainly active in retail banking to individuals and SMEs
Cooperative banks	Cooperative banks have a cooperative ownership structure and are mainly active in retail banking to individuals and SMEs
Real estate & mortgage banks	Mainly active in mortgage financing and project development
Investment banks	Mainly active in corporate finance, debt and equity issues, mergers & acquisitions, securities trading and private banking
Islamic banks	Active in line with predetermined islamically -acceptable social and financial objectives in accordance with the principles of Islamic Shari'a
Other non-banking credit institutions	Institutions providing guarantees, money transfer companies, companies providing banking and non banking financial services to groups of financial institutions
Specialized governmental credit institutions	Institutions providing national development finance, sectoral finance and export or import finance.
Bank holdings & holding companies	Holding companies of bank groups
Central banks	Supervising national banking systems
Multi-lateral governmental banks	Active in multi-lateral development finance
Micro-financing institutions	Providing microfinance to individuals and very small companies
Private banking & asset management companies	Banks mainly active in private banking and asset management
Finance companies	Consumer finance companies, credit card companies, factoring companies, leasing companies, trade finance companies
Group finance companies	Companies mainly active in attracting funding for and lending on behalf of the group

Table 2.2.3: Different bank business models based on activities (adapted from Bureau van Dijk, 2014).

Although a large number of bank business characterizations may exist, the bank business orientation continuum indicate that at least two bank business models are predominant in the Euro Area: the retail-oriented bank and the investment-oriented bank. In line with hypothesis 1d, we expect that these bank business orientations influence deposit funding levels greatly. Retail-oriented banks focus on retail customers and are inherently more involved with retail products such as deposits and loans while investment-oriented banks focus on other customer types and are hence less involved in deposit taking activities. Hence, we expect that a retail-orientation influences the deposit funding level positively while an investment orientation has a negative influence on deposit funding levels.

Hypothesis 4a Bank deposit funding levels are higher (lower) for banks with a retail (an investment) orientation.

Defining business models – Investment and retail orientations are generally assigned to banks by the

[30] For example, Ayadi *et al.* (2011), Köhler (2014), Baele, De Bruyckere, De Jonghe, and Vander Vennet (2010) typify universal banks by an investment-orientation with some retail-oriented activities, Cavelaars and Passenier (2012), Prabha and Wihlborg (2014) considers universal banks as commercial banks focussed on retail customers and large non-financial customers and Goddard *et al.* (2007) regards universal banks as those involved in investment, traditional and insurance activities.

bank's income structure, asset mix and funding structures. These financial statistics are predominant in bank business model identification since assets and income demonstrate their main activities, and the liabilities and expenses show the bank's main commitments and are comparable across banks. Hence, financial statements allow measurable identification of customer bank orientations based on five characteristics (IMF, 2013, p. 107):

- *Bank size* – Bank size is an important indicator of scale economies, and to a lesser extent of scope economies. Bank size broadly differentiates between specialization and diversification and hence between boutique banks and large, systemic important financial institutions[31] and in relation to the bank size of other banks it indicates concentration, competition and consolidation in the banking sector (see Section 2.2.4). Total assets are generally the indicators considered to measure bank size.[32] Large bank sizes indicate diversification away from the primary economic function and hence relate to an investment orientation (De Bandt & Davis, 2000; Bikker & Haaf, 2002).
- *Funding structures* – Bank funding structures reflect banks' main commitments to retail customers or professional investors. Large deposit shares in a bank's funding structure reflect a retail-orientation while a large dependence on other non-depositor funding sources indicate a more investment-orientated focus (Ayadi *et al.*, 2011; Blundell-Wignall & Roulet, 2012; Van Ewijk & Arnold, 2014).
- *Asset mix* – Similar to the funding structures, the asset mix in bank balance sheets reflects the main bank activities. Lending activities are generally associated with a retail-orientation, especially with high deposit levels as these are closely related to the main asset transformation mechanism. In contrast, derivatives and securities indicate a focus on professional investors and large corporations and hence an investment orientation.[33]
- *Income profile* – Income profiles give additional information on the bank's main activities. Especially the interest and non-interest shares in the income profile are distinctive for different business models. Interest income is related to relationship banking while non-interest income – including trading and fee income – indicate a more investment-orientated and transaction-based business model.
- *Risk characteristics* – Financial statements are also used to estimate bank riskiness. Bank risk profiles not directly reflect business model classes but reflect a value offering in terms risk-return characteristics. As banks are allowed to attract deposit funding from uninformed retail customers, regulators monitor bank risk profiles and emphasize on risk aversion to ensure customer protection and financial stability. Hence, retail orientations are associated with lower risk profiles over investment orientations (Stiroh & Rumble, 2006; Demirgüç-Kunt & Huizinga, 2010; Köhler, 2014). Non-performing loans and dependency on interest[34] and other income are used as basic indicators of bank risk profiles, as well as equity and leverage ratios which show banks' ability to fund with own resources (Laeven & Levine, 2007; Mercieca *et al.*, 2007). Furthermore, a common encountered measure of bank riskiness is the Z-score[35] which reflects a bank's distance to default (Stiroh & Rumble, 2006; Demirgüç-Kunt & Huizinga, 2010; Köhler, 2014).

Conclusion – Bank deposit demand is influenced by banks strategic choices and reflected in their business model. Business models are configurations of products, services, customers, distribution channels and sources of profit and span over a continuum between retail and investment orientation. Customer orientation – retail or investment – are to a large extent reflected in their activities (assets

[31] Systemically important financial institutions (SIFIs) are banks which are considered 'too big' or 'too complex' to fail. Stricter regulation limit the consequences of a resolution of SIFI banks for (implicit) guarantor, i.e. the government. See also Blundell-Wignall and Paul Atkinson (2011).

[32] Banks have increasingly large off-balance sheet liabilities which are important additions to bank size measures. However, as these are not uniformly reported over time and across banks we limit our bank size measure to total assets.

[33] See also Ayadi *et al.* (2011), Blundell-Wignall and Roulet (2012), Baele *et al.* (2010), Prabha and Wihlborg (2014), Stiroh and Rumble (2006).

[34] Interest income is considered less volatile and indicate lower bank riskiness (Elsas *et al.*, 2010; Van Ewijk & Arnold, 2014).

[35] Numerous bankruptcy risk measures have been developed, Lepetit and Strobel (2013, p. 73) found that the most predominant in current bank research is the $Z-$score attributed to Boyd and Graham (1986, p. 6). This measure is less elaborate than many measures of bankruptcy risk in corporate finance settings (e.g, see Altman and Narayanan (2003) for an elaborate discussion of business failure models.)

and income) and commitments (liabilities and expenses) and hence in their financial statements. Retail-oriented banks focus on households, small and medium enterprises and private individuals, provide standardized interest-linked products funded by retail deposit funding while investment-oriented banks focus on financial institutions and large corporations and provide fee-driven customized products funded by wholesale funding. Retail-oriented banks are as a result of their customer orientation more involved in deposit taking and hence have higher levels of deposit demand and funding than investment-oriented banks.

The extent to which banks deploy their business models to fund with deposits is however limited by the availability of deposit funding. Furthermore, larger banks are more likely to diversify and hence fund with other funding sources. Hence, bank size is likely to relate negatively to deposit funding levels:

Hypothesis 4b Bank deposit funding levels are lower (higher) for large (small) banks.

The influence of business models on banks' deposit funding demand suggests that deposit funding demand is a result of the bank's strategic actions. European Union harmonization efforts have created a competitive Euro Area banking market in which strategic actions of different banks interact and compete for resources. In the next section, we discuss competitive considerations for deposit funding demand.

2.2.4 Competitive strength: retaining deposit market share

The asset transformation mechanism between deposits and loans highlighted the desirability and scarcity of deposits for which – especially retail-oriented – banks compete.[36] Bank deposit demand is therefore not merely a bank's individual reaction to regulatory incentives and strategic choices but also a result of interplay with the demand for deposits from other banks. Hence, a bank's deposit funding ability depends on its relative competitive strength compared to other banks and the competitive conditions of the banking sector in general. These competitive conditions are primarily shaped by other market participants and regulatory efforts discussed earlier.

Market-oriented competition – From a bank perspective, deposits are especially valued as an inexpensive funding source and for the intrinsic scope advantages. However, in deposit markets with strong competition the attractiveness deteriorates as spreads between wholesale and deposit funding rates in these markets decrease. This is especially true for smaller banks with less market power to attract deposit funding (Craig & Dinger, 2013, p. 3621). Furthermore, banks increasingly deploy their asset transformation mechanism locally[37] which may induce competition for deposits in areas with high deposit scarcity and loan demand Mesquita (2010, pp. 22, 31).

Regulatory-induced competition – Regulatory favouritism for banks in deposit service provisioning impedes perfect competition between Euro Area banks and has led to bank sectors characterized by monopolistic competition based on product-differentiation (Molyneux, Lloyd-Williams, & Thornton, 1994, p. 455; Freixas & Rochet, 1997, p. 81).[38] From a regulatory perspective, imperfect competition is the price to pay for financial stability and customer protection but nevertheless has to be minimized.

As discussed, the recent regulatory initiatives aim to increase financial stability and customer protection (see Table 2.2.4). In addition, these initiatives also prohibit complex organisational bank structures. The increased homogeneity bank structures might stimulate competition. However, the actual effects of regulatory incentives on the competitive market conditions are unclear and competition might even result in systemic risk (Le Leslé, 2012, p. 28): "if banks try to simultaneously shift away from wholesale funding and into deposit gathering, possibly increasing competition to attract and retain deposits. Higher competition leads to banks paying higher fees to customers, and this may result in behavioral shifts

[36] Even if banks do not compete for the deposits themselves, the related cross-selling opportunities and other scope advantages are attractive characteristics for banks.

[37] Decentralization of bank activities and funding helps to diversify funding sources, exploit the value of local presence – for example through better access to retail funds and central bank facilities in host countries – increases transparency and market discipline for autonomous subsidiaries since local risks are priced in the local funding costs. However, it limits the effects of economies of scale and coherence provided by centralized funding operations, limit balance sheet growth and increase funding costs (Mesquita, 2010, pp. 13-14; Beck *et al.*, 2013, p. 240).

	Volcker	Liikanen	Vickers
Broad approach	**Institutional seperation**	**Subsidiarization**	**Ring-fencing**
Banks may:			
deal as principal in securities and derivatives	No	No	No
engage in market-making	Yes	No	No
perform underwriting bussiness	Yes	Yes	Restricted
hold non-trading exposures to other financial intermediaries	Unrestricted	Unrestricted	Restricted
Holding company with banking and trading subsidiaries	Not permitted	Permitted	Permitted
Geographical restrictions	No	No	Yes

Table 2.2.4: Comparison of the Volcker, Liikanen en Vickers structural reform proposals (adapted from Gambacorta & Rixtel, 2013, p. 3).

as depositors "shop around" and move from bank to bank more frequently. In turn, the stability and predictability traditionally associated with retail deposits would be reduced."

Measuring competition – Competition is in itself a characteristic of the banking market, complex and difficult to measure (Beck *et al.*, 2013). Nevertheless, measures for competition in the banking sector have been proposed and focus on homogeneity of prices and market concentration (market characteristics). The homogeneity of prices measures follow the 'law of one price' hypothesis which indicates perfect competition in the presence of a single market price. However, deposit services are not homogeneous products and inherently have different prices as their characteristics vary through different levels of trust and confidence[39], cross-selling activities, local differences in information asymmetries and regulatory barriers (Dermine, 2006, p. 70). Market concentration, on the other hand, also captures competitive market conditions incompletely. Opponents argue that concentrated markets with few large banks exhibit higher profit levels as a result of economies of scale – the 'efficiency hypothesis – as opposed to collusive price-setting strategies – the collusion hypothesis (Goddard *et al.*, 2007, p. 1920).

Admittedly, the complexities of competition are not fully captured by the market concentration measure but there is evidence that market concentration relates to the competitive environment of a banking sector (Bikker & Haaf, 2002, p. 2210). For individual banks, a widely used measure for competition is market power. Market power follows the efficiency hypothesis and is generally proxied by market share. As such market power is the relative contribution of a bank to the market concentration (Bikker & Haaf, 2002, p. 2206).

Developments in Euro Area competition – Bank competition in the Euro Area has increased from monopolies to monopolistic competitions since the initial steps of the transition into the European monetary union (Molyneux *et al.*, 1994, p. 455; De Bandt & Davis, 2000, p. 1063). This increase of competitiveness of the European banking sector might be a result of increased funding costs related to attracting and retaining deposits (Le Leslé, 2012, p. 22), increased reliance on wholesale funding discipline (Bikker & Haaf, 2002, p. 2210) or vice versa since banks turn to wholesale funding to fill their funding gap and finance a broader range of activities (Le Leslé, 2012, p. 4). Regardless of the direction of the relationship, the higher wholesale levels resulted in lower relative levels of deposit funding, increased market discipline exerted by wholesale providers and higher levels of market concentration (ECB, 2013, p. 12). Furthermore, highly concentrated bank sectors contain by definition a relatively small number of large banks which are likely to be diversified in terms of their business models and thus funding structure and

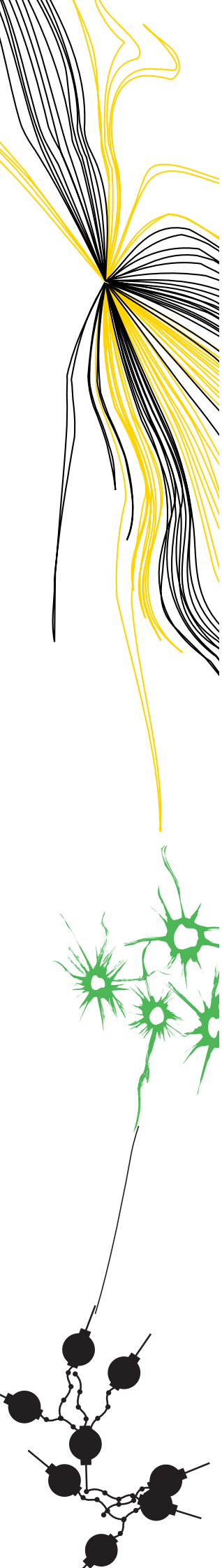
[39] Although the influence of trust and confidence perceptions on deposit rates is limited by the deposit guarantee schemes.

income statement. This suggests that banks in concentrated markets and similarly banks with a strong market power are less involved in deposit funding. As we focus on bank demand determinants rather than country-level characteristics, we focus on market power as measure for competitive influences on deposit funding levels and expect that market power is negatively related to deposit funding:

Hypothesis 5 Bank deposit funding levels are lower (higher) for banks with high (low) market power.

Conclusion – Competition in deposit funding markets is defined by market and regulatory conditions. Local deposit sourcing and regulatory incentives are likely to increase competition for deposit funding. Competition is difficult to measure but there is evidence that market concentration (country characteristic) and market power (bank characteristic) are related to banks' competitive environments. In line with these measures, we expect that banks with a strong competitive position are relatively large and hence less reliant on deposit funding.

In this chapter we discussed the main sources and characteristics of bank funding (Section 2.1) and identified four themes with factors influencing bank demand for deposit funding (Section 2.2): banks' economic function, regulation, business models and competitive considerations. However, as in many economic cases deposit funding levels are merely influenced by demand characteristics but also by supply characteristics. The banks' deposit supply is the subject of the next chapter.



CHAPTER 3

BANKS' DEPOSIT SUPPLY

In this chapter we continue the discussion of relevant literature on deposit funding and the main determinants to answer Sub-Question 1:

"What are the main determinants for Euro Area deposit funding?"

Our focus in this chapter is on the deposit supply perspective which concerns primarily country-level determinants.

3.1 Why individuals use deposit services

General economic theory assumes that individuals are rational, utility maximizing agents who allocate their income to consumption and savings[1] based on their unique current and future preferences (Sidrauski, 1967, p. 535). Hence from a macroeconomic perspective, individuals continuously balance their income allocations between consumption and savings guided by their time-dependent preferences. In his opus magnus Keynes (1936) describes that the preferences positively influencing income allocation to savings are based on individuals' preference for liquidity over direct consumption. Three main motives for liquidity preference are distinguished: the transaction motive, the precautionary motive and the speculative motive. Nowadays, these motives are corner stones for monetary policy as they describe the rationale behind the demand for liquidity – in terms of currencies, deposits and other monetary aggregates[2] (see Table 3.1.1). This importance is reflected in the well-developed money demand theory and empirical evidence[3] (De Bondt, 2009, p. 6).

In this section, we link the general economic theory on money demand and motives for liquidity to deposit funding. We discuss different factors underlying the motives for liquidity preference as these underpin the liquidity preference, demand for deposit services and hence supply of deposit funding. Where we discussed mainly bank-specific factors influencing bank deposit demand in Chapter 2, in this chapter we limit our discussion to country-level factors influencing the bank deposit supply. This perspective is in line with the field of money demand theory which has shown that explanatory variables for money demand primarily varies across Euro Area member states (Setzer, Van den Noord, & Wolff, 2011).

3.1.1 Transaction motive: deposits for foreseen future expenses

The transaction motive for liquidity preference over consumption refers to individuals' expectations of future consumption. Individuals generally receive income at specific intervals which not necessarily match their consumption needs. Deposits limit this temporal mismatch between income and consumption and are hence closely to individuals' income. Hence the transaction motive is reflected on the micro level in time-specific consumption and saving patterns which depend strongly on individuals' income.

A similar mechanism is found on a country-level where the transaction motive for liquidity demand is primarily reflected by the country's gross national income (GNI) (De Bondt, 2009). The rationale behind the transaction liquidity motive is that higher levels of expected future consumption result from higher levels of income. As bank deposits are an important component of monetary aggregates (see

[1] Savings is that proportion of income which is not consumed. Savings may take any form, e.g., deposits, equity, cash.

[2] The definitions of money differ slightly between central banks. For this discussion, we focus on M1 and M2 aggregates, defined by the European Central Bank which is most in line with our data sources and our focus on the Euro Area.

[3] See De Bondt (2009, pp. 8-9) for a selection of recent empirical money demand models and Duca and VanHoose (2004) for a discussion on developments in money demand estimation.

Liabilities	**M1**	**M2**	**M2**
Currency in circulation	•	•	•
Overnight deposits	•	•	•
Deposits with agreed maturity of up to 2 years		•	•
Deposits redeemable at notice of up to 3 months		•	•
Repurchase agreements			•
MMF shares			•
Debt securities issued by MFIs up to 2 years			•

Table 3.1.1: Definition of euro area monetary aggregates (adapted from ECB, 2012, p. 110)

Table 3.1.1), we expect that this relationship is reflected by a positive relationship with bank-level deposit funding levels:

> **Hypothesis 6a** Bank deposit funding levels are higher (lower) in countries with a high (low) gross national income.

In addition to income, individuals transaction motive for holding liquidity and hence deposits are reflected by house prices and demographics which we discuss next.

Housing – House prices have a strong influence on Euro Area money demand and hence deposit supply. In the long run, housing prices influence deposit levels through speculative wealth effects and the banks' asset transformation mechanism (Setzer *et al.*, 2011, p.766; see Section 2.2and Section 3.1.3). On the short term, mortgage refinancing activities can temporarily boost deposit levels at times with high transaction volumes (Duca & VanHoose, 2004, p. 256). This transaction effect on deposit funding levels implies a positive relationship with housing prices:

> **Hypothesis 6b** Bank deposit funding levels are higher (lower) in countries with high (low) housing prices.

Demographics – Demographics influence the transactions motive and are found to induce heterogeneous savings behaviour in the European Union (Niculescu-Aron & Mihăescu, 2012, p. 490). The influence of ageing on deposit levels is in line with the life cycle theory proposed by Ando and Modigliani (1963) which states that financial behaviour is age-dependent: in early stages working individuals save for post-retirement where they consume these savings. However, aged populations are not found to systematically disave. Hence, deposit funding levels are likely to increase with the average population age:

> **Hypothesis 6c** Bank deposit funding levels are higher (lower) in countries with an aged (young) population.

Furthermore, the life cycle motive for savings behaviour is also affected by other retirement provisions and legal regimes which are discussed in the next sections.

3.1.2 Precautionary motive: deposits for unforeseen future expenses

The precautionary motive for liquidity preference over consumption refers to the individual's desire to have liquidity at hand for unforeseen circumstances. The precautionary motive is – as with the transaction motive – related to the individual's and gross national income as unexpected expenses tend to relate proportionate to similar income levels. However, a distinct difference with the transaction motive is the individuals perception of uncertainty and risk in future unforeseen expenses. General indicators of uncertainty are unemployment rates and – especially in the Euro Area – the economic sentiment indicator and are associated with increased levels of deposit funding (Duca & VanHoose, 2004; De Bondt, 2009). Hence, in times of uncertainty of future employment and the economic environment as a whole, we expect that bank deposit funding levels are higher than in more certain times:

> **Hypothesis 7a** Bank deposit funding levels are higher (lower) in countries with high (low) unemployment rates.

> **Hypothesis 7b** Bank deposit funding levels are lower (higher) in countries with high (low) levels of the economic sentiment indicator.

Other factors which influence deposit levels from a precautionary motive are captured by social security provisions and legal regimes.

Social security provisions – Life cycle theory suggest that individuals save for retirement. A similar argument holds for periods of unemployment and disability. However, in Euro Area countries the necessity for retirement, unemployment and disability savings is strongly influenced by the presence of social

security provisions. In general, a lower saving rate – i.e. lower levels of non-consumption – are expected in the presence of social provisions (Alessie & Kapteyn, 2001, p. 81) but this relationship is difficult to establish due to interrelations in economic aggregates: the saving rate also includes old-age savings in retirement plans, hence distorting measurements (Meguire, 2003). In contrast, deposit funding levels are not confounded by these savings and are likely negatively affected by high levels of social security:

> **Hypothesis 7c** Bank deposit funding levels are lower (higher) in countries with high (low) levels of social security provisioning.

Legal regimes – Regulation is an important determinants of deposit characteristics and primarily aims to increase stability through depositor protection (see Section 2.2.2). Although depositor protection is not directly related to unforeseen future expenses, it still reduces actual and perceived risk of deposits. Two legislative mechanisms provide depositor protection. First, Euro Area countries allow depositors to net debts and assets in case of bankruptcy. Hence, individuals with a precautionary motive for liquidity have an incentive to hold deposits and debts at the same bank since the exposure to the bank is limited to the level of deposits over debts. Second, depositor guarantee schemes shift depositors' exposure to bank insolvency to the bank sector as a whole. As such, deposit guarantee schemes "assure the public, prevent a run on the banking system as a whole, avoid capital outflows and aid the economy to recover from the financial shock by ensuring the continuing supply of banking and payment services" (Garcia, 2000, p. 53). In the last two decades deposit guarantee schemes have evolved towards mechanisms which provide stability and limit the impact of moral hazard.[4]

The most recent development in the European Union's depositor protection is the adoption of directive 2014/49/EC which further harmonizes the deposit guarantee schemes in Europe (European Parliament and Council, 2014). End of May 2016, this new directive is in full force and harmonizes the coverage level, eligible deposits and pay-out procedures. The harmonization increases the homogeneity of deposit preference in the Euro Area and might increase competition for deposits (Merck Martel *et al.*, 2012, p. 116). However, although few cross-country differences in the deposit guarantee schemes remain, the protection provided by the schemes is not identical as purchasing power is not identically distributed over all Euro Area member states (Setzer *et al.*, 2011, p. 766). Hence, bank deposit funding levels are likely higher when the – purchasing power adjusted – depositor protection is stronger since it decreases the risk of holding deposit over other assets:

> **Hypothesis 7d** Bank deposit funding levels are higher (lower) in countries with strong (weak) depositor protection.

3.1.3 Speculative motive: deposits with preferable risk-return characteristics

The speculative motive for liquidity refers to an individual's expectations on the relative risk-return of different asset classes. Individuals may hold deposits as the risk-return characteristics are more attractive than those of equity, bonds or other asset classes. Hence, the speculative motive for liquidity is closely related to the opportunity costs for holding liquidity. In addition, wealth effects also influence deposit funding levels (Tobin, 1969): an increase in wealth requires rebalancing of the asset portfolio to maintain the desired risk-return characteristics. The speculative motive for liquidity preference is generally captured by returns on equity indices and interest rates and national wealth (De Bondt, 2009, pp. 6-7).

> **Hypothesis 8** Bank deposit funding levels are lower (higher) in countries with higher (lower) opportunity costs.

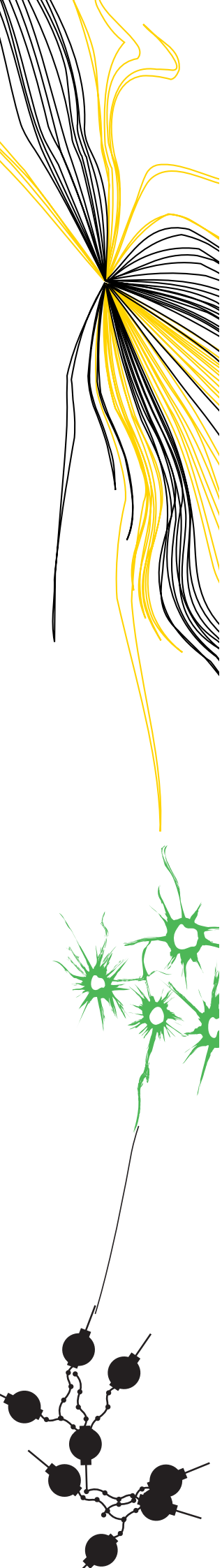
Deposit funding levels are also from a speculative motive related to housing prices through wealth effects which might manifest in a number of ways (Setzer *et al.*, 2011, p. 766):

- house prices might increase the demand for liquidity as a result of portfolio rebalancing portfolio of assets after an increase in house prices.

[4] See Demirgüç-Kunt and Huizinga (2004), Demirgüç-Kunt *et al.* (2008) for an overview of desirable characteristics of deposit guarantee schemes.

- house prices might decrease the demand for liquidity as a result of opportunity costs, e.g., investments in housing is more attractive when the prices rise – especially in a low interest rate environment (Sousa, 2010, p. 103).
- house prices might increase the demand for liquidity as a result of increased transaction volumes during sale and purchasing of houses.

In addition to the themes and factors that influence bank deposit funding levels from a demand perspective, we discussed motives and factors from a supply perspective. In the next chapters, we test the developed hypotheses and discuss the consequences for a banks ability to fund with deposits.



CHAPTER 4

METHODS & DATA

In this chapter we develop methods to test our hypothesis and describe our data sources, collection and treatment. We differentiate between an exploratory analysis and a regression analysis.

The exploratory analysis focuses on Hypothesis 1a-d and Sub-Question 2 and allows us to familiarize ourselves with the Euro Area deposit funding market. With the regression analysis, we focus on the remaining hypotheses and Research Question 3.

4.1 Explorative analysis on bank deposit funding levels

In the previous chapters we reviewed related literature which enables us to answer Sub-Question 1 "What are the main determinants for Euro Area banks deposit funding?". We found that demand and supply factors influence Euro Area deposit funding levels and we developed hypotheses to test these determinants empirically (H2-8). An overview of these variables is included in Table 4.2.2 on page 47. Furthermore, we hypothesized that deposit funding levels have grown with different rates for different countries, bank business orientations and time periods (H1).

We differentiate between Hypothesis 1 and Hypotheses 2 to 8 as the former is explorative in nature and focusses on general trends in bank deposit funding levels over time and cross-sectional differences between countries and bank business orientations. This allows us to familiarize ourselves with and develop a basic intuition of the Euro Area deposit funding market. We refer to the examination of the Hypotheses 2 to 8 as the regression analysis since it focuses on establishing various regressive relationships between the identified determinants and deposit funding levels.

In this chapter, we elaborate on the hypothesis developed in the theoretical framework. Specific test strategies are outlined for Hypothesis 1 and 2. Hypotheses 3 to 8 are examined in a multivariate framework for which the earlier hypothesis offer sufficient guidance.

4.1.1 Methods

For our explorative analysis, we explore basic trends (H1a-b) across bank business orientations (H1c) and across Euro Area member states (H1d) which allows us to answer Sub-Question 2 "What are the recent changes in Euro Area bank funding profiles?". In this section we highlight our approach, in later sections we discuss available data sources, collection methods, treatment and descriptives.

Time-dependency *(H1a-c)* **–** Our hypothesis of increasing Euro Area deposit funding levels over time (H1a) implies time-dependency. However, in a time series setting time-dependency may bias standard OLS regression techniques (Granger & Newbold, 1974, p. 111) which makes the results less reliable. Furthermore, growth in Euro Area deposit funding levels between 1999 and 2013 is not necessarily related to the passing of time but may result from other factors. We are interested in the overall, time-invariant characteristic 'growth' of deposit funding levels and hence we examine characteristics underlying the deposit funding levels – i.e. characteristics of the data generating process – and differentiate between growth resulting from events (time-dependency) and growth resulting from general characteristics of Euro Area deposit funding levels (time-invariance). In addition, our regression analysis on interdependent deposit funding and loan levels (H2) requires more in-depth knowledge on the data generating processes of Euro Area deposit funding levels and requires us to especially consider stationarity.

Stationarity – Stationarity is a property of the data generating process of time series. Stationary time series are those where "the whole joint distribution [of the observations in the series] is independent of the date at which it is measured and depends only on the lag[1]" (Alexander, 2001, p. 318). Presence of the stationarity property has strong implications for the analysis of time series: stationary time series exhibit no time-specific influences and hence the statistical properties are independent over time. As we have seen a doubling of aggregate Euro Area deposit funding levels since 1999, we have a strong indication that the level of deposit funding has grown over time (see Section 2.1). However, this deposit funding level growth not necessarily results from the passing of time but may be the result of other factors as well. Furthermore, doubling deposit funding levels does not indicate a consistent, overall growth in all years as the growth may result from some specific 'events'.

[1] Where the lag refers to the prior observation(s) with which it is compared. As a result, any sequence of observations from a strictly stationarity time series, $x_{t_1}, x_{t_2}, \cdots x_{t_n}$, has the same distribution as a sequence of observations which is shifted in time by a constant (lag s), $x_{t_{1+s}}, x_{t_{2+s}}, \cdots x_{t_{n+s}}$. In practice strict stationary time series are difficult to measure; therefore, the weaker form covariance-stationarity is generally considered. A time series y_t is weakly or covariance stationary if the expectation $E(y_t) = \mu_t = \mu$ and covariance $cov(y_t, y_{t-l}) = \gamma_l$ is finite and constant for all observations in time t and all prior observations l.

We can account for these considerations and examine the time-independent aggregate Euro Area deposit funding level growth in a stationarity framework (H1a). We employ the Philips-Perron unit root test[2] which involves fitting the regression model (Alexander, 2001, p. 325):

$$y_t = \alpha + \rho y_{t-1} + \beta t + \varepsilon_t \tag{4.1.1}$$

by ordinary least squares[3] (OLS) where the regression residuals ε_t are assumed independent and normally distributed with a variance σ^2. Three cases are considered which are tested under the null hypothesis of non-stationary and varying restrictions on the regressors (see Table 4.1.1). We follow the unit root test strategy proposed by Elder and Kennedy (2001, p. 139) which systematically evaluates the three cases in Table 4.1.1:

- Examine the time series as if it has a unit root (non-stationary) without any restrictions (H_0 under Case 3, see Table 4.1.1). When the the null hypothesis is rejected and the regressors (α, β) are significant, the underlying data generating process results in a *drift- and trend-stationary* time series. In all other situations, the time series is evaluated at the next step.
- Examine the time series as if it has a unit root without trend (H_0 under Case 2). When the null hypothesis is rejected and α is significantly different than zero, the underlying data generating process results in a *drift-stationary* time series. In all other situations, the time series is again evaluated at the next step.
- Examine the time series as if it has a unit root without drift and trend (H_0 under Case 1). When the null hypothesis is rejected, the underlying data generating process results in a *stationary* time series. In all other situations, the time series is again evaluated at the next step.
- At current level, the underlying data generating process of the time series results in a unit root and hence *non-stationary* time series. However, this implied time-dependency is known to often vanish after differencing the time series indicating that the changes in the time series are time-invariant. After differencing, this testing procedure is again initiated.

Note that drift-stationary or trend-stationary time series are not stationary themselves: only the transformed series after removal of the trend or drift is stationary. This trend or drift indicate a property of the underlying data generating process of Euro Area deposit funding levels which is not dependent on time.[4] Hence, for trend- or drift-stationary time series positive trends and drifts indicate a time-independent increase of deposit funding levels in the Euro Area. As we hypothesized increasing Euro Area funding levels since 1999 (H1a), we expect some form – at level or difference – of trend- or drift-stationarity in the Euro Area deposit funding level time series.

Test strategy for H1a

H_0	Euro Area deposit funding level time series have a unit root (H_0: $\rho = 1$, $\alpha = 0$ and $\beta = 0$).
H_a	Euro Area deposit funding level time series are stationary with positive drift and / or trend (H_a: $\rho = 0$ and $\alpha > 0$ and/or $\beta > 0$)
Decision rule	We do not reject Hypothesis 1a if H_0 is rejected.

Structural break unit root tests – In addition to our hypothesis of overall Euro Area deposit funding level growth, we hypothesized a stronger growth since the recent financial crisis (H1b). To examine the impact of the recent financial crises (H1b) we allow for structural breaks in Equation 4.1.1 with the Zivot-Andrew (ZA) and Clemente-Monates-Reyes (CMR) unit root tests (Zivot & Andrews, 1992; Clemente, Montañés, & Reyes, 1998). These tests follow Phillips and Perron (1988) and allow for the influence of an endogenous structural break at some time T. Similar cases as for the Philips-Perron unit root test are considered and under the null hypotheses the process is assumed a unit root without endogenous

[2] The standard Dicky-Fuller-based unit root tests examine for correlation between lagged observations, i.e. $H_0 : \rho^* = 0$ vs. $H_1 : \rho^* < 0$ where $\rho^* = 1 - \rho$, the correlation in regression $\Delta y_t = \rho^* y_{t-1} + \varepsilon_t$. The Philips-Perron unit root test is an extension of the Dicky-Fuller unit root test which is more robust in the presence of autocorrelation and heteroskedasticity (Phillips & Perron, 1988, p. 336; Zivot & Wang, 2006, p. 127). In Section 4.1.2 we discuss the importance of this robustness in the context of the assumptions underlying our methods.

[3] The OLS regression standard errors are biased and hence we evaluate the unit root hypothesis with MacKinnon-critical values.

[4] A more extensive discussion on the technical details of stationarity is included in Appendix A.2.

Case	Data generating process under H_0	Regression restrictions
1	Random walk without drift	$\alpha = 0$, $\beta = 0$
2	Random walk without drift	$\beta = 0$
3	Random walk with or without drift	(none)

Table 4.1.1: Unit root test cases (adapted from Stata, 2013, p. 402).

structural break.[5] Examination of aggregate Euro Area deposit funding levels with unit root tests that allow for possible presence of a structural break provides information on the timing of the impact of the economic crisis and it prevents false non-rejection of the unit root hypothesis in the Phillip-Perron unit root tests(Glynn, Perera, & Verma, 2007, p. 69). As a result, the structural break unit root tests functions as a robustness test for H1a. Furthermore it allows us to examine pre- and post-crisis differences in the behaviour of the Euro deposit funding levels by different unit root tests for these periods.

Test strategy for H1b

H_0	Euro Area deposit funding level time series have a unit root without structural break (H_0: $\rho^* = 0$, $\alpha = 0$, $\beta = 0$ and no break).
H_a	Euro Area deposit funding level time series are stationary with structural break and a with positive drift and / or trend which is higher after the break (H_a: $\rho^*_A = \rho^*_B = \rho^* = 0$, break and $\alpha_B > \alpha_A > 0$ and/or $\beta_B > \beta_A > 0$ where $A = 1999-$break and $B =$break$-B$).
Decision rule	We do not reject Hypothesis 1b if H_0 is rejected.

Rationale of stationarity analysis approach – Examination of deposit funding level time series in a stationary setting allows us to reveal underlying characteristics in a robust manner. First, the analysis permits analysis of growth or decline of deposit funding levels. Second, we may a differentiate between time-specific influences and characteristics of the whole data generating process. In other words, we can determine whether deposit funding levels have consistently grown over time or that there have been influential changes at some point in time. Finally, inclusion of a structural break allows to control for such a single time-specific influence, i.e. the financial crisis.

Test strategy for H1c

Precondition	Euro Area deposit funding level time series are non-stationary with structural break and with positive drift and / or trend.
H_0	Drift terms $\beta_i =$ for country i are identical to drift terms β_j for country j (H_0: $\beta_i = \beta_j$ for all countries i and j).
H_a	At least one country i reports a different drift term β_i than other countries reporting drift terms β_j (H_a: $\beta_i \neq \beta_j$).
Decision rule	We do not reject Hypothesis 1c if H_0 is rejected.

Cluster analysis *(H1d)* **–** Country-level differences in deposit funding levels (H1c) are examined in a panel context where the data assignment to countries is directed by the data source (see next Section 4.1.2). Our bank-level cross-sectional analysis requires a method to distinguish between different bank business orientations (H1d). Hence, we need to assign banks individually to a bank orientation. In line with Ayadi *et al.* (2011), we employ Ward's (1963) hierarchical cluster analysis to assign a bank to a business orientation. Cluster analysis is a statistical technique assigning observations into distinct clusters based on some similarity measure. By definition, this results in clusters with common characteristics based on the variables included.

Clustering procedure – Assuming that banks choose their business model consciously, we cluster the banks on variables that they can control. Ward's (1963) cluster analysis method evaluates the data structure and aims to create distinct clusters based on minimization of within-cluster variance. Hence, at the start of the cluster analysis each bank is assigned to its own cluster. Then the clusters are combined in such a way that the new aggregated clusters have a minimum within-cluster variance. In

[5]The Zivot-Andrew structural break test evaluates each possible break date and selects the date with the lowest test statistic (Glynn *et al.*, 2007, p. 68).

line with Ayadi *et al.* (2011), we use the Calinski and Harabasz's (1974) stopping rule to determine the number of distinctively different clusters. This rule uses the Calinski-Harabasz pseudo$-F$ score calculated for each possible cluster configuration[6] and chooses the largest pseudo$-F$ score as an indicator of the most distinct cluster structure. In contrast to Ayadi *et al.* (2011) we do not control for missing values as imputation techniques generate similar values to similar observations and hence bias the assignment of banks to the business orientation with the least missing values. As we discuss in more detail in Section 4.1.2, we account for the influence of missing values with the construction of aggregate variables with few missing values.

Limitations and rationale of the cluster analysis approach – It is important to note cluster analysis' severe reliance on assumptions. In essence, cluster analysis examines structure in (large) data sets based on selected variables, a similarity measure and available data. As a result, the choice for clustering variables, similarity measure and the data treatment (e.g., missing values) have strong implications for the outcome of the cluster analysis. The influence of clustering variable selection on the the cluster assignment is guided by our theoretical framework of bank business models. We include variables that indicate the asset mix, funding structure and income profile and we normalize the different measures with the bank size to prevent large reliance of the differentiation on bank size. We do not include a risk measure as we identified that these only indirectly reflect business model classes (see Section 2.2.3). Assignment of banks to a bank business model allows us to examine differences with $t-$tests on variables of interest – in particular the deposit funding level. Furthermore, the variance-minimizing similarity measure includes – in contrast to other methods[7] – the first central and centred sample moments which allows to differentiate on large between-cluster differences and small within-cluster differences. Finally, as we discuss later, the data treatment results in aggregated classes where the total asset classes is equal to the total of liability classes. This allows us to assume that not reported values are zero and we do not have to use imputation techniques. Regardless of the logic of this cluster analysis procedure, it remains important to keep the assumptions in mind when interpreting the cluster analysis results.

Test strategy for H1d

H_0	Average deposit funding levels of investment-oriented banks μ_i are equal to the average deposit funding levels of retail-oriented banks μ_j (H_0: $\mu_i = \mu_j$).
H_a	Average deposit funding levels of investment-oriented banks μ_i are different than the average deposit funding levels of retail-oriented banks μ_j (H_a: $\mu_i = \mu_j$).
Decision rule	We do not reject Hypothesis 1d if testable hypothesis H_0 is rejected.

4.1.2 Data

The explorative analysis on bank deposit funding levels primarily concerns deposit funding level data (H1a-d) and requires secondary data on other balance sheet classes and income statement items (H1d). We define different measures and definitions for bank-level and country-level financial statements, discuss our data sources and collection and treatment and provide with descriptives.

Measures and definitions – Both our exploratory and regression analyses require definitions for the different bank balance sheet classes and income statement items. Out of pragmatism, we use definitions in line with our bank-level (accountancy standard-based; IASB, 2013)) and country-level (regulatory standard-based; ECB, 2012) data sources. As a consequence of the centrality and importance of deposit funding in this thesis, we discuss the deposit funding definition in more detail. Furthermore, we define different measures for the cluster analysis.

Deposit funding definition – International accountancy standards have not defined deposit funding and hence our bank-level deposit funding measure is based on the broader definition of financial liability "a contractual obligation to deliver cash or another financial asset" (IASB, 2013, A907-A908). A more concise definition of a deposit funding measure is based on the ECB definition (ECB, 2012, p. 66) and comprises "amounts (...) owed to creditors, (...) not negotiable instruments, and therefore not

[6] Hence, for N observations the Calinski-Harabasz pseudo-F score is computed $N-1$ times: for the configuration with 2 distinct clusters, the configuration with 3 distinct clusters, $\cdots$, the configuration with N distinct clusters.

[7] For example, centroid, average and weighted-average examine only the first centred moment of the sample.

Variable	N	Description
Balance sheet items	9	*Assets* – Advances to banks, external assets, fixed assets, loans, money market shares, remaining assets and cash (euro denominated), securities other than shares, shares and other equities, total assets
	7	*Liabilities* – Capital and reserves, debt securities issued, deposit funding, external liabilities, interbank liabilities, money market funds shares, remaining liabilities
Observations	204	Monthly data from September 1997 to August 2014
Countries	12	Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain
Counterparties	6	Central Government, general government, MFIs, non-MFIs excluding central government, non-MFIs excluding general government, unspecified counterpart
Origin	3	Euro Area, Extra Euro Area, rest of the world

Table 4.1.2: Description of country-level Euro Area bank balance sheet data (1997-2014).

marketable. They combine the features of transferability, convertibility, and certainty (in terms of their nominal value)." In line with these definitions we define deposit funding:

> **Definition 1** Deposit funding are cash amounts owed to creditors which are non-transferable and repayable at nominal value.

Measure types – In general, we differentiate between four types of measures:

A. Plain measure

B. Logarithmic plain measure

C. Normalized plain measure

D. Relative measure between two points in time

The distinction is required to limit the influence of outliers, scale coefficients and for an elasticity interpretation of regression results (see Section 4.2.1) but also in order to differentiate between reliance on deposit funding (measure type C) and the deposit funding level (measure A). Measure type A reflects the variable *at level*. For the balance sheet classes these are reported in millions, unless indicated otherwise. We use measure type B as our main measure for most hypotheses – both exploratory and regressive – as the logarithmic transformation scales the coefficients. Measure type C is deployed in the cluster analysis and normalizes measure type A over total assets (balance sheet class) or gross income or expense (income statement item). Measure type D reflects balance sheets *at difference* and is applicable for the explorative analysis in a stationarity context.

Cluster analysis – For the analysis of deposit funding level differences between business orientations, we define measures for the cluster analysis. In agreement with Ayadi *et al.* (2011) and our earlier discussion on bank business models, we differentiate between business orientations by total securities and loans[8] (asset mix) and deposit funding and capital (funding structure). Additionally, we include interest income, income on fees and commissions and income on securities and trading assets (income profile). In order to distinguish between business orientation rather than size, we deploy type C measures normalized over total assets (balance sheet classes) and gross income[9] (income statement items) and include total assets (measure type B) to control for size effects.

[8] Similar to our definition of deposit funding, we define loans as amounts owed to debtors which are repayable at nominal amount. As we are interested in levels, we focuses on the gross loan levels and disregard the quality ('impaired proportion').

[9] Gross income is defined as the income from interest, fees, commissions and securities and trading assets.

Variable	N	Description
Balance sheet classes	40	See Appendix B, Table B.1 for the asset classes
	36	See Appendix B, Table B.1 for the liability classes
Income statement items	43	See Appendix B, Table B.1 for the income statement items
Observations	15	Yearly data from 1999 to 2013
Countries	12	Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain

Table 4.1.3: Description of bank-level Euro Area bank financial statement data (1999-2013).

Data sources and collection – Country-level monetary and financial statistics are sourced from the European Central Bank and other central banks and include aggregate MFI statistics of the different countries in the Euro Area. We collect raw, monthly data between September 1997 and August 2014 from the ECB Statistical Datawarehouse (ECB, 2014) which contains different balance sheet classes with breakdowns to different countries, counter parties and origin. In line with our scope, we collect all data for the member states of the Euro Area as of 2008[10] (see Table 4.1.2). All bank balance sheet classes and income statement items – bank and country-level – are denoted in millions.

Bank-level financial statements are obtained from banks in the countries of interest which reported deposit funding in 2008-2013 and total assets of at least EUR 1.5 billion to limit the influence of non-banks with a bank permit.[11] We collect raw, yearly data between 1999 and 2013 from Bureau van Dijk Database (Bureau van Dijk, 2014) which contains different balance sheet classes and income statement items. In line with our scope, we collect all data for banks with deposit funding levels in the period 2008-2013 and are located in one the member states of the Euro Area as of 2008 (see Table 4.1.3).

Data treatment – Both the country-level and bank-level data sets are unbalanced and the categories are not in line with the asset and liability classes discussed in Chapter 2. We aim to increase consistency in the asset and liability classes between the country-level and bank-level data sets and seek to limit the influence non-reporting values. Therefore, we aggregate different asset and liability classes for both datasets.

Country-level balance sheet data set – We aggregate the country-level monetary and financial statistics into five liability classes – (1) capital, (2) issued debt, (3) interbank liabilities, (4) deposit funding and (5) other liabilities – and five asset classes – (6) loans, (7) securities, (8) advances to banks, (9) other assets and (10) total assets. The balance sheet classes are constructed by aggregation over origin and counterparties.[12] Furthermore, we combined a number of smaller categories as followed:

- Issued debt includes debt securities and money market funds shares since both classes are interest bearing and 'bailin-able' in the event of bank insolvency.
- Other liabilities comprise of the external liabilities and remaining liabilities.
- Loans comprise of the original classes loans and money market shares since both classes are interest bearing and feature principal protection (ECB, 2012, p. 9).
- Securities comprise of shares and other equities and securities other than shares.
- Other assets include the external assets, fixed assets and remaining assets and cash (euro denominated).

[10] Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal and Spain.

[11] We defined banks as financial institutions who attract deposits funding. Hence, institutions without reported deposit funding classify not as banks for our analysis.

[12] With the exception of deposits funding from MFIs and the loans to MFIs which are classified as interbank liabilities respectively advances to banks.

Similar to Section 2.1, for a number of balance sheet figures (e.g., Figure 2.1.2) we do not differentiate between issued debt and interbank liabilities and aggregate these to the 'wholesale funding' class. Euro Area aggregates are obtained as a summation over the selected countries by date. Although we collected monthly data from the period September 1997 to August 2014, in our analysis we trim the data to January 1999 to December 2013 in line with our scope.

Bank-level balance sheet data set – In line with our data treatment of the country-level Euro Area bank data set, each bank-level balance sheet is aggregated into five asset and six[13] liability classes which capture the key balance sheet structure. The balance sheet items are combined as followed:

- Advances to banks include loans and advances to banks and cash and due from banks.
- Other assets include investments in property, insurance assets, other earning assets, foreclosed real estate, fixed assets, goodwill, other tangibles, current tax assets, deferred tax assets, discontinued operations and other assets.
- Issued debt include senior debt maturing after one year, subordinated borrowing, other assets and prefered shares and hybrid capital accounted for as debt.
- Trading liabilities include repos and cash colleterals, derivatives and trading liabilities.
- Capital includes total equity and prefered shares and hybrid capital accounted for as equity.
- Other liabilities include other deposits and short term borrowings, fair value portion of debt, credit impairment reserves, reserves for pensions, current tax liabilities, deferred tax liabilities, other deferred liabilities, discontinued operations, insurance liabilities and other liabilities.

Other aggregated asset and liability classes include (net) loans, securities, deposit liabilities, interbank deposits and total assets. By construction, the different asset classes and the different liability classes sum up to total assets. However, there are differences between the Euro Area country-level data and bank-level data which are mainly the result of differences in definitions and coverage.[14] Bank income statement items are used as is and hence require no adjustments (see Appendix B).

Missing values – The aggregation of asset and liability classes limits an in-depth analysis on specific categories and ignores impact of missing values. We focus on high level bank balance sheet classes which renders the former limitation irrelevant, the latter limitation requires more attention since missing values may resort from numerous reasons. Our data treatment implicitly assumes that missing values are zero rather than null, non-existing or not reported. As a result, different aggregates may be underestimated. We are however confident that the impact of missing values is negligible as the data are moderated by the bank balance sheet equilibrium relationship[15] of the form:

$$0 = \sum_i A_{it} - \sum_j L_{jt} \tag{4.1.2}$$

in which A_{it} is asset class i at time t and L_{it} is liability class j at time t. Hence, non-zero missing values must exist in asset-liability pairs. Although this is an unlikely event, existence of these pairs also increases the potential influence of missing on the reliability of the data. Since the data originates from a well-know and widely-used source, the reports are audited by accountancy professionals and we make use of large classes for which aggregation needs are limited, we do not account further for non-zero missing values (Note that by construction no missing values are collected for deposit funding level bank data).

Assumptions – At this point, it is important to note that all statistical procedures deployed are based on a number of assumptions of the data. Important assumptions underlying the methods used in the

[13] A major difference between regulatory and accounting classifications is that of derivatives and trading liabilities which we therefore classify as a sixth liability class. For reasons of comparability between country- and bank-level data, we sometimes include the trading liabilities within the other liabilities category.

[15] This equilibrium relationship holds for all bank-year combinations in the data set.

[15] The country-level data on bank statistics are based on ECB definitions of asset and liability classes (see for the ECB definitions ECB, 2012) while the bank-level data on bank statistics are based on IFRS and GAAP standards and in the early years on national legislation.

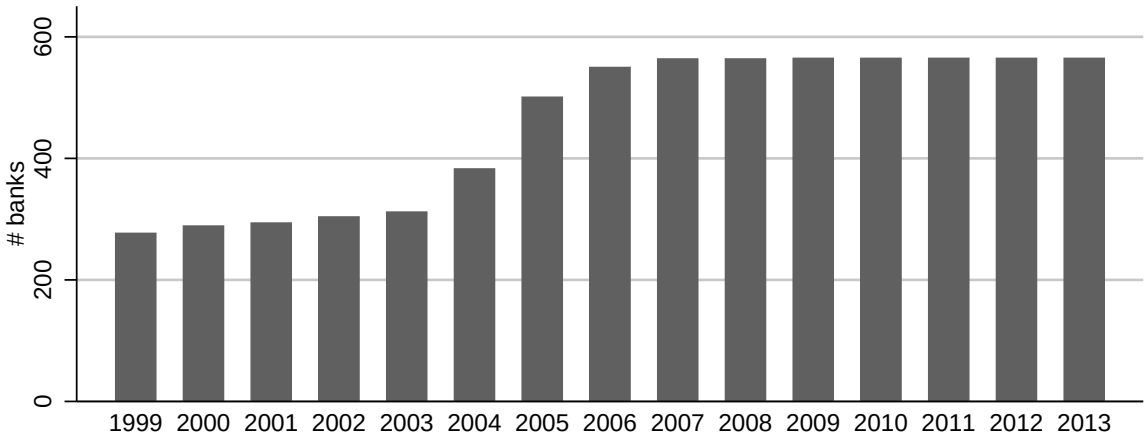


Figure 4.1.1: Number of banks by year between 1999-2013.

explorative analysis of country-level and bank-level deposit funding levels are primarily concerned with normality, homoskedasticity and autocorrelation of the (stationarity) data and regression errors. We accounted with for these assumptions through the Phillips-Perron type tests in the stationarity framework. Furthermore, given the large number of observations in the data it is important to note that other tests are robust for non-normality (Lumley, Diehr, Emerson, & Chen, 2002, p. 164). Hence, we do not need to adjust the data any further for assumptions underlying our methods.

Descriptives – An overview of the aggregated Euro Area bank data (measure type A) aggregated over all countries in our scope is included in Table 4.1.4. Summary statistics of the country-level bank data for each country are included in Appendix B.1. An overview of the aggregated asset and liability classes for the bank level data are included in Appendix B, Tables B.1.

The country-level data set is contains balanced panels in our period of interest 1999-2013. The bank-level data set, however, is strongly unbalanced as a result of the data collection criteria and limited data availability in Bankscope (see Figure 4.1.1). For the exploratory analysis, we do not require complete balance sheets for any bank since we have by construction at least the deposit funding measures between 2008-2013. Furthermore, as we discuss in Chapter 5, from 2005 onwards the total assets and deposit funding levels show great similarities between the country-level and bank-level data sets. Although the banks in the sample differ by year and not all banks report their balance sheet each year, the aggregated total asset and deposit funding levels remain fairly similar to the balanced balance sheet in the Euro Area.

4.2 Regression analysis on bank deposit funding levels

In Chapter 2 and Chapter 3 we identified a number of themes and motives influencing deposit funding levels (see Figure 4.2.1). For the main part we hypothesized a positive or negative influence of the related determinants (independent variable) on deposit funding levels (dependent variable); however, this is different for the economic function as we hypothesize a strong interrelationship between deposit funding and loans. As a result, we formulate in this section two approaches: an vector error correction model approach to model the interdependencies between deposit funding and loan levels (H2) and the Fama-MacBeth approach for the dependency of deposit funding level on the identified themes and motives (H3-8).

Since we specifically focus on bank-specific characteristics including bank business orientation, competitive position and regulatory requirements we focus on the bank-level data set for the regression

[16] Differences between the summed asset classes, liability classes and total assets is due to rounding.

Balance sheet class	N	Mean	SD	Min	Max	Q1	Median	Q3
Capital	180	1499945	489401	772996	2363183	1091908	1388788	1091908
Issued debt	180	4525575	1040924	2550187	5856417	3527056	4769037	3527056
Interbank liabilities	180	5071825	1058566	3383073	7160412	3990490	5081994	3990490
Deposit liabilities	180	8015883	2144478	5042160	11196400	5915845	7671098	5915845
Other liabilities	180	5884729	1858839	2908790	9348458	4097282	5944632	4097282
Loans	180	9637568	2176723	6004004	12354321	7592243	9698538	7592243
Securities	180	4724888	1209015	2712193	6345042	3499328	4735392	3499328
Advances to banks	180	4855700	980786	3293671	6563339	3906281	4777207	3906281
Other assets	180	5779864	2161402	2592362	9895403	3650857	5644363	3650857
Total assets	180	24998020	6469495	14728051	34535626	18606312	24870460	18606312

Table 4.1.4: Summary statistics of country level Euro Area bank data (monthly aggregates, 1999-2013)[16].

Balance sheet class	N	Mean	SD	Min	Max	Q1	Median	Q3
Capital	15	878807	662009	56151	1611718	85288	1203638	85288
Issued debt	15	3291784	2416789	220454	6040009	337964	4203340	337964
Interbank deposits	15	2607923	1768762	342411	5064808	510355	3247001	510355
Deposit liabilities	15	6187884	4428691	612892	11025564	843560	8041552	843560
Trading liabilities	15	3188157	2780851	91590	6876644	138585	3361761	138585
Other liabilities	15	2340613	1828952	42551	4242626	73992	3227353	73992
Loans	15	8106806	5843837	752423	13922155	1002911	10690930	1002911
Securities	15	6657413	5112034	328213	12382933	565406	9664324	565406
Advances to banks	15	2481385	1726411	252948	4213077	362476	3669318	362476
Other assets	15	1249564	950624	32464	2305454	59910	1706209	59910
Total assets	15	18495169	13598452	1366049	32191940	1990702	25730781	1990702

Table 4.1.5: Summary statistics of bank level Euro Area bank data (yearly aggregates, 1999-2013).

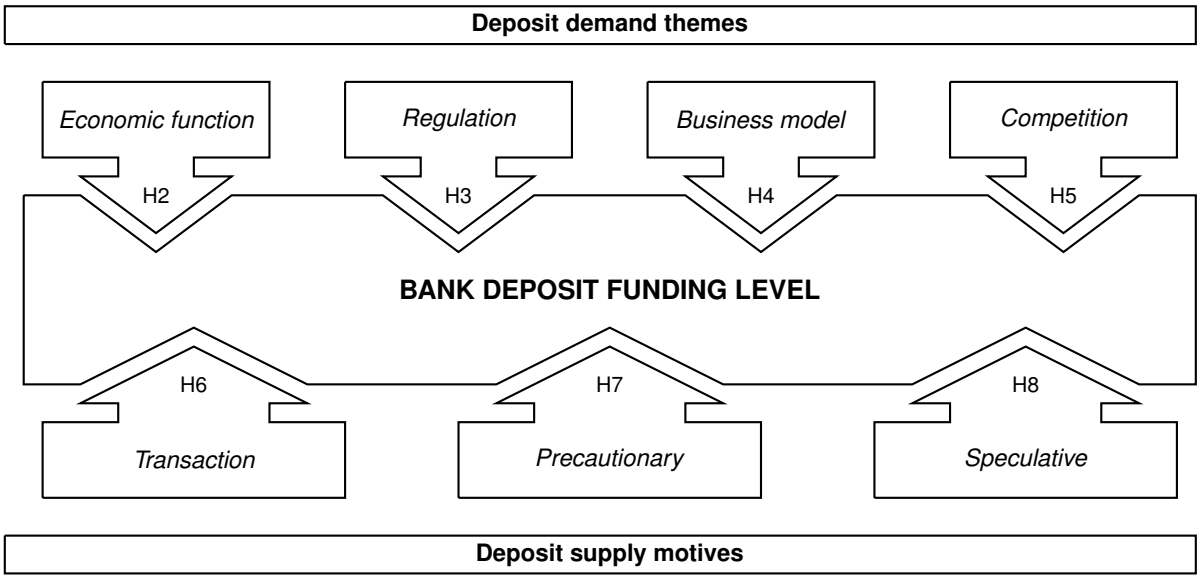


Figure 4.2.1: Theoretical framework of factors influencing bank deposit funding levels

analysis hypotheses. As we have shown in Figure 4.1.1 and discussed in more detail in Chapter 5, the bank-level data shows great similarities with country-level data while it enables us to obtain a bank-level insight rather than a high-over country-level overview.

4.2.1 Methods

We analyse the relationship between deposit funding levels and loans as main element of the economic function (H2) and furthermore focus on the impact on deposit funding levels of regulation with a focus on deposit funding variability and bank risk (H3), bank business models (H4), competition with a focus on market power (H5). From a supply perspective, we focus on the different motives for liquidity preference – transaction, precautionary and speculative – and their impact on deposit funding levels (H6-8). In this section we highlight our approaches, define measures and discuss data collection, treatment and descriptives.

Interrelation of deposit funding and loan levels *(H2a)* **–** As discussed, stationarity is an important characteristic to consider in (regression) analysis of time series. Differencing the data – e.g., transforming data from measure type A to measure type D – generally resolves this issue. However, this is not sufficient for our analysis of the economic function of banks (H2). With our analysis of the interdependence between loan levels and deposit funding levels, we are primarily not interested in time-invariant characteristics of the underlying data generating processes but on their time-dependent and dynamic relationship. This dynamic relationship is best seen in an autoregressive context where deposit funding and loan levels influence subsequent observations. Moreover, the economic function implies a long-run relationship between the deposit funding and loan level time series. As a result, we examine the economic function by estimation of a vector error correction model (VECM) which allows for a long-run cointegrating relationship in the autoregressive context.

Cointegration – Cointegration is closely related to stationarity since cointegrated time series are those who themselves "are non-stationary while there exists a linear combination between the series that is stationary" (Zivot & Wang, 2006, p. 444). Presence of a cointegration relationship between deposit funding and loan levels is evidence for a long-run dynamic relationship and hence for the economic function of banks. For the bivariate case, testing for cointegration involves OLS estimation of a linear

relation between two non-stationary[17] time series D_t and L_t:

$$u_t = D_t - \theta L_t + \delta + \phi t \tag{4.2.1}$$

where δ is the drift term and ϕ indicates a trend. In a second step, the estimated series u_t is tested for stationarity in a similar fashion as discussed earlier. This procedure is known as the Engle-Granger (1987) two-step method which is generally sufficient for estimation of a cointegration relationship between two time series. However as a result of our panel context, Pedroni and Vogelsang's (2005) test for cointegration is more appropriate. This test is in essence the Engle-Granger two-step method but corrected for cross-panel dependencies – in a similar fashion as the Phillips-Perron type unit root tests – and for correlations along the time dimensions. Especially, in small samples the Pedroni and Vogelsang tests produce more robust results than other tests for cointegration.[18]

Panel unit root tests – A necessary requirement for a cointegration relationship between two time series is that both time series are non-stationary at level and stationary at difference. To examine the stationarity property of deposit funding and loan level time series, we need to deploy panel unit root tests.[19] Due to the heterogeneous nature of bank business models, we focus on the Phillips-Perron Fisher type unit root test which allows for unbalanced panels, heteroskedasticity, autocorrelation and varying time frames and is superior to the Levin-Lin and Im-Pesharan-Shin alternatives (Maddala & Wu, 1999, pp. 634, 650). The Phillip-Perron Fisher type unit root tests performs a Phillips-Perron unit root tests on each panel separately similar as discussed earlier and then combines the $p-$values to test whether all panels contain a unit root (H_0). Critical values are provided by Choi (2001) which are more robust for small small samples (Pesaran, 2007, p. 267).

Test strategy for H2a

Precondition	Loan level time series and deposit funding level time series are $I(1)$.
H_0	Bank deposit funding level time series and loan levels have a cointegrating relationship (H_0: u_t is stationary).
H_a	Bank deposit funding level time series and loan levels have no cointegrating relationship (H_0: u_t is non-stationary).
Decision rule	We reject Hypothesis 2a if H_0 is rejected.

Vector error correction model *(H2b-c)* **–** In the presence of cointegration, short-term dynamics between deposit funding and loan-levels are influenced by the long-term relationship. Therefore, we need to include the cointegration relationship in the estimation of the deposit funding and loan levels. We deploy a vector error correction model of the form[20]:

$$\begin{aligned}\Delta D_t &= \alpha_1 + \gamma_1(D_{t-1} - \theta L_{t-1}) + \sum_{i=1}^{i=p}(\beta_{1i}\Delta D_{t-i} + \beta_{1,i+1}\Delta L_{t-i}) + \varepsilon_{1t} \\ \Delta L_t &= \alpha_2 + \gamma_2(D_{t-1} - \theta L_{t-1}) + \sum_{i=1}^{i=p}(\beta_{2i}\Delta D_{t-i} + \beta_{2,i+1}\Delta L_{t-i}) + \varepsilon_{2t}\end{aligned} \tag{4.2.2}$$

where ΔD_t denotes the change in deposit funding levels at time t relative to time $t-1$ and ΔL_t denotes the change in loan levels at time t relative to time $t-1$ (measure type D). γ is the coefficient from Equation 4.2.1, α is the intercept (drift) coefficient, γ is the coefficient indicating the cointegration adjustment and β denote the influence of prior deposit funding and loan levels up to time $t-p$.

The panel context and associated cross-sectional and time-dependencies require extensive adjustments in the estimation procedures to create robust estimates. Pedroni (2000, pp. 114-115) describes a step-by-step procedure to implement these adjustments based on fully modified ordinary least squares (FMOLS) principles which in essence comprise three steps: (i) the collection of residuals from a panel

[17] More specifically $I(1)$ time series, see Appendix A.2.

[18] See for a more extensive discussion on panel cointegration tests Pedroni (1999), Maddala and Wu (1999) and Appendix A.2

[19] See for example Maddala and Wu (1999) for a discussion of unit root tests in a panel data context. In general, unit root tests for the complete sample test all the cross-sections for the presence of a unit root (H_0) against no unit root (H_1), while the combined individual unit root tests examine the presence of a unit root (H_0) against some cross-sections without a unit root (H_1).

[20] For clarity, the bank-indices are dropped from the notation.

regression for deposit funding levels as a function of loan levels, (ii) estimation of the long-run covariance and auto-covariance matrix of the residuals and (iii) construction of the estimator adjusted with the covariance and auto-covariance matrix. The FMOLS adjustments are complex, hence we turn to the built-in features of the statistical software package Eviews 8.1 (see Chapter 42 Eviews documentation IHS Global, 2014, pp. 797-817).

Granger-causality – Following Granger's (1980) Representation Theorem, the VECM specification provides us with valuable information on the 'Granger causality' between deposit funding and loan levels. This causality is not a causality in the form that a structural change in one time series results in a change in the other time series; rather, Granger causality indicates "that turning points in one series precede turning points in the other" series (Alexander, 2001, p. 362). Examination of the Granger causality between deposit funding and loan levels allows us to test our hypothesis that changes in deposit funding levels precede changes in loan levels (H2b).

More specifically, the representation theorem shows that in a VECM specification the coefficient pairs (γ_1, γ_2) and (β_1, β_2) indicate long and short-run 'Granger causal flows' between deposit funding and loan levels. This is best seen from Equations 4.2.1 and 4.2.2: when $\alpha_1 > 0$ and $\alpha_2 > 0$, we need $\gamma_1 < 0$ and $\gamma_2 > 0$ in order to adjust deviations from the long-run cointegration relationship 4.2.1 back to the long-run equilibrium relationship. When this does not hold, the VECM is misspecified and the has the tendency to 'explode'. This mechanism describes precisely the 'error correction' mechanism in the VECM and is the basis for Granger's (1980) representation theorem. Similarly, the inclusion of lags for deposit funding and loan levels in Equation (4.2.2), allows us to examine short-run causal flows, reflected in (β_1, β_2). For example, if the β_{1i} coefficients are significant this is evidence for a causal flow from prior deposit funding and loan levels to deposit funding levels; deposits funding and loan levels are then said to *Granger cause* deposit funding levels.

Test strategy for H2b

Precondition	Loan level time series and deposit funding level time series are $I(1)$ and a cointegration relationship exists.
H_0	Deposit funding levels Granger cause loan levels (H_0: $\beta_{21} > 0$ or $\gamma_2 < 0$).
H_a	Deposit funding levels do not Granger cause loan levels (H_a: $\beta_{21} \leq 0$ or $\gamma_2 \geq 0$).
Decision rule	We reject Hypothesis 2b if H_0 is rejected.

Rationale of the VECM approach – In essence, our vector error correction model is a dynamic model that describes the behaviour and interaction of deposit funding levels and loan levels over time. Since the deposit funding and loan levels have a common origin in the bank balance sheet – and the driving forces behind balance sheets including its economic function, regulation, business model and competitive environment – we expect a long-run equilibrium relationship between the series. The error correction term allows for this relationship with a self-regulating mechanism which 'corrects' deviations from the long-run equilibrium while allowing short-term deviations. A long-run equilibrium relationship for the economic function. Furthermore, the results from the test for a structural break in the time series allows us to estimate different VECMs and examine the impact of the financial crises (H2c) on the economic function of banks in the Euro Area.

Test strategy for H2c

H_0	VECM parameters are identical for different estimations over time (H_0: $\beta_{ij,A} = \beta_{ij,B}$ and $\gamma_{i,A} = \gamma_{i,B}$ where $i = j = 1, 2$ and $A = 1999-$break and $B =$break-2013).
H_a	VECM parameters vary for different estimations over time (H_a: $\beta_{ij,A} = \beta_{ij,B}$ and / or $\gamma_{i,A} = \gamma_{i,B}$ where $i = j = 1, 2$ and $A = 1999-$break and $B =$break-2013).
Decision rule	We do not reject Hypothesis 2c if H_0 is rejected.

Hence, by way of summary, our procedure for the analysis of the economic function of banks (H2a-b) involves four steps:

- Examination of the deposit funding and loan level time series on their stationarity. We use the Fisher type Phillips-Perron panel unit root test and follow Elders and Kennedy's (2001) strategy for unit root testing.
- Examination of cointegration between the deposit funding and loan level time series. We use the

		Firm 1			Firm 2			Firm 3	
Firm 1	ε_{11}^2	$\varepsilon_{11}\varepsilon_{12}$	$\varepsilon_{11}\varepsilon_{13}$	0	0	0	0	0	0
	$\varepsilon_{12}\varepsilon_{11}$	ε_{12}^2	$\varepsilon_{12}\varepsilon_{13}$	0	0	0	0	0	0
	$\varepsilon_{13}\varepsilon_{11}$	$\varepsilon_{13}\varepsilon_{12}$	ε_{13}^2	0	0	0	0	0	0
Firm 2	0	0	0	ε_{21}^2	$\varepsilon_{21}\varepsilon_{22}$	$\varepsilon_{21}\varepsilon_{23}$	0	0	0
	0	0	0	$\varepsilon_{22}\varepsilon_{21}$	ε_{22}^2	$\varepsilon_{22}\varepsilon_{23}$	0	0	0
	0	0	0	$\varepsilon_{23}\varepsilon_{21}$	$\varepsilon_{23}\varepsilon_{22}$	ε_{23}^2	0	0	0
Firm 3	0	0	0	0	0	0	ε_{31}^2	$\varepsilon_{31}\varepsilon_{32}$	$\varepsilon_{31}\varepsilon_{33}$
	0	0	0	0	0	0	$\varepsilon_{32}\varepsilon_{31}$	ε_{32}^2	$\varepsilon_{32}\varepsilon_{33}$
	0	0	0	0	0	0	$\varepsilon_{33}\varepsilon_{31}$	$\varepsilon_{33}\varepsilon_{32}$	ε_{33}^2

Table 4.2.1: An example of a cross product matrix that violates the standard OLS assumption (adapted from Petersen, 2009, p. 441).

Pedroni tests for cointegration and follow a cointegration testing strategy analogue to Elders and Kennedy's (2001) strategy for unit root testing.

- Estimate the cointegration time series with the fully modified OLS (FMOLS) estimation. We use the results of the cointegration tests for the FMOLS specification (e.g., for decisions on inclusions on intercepts and trends).
- Estimation of the vector error correction model (VECM) between the deposit funding and loan level time series. We again use the results from the FMOLS estimation in the VECM specification.

This procedure allows us to systematically analyse the short-run and long-run interdependencies between deposit funding and loan levels for different cross-sections and time periods.

Multivariate regression analysis *(H3-8)* **–** Panel data sets are notorious for their within and between correlations which bias the results of standard OLS regressions in panel data (see Table 4.2.1). In our case it is likely – and reflected in the data – that there are correlations in their deposit funding level at the bank-level – e.g., within each bank – across years. Similarly, correlations are also likely to exist between deposit funding levels of different banks. As discussed earlier and in Appendix A.1, these correlations lead to underestimated standard deviations and hence biased test-statistics. This may result in type I errors and hence incorrect conclusions on the effect of determinants on deposit funding levels.

An effective method which accounts for these correlations is important but is highly dependent on the structure of the variance-covariance matrix. A number of methods have been developed[21] but their use is not the default in financial studies. In a recent review of panel regression methods in financial studies Petersen (2009, pp. 435-436) found that 42 per cent of the papers did not adjust for cross-sectional or autocorrelation in the regression errors. The remainder of the papers deployed either the Fama-MacBeth (1973) procedure (20%) or included dummy variables (17%).

Fama-MacBeth approach – The Fama-MacBeth (1973) method is a two-step procedure that adjusts for the cross-sectional correlations (e.g., across banks) by estimation of a standard OLS regression for each year in the sample period. This results in coefficient estimates for each year. As a second step these estimates are averaged over the years to obtain the coefficients for the overall model. This procedure results in standard errors that are adjusted for cross-sectional correlation but not for autocorrelation. As Petersen (2009, p. 460) points out, adjusting for autocorrelation in our sample only improves the standard error estimation slightly (see Appendix H for a more elaborate discussion of the Fama-MacBeth (1973) procedure).

[21] See for example Thompson (2011), Petersen (2009) for a discussion.

However, the Fama-MacBeth procedure poses problems for our estimation. From our literature review, we found a number of bank-specific (demand themes) and country-specific (supply motives) factors influencing deposit funding. As a result, our regression model not only needs to deal with correlation across banks but also across countries. Furthermore we have a difference in the number of banks (565) and countries (12) included in our analysis. As a result the variability in country-specific variables is lower than those for the bank-specific variables which biases the estimates for the country-level coefficients.

Fixed effects model – To accommodate the difference in variability we turn to the second-most-used method found by Petersen (2009) – inclusion of dummy variables. These models – generally referred to as fixed effects models – include a dummy variable for each panel member (banks) to control for a biases resulting from bank-specific differences (Bell & Jones, 2012, p. 13).[22] This approach limits our possibilities for inferences on out-of-sample banks (Clark & Linzer, 2015, p. 403) but given our large sample and scope on the Euro Area, this is not a large limitation. Furthermore, a fixed effects model effectively removes correlations between banks if there is are no dependencies across the time dimension (time-invariance). As discussed, these correlations are present and hence we follow the field and use year dummies to control for these correlations. These fixed effects models with year dummies are not only widely used in the general finance studies but also specifically in studies on bank funding structures (see for recent examples Demirgüç-Kunt & Huizinga, 2013; Van den End, 2013; Prabha & Wihlborg, 2014; Köhler, 2014).

We deploy a fixed effects model and to control for time variance we include year dummies. We follow the results from the literature review and include all determinants in the regression specification:

$$D_{it} = \alpha_i + \sum_{k=1}^{k=l} \beta_k[\text{Deposit demand determinant } k \text{ for bank } i \text{ on time } t] + \sum_{k=k+1}^{k=l+m} \beta_k[\text{Deposit supply determinant } k \text{ for bank } i \text{ on time } t] + \gamma_t + \varepsilon_{it} \quad (4.2.3)$$

where i denotes the bank, j denotes the country, k denotes the determinant, γ_t is a year dummy and α_i is bank-specific fixed effect. Furthermore, l is the bank demand determinant and m the bank supply determinant, hence we have max(k)$= l + m$. In the next paragraph, the measures are defined and the rationale behind the regression specification is discussed.

Test strategy for H3a, H3b, H4b, H5, H7b, H7c and H8

H_0	Determinant k is not associated with deposit funding levels (H_0: $\beta_k = 0$).
H_a	Determinant k has a association with deposit funding levels (H_a: $\beta_k < 0$).
Decision rule	We do not reject the hypothesis if H_0 is rejected.

Test strategy H4a, H6a, H6b, H6c, H7a and H7d

H_0	Determinant k is not associated with deposit funding levels (H_0: β_k).
H_a	Determinant k has positive relationship with deposit funding levels (H_a: $\beta_k > 0$).
Decision rule	We do not reject the hypothesis if H_0 is rejected.

4.2.2 Data

In the bank-level balance sheet data description, we discussed our deposit funding and loan level data. In this section we discuss the different data needs, define measures, describe the collection and treatment and provide descriptives.

Measures – Where possible, we connect for the definition of our measures to central measures and data sources in the Euro Area. Furthermore, we build on the earlier data collection and the results of

[22] Bell and Jones (2012, pp. 15,21) argues that these type of models also may be inappropriate since fixed effects models effectively remove variance between banks and hence prevents inferences on this level. However as we focus on banks in general, bank-level differences are out of our scope.

the cluster analysis. An overview of the variables is included in Table 4.2.2 where deposit funding is our only dependent variable.

Deposit demand determinants – We identified determinants for deposit funding in four bank demand themes (see Figure 4.2.1 and Chapter 2 and Chapter 3): bank's economic function, regulatory attention, bank business model and competitive considerations. These determinants are time and bank-specific and hence we define the associated measures on the bank-level. First, we define loans for the analysis of bank's primary economic function consisting of deposit taking and lending. We have defined deposit funding earlier; similar to our deposit funding definition we define loans as amounts owed to debtors which are repayable at nominal amount. Second, regulatory efforts focus on customer protection and financial stability with a special focus to deposits since these are considered a stable source of funding. We examine the impact of deposit funding stability and variability on deposit funding levels and define the deposit funding variability as the standard deviation of deposit funding level. Hence, we focus on bank-specific variability rather than time-specific variability. Furthermore, we follow prior research on bank risk profiles[23] and employ the $Z-$score to measure bank's risk profile. The $Z-$score is defined as the number of standard deviations between the return on assets and capital and insolvency.

Where ROA_{it} is the return on assets (net income over total assets) of bank i at time t, C_{it} the capital of bank i at time t and $\sigma(ROA_i)$ is the standard deviation of the return on assets measured over T. As such, the $Z-$score is an inverse of the probability of insolvency (Köhler, 2014, p. 201). Third, we use the results of our cluster analysis to assign banks to clusters for the business model definition. We focus on the levels of wholesale funding, securities and trading income to distinguish between the retail orientation (relatively low) and the investment orientations (relatively high). Furthermore, we define bank size by total assets. Fourth, banks' competitive considerations are captured by the market power which we define as the bank's share in the country's total assets. This market power measure is closely related to market concentration measures as the Herfindahl index which are a summation of the squared market shares for all banks in the country. As discussed, we here focus on bank-level characteristics rather than country-level market characteristics.

Bank supply determinants – For the bank supply of deposit funding we identified determinants closely linked to the three motives for liquidity. In contrast to the bank-specific demand determinants, these determinants are time and country-specific and hence we define measures which we link to specific banks. First, we define gross national income (GNI), the house price index (HPI) and median age as a measures for the transaction motive. GNI is primarily a scaling indicator for consumption and non-consumption and defined as the total primary income receivable by a residents of a country for a productive activity. As we do not differentiate by income origin we focus on the broader GNI measure which includes income from both domestic and international production rather than the gross domestic product (GDP). The influence of housing prices is captured by the house price index which is a composite measure with market prices of country-level house prices. The HPI measures house prices relative to a reference date and primarily changes in house prices. Furthermore, we define the country's median age as measure for the influences of ageing on deposit funding levels. Second, we hypothesized that the unemployment rate, economic sentiment indicator (ESI), social security provisioning and the inverse purchasing price parity (PPP) exchange rate influence deposit funding levels from a precautionary motive for liquidity preference. We follow the broad Eurostat definition for the unemployment rate and follow the methodology for the economic sentiment indicator (European Commission, 2014c, p. 19). The latter combines indices based on consumer and business surveys and aggregates these into one measure. Social security provisioning is measured as the country-level social security benefits which include benefits for old age, unemployment and disability. Depositor preference in the Euro Area is primarily provided by deposit guarantee schemes. As the coverage level is harmonized across all member states, the main difference in protective value stems from country-level differences in purchasing power. Hence, we define depositor preference as the coverage level divided by the country-level purchasing power parity exchange rate. Third, the speculative motive influencing deposit funding levels is captured by long-term government bond yields and equity index returns. The long-term government bond yields are defined by the Maastricht criterion for monthly long-term interest rates. The equity indices returns

[23] See for example Stiroh and Rumble (2006), Demirgüç-Kunt and Huizinga (2010), Köhler (2014). Moreover, see our discussion of the bankruptcy measures in Section 2.2.2, specifically Footnote 35.

Variable		Description	Source
		Bank-level determinants	
Deposit funding	DEP	Cash amounts owed to creditors which are non-transferable and repayable at nominal value	Bureau van Dijk (2014)
Loans	LOA	Amounts owed to debtors which are repayable at nominal amount	Bureau van Dijk (2014)
Deposit funding variability	DVR	Deposit funding level standard deviation over deposit funding level	Bureau van Dijk (2014)[1]
Risk profile	RSK	Standard deviations between the bank's expected return on assets and equity depletion ($Z-$score)	Bureau van Dijk (2014)[A]
Retail orientation	RET	Banks categorized by Wald's clustering procedure to the cluster with relative lower wholesale funding, securities and trading income	Bureau van Dijk (2014)[A]
Investment orientation	INV	Banks categorized by Wald's clustering procedure to the cluster with relative higher wholesale funding, securities and trading income	Bureau van Dijk (2014)[A]
Bank size	SZE	Total assets	Bureau van Dijk (2014)
Market power	MPW	Total assets share in country	Bureau van Dijk (2014)[A]
		Country-level determinants	
Gross national income	GNI	Total primary income receivable by resident institutional units in return for some engagement in productive activity	Eurostat (2015)[B]
Housing prices	HPI	Average house price index (2010=100)	Eurostat (2015)
Ageing	AGE	Median age	Eurostat (2015)
Unemployment rate	UNR	Number of people 15 to 74 years of age who worked less than one hour during the reference period[C]	Eurostat (2015)
Economic sentiment indicator	ESI	Weighted average of the industry, services, consumers, construction and retail confidence indicator	Eurostat (2015)[A]
Social security provisioning	SSP	Total social security benefits	Eurostat (2015)
Depositor protection	DPR	Inverse Purchasing Price Parity	Eurostat (2015)
Deposit opportunity costs	IND, GYI	Long-term government bond yield (Maastricht definition) and equity index return	Various[D]

[A] Supplemented with own calculations | [B] Values for Greece, Ireland and Luxembourg from OECD (2015) | [C] Compact definition, see full definition Eurostat metadata [link] | [D] Bourse de Luxembourg (2015), Eurostat (2015), The Wallstreet Journal (2015), Yahoo Finance (2015). Missing values for Portugal obtained from Euronext (2015).

Table 4.2.2: List of variables used in the regression analysis.

are defined by the relative changes in the monthly countries' leading indices.[24]

Data collection – Data sources are included in Table 4.2.2. Data for the bank-level demand determinants are construed from the bank-level balance sheet data collected earlier. Country-level supply determinant data is primarily collected from Eurostat (2015) databases with additions for missing values from the OECD Statistical Database. Equity indices are collected from Yahoo Finance, Wallstreet Journal, Euronext and the Bourse de Luxembourg. The dataset contains monthly and yearly observations and is complete over the period 1999-2013, with the two exceptions: (i) the house price indices are published since 2000 and hence observations for 1999 are not included in our data set and (ii) social securities benefits are published with a two-year delay and hence not yet available.

Data treatment – Data for the equity indices and government yields are collected monthly. In line with the earlier aggregation of Euro Area balance sheet data, we construct the yearly averages from the monthly observations. In addition to the construction of the measures discussed earlier, we needed to account for missing values in economic sentiment indicator. We used the original methodology by the European Union Directorate-General for Economic and Financial Affairs and construct for all date-country combinations a new indicator from the different confidence indicators[25] (industry, services, consumers, construction, retail trade). Finally, the values collected for the purchasing power parity reflected the price level against the Euro Area 15 benchmark. In line with our scope on Euro Area members as of 2008, we deflated these measures with the purchasing power parity for the Euro Area 12.

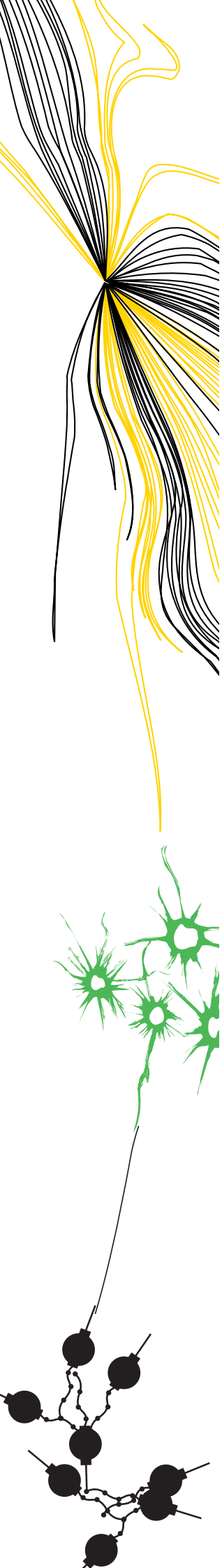
Descriptives – Descriptives are included in Table 4.2.3. The house price index measure shows percentages relative to 2000, the economic sentiment indicator shows percentages relative to 1999 and the purchasing power parity shows percentages relative to the Euro Area 12 benchmark.

[24] Included indices are ATX (Austria), BEL20 (Belgium), OMXH25 (Finland), CAC40 (France), DAX (Germany), ASE (Greece), ISEQ20 (Ireland), FTSE MIB (Italy), LuxX (Luxembourg), AEX (Netherlands), PSI20 (Portugal) and IBEX35 (Spain).

[25] In line with the methodology, for each indicator the sample arithmetic mean and sample standard deviation are determined over period 1990:01 to 2013:12. The different indicator scores are adjusted with the sample mean and sample standard deviation and a new indicator is composed by a weighted sum of the adjusted indicators. The ESI is again the normalized transformation of this weighted sum. See European Commission (2014c, p. 19) for the detailed construction.

Regression variables		N	Mean	SD	Min	Max	Q1	Median	Q3
Loans	million Euro	6863	17719	62904	0	745678	1278	2376	7283
Deposit funding variability	%	6863	94.823	2199.801	2.105	176485	12.70	20.12	33.88
Bank risk		6844	68.53	99.56	-13.99	1520.36	18.55	41.95	81.685
Total assets	million Euro	6863	40424	163373	157	2202423	2286	4414	12219
Market power	%	6863	2.215	7.520	0.008	100.000	0.062	0.143	0.557
Gross national income	million Euro	180	683157	746854	17866	2813780	156122	281223	2433460
Median age	year	180	39.48	2.53	32.20	45.30	38.25	39.60	43.20
House price index	%	168	89.83	17.96	44.70	151.11	78.71	93.31	105.5
Social security benefits	million Euro	168	183157	210683	3942	754573	38699	75340	646952
Unemployment rate	%	180	8.30	4.20	1.90	27.50	5.15	7.90	9.30
Economic sentiment indicator	%	180	99.65	9.77	74.57	118.43	93.53	100.36	106.28
Purchasing power parities	%	180	100.24	11.54	74.79	118.31	90.71	103.65	107.43
Return on equity indices	%	180	0.155	2.485	-8.327	6.023	-1.217	0.968	1.958
Government bond yield	%	180	4.496	2.094	1.495	22.498	3.712	4.257	4.317

Table 4.2.3: Summary statistics of regression variables (1999-2013).



CHAPTER 5

EXPLORATIVE ANALYSIS OF EURO AREA DEPOSIT FUNDING

In Chapter 2, we developed a number of explorative hypotheses concerning the Euro Area deposit funding market. In this chapter we familiarize ourselves with the Euro Area deposit funding market and test the hypotheses related to Sub-Question 2:

"What are the recent changes in Euro Area bank funding profiles?"

All bank balance sheet classes and income statement items – bank and country-level – are denoted in million euros.

5.1 Euro Area time series

In Section 2.1 we discussed the difference in deposit funding levels (Measure A) in the Euro Area between 1999 and 2013 which doubled from 5,064 to 10,969 billion Euro, corresponding with an increase of 117 per cent and a 5.29 per cent compounding annual growth rate (CAGR).[1] The normalized deposit funding levels (Measure C) increased from 34.08 to 36.15 per cent over total assets which reflects sharper growth of deposit funding levels than total assets[2] and a larger reliance on deposit funding levels. In this section we examine Euro Area deposit funding levels and the underlying structure of deposit funding levels growth. Furthermore, we examine changes in the deposit funding level behaviour since the recent crisis.

Growth in deposit funding levels *(H1a; accepted)* **–** We hypothesized that deposit funding levels have grown since 1999 (H1a). Figure 5.1.1 indeed graphically indicates the increase in deposit funding level.[3] To examine the underlying structure of the deposit funding level growth and differentiate between a time-dependent growth (e.g., from events) and time-invariant growth as property of the underlying data generating process, we formally test our hypothesis and test for the presence of a unit root (H_0) the Philips-Perron unit root test and Newey-West lag selection. We follow Elder's and Kennedy's (2001) unit root testing strategy (see Chapter 4) and report the results in Table 5.1.1.

All specifications indicate presence of a unit root (non-stationarity) which indicates the presence of time-dependencies in the changes of deposit levels over time. As we test for – and expect from Figure 5.1.1 – growth we follow Elder and Kennedy (2001, p. 143) and focus on the deposit funding levels at first difference. From specifications (5) and (6) we conclude that deposit funding levels at first difference in the Euro Area (Measure D) are stationary without trend and with monthly increase (drift). Drift-stationarity at first difference indicates that yearly increments of deposit funding levels are not dependent on the passing of time, i.e. the *difference* (Measure D) in deposit funding levels in the Euro Area between two months grows with a constant time-invariant drift. Since the month-on-month differences increase with a positive drift, the deposit funding levels in the Euro Area show a consistent, overall growth.

As a result of the Phillips-Perron unit root test, the results are robust for non-autocorrelation and homoskedasticity assumptions. We use MacKinnon critical values and since the Q-Q-plot shows that the violation of normality assumption is limited the results on Hypothesis 1a robust for the main assumptions (see also Appendix I, Table I.1). Hence, we conclude that their is support for Hypothesis 1a since the test hypothesis of a unit root was rejected in favour of stationarity with a positive drift.

[1] The CAGR is calculated by $CAGR = \frac{v_T}{v_1}^{1/T} - 1$.

[2] Indeed, total assets of banks in the selected countries in the Euro Area increased with 103 per cent from 14,858 billion Euro to 30,177 billion Euro.

[3] Graphs of other asset and liability classes are included in Appendix C.1.

Figure 5.1.1: Monthly Euro Area bank deposit funding levels between January 1999-December 2013.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors are reported in parenthesis.
MacKinnon Critical Values: 2.630 $p < 10\%$; $p < 5\%$ -3.000; $p < 1\%$ -3.750.

	At level			At first difference		
	(1) Standard	(2) Drift	(3) Trend	(4) Standard	(5) Drift	(6) Trend
ρ	1.000^{***}	0.998^{***}	1.007^{***}	0.368^{***}	0.068	0.056
	(0.00)	(0.00)	(0.01)	(0.07)	(0.08)	(0.08)
β			-0.000			-0.000
			(0.00)			(0.00)
α		0.042	-0.108		0.004^{***}	0.005^{***}
		(0.03)	(0.18)		(0.00)	(0.00)
$Z(\tau)$	8.263	-1.297	0.505	-9.438^{***}	-12.428^{***}	-12.551^{***}
N	179	179	179	178	178	178

Table 5.1.1: Results Phillips-Perron unit root tests on Euro Area deposit funding levels between 1999-2013 (Measure B). Significant drift (α) or trend (β) terms in combination with a stationarity ($Z(\tau)$) implies respectively drift or trend-stationarity.

The consistent, time-invariant growth in Euro Area deposit funding levels in the last years strongly indicates that there are other factors than the passing of time that influence deposit funding level growth. This finding justifies the examination of the identified potential factors influencing deposit funding levels in the next chapter.

Changes since last crisis *(H1b; rejected)* **–** Differentiation between deposit funding levels with drift or trend is especially relevant when the deposit funding level time series is influenced by a time-specific event. Such an event may result in an endogenous break which changes the behaviour of the time series from that moment on. Trend-stationary processes recover towards the level prior to the break while drift-stationary processes do not have such a 'memory' property.

We examine the influence of the recent crisis and its influence on the deposit funding level process. We hypothesized an increased growth in deposit funding levels since the crisis. To test this hypothesis, we examine in a similar fashion as for the previous hypothesis (H1a) the properties of the data generating process underlying deposit funding level and specifically test for a change since the recent financial crisis. Although the bankruptcy of Lehman Brothers – September 15, 2008 – is often referred to as the start of the recent financial crisis, it remains unclear whether Lehman Brother's bankruptcy also influenced deposit funding levels in the Euro Area directly.

Therefore, we examine the deposit funding levels in the Euro Area in the presence of a unit root without an exogenous change in the behaviour of the underlying process (H_0). First, we deploy the Zivot-

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors are reported in parenthesis.

	At level			At first difference		
	ZA	AO	IO	ZA	AO	IO
Break point 1	$2011:10$	$2002:12$	$2002:07$	$2009:02^{***}$	$2005:04$	$2004:07$
Break point 2		$2006:12$	$2005:03$		$2009:01^{*}$	$2008:12^{***}$
$Z(\tau)$	-1.509	-3.282	-5.126^{*}	-8.410^{***}	-9.034^{***}	-9.160^{***}
N	176	176	176	175	175	175

Table 5.1.2: Results Zivot-Andrews (ZA) and Clementes-Montanes-Reyes Additive Outlier (AO) and Innovational Outlier (IO) unit root test on Euro Area deposit funding levels between 1999-2013 (Measure B).

Country	N	Mean	SD	Min	Max	Q1	Median	Q3
Austria	180	12.403	0.230	12.055	12.716	12.175	12.411	12.632
Belgium	180	12.796	0.274	12.334	13.171	12.520	12.834	13.053
Finland	180	11.377	0.285	10.969	11.890	11.107	11.326	11.624
France	180	14.090	0.271	13.694	14.527	13.810	14.061	14.327
Germany	180	14.728	0.168	14.475	14.985	14.572	14.696	14.890
Ireland	180	11.963	0.378	11.154	12.483	11.617	12.147	12.297
Italy	180	13.711	0.348	13.236	14.267	13.408	13.617	14.028
Greece	180	11.982	0.279	11.405	12.422	11.767	12.021	12.202
Netherlands	180	13.326	0.316	12.746	13.739	13.042	13.343	13.633
Spain	180	11.997	0.258	11.550	12.410	11.770	11.962	12.265
Luxembourg	180	13.809	0.507	12.930	14.399	13.332	13.922	14.292
Portugal	180	12.150	0.171	11.828	12.413	11.990	12.222	12.288

Table 5.1.3: Descriptives of deposit funding levels on all countries (Measure B).

Andrews unit root test to test for a single structural break. We only consider a break in the intercept since our earlier analysis prevents inclusion of a trend. Furthermore, we trim the first and last 1% of the series to prevent false break points in the extremities. We use the Akaike Information Criterion (AIC) for our lag selection and in line with the Newey-West lag selection in the Phillips-Perron unit root test, we allow for a maximum of four lags. Second, we control for a potential second structural break with the Clementes-Montanes-Reyes unit root test where we use a similar setup as for the Zivot-Andrews unit root test with two differences: (1) AIC is not used for the lag selection as our Stata procedure does not allow for that and (2) we examine the innovational and additive outlier unit root test rather than inclusion of a break in the intercept. We implement the strategy in Stata which uses the critical values provided by Zivot and Andrews (1992), Clemente *et al.* (1998).

In Table 5.1.2 we report the break points and potential rejection of the null hypothesis and residual tests are reported in Table I.2 (Appendix I). The Clementes-Montanes-Reyes unit root test indicates rejection of two structural breaks in the data generating process underlying the aggregate deposit funding levels. Furthermore, the Zivot-Andrews unit root test strongly rejects the hypothesis of a unit root process without a structural break and indicates a stationary process at first difference with a break in Februari 2009. To examine the difference in behaviour of the processes underlying the deposit funding levels, we deploy the Phillips-Perron unit root test on samples 1999:01-2009:01 and 2009:02-2013:12 and examine the differences between the drift coefficients. A Wald test show at the 99% significance-level higher growth prior to the financial crisis ($\alpha_{1999:01-2009:01} = 0.006$) than since Februari 2009 ($\alpha_{2009:02-2013:12} = 0.002$). Hence, although the crisis impacted the deposit funding levels with a decrease in the month-on-month growth, the Euro Area deposit funding levels (Measures A and D) remained increasing after the financials crisis. Therefore, we reject Hypothesis 1b.

We hypothesized increased deposit funding growth as banks decreased their sources of market funding (see Figure C.1, Appendix C.1). However, growth in total bank assets simultaneously stagnated (see Figure C.5). Rather than an acceleration of deposit funding level growth due to decreases in market funding, banks stopped expanding their overall activities. As a result of the decrease of market funding and stagnated expansion of activities in combination with moderate growth, the reliance on deposit funding increased sharply since the financial crisis (see Figure 5.1.1, Measure C).

5.2 Cross-sections

In Section 2.1 we hypothesized that deposit funding levels vary across countries and bank orientations which reflects differences in socio-economic and regulatory contexts and strategic focus. In this section,

we assign banks to a business orientation and examine variations in country-level and bank-level deposit funding levels.

5.2.1 Country-level cross section

Country-level aggregated bank balance sheets vary greatly across the Euro Area (see the aggregated country-level balance sheets in Appendix D.1). A quick overview shows that the funding and asset structures of France, Germany, Italy, Luxembourg and the Netherlands are relatively stable. These countries also own 80-85 per cent Euro Area deposit funding market share (see Figure 5.2.1). The other countries – especially Greece, Finland and Ireland – show large shifts between different asset classes and liability classes. Greece has a large reliance on deposits for funding and this reliance showed a sharp increase in 2000 and 2001 – the start of the Euro Area – and a sharp decrease in 2008 – the start of the financial crisis. Interestingly, the southern Euro Area members Greece, Italy, Portugal and Spain show similarities with the Dutch balance sheet in the reliance on lending, although the southern countries also are more reliant on deposit funding.

Although Greece, Spain and Portugal rely for a large proportion (on average 41-52 per cent) of their funding on deposits, their overall share of deposit funding is small with a combined volume of 6.5 per cent of the average total deposit funding in the Euro Area. In contrast, Germany, Italy and the Netherlands are for one-third dependent on deposits for their funding while their share in the total Euro Area deposit funding market is on average more than 50 per cent. France and Luxembourg are even less reliant on deposit funding (on average 20-22 per cent of funding needs) while their combined market share is an approximate 30 per cent.

Cross-country variations *(H1c; accepted*) **–** In line with Hypothesis 1c, this overview indicates cross-country variations in deposit funding levels (Measure A) and variations in dependency on deposit funding (Measure C, see Figure 5.2.4). In Figure 5.2.3, large differences are reflected in country deposit funding level distributions. Descriptives for deposit funding levels in each Euro Area country are included in Appendix B.1 (Table B.2, Measure type A) and Table 5.1.3 (Measure type B). The descriptives and histograms clearly indicate large differences in deposit funding levels between countries: the deposit funding level of the largest country (Germany) is – at mean and median – thirty times larger than the smallest country (Finland).

To test the hypothesis of varying bank funding levels across countries formally, we employ an ANOVA test on identical country-level means (H_0) which is rejected at the 99% level of confidence. These differences in means are also found in total assets and in deposit funding levels over total assets – both at 99% – providing with support for Hypothesis 1c.

Underlying characteristics – A closer examination of the country-level variation in deposit funding levels shows that the underlying characteristics also vary across countries (see Table 5.2.1 and Appendix C.1). We examined the individual countries for unit root processes in the deposit funding levels and conclude that the majority is stationary with a monthly increase (see Appendix F, Tables F.1-F.4). The deposit funding levels in Ireland, Greece and Luxembourg are drift-stationary at level, in France drift- and trend-stationary at level and the Netherlands drift- and trend-stationary at difference.[5] Hence, deposit funding levels for the majority of countries differences (Measure D) are not influenced by prior differences but only dependent on a monthly time-invariant constant (e.g., the month-on-month differences generally increase). The deposit funding levels in Ireland, Greece and Luxembourg differ in that not only the prior *differences* in deposit funding levels (Measure D) have no influence on subsequent differences but also the prior *levels* (Measure A) do not influence the deposit funding levels. Hence, for the majority of countries the monthly *differences* in deposit funding levels (Measure D) increase with a fixed time-invariant amount while for Ireland, Greece and Luxembourg also the deposit funding *levels* increase with a fixed time-invariant amount.

[4] The legend reads left-right and corresponds top-down with the graph: Luxembourg is the top-layer and Austria the bottom-layer in Figure 5.2.1.

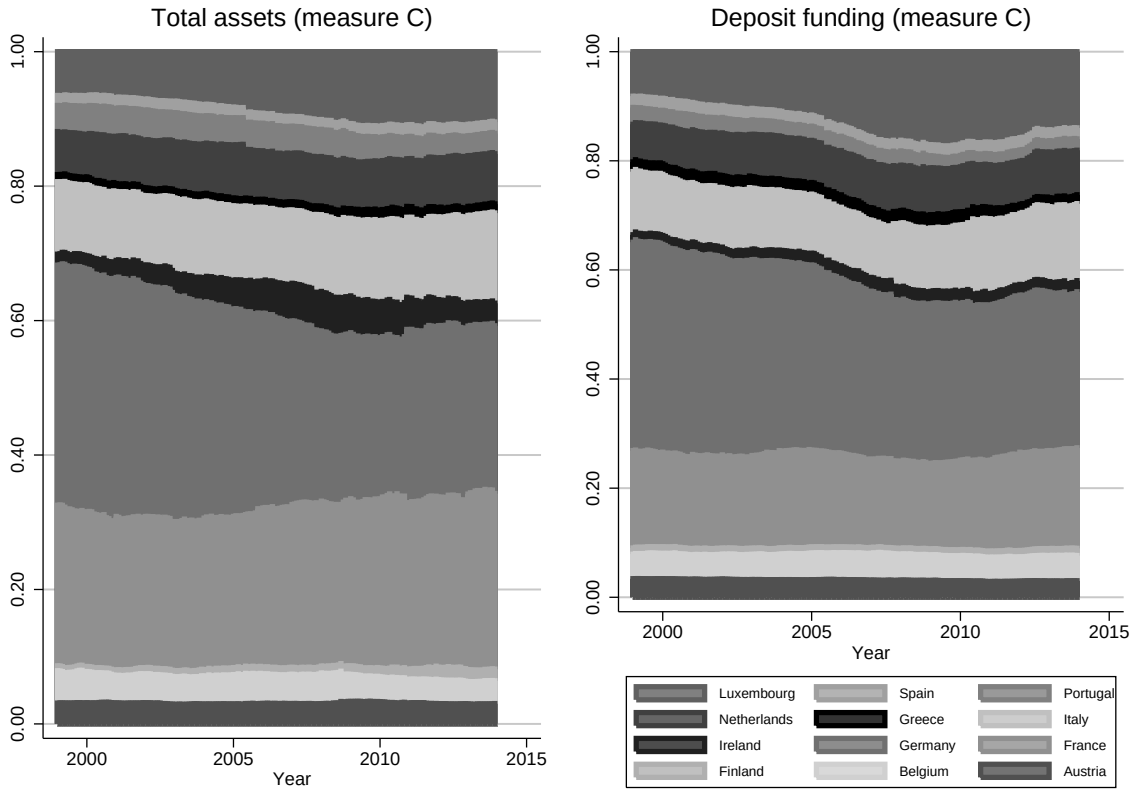


Figure 5.2.1: Country-level deposit funding levels and total assets relative to the Euro Area aggregate between January 1999-December 2013.[4]

$^{*}\ p < 0.10$, $^{**}\ p < 0.05$, $^{***}\ p < 0.01$

	At level			At first difference		
	(1) Standard	(2) Drift	(3) Trend	(4) Standard	(5) Drift	(6) Trend
Austria					●***	
Belgium					●***	
Finland					●***	
France			●**			
Germany					●***	
Ireland		●**				
Italy					●***	
Greece		●*				
Netherlands						●***
Spain					●***	
Portugal					●***	
Luxembourg		●*				

Table 5.2.1: Summary of results Phillips-Perron unit root tests on country-level deposit funding levels between 1999-2013 (Measure B). This summary is based on the results of country-level Phillips-Perron unit root tests on deposit funding levels reported in Appendix F.

France and the Netherlands differ in the underlying characteristics of the deposit funding level time series. The increase in French deposit funding levels (Measure A) is time-dependent (drift- and trend-stationary) at *level* while the deposit funding level in the Netherlands is drift and trend-stationary at first *difference* (Measure D) which indicates that the French and Dutch deposit funding levels time-dependent.

Changes since last crisis – As noted earlier,[6] this is especially important for the behaviour of deposit funding levels after an exogenous break. A country-level examination of deposit funding levels (Measure B) in a stationarity framework with exogenous breaks indicates that all countries exhibited one exoge-

[5]This indicates that the deposit funding level development in France and the Netherlands show a more systematic growth, i.e. external changes have less influence on their long-run deposit funding levels. Results of residual diagnostics are reported in Appendix I, Table I.3.

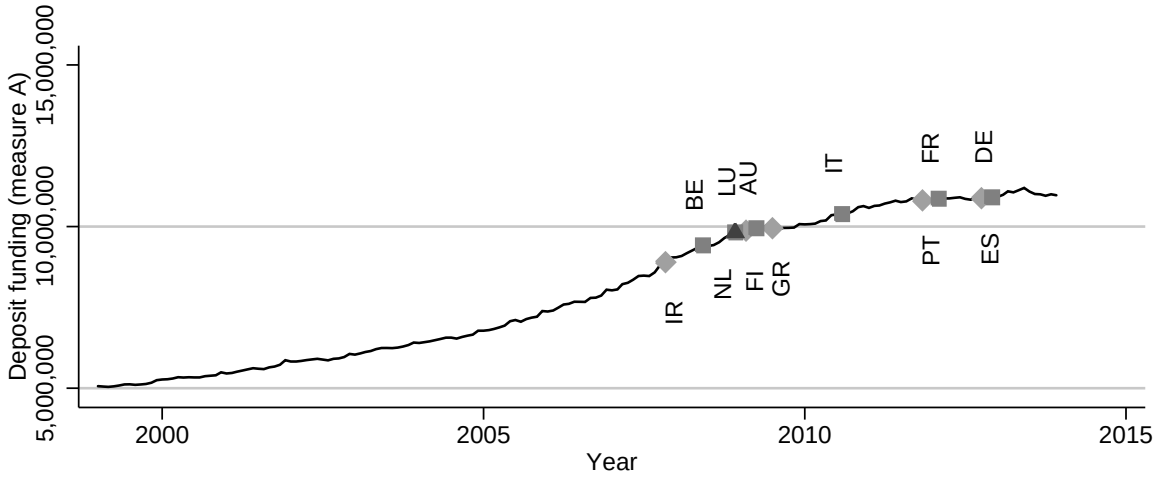


Figure 5.2.2: The aggregate Euro Area deposit funding level between 1999-2013 with country-level breaks (Measure A).

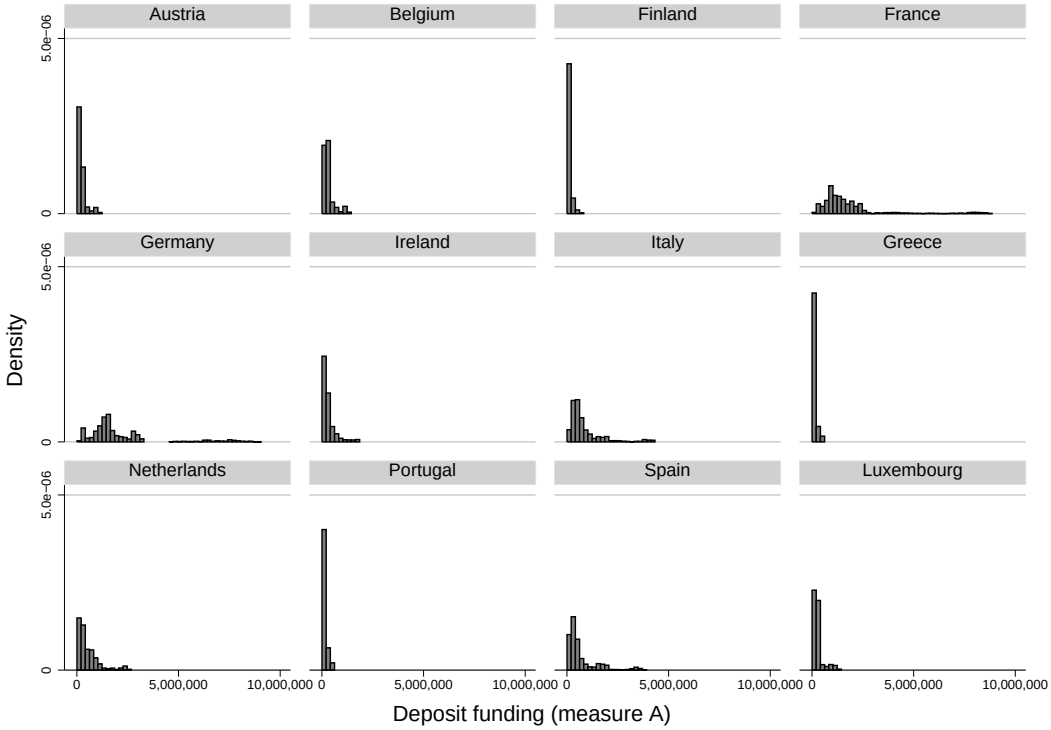


Figure 5.2.3: Histograms of deposit funding levels in Euro Area countries between 1999 and 2013 (Measure A).

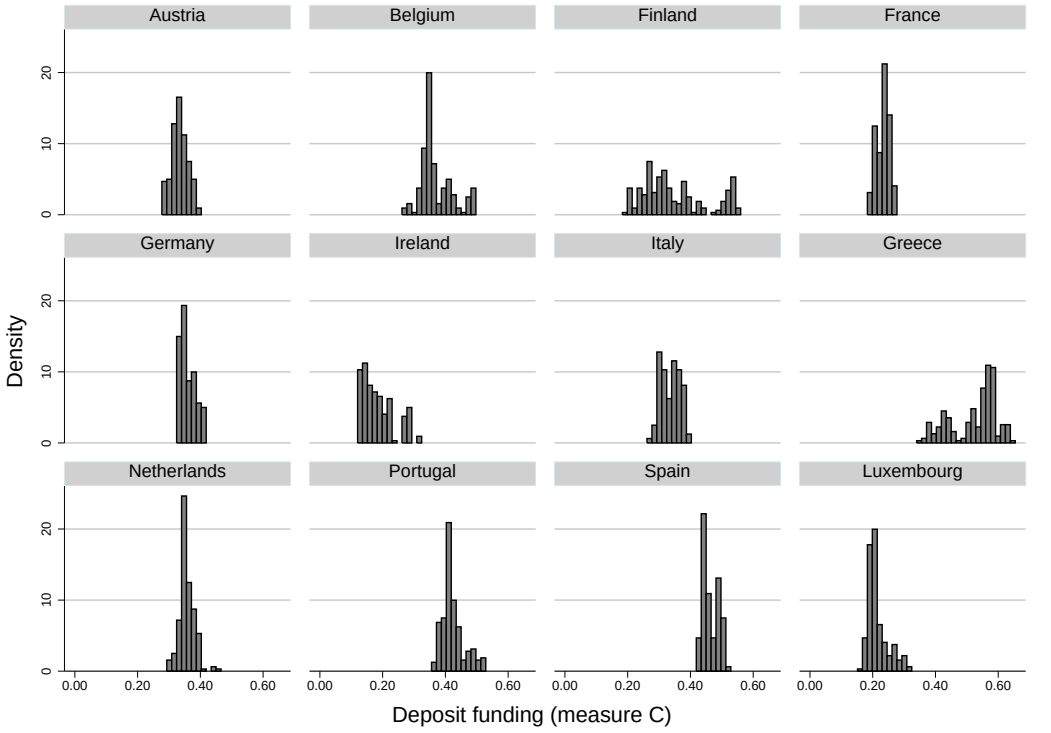


Figure 5.2.4: Histograms of deposit funding levels in Euro Area countries between 1999 and 2013 (Measure C).

Country	Total assets		Deposit funding	
	Bank-level data	*Country-level data*	*Bank-level data*	*Country-level data*
Austria	3.09	3.08	3.88	3.12
Belgium	3.98	4.01	3.67	4.67
Finland	1.31	1.24	1.12	1.13
France	31.52	24.17	27.44	17.02
Germany	26.46	28.21	24.81	31.50
Greece	9.88	1.32	1.66	2.07
Ireland	2.45	4.26	1.31	2.09
Italy	8.99	11.56	10.60	11.95
Luxembourg	7.60	3.78	0.97	2.39
Netherlands	11.32	7.28	12.72	8.02
Portugal	0.96	1.63	1.45	2.09
Spain	8.17	9.48	10.36	13.95

Table 5.2.2: Distribution of total assets and deposit funding over countries in the country-level and bank-level data sets.

nous break in the deposit funding level (see Figure 5.2.2 and Appendix F). The results indicate that the timing of the influence of the financial crisis on deposit levels differed between individual countries. A large number of countries showed a change in behaviour of the deposit funding level time series around the Euro Area aggregate break; however in Italy, France, Portugal, Germany and Spain the impact of the structural break emerged later.

Hence, the deposit funding levels not only vary cross-sectional across countries (Measures A and C); they also develop differently over time. The results show that the month-on-month differences in country-level deposit funding levels (Measures A and D), in general, increase with a fixed amount while the changes in deposit funding levels of France (Measure A) and the Netherlands (Measure D) are linked to time. Furthermore, the impact of the crisis differed across countries in terms of timing.

5.2.2 Bank-level cross-section

A first overview of the average bank-level balance sheet shows distinct larger deposit funding and loans levels than reflected in the country-level balance sheet (cf. Figure 2.1.2, p. 10 and Figure 5.2.5). This highlights the differences in definitions between our country-level and bank-level data sources. On average the deposit funding levels in sample shows an increase which is in line with the country-level data. The majority of all country-year observations (6,863) originate from France (1,050) and Germany (4,009). In terms of total asset and deposit funding distributions, the country-level and bank-level data set show great similarities (see Table 5.2.2), and again France, Germany Italy, Luxembourg and the Netherlands account for 80 per cent of total assets. The similarities in bank-level and country-level data are manifested especially from 2005 and onwards (see Appendix B, Figures B.1-B.3).

Changes in the relative deposit funding levels (Measure C) since the crisis are minor with approximately 2 per cent and the relative Measures for other balance sheet classes remain stable as well. The stability of bank balance sheet classes over total assets (Measure C) is also found in the other balance sheet classes – with the exception of advances to banks. An overview of the bank balance sheet classes over total assets is included in Appendix E.1.

Assignment to clusters – In order to examine deposit funding levels across the bank orientation cross-section, we assign banks with similar characteristics to the same bank business orientation cluster.

[6] See the discussion of the impact of the financial crisis on the Euro Area deposit funding levels.

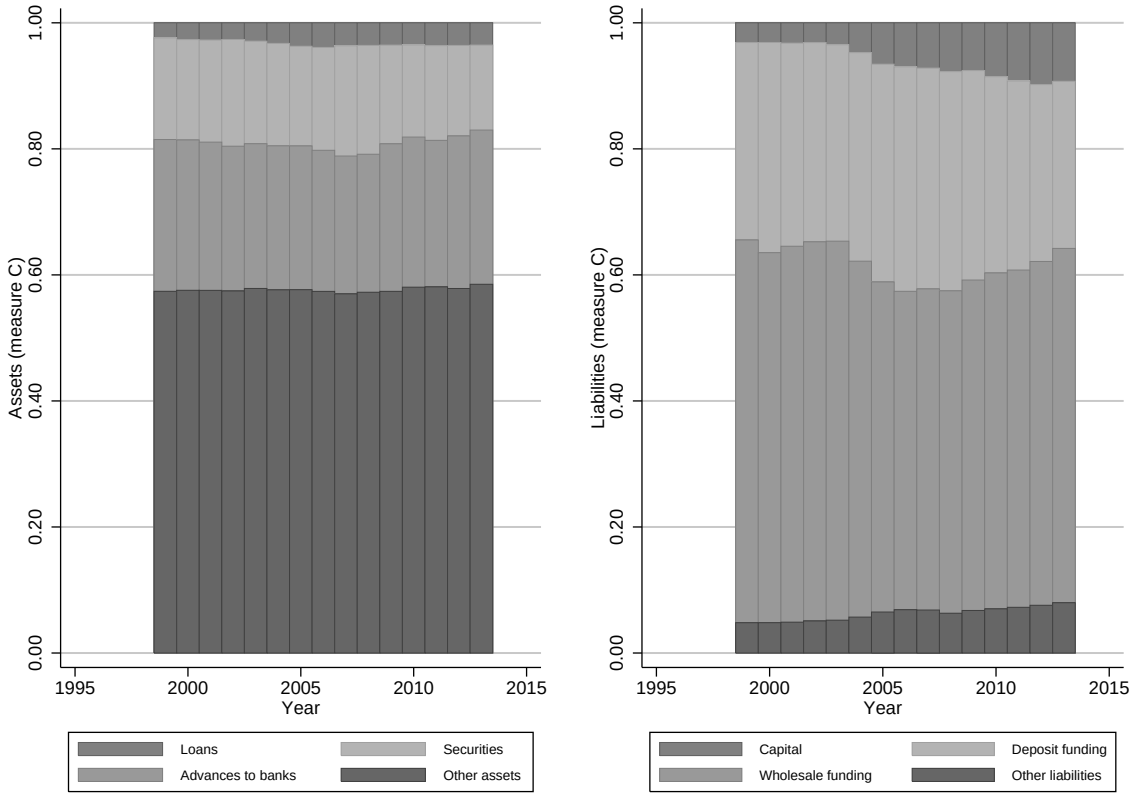


Figure 5.2.5: Average bank-level bank balance sheet between 1999-2013.

In line with Ayadi *et al.* (2011), we employ Ward's (1963) hierarchical cluster analysis technique to differentiate between banks on the continuum of investment and retail orientations (see Table 2.2.2). We base the analysis on deposit funding, wholesale funding and capital as the main variables of the funding structure, loans, securities and advances to banks as the main variables of the asset mix and interest income, fee and commission income and trading income. We normalize these variables over total assets and gross income (Measure C) and include the natural logarithm of total assets (Measure B) to moderate size differences. The clustering procedures shows a maximum in the pseudo $F-$index and pseudo T^2-index at the two cluster configuration,[7] indicating the most distinct combination of maximum between-cluster variance and minimum within-cluster variance with two clusters (see Table 5.2.3). This distinction is supported by the cluster-tree in Figure E.8 which schematically shows the dissimilarities between different cluster configurations.

Robustness of clustering – In order to determine the robustness of this result, we examined the cluster analysis for for different time windows and found also a distinct two cluster configuration in the period 2008-2013. The use of non-normalized measures (Measure A) also had no influence on the dominant cluster configuration. In line with Demirgüç-Kunt and Huizinga (2010), Köhler (2014) and others, we consider the exclusion of the income items and drop a number of asset and liability classes which results in a five distinct cluster configuration. A closer examination reveals that the difference with our earlier findings results from sub-categorization on total assets while other characteristics remain identical. Hence, the different configuration is due to a number of large outliers in terms of total assets and due to differences in bank business orientation. This examination of robustness shows that the two cluster configuration indeed reflects the most likely dominant configuration of bank business models.

[7] Two major outliers were removed. In 2011 Delta Lloyd NV-Delta Lloyd Group and in 2012 Banque Internationale à Luxembourg reported negative income from interest which heavily influenced the cluster analysis: it resulted in individual clusters for these

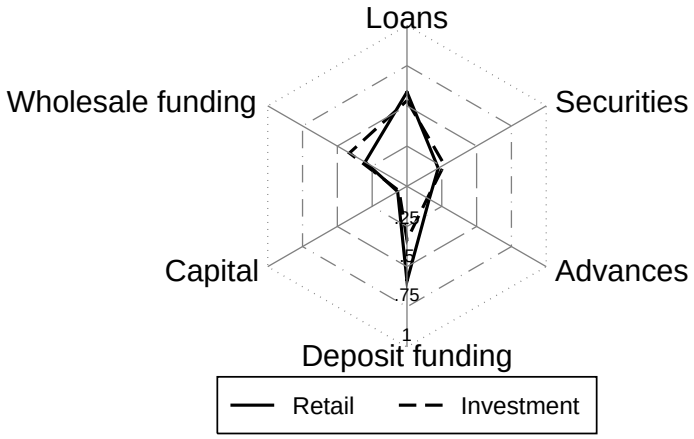


Figure 5.2.6: Spider diagram of the different bank business orientations.

Bank business orientation typologies – The descriptive details of the two clusters are reported in Table B.1. With the reservations mentioned earlier, we describe the two business orientations as a retail orientation (Cluster 1) and an investment orientation (Cluster 2). This differentiation is primarily based on the difference in reliance on deposit funding, wholesale funding, securities and trading income; however, simple $t-$tests show that the two clusters differ on all selected variables at the 99% significance level. The retail oriented bank sample comprises roughly 75 per cent of the sample and relies primarily on deposit funding which is nearly one sample standard deviation greater than the investment orientation. Furthermore, the retail oriented bank sample relies significantly less on wholesale funding, securities and trading income. Differences on the other variables are in line with our expectations, with the exception of the income profile variables and advances to banks. The advances to banks are most likely due to the large number of German banks included in the sample and the German bank sector structure.[8]

Over the complete period from 1999 to 2013, the sample contains more banks with a retail orientation than with an investment orientation. However, the number of banks for each bank business orientation was not constant (see Figure 5.2.8). Between 1999 and 2009 more banks showed an investment orientation while since 2010 the retail orientation was the most dominant orientation again. Although investment-oriented banks were less reliant on deposits for funding and just 17 per cent of the banks were assigned to the investment orientation, in absolute levels 82 per cent of the total deposit fund-

specific banks. We assigned these banks to the cluster in the previous year.

[8]Germany has a number of large co-operative and government-owned regional banks which are interconnected through interbank deposits and advances to banks.

#	Pseudo $F-$index	Je(1)/Je(2)	Pseudo T^2-index	#	Pseudo $F-$index	Je(1)/Je(2)	Pseudo T^2-index
1	–	0.395	10482	9	6313	0.838	453
2	10482	0.493	5805	10	5921	0.800	495
3	9728	0.484	1279	11	5580	0.631	342
4	9503	0.677	1234	12	5314	0.754	260
5	8418	0.475	622	13	5091	0.761	580
6	7763	0.785	836	14	4895	0.599	135
7	7115	0.562	495	15	4711	0.752	209
8	6742	0.796	354				

Table 5.2.3: Results of the cluster analysis on the complete sample 1999-2013.

ing level in the sample were concentrated within investment-oriented banks (see for more descriptives Table B.1 in Appendix B.4).

Cross-bank business orientation variations *(H1d; accepted)* **–** Banks vary in size across their bank orientation. Retail oriented banks are larger in number and their relative deposit funding level is significantly higher than those of the investment oriented banks. However, retail banks are on average also approximately 40 times smaller in size (see Appendix B.1, Table B.2). Paired $t-$tests indicate significant differences in deposit funding levels between the two identified business orientations, both on Measure A and Measure C. Furthermore, the box plot of deposit funding levels (Measure B) show consistent differences across business orientations (see Figure 5.2.9). Hence, we accept Hypothesis 1d.

The finding of variation in bank business orientations is not new (see e.g., Cavelaars & Passenier, 2012; Köhler, 2014; Ayadi *et al.*, 2011). However, most researchers differentiate business orientations distinctively by the proportion deposit funding in their funding profile. Furthermore, implications of on the concentration of deposit funding *levels* are rarely discussed. Due to differences in sheer size, investment-oriented banks accumulate the majority of deposit funding in the Euro Area: roughly 75-85 per cent of the yearly total deposit funding volume in the Euro is allocated to investment-oriented banks while retail-oriented banks are twice as reliant on deposits for funding.

5.3 Conclusion

This chapter presented the findings of the exploratory analysis on deposit funding levels in the Euro Area with which we tested hypotheses 1a-d, developed in the literature study. First, we found evidence supporting our overall growth between 1999-2013 in Euro Area deposit funding levels (H1a). The stationarity analysis on country-level deposit funding levels provide support for increased deposit funding levels in the Euro Area between 1999 and 2013. This increase is a characteristic of mechanisms influencing deposit funding level growth and not attributable to a specific event in time. Second, inclusion of a break in the stationarity analysis showed a change in behaviour of in February 2009. In contrast to our hypothesis (H1b) of increased deposit funding level growth since the crisis, we found support for a decreased growth. Third, an closer examination of the country-level deposit funding level time series provided evidence supporting our hypothesis of country differences (H1c). These differences exist for the relative and absolute deposit funding levels and for the timing of the impact of the financial crisis. Furthermore, the nature of the deposit funding level growth varies across countries. Fourth, we found evidence for our hypothesis of differences across bank business orientations (H1d). Although retail-oriented banks rely more on deposits for funding, the deposit funding levels of investment-oriented banks are significantly higher than those of retail-oriented banks. This indicates a strong size effect on

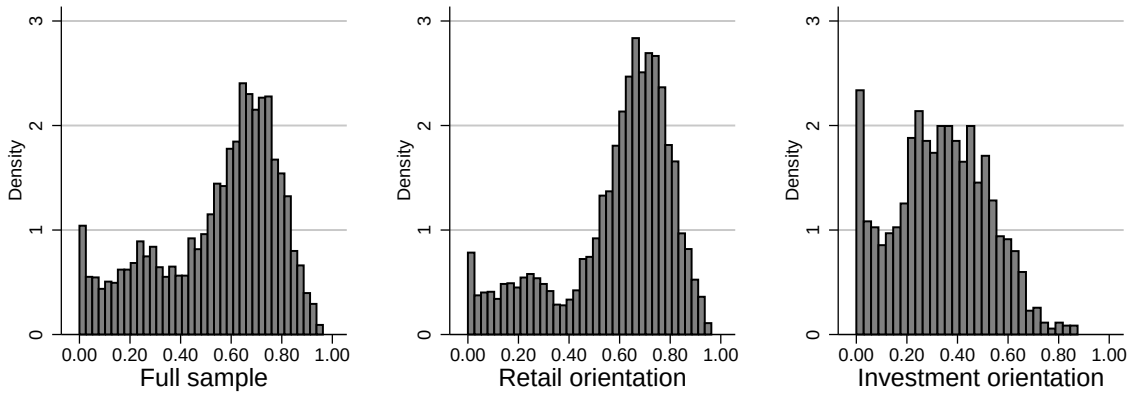


Figure 5.2.7: Histogram of deposit funding levels for each business orientation (Measure C).

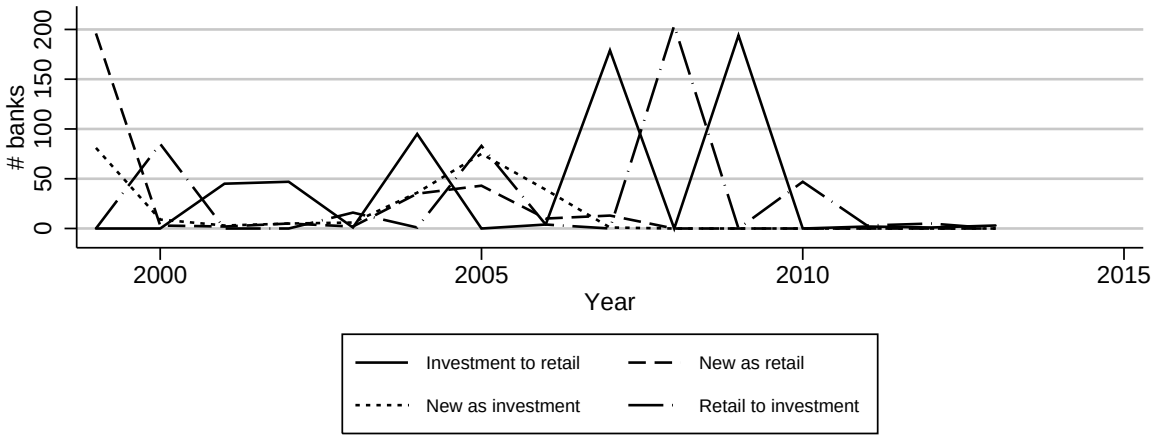


Figure 5.2.8: Transition of bank orientations within the sample between 1999 and 2013.

deposit funding.

The finding of the explorative analysis that the growth in Euro Area deposit funding levels is time-independent indicates that other factors than time influence deposit funding levels. In the next chapter, we examine a number of these factors identified in the literature study.

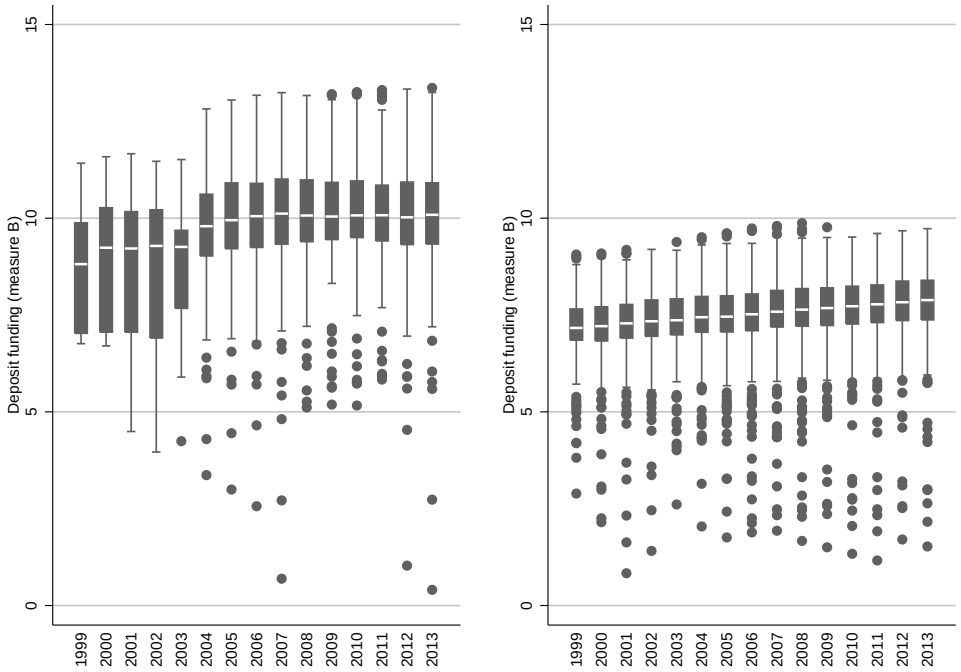


Figure 5.2.9: Box plot of deposit funding levels (Measure B) by investment orientation (left) and retail orientation (right) between 1999 and 2013.

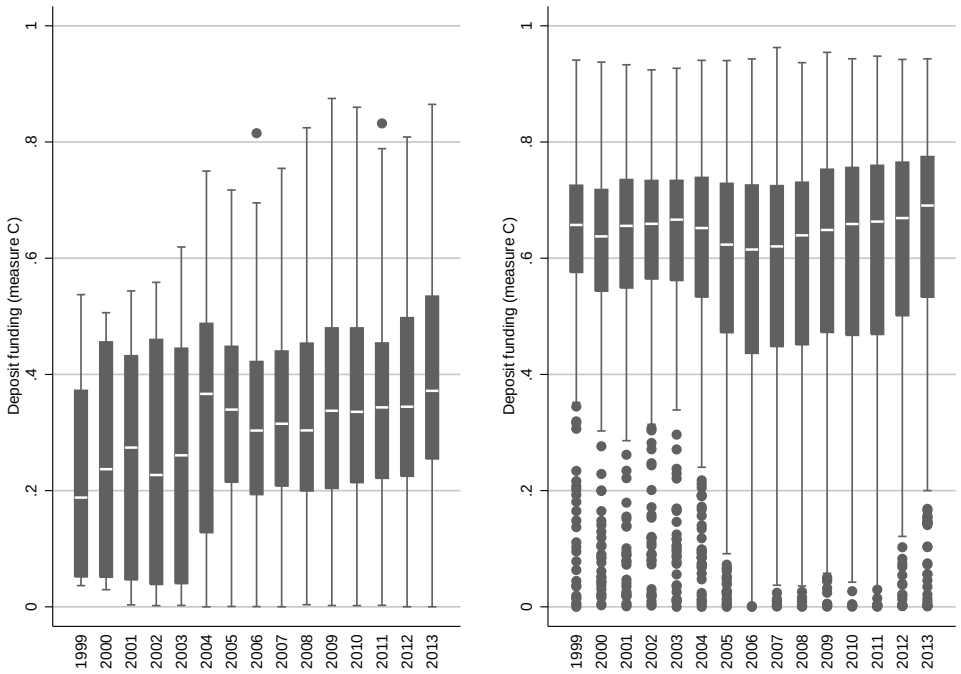


Figure 5.2.10: Box plot of deposit funding levels (Measure C) by investment orientation (left) and retail orientation (right) between 1999 and 2013.

CHAPTER 6

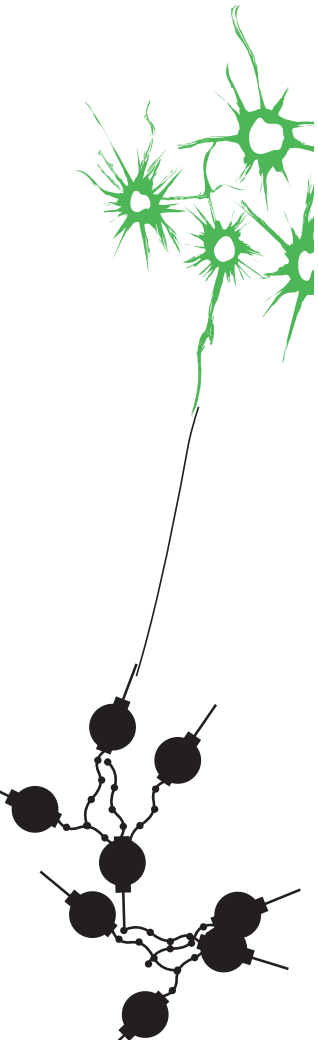
REGRESSION ANALYSIS OF EURO AREA DEPOSIT FUNDING

In this chapter we examine the remaining hypothesis to answer Sub-Question 3:

"How do the identified determinants relate to the selected banks' deposit funding levels?"

We start with the hypothesis concerning banks' economic function (H2a-c; Section 6.1). Subsequently, we discuss the other potential determinants of deposit funding levels identified in Chapters 2 and 3 (H3-8).

All bank balance sheet classes are denoted in million euros.



6.1 Banks' economic function in the Euro Area

In the previous chapter we explored deposit funding levels in the Euro Area over time and across countries and bank business orientations. We found that deposit funding levels showed a steady increase since 1999, although the growth slowed down since the recent financial crisis. Furthermore, we found differences in deposit funding levels across countries and banks. In this chapter we focus on the determinants underlying the deposit funding levels. We start by examination of the economic function by analysis of the main asset transformation mechanism between deposits and loans (Section 6.1). Then we focus specifically on the determinants identified in our literature study.

Interrelation of deposit funding and loan levels *(H2a; accepted)* **–** The literature findings suggest that banks' deposit demand is a direct result of the economic function: liquidity distribution at minimum transaction costs. At the core of traditional bank operations, this economic function is reflected in the transformation of deposit funding into loans. Hence, a strong relationship between deposit funding and loan levels is expected (H2a) while liquidity flows from changes in deposit funding levels to subsequent changes in loan levels (H2b). Furthermore, we expect that the deposit-loan transformation mechanism has changed since the crisis (H2c) as lending activities decreased while deposit funding levels increased (Howcroft *et al.*, 2014, p. 489).

We test these hypotheses by estimation of a robust vector error correction model following the four-step approach developed in Section 4.2.1 (see page 43): (i) test for stationarity in the time series, (ii) test for cointegration, (iii) estimate the cointegrating time series and (iv) estimate the vector error correction model. We use the logarithmic transformation (measure type B) as the transformation increase similarities between the normal distribution and the deposit funding and loan levels (see Appendix E.1, Figures E.9-E.10). Moreover, the natural logarithm specification of the vector error correction model has an elasticity interpretation which aids our analysis of the deposit-loan relationship.

Test for stationarity – To test the conditions for a VECM framework and test Hypothesis 2a, we first examine the deposit funding and loan level panel data for stationarity and consequently for a cointegrating relationship. We deploy the Fisher-type Phillips-Perron unit root test and again focus on the Choi Z-statistic which is more robust for the small time-dimension in our sample. The Fisher-type Phillips Perron test examines all panels for a unit root process (H_0). Phillips-Perron unit root tests on each bank separately report Newey-West selected lags of two and hence we include two lags in the panel unit root tests. The results are reported in Table 6.1.1 and we find that all panel deposit funding and loan levels (measure B) are non-stationary at level and at least one panel is stationary at first difference. These results are in line with the findings for the Euro Area country-level deposit funding levels (Table 5.1.1)

Case	**Deposit funding (level)**		**Loans (level)**	
	Choi $Z-$statistic	Probability	Choi $Z-$statistic[1]	Probability
1	48.5692	1.0000	255.994	1.0000
2	6.2565	1.0000	16.1182	1.0000
3	−1.2380	0.1079	8.5231	1.0000
	Deposit funding (first difference)		**Loans (first difference)**	
	Choi $Z-$statistic	Probability	Choi $Z-$statistic	Probability
1	−45.2428	0.0000	−40.8754	0.0000
2	−50.5846	0.0000	−29.2409	0.0000
3	−42.0014	0.0000	−34.4390	0.0000

Table 6.1.1: Fisher type Phillips Perron unit root test results bank-level deposit funding and loan levels (complete sample, measure B). Case numbers refer to Elders and Kennedy 2001 unit root testing strategy from Table 4.1.1.

Case	Deposit funding (level)		Loans (level)	
	Within (panel) cointegration		Between (group) cointegration	
	Panel PP-Statistic	Probability	Group PP-Statistic	Probability
1	-10.1404	0.0000	-6.1304	0.0000
2	-9.1743	0.0000	-3.7584	0.0001
3	-14.0636	0.0000	-17.5637	0.0000

Table 6.1.2: Pedroni test results for cointegration of bank-level deposit funding and loan-levels (complete sample, measure B). Cases refer to Table 4.1.1.

and we can examine the cointegrating relationship between the two panel sets.

Test for cointegration – Since we cannot differentiate between the Elders and Kennedy's (2001) unit root testing cases, we examine the long-run association between deposit funding levels also on all three cases. Pedroni and Vogelsang (2005) propose nine statistics with varying degree of size and power over the time- and cross-section dimensions which all examine the null hypothesis of no cointegration against a cointegration relationship (H_a). In line with our earlier unit root tests, we focus on the Phillips-Perron based statistics to examine the panel-level (within bank) cointegration and the group-level (between banks) cointegration. The results are reported in Table 6.1.2 and show a evidence for a cointegrating relationship between deposit funding and loan levels which supports Hypothesis 2a.

Presence of a cointegration relationship implies a dynamic relationship between bank deposit funding and loan levels and requires us to include the cointegration relationship in the VECM. Now that the two important conditions for a VECM – stationarity at first difference and a cointegrating relationship – are satisfied, we proceed to the estimation of the cointegrating time series and estimation of the VECM.

Vector error correction model estimation *(H2b; accepted)* **–** The presence of cointegration between deposit funding and loan levels suggests a long term relationship between them.[2] Using FMOLS we estimate the cointegration relationship with – in line with our research aim – deposit funding levels (D_t) as dependent variable and loan levels (L_t) as independent variable. As the Elders and Kennedy (2001)

[1] χ^2 test statistic reported, as the Choi $Z-$statistic is not available due to asymptotic properties around $P-$value of one.
[2] We examined the panel series separately for a unit root and cointegration on the periods 1999-2007 and 2008-2013 which resulted in similar outcomes as shown in Tables 6.1.1 and 6.1.2: all series are $I(1)$ and cointegrated.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors are reported in parenthesis.

		Δ*Deposits*$_t$	Δ*Loans*$_t$	Δ*Deposits*$_t$	Δ*Loans*$_t$	Δ*Deposits*$_t$	Δ*Loans*$_t$
		1999 - 2013		**1999 - 2007**		**2008 - 2013**	
CE	θ	0.7685^{***}		0.7419^{***}		0.5741^{***}	
		(0.0301)		(0.0332)		(0.0579)	
VECM	γ_1, γ_2	-0.3055^{***}	0.0334^{*}	-0.6452^{***}	0.0867^{*}	-0.5885^{***}	0.0524
		(0.0611)	(0.0173)	(0.1050)	(0.0484)	(0.1015)	(0.0333)
	β_{11}, β_{21}	0.0821^{**}	0.0235	0.1524^{*}	0.0386	0.1622^{***}	0.0066
		(0.0393)	(0.0170)	(0.0794)	(0.0361)	(0.0385)	(0.0162)
	β_{12}, β_{22}	-0.0605^{*}	0.0076	-0.1261^{**}	-0.0240	-0.0869^{*}	0.0261
		(0.0360)	(0.0531)	(0.0598)	(0.0698)	(0.0477)	(0.0713)
	α_1, α_2	0.0470^{***}	0.0378^{***}	0.0570^{***}	0.0547^{***}	0.0298^{***}	0.0275^{***}
		(0.0037)	(0.0042)	(0.0052)	(0.0058)	(0.0046)	(0.0055)

Table 6.1.3: Estimation results of the cointegration equation (CE) and vector error correction model (VECM) for the full sample (full results included in Appendix G).

$^{*}\ p < 0.10$, $^{**}\ p < 0.05$, $^{***}\ p < 0.01$. Standard errors are reported in parenthesis.

	$\Delta Deposits_t$	$\Delta Loans_t$	$\Delta Deposits_t$	$\Delta Loans_t$	$\Delta Deposits_t$	$\Delta Loans_t$
	1999 - 2013		**1999 - 2007**		**2008 - 2013**	
Total	-0.3055^{***}	0.0334^{*}	-0.6452^{***}	0.0867^{*}	-0.5885^{***}	0.0524
sample	(0.0611)	(0.0173)	(0.1050)	(0.0484)	(0.1015)	(0.0333)
Investment	-0.4072^{**}	0.0198	-0.5907^{**}	0.0465	-0.7293^{***}	0.0258
orientation	(0.1620)	(0.2667)	(0.2667)	(0.0494)	(0.0924)	(0.0329)
Retail	-0.2816^{***}	0.0518^{**}	-0.6548^{***}	0.0863	-0.4992^{***}	0.0290
orientation	(0.0469)	(0.0221)	(0.1124)	(0.0538)	(0.0876)	(0.0337)

Table 6.1.4: Cointegration correction coefficients for the bank business orientations over the different time periods.

testing strategy has not provided with a definite decision on inclusion of a trend or intercept (drift), we use the results from the Euro Area and country-level unit root tests and include a bank-specific intercept in the long-run association between deposit funding and loan levels.[3] Sandwich estimators are deployed to correct for heterogeneous variances and the FMOLS procedure in itself corrects for cross-sectional and time-interdependencies. Results for the cointegration relationship are included in full in Tables G.1-G.3. In Table 6.1.3 a summary is included for the complete sample of 565 banks.

Cointegration results – The cointegration relationship for the full sample (1999-2013) are not surprising since the summed deposit funding levels are indeed over 23 per cent smaller than the summed loan levels. Similar results are found pre-crisis, post-crisis (2008-2013) the cointegration factor (θ) drops drastically. A closer examination on the intercepts shows that these on average increase from 1.83 (1999-2007) to 3.40 (2008-2013; measure B). This indicates an decrease in the relationship between deposit funding and loan levels as loan levels are less explanatory for deposit funding levels.

VECM results – The results of the FMOLS cointegration estimation are used in our VECM estimation. Unit root tests indicate the inclusion of one lag ($p = 1$) in specification (4.2.2) since one lag is used for the differencing operation. To account for temporal and cross-sectional correlations, we deploy diagonal White variance-covariance adjusted matrices. In Appendix G, we report the full estimation result of the VECM estimations for the complete sample and differentiations to time period and bank business orientation. In general, the estimations of the deposit funding levels show high adjusted R^2 and the Durbin-Watson statistics report values around two which indicates removal of autocorrelation in the residuals from the regression.

In Table 6.1.4, the cointegration adjustments are included and show a stable system since $\gamma_1 < 0$ and $\gamma_2 > 0$ while $\alpha_1, \alpha 2 > 0$, although not all results are significant. In other words, deposit funding and loan levels return to their long-run equilibrium relationship. However, the speed of adjustment is far stronger for deposit funding levels than for loan levels: in the total sample between 1999 and 2013, 30.55 per cent of the disequilibrium is 'corrected' each year by changes in deposit funding levels and only 3.34 per cent is 'corrected' by changes in deposit funding levels. This difference is found in all different specifications and indicates that deposit funding levels are 'controllable' variables with which disequilibria in Euro Area bank deposit-loan levels are adjusted.

Granger causality – The indication from the cointegration correction adjustments (γ) that deposit funding is the controllable variable is supported by a closer examination of the short-run dynamics. The influence of prior deposit funding and loan levels (β_{12}, β_{11}) are significant for the deposit funding levels but not for the loan levels. Since deposit funding levels are improved by inclusion of prior deposit funding and loan levels, a causal flow runs from deposit funding and loan levels to deposit funding levels, i.e. deposit funding and loan levels *Granger cause* deposit funding levels. In contrast, this causal flow is not found for the loan levels. Hence, the long-run adjustment coefficients show that deposit funding levels are

[3]Hence, in Equation 4.2.1 we force $\phi = 0$ and estimate δ_i and θ. The cointegration specification with inclusion of an intercept performs better on both the adjusted R^2 and the standard error of the regression.

more sensitive to deviations from the long-run equilibrium than loan levels. Furthermore, the short-run adjustment coefficients show that banks adjust their deposit funding levels in response to changes in loan levels and not vice versa. Therefore, we reject Hypothesis 2b. In contrast to our expectation, the findings suggest that banks grant loans and subsequently attract deposit funding levels. This finding conflicts with the primary economic function but overlooks other bank funding sources. While attracting deposit funding is time-consuming, other – primarily wholesale – funding sources are more volatile and easy to attract on the short-run.

Influence of the crisis *(H2c; accepted)* **–** Our estimations of the long-run adjustment coefficients for the pre- and post-crisis deposit funding level development show a decreased speed of adjustment towards the long-run equilibrium. The decreased influence of the equilibrium relationship between deposit funding and loan levels is supported by the cointegration estimation which shows a decrease in the direct relationship. The short-run feedback effect show different pre- and post-crisis changes. The adjustment to prior deposit funding levels to subsequent levels (β_{11}) is with one per cent stronger in the post-crisis period while the influence of loan levels decreases with four per cent. This indicates that deposit funding levels have been more sensitive to short-run changes in deposit funding levels since the crisis. However, the sensitivity towards changes in the long-run equilibrium relationship decreased since the crisis. Hence, we accept Hypothesis 2c. The changed dynamic relationship between deposit funding and loan reflects the decreased deposit funding growth while the overall bank activities (total assets) has stabilized since the crisis (see Chapter 5 and Appendix C.1).

6.2 Deposit funding and demand and supply factors

The preceding analysis focused on the economic function of banks. In the literature review, we distinguished a number of additional themes and motives. To analyse the impact of the different associated determinants on bank deposit funding levels, we use a regression model with bank-fixed effects[4] described in Section 6.2.

In line with Köhler (2014, p. 203), we include capital funding levels[5] as control variable and use year dummies to control for time-dependencies. We allow for clustering in the standard errors by country in order to limit the influence of the differences between demand and supply factors in bank-country level. Finally, we exclude total assets (SZE) and gross national income (GNI) from the specification as large correlations[6] (ρ >0.90) exist with variables loans (LOA) and market power (MPW) and social security benefits (see Table H.1). Exclusion of these variables prevents us to test Hypotheses 4b (total assets) and 6a (gross national income) directly. We account for this loss of information in later sections where we examine the model for robustness. The model described above is our baseline model and follows specification:

$$\begin{aligned} \mathsf{DEP}_{it} = \alpha_i &+ \beta_1 \mathsf{LOA}_{it} + \beta_2 \mathsf{DVR}_i + \beta_3 \mathsf{RSK}_{it} + \beta_4 \mathsf{CLU}_{it} + \beta_5 \mathsf{MPW}_{it} + \beta_6 \mathsf{HPI}_{it} \\ &+ \beta_7 \mathsf{AGE}_{it} + \beta_8 \mathsf{UNR}_{it} + \beta_9 \mathsf{ESI}_{it} + \beta_{10} \mathsf{SOC}_{it} + \beta_{11} \mathsf{PPP}_{it} \\ &+ \beta_{12} \mathsf{IND}_{it} + \beta_{13} \mathsf{GYI}_{it} + \gamma_t + \eta_{it} + \varepsilon_{it} \end{aligned} \tag{6.2.1}$$

where γ_t is the year-dummy, η_{it} the control variables and CLU_{it} the dummy variable indicating the bank's business orientation.

Baseline results – The results of the baseline specification (6.2.1) are included in Table 6.2.1. The regression residuals do not violate the normality assumption[7] (see Figure I.1). The results provide evidence for the existence of banks' primary economic function which supports the earlier findings of interrelations between deposit funding and loan levels. The significant positive relationship between loans and deposit funding levels also indicate that bank size matters since loan levels and total assets are strongly correlated. The significant positive coefficients for deposit funding variability and bank

[4] A Hausman test justifies the choice for fixed over random effects.
[5] We use natural logarithms (measure B) for deposits (DEP), loans (LOA), capital (CAP) and social security benefits (SOC).
[6] These findings are supported by large variance inflation factors (VIFs) for SZE and LOA.

$^{*}\ p < 0.10$, $^{**}\ p < 0.05$, $^{***}\ p < 0.01$

	Baseline	**Bank size**		
		Small banks	Medium-sized banks	Large banks
LOA	0.186^{***}	0.257	0.144^{***}	0.219^{**}
	(0.027)	(0.178)	(0.022)	(0.086)
DVR	-0.004^{***}	-0.003^{***}	-0.004^{***}	-0.005^{***}
	(0.000)	(0.000)	(0.000)	(0.001)
RSK	-0.002^{***}	-0.001^{**}	-0.001^{***}	-0.004
	(0.000)	(0.000)	(0.000)	(0.002)
CLU	-0.004	-0.042^{***}	-0.004	0.003
	(0.008)	(0.011)	(0.018)	(0.012)
MPW	0.001	-0.000	-0.001	0.002
	(0.003)	(0.002)	(0.005)	(0.004)
HPI	-0.003^{**}	-0.005^{***}	-0.004^{*}	-0.003
	(0.001)	(0.001)	(0.002)	(0.002)
AGE	0.000	-0.085^{***}	0.036	0.012
	(0.010)	(0.024)	(0.059)	(0.023)
UNR	-0.001	-0.009^{*}	-0.009	0.001
	(0.003)	(0.004)	(0.013)	(0.005)
ESI	-0.001	-0.001	-0.004	0.000
	(0.001)	(0.002)	(0.002)	(0.002)
SOC	0.070	0.508	0.937^{*}	-0.120
	(0.229)	(0.439)	(0.510)	(0.231)
PPP	0.010^{***}	0.005^{*}	0.002	0.012^{*}
	(0.002)	(0.002)	(0.006)	(0.006)
IND	-0.002	-0.005	0.006	0.000
	(0.003)	(0.005)	(0.007)	(0.006)
GYI	-0.007	-0.002	-0.008	-0.009
	(0.005)	(0.006)	(0.016)	(0.010)
α	3.914	1.128	-6.972	6.177^{*}
	(2.730)	(4.899)	(7.429)	(3.047)
Controls				
CAP	0.192^{**}	0.249^{***}	0.151^{**}	0.156
	(0.068)	(0.044)	(0.054)	(0.100)
N	5989	1726	2552	1711
Overall R^2	0.860	0.849	0.830	0.854

Table 6.2.1: The baseline regression shows the results of the baseline specification. Bank-specific fixed effects are used, standard errors are clustered by country and year-dummies are included. The bank size specifications are estimated for the subsets small banks (total assets $\leq$ 1.5 billion), medium sized banks (total assets 1.5-10 billion) and large banks (total assets $>$ 10 billion). Standard errors are reported in parentheses; all bank-level variables (complete bank-year sample) are winsored at the 1- and 99-percentile level. Note that the CLU dummy variable indicates the impact of a retail orientation on deposit funding relative to an investment orientation.

riskiness suggests that banks hold higher levels of deposit funding with lower deposit funding variability and bank riskiness ($Z-$score). These findings provide support for the impact of regulatory emphasis on deposit funding for bank stability and are consistent with Goddard *et al.* (2007).

The impact of bank business orientations and competitive considerations show no significant results in the baseline specification. Similar insignificant results are found for many factors of the country-level motives for deposit funding supply. Ageing, unemployment rates, economic sentiment and social security benefits show no significant coefficients. The negative significant coefficient for housing prices contradicts our expectations and the findings on the economic function. This finding suggests that individuals deposit less at banks and are driven by the 'speculative' wealth effects from house prices rather than the precautionary motive to increase deposits in order to rebalance the risk profile of their asset portfolios (Setzer *et al.*, 2011). The results of the baseline specification do not provide with evidence for other speculative motives for deposit funding supply in terms of significant negative relationships with equity indices and government bond yields. The positive significant coefficient for the purchasing power parity (PPP) contradict the presence of a precautionary motive for deposit funding supply: banks in countries with higher purchasing power parity adjusted deposit guarantee protection levels attract less deposit funding. This indicates that banks in countries with relative higher deposit guarantee levels attract less deposit funding levels than banks in countries with relative lower deposit guarantee levels. This suggests that the deposit guarantee schemes in general not relate to higher levels of deposit funding in Euro Area bank funding profiles. Finally, the significant positive coefficient for the control variable capital shows that banks may hold higher levels of capital in order to hold higher levels of deposit funding levels. This finding contradicts the interpretation that capital and deposit funding are interchangeable.

Concluding remarks – To conclude the discussion of the baseline results, we briefly summarize the results of the baseline regression. We found support for Hypotheses 3a and 3b: higher levels of deposit variability and bank riskiness relate to lower levels of bank deposit funding levels. Furthermore, we found support against Hypotheses 6b and 7d since housing prices and purchasing power parity adjusted deposit guarantee levels are negatively related to bank deposit funding levels. In the next sections, we discuss focus on different cross-sections of the Euro Area banks to examine the relationships between the identified determinants and deposit funding in more detail.

Small, medium-sized and large banks – Bank size is not directly measured in the baseline regression as a result of multicollinearity. We include in Table 6.2.1 we different regression results for a breakdown of the banks to the level of total assets, in order to test the baseline specification regression results for robustness towards differences in bank size. In line with Köhler (2014) and definitions employed in Bankscope (2014), we define small banks as those with total assets of 1.5 billion euros or less. Medium-sized banks are those with total assets larger than 1.5 billion euros up to 10 billion. Large banks are those with total assets of over 10 billion euros.

Small banks – The results show a number of differences between the baseline specification and the small bank regression results. First, the findings show that the economic relationship is not significant for small banks which suggests high variation in the relationship between loans and deposits for small banks. Furthermore, the results indicate that a retail orientation relate to lower deposit funding in small banks. This finding contradicts our expectations but is in line with our earlier note on size effects: investment oriented banks hold on average 39 times the total assets of retail oriented banks and 23 times the deposit funding levels. In contrast to our hypotheses, small banks hold less deposits funding in aged countries. One possible explanation for this conflict with the life-cycle theory of accumulating wealth is that aged populations using small banks accumulate wealth in other forms (e.g., equity, houses or government bonds); this explanation is not supported by our results.[8] A final difference between the baseline specification and regression results for small banks is the negative significant coefficient for the unemployment rate. This finding indicates that banks' deposit funding levels are lower in environments with higher unemployment rates which contradicts with our hypothesis (H7a). The direction of the effect of unemployment rates and the precautionary motive is the opposite of our expectations. Unemployment

[7] Similar results hold for the other specifications. Country-clustered standard errors correct for potential homoskedasticity and we corrected for potential influence of dependencies amongst the variables.

[8] However as noted earlier, the results indicate the presence of a speculative motive for deposit funding in the form of housing prices.

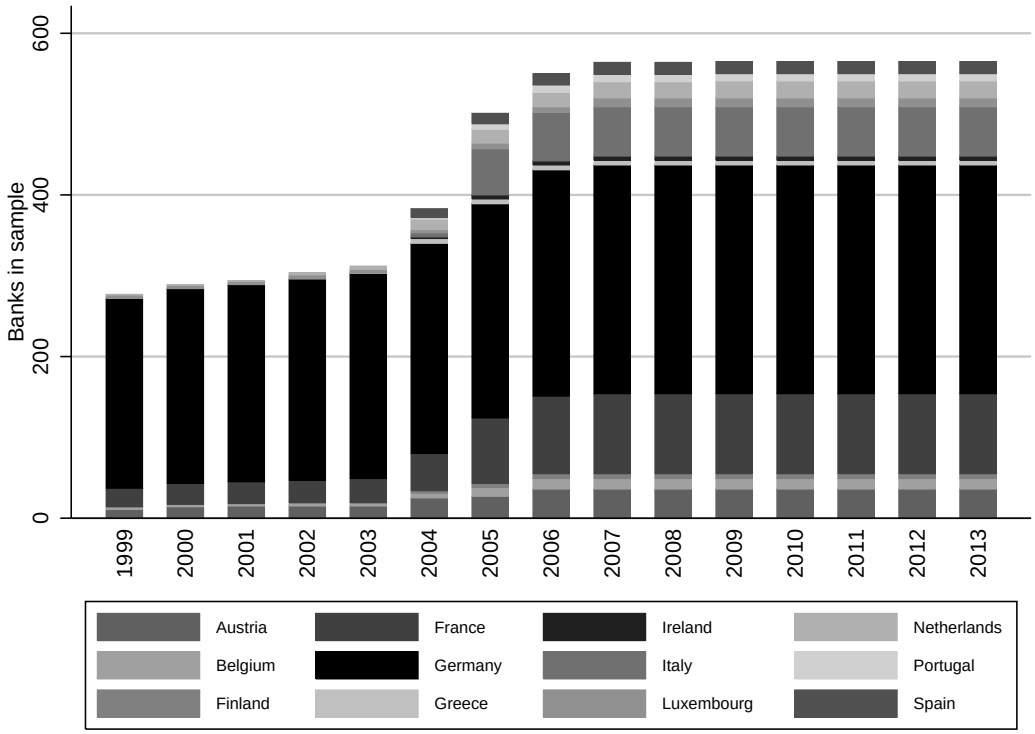


Figure 6.2.1: Number of banks in the sample by country and year between 1999-2013.

rates result in the outflow (consumption) rather than inflow (deposit saving) of deposit funding.

Medium-sized banks – The results for the medium-sized banks support the baseline regression results, with two exceptions. First, the results show a positive relationship between social security benefits and medium-sized banks' deposit funding levels. This finding contradicts our hypothesis (H7c) but may reflect the transactionary motive for deposit funding since gross national income – dropped from the baseline specification to avoid multicollinearity – is strongly related to social security benefits. Second, the effect of depositor protection on deposit funding levels is not reflected in the medium-sized specification.

Large banks – The large bank regression results show, in contrast to the baseline specification, no significant result for the effect of bank riskiness on deposit funding levels. This also holds for the control variable capital. These findings follow the earlier note that large banks more often have an investment orientation (1,205 against 756 bank-year observations) and hence are less involved in deposit funding. This is supported by the insignificance of housing prices on deposit funding levels in the large bank regression results. Large, investment-oriented banks are less involved in the primary economic function and hence less sensitive to housing prices.

Concluding remarks – Small banks show stronger relationships between deposit funding levels and country-specific ageing and unemployment rates while the relationship with loans is not present for small banks. Medium-sized banks show a strong relationship between deposit funding levels and social security benefits while the effect of depositor protection on deposit funding levels is insignificant. The relationship between bank riskiness and housing prices with deposit funding levels is not present for large banks. Therefore, overall the results from the baseline specification do not seem to be driven by a specific bank size.

Country-differences – The dataset contains a relative large number of German banks (approximately two-third of the bank-year observations; see Table 6.2.1). As a robustness check, we exclude these banks and the results are reported in Appendix H. The smaller sample shows similar results as the

baseline with the exception that the negative relationship with housing prices is insignificant. The regression results for Germany do show a similar relationship with housing prices and in addition a significant negative relationship with the market power which supports our Hypothesis 5: German banks with a lower market power have lower deposit funding levels. Furthermore, similar to the small bank regression results a negative significant relationship exists between unemployment rates and deposit funding levels, indicating that individuals use their deposits for consumption in times of higher unemployment. The effect of depositor protection on deposit funding levels is insignificant in the German bank regression results while a significant negative relationship exists between German government bond yields and deposit funding levels. This indicates the negative impact of (speculative) opportunity costs of holding deposits, supporting our Hypothesis 8.

In addition to the robustness test for German banks, we examined the difference between banks in Northern and Southern Euro Area[9] countries (see Appendix H). The regression results indicate that deposit funding levels in Northern Euro Area banks are lower in presence of higher bank riskiness and housing prices (similar to the baseline specification) while this relationship is insignificant for Southern Euro Area banks. While for both Northern and Southern Euro Area banks the relationship between deposit funding levels and depositor protection is insignificant, the Northern Euro Area banks show a negative significant relationships with economic sentiment. This finding is in line with our expectation that individuals from a precautionary perspective increase deposit funding levels with decreasing economic sentiment (H7b). Finally, similar to the findings of medium-sized banks, the findings show a positive relationship between social security benefits and Northern Euro Area banks' deposit funding levels which may indicate the transactionary effects of larger gross national incomes.

Concluding remarks – Although minor differences exist between the Euro Area (excluding Germany) regression results and the results from the baseline specification, these differences are not attributable to the large number of German banks. The large differences between Northern and Southern Euro Area banks and the similarities between the Northern Euro Area regression results, however, indicate that the baseline regression results are relying on the Northern Euro Area countries.

Differences in business orientation – As a third way of robustness test, we performed a regression on a cross-section in bank business orientation (see Appendix H). The results show no great differences between business orientations and with the baseline specification. As noted with the discussion of the regression results for large banks and earlier (see Section 5.2.2), investment banks are in general large banks with relative high deposit funding levels but relative lower dependence on deposit funding. The investment-oriented bank regression results reflect the large bank - investement orientation relationship with similarities with the large bank regression results. Retail-oriented banks show greater similarities with the baseline specification, although – similar to the investment-oriented banks – the relationship between depositor protection and deposit funding levels is insignificant. Therefore, overall, the baseline specification results seem to be driven by retail-oriented banks.

Influence of the crisis – As a final way of robustness test, we included in Appendix H the results of regressions over two time periods: pre-crisis (1999-2007) and post-crisis (2008-2013). Both periods are identical to the baseline regression result with the addition that the pre-crisis regression also shows a significant negative coefficient for the cluster variable. This indicates that pre-crisis, a retail-orientation related to lower levels of deposit funding (as opposed to investment-oriented banks). This finding contradicts our hypothesis (H4a) as we expected higher levels of deposit funding for retail-oriented banks. The post-crisis regression result follow the baseline regression results with a positive significant coefficient for market power. This finding indicates that banks with higher market power have higher levels of deposit funding. This result contradicts our hypothesis (H5) as we expected lower deposit funding levels for banks with higher market powers. However, high market powers also indicate large banks – at least relative to the country – which have larger levels of deposit funding. Overall, the baseline specification seems not be driven by differences between pre- and post-crisis.

[9]Northern Euro Area countries include Austria, Belgium, Finland, France, Germany, Luxembourg and Netherlands and Southern Euro Area countries include Greece, Ireland, Italy, Portugal and Spain. 83 per cent of the banks in the sample are banks from the Northern Euro Area countries.

6.3 Conclusion

This chapter presented the findings of the regression analysis on deposit funding levels in the Euro Area with which we tested Hypotheses 2-8, developed in the literature study. First, we examined the influence of banks' economic function on deposit funding. The presence of cointegration relationship between deposit funding and loan levels indicate a strong long run interrelationship (H2a). The estimation of the vector error correction model provided with insight in causal flows between deposit funding and loan levels. In contrast to our hypothesis (H2b), we found evidence that on the short-run changes in lending activities precede changes in deposit funding. This indicates that banks attract fund loans on the short run with non-deposit funding sources. On the long-run, the causal flow is reciprocal; however, this relationship is not significant for investment business orientations. Closer pre- and post-crises examination of the economic function shows a decreased long-run relationship between deposit funding and loan levels. Since the crisis deposit funding levels are more sensitive to short-run changes in deposit funding levels and less to loan levels. This implies that banks changed their behaviour since the crisis and that they transform less of their deposit funding into loans, both on the short- and long-run.

Second, we examined the influence of different deposit demand and supply determinants identified earlier (H3-8). We found evidence supporting again the importance of the economic relationship. Furthermore, our hypothesis of a negative relationship between deposit funding variability on deposit funding levels is supported by the results (H3a). This finding reflects the regulatory efforts to increase stability of deposit funding and is in line with the negative relationship found between bank riskiness and deposit funding levels (H3b). The positive effect of a retail orientation and a negative effect of an investment orientation (H4a) on deposit funding levels is not supported by our results. Only the pre-crisis results show a negative result of a retail orientation on deposit funding levels. This finding conflicts with our hypothesis but is in line with the earlier findings in Chapter 5 which show a significant size difference between business orientations. Banks with an investment orientation are distinctively larger than retail-oriented banks and hold significantly larger levels of deposit funding. With this finding and the positive significant relationship between deposit funding and loan levels – showing strong multicollinearity with total assets – we have strong indication that bank size is positively related to deposit funding, rejecting H4b. The analysis shows no significant influence of market power on deposit funding levels (H5). Only for Germany a significant negative relationship exists which is in line with our hypothesis. On the other hand, the post-crisis results show a positive relationship which – again – indicate that deposit funding levels are larger for relative large banks.

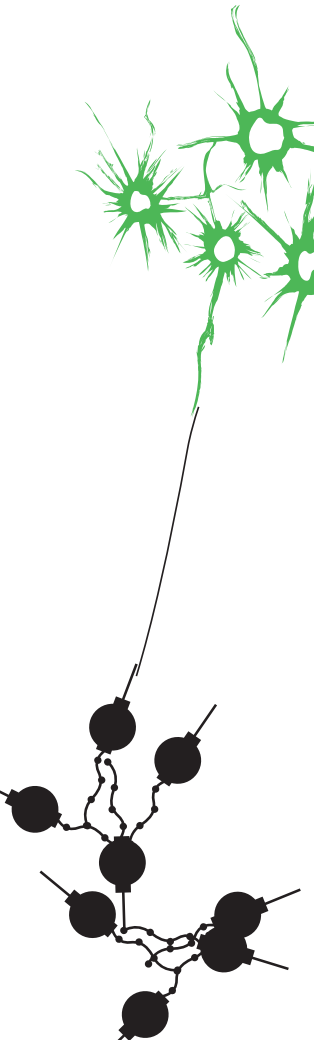
The deposit supply determinants (H6-8) show few significant results in the baseline regression. In contrast to Hypothesis H6b, housing prices are negatively related to deposit funding level. This finding relates to a speculative motive for preference of housing over deposit funding. The expected positive relationship between deposit funding levels and an aged population was only found for Northern Euro Area countries (H6c) and in contrast to our hypothesis of increasing deposit funding levels with increasing unemployment rates, we found a negative relationship only for small banks and German banks (H7a). This finding indicates that depositors of these banks do not as a precaution increase their deposit funding levels in times of increasing (employment) uncertainty. Rather, in aggregate they use deposits for other purposes (e.g., consumption or other forms of saving). The findings provide with no evidence of a positive relationship between economic sentiment and deposit funding (H7b). The positive relationship between social security benefits and deposit funding found for medium-sized banks and Northern Euro Area banks conflicts with Hypothesis H7c. Hence, these banks increase their deposit funding in the presence of more generous social security. As a result of the strong multicollinearity with gross national income also provide evidence for a positive relationships between GNI and deposit funding levels (H6a). In contrast to Hypothesis H7d, our findings provide evidence of lower deposit funding levels in countries with higher purchasing power parity adjusted deposit guarantee levels. Finally, the expected negative relationship between opportunity costs – equity indices returns and government bond yields – proved only for German government bond yields significant.

CHAPTER 7

DISCUSSION AND CONCLUSION

In this chapter, we summarize main results of the exploratory and regression analysis and discuss these in light of different studies. We discuss directions for further research and provide managerial recommendations which reflect on the main Research Question:

"What are Rabobank's difficulties and opportunities for increased deposit funding in the Euro Area"?



7.1 Main results

Many factors drive banks to attract and retain deposit funding. We have discussed different themes that influence deposit funding levels from a bank demand perspective – economic function, regulation, business models and competitive strength – and we have seen different motives for depositors to use deposit services and hence supply banks with deposit funding. Although these studies provide valuable insight in rationales for bank behaviour linked to deposit funding, the relationships between deposit funding levels and underlying factors and dynamics remained empirically unconnected. With this exploratory study, we examined general trends and dynamics in Euro Area deposit funding. Furthermore, we examined relationships between deposit funding levels and factors discussed in literature. In this section, we discuss the main results of this study. In next sections we reflect on the results and answer the research questions.

General developments in Euro Area deposit funding levels – We composed a sample of Euro Area banks with a presence in the Euro Area in 2008-2013 to focus specifically on the period since the financial crisis. In total, 565 banks were included and we gathered data for the time period 1999-2013. Deposit funding levels on average amounted 13.5 billion euros with a strong skewed distribution to lower levels (median: 2.26 billion). Country-level data show that the compounding average deposit funding level growth rate was 5.29 per cent between 1999 and 2013.

Closer analysis of Euro Area deposit funding levels in a stationarity framework indicate a consistent growth between 1999 and 2013 which was not attributable to specific time events (H1a). This finding was robust for the impact of the financial crisis from February 2009 onwards. Since the financial crisis, deposit funding levels still increased; however, at a lower rate than before the crisis (H1b). Deposit funding levels are not evenly distributed across Euro Area countries (H1c). Moreover not only the absolute levels of deposit funding differ by country, also the reliance of banks on deposit funding, the development of deposit funding levels over time and the impact of the crisis show country-specific differences. Similar variations exist between bank business orientations (H1d). Two distinct business orientations are present in the Euro Area: retail-oriented banks and investment-oriented banks. The latter hold significantly higher levels of deposit funding while retail-oriented banks more strongly rely on deposits for funding. An examination of the driving factors behind the cross-sectional and inter-temporal differences allows us to highlight opportunities and difficulties for banks to increase their deposit funding levels.

Themes for Euro Area deposit funding demand – The literature study suggested four themes influencing deposit funding levels on the bank-level, i.e. the bank demand perspective: the economic function of banks, regulation, bank business models and competitive strength.

Economic function: the role of deposits in banks' main function – Banks traditional primary business activity is to attract deposits from the public which they use to grant loans for own account. This main asset transformation mechanism is important for the economy as it ensures efficient allocation of funds to most profitable uses. This mechanism is reflected in a strong interrelationship between deposit taking and lending in the Euro Area (H2a). On the long run, Euro Area banks adjust their loan levels to deposit funding levels and vice versa; on the short run banks' lending precede deposit taking activities (H2b). These short-run dynamics are also present in the pre- and post-crisis. However, since the crisis the sensitivity changed (H2c). Banks focused more on adjusting their deposit funding levels after changes in their lending books than adjusting their lending books after changes in their deposit funding levels. Hence, this finding may indicate that banks seeking to increase their deposit funding levels need to focus on their primary economic function and increase their involvement in the main asset transformation mechanism.

Regulation: regulatory incentives for deposit preference – Regulators are involved with banks for numerous reasons including to foster financial stability and customer protection. As deposit funding is considered a stable source of funding, regulators closely monitor deposit funding level variability and similarly pay special attention to bank riskiness. This attention emphasizes on banks with higher levels of deposit funding and hence likely results in lower variability and riskiness for banks with higher deposit funding levels. The results of our analysis show that banks with lower deposit funding variability and

bank riskiness indeed hold higher levels of deposit funding (H3a-b). For banks aiming to attract more deposit funding, the results show that those banks may decrease the deposit funding level variability and bank risk profiles.

Bank business model: deposits as a strategic funding choice – In recent years, bank business models have received increased attention as an explanatory factor for bank behaviour. Business models express banks' business logic and value offering and hence explicate banks' strategic choices. The results from the analysis show presence of two dominant general business models which we refer to as business orientation: the retail orientation and investment orientation. Banks with a retail orientation focus on households and small and medium enterprises and are primarily involved in the main asset transformation mechanism of lending and deposit taking (H4a). This involvement is reflected in the long-run relationship between deposit funding and loan levels. While retail-oriented banks adjust their deposit funding and loan levels reciprocally, investment-oriented banks only adjust deposit funding levels to changes in loan levels – and not vice versa.

Banks with an investment orientation focus on financial institutions and large corporations, are more involved in wholesale funding and securities and are considerably larger (factor 40; H4b). The size effect results is only reflected in the pre-crisis multivariate estimation results and show a negative effect of a retail orientation - relative to the investment orientation – on deposit funding level. These results indicate that banks considering to increase their deposit funding levels benefit from size effects and hence may aim to obtain a larger bank size (H4c).

Competitive strength: retaining deposit market share – Competitive positioning and strength is closely related to bank business models and bank size. Banks with a strong competitive position have a strong presence in their respective market. However, these banks are generally larger, more diversified and less involved in deposit funding. Our analysis provides no support for a positive relationship of competitive strength on banks' deposit funding levels (H5). Hence, we conclude that competitive strength is not likely to affect a bank's deposit funding levels.

Motives for Euro Area deposit funding supply In addition to the four themes, the literature study on money demand theory suggested three motives influencing deposit funding levels on the country-level, i.e. the supply perspective: transaction motive, precautionary motive and speculative motive.

Transaction motive: deposits for foreseen future expenses – Money demand theory dictates that individuals hold liquidity for foreseen future expenses. Deposit services provide depositors with means to temporarily store income. As a result, we hypothesized that on the country-level income gross national income (GNI) is positively related to deposit funding levels (H6a). GNI is strongly related to a countries social security benefits which show in Northern Euro Area countries indeed a positive influence on bank deposit funding levels. The robustness tests showed that the multivariate results are primarily driven by Northern Euro Area banks. In addition, different scholars indicate that housing prices boost the demand for money on the short run as a result of high house transaction volumes (H6b). However, our examination show a consistent negative effect of housing prices on deposit funding levels which may indicate the presence of wealth effects and a speculative motive. For investment-oriented banks no significant relationship was established between deposit funding and housing prices, again suggesting less involvement with retail-oriented activities (e.g., mortgage lending).

The life-cycle theory indicates that individuals accumulate wealth over their life time. As deposits are one source for storing wealth, we expected that an aged population lead to higher levels of deposit funding (H6c). This relationship was indeed established for Northern Euro Area banks. The results indicate that banks aiming to increase their deposit funding levels may increase their presence in large Northern Euro Area economies with high GNIs and an relative aged population. Furthermore, banks' deposit funding levels benefit from lower housing prices.

Precautionary motive: deposits for unforeseen future expenses – In addition to foreseen expenses, individuals also hold liquidity for unforeseen expenses. This precautionary motive relates closely to individuals perception of uncertainty and risk. We examined influence of the precautionary motive for liquidity on deposit funding levels by the unemployment rate and economic sentiment indicator. The influence of the unemployment rate proved only present for small banks and German banks (H7a) while

the negative impact of economic sentiment on deposit funding levels was proven significant for Northern Euro Area banks (H7b)

Life-cycle theory suggests – and we found evidence thereof – that aged countries hold higher levels of deposit funding for old-age provisions. However, Euro Area countries provide social security provisions for unforeseen circumstances, including old-age, disability and unemployment. Hence, we expected that high levels of these social security provisions result in lower levels of deposit funding (H7c). This relationship was not established and hence social security provisions likely not affect deposit funding levels. In contrast, Northern Euro Area banks show significantly higher social security provisions and higher deposit funding levels. As the precautionary motive for liquidity is driven by individuals' perception of risks, we expected that the level of depositor protection influence deposit funding levels (H7d). The results counter this intuition and show that the PPP-adjusted deposit guarantee coverage level negatively relates to deposit funding levels. Hence, in conclusion banks aiming to increase their deposit funding levels benefit may benefit from lower levels of economic sentiment while the relationship with the unemployment rate, social security provisions and deposit guarantee coverage level remains unestablished.

Speculative motive: deposits with preferable risk-return characteristics – The third motive for liquidity preference indicates that benefits for holding liquidity in the form of deposits is related to the relative return on deposits over other assets (H8). As a result, individuals hold less deposits when other assets provide with higher return. This theoretical notion is not supported by our analysis of equity indices and government bond yields. However, the negative effect of housing prices on deposit funding levels provides with evidence for the speculative motive. In line with the impact of the transaction motive for liquidity on deposit funding, banks' deposit funding levels may benefit from lower housing prices.

7.2 Discussion

The importance of loan levels for deposit funding levels and vice versa is in line with earlier studies (cf., Ivashina & Scharfstein, 2010, p. 335; Howcroft *et al.*, 2014, p. 489). However in contrast to these studies, we found valuable insights on the the dynamics between the deposit funding and loan levels. The change in dynamics and the large shift from retail towards investment orientations in 2009, supports earlier findings in different studies of changed bank behaviour, a renewed emphasis on deposit funding and less reliance on wholesale funding (cf., Van den End, 2013; Cecchetti *et al.*, 2011; Merck Martel *et al.*, 2012). Moreover, the dynamics showed counterintuitive insights in the direction of causal flows between deposit funding and loan levels. From a prudential perspective, we expected that banks attract deposits prior to increased lending activities. However, the results showed that on the short-run prior increases in lending activities had a negative impact on subsequent deposit funding level growth while on the long-run banks adjust their deposit funding levels to changes in loan levels and vice versa. Hence, banks fund on the short-run their lending activities with other types of funding which are substituted at a later stage with deposit funding.

The delayed effect of increased lending activities on deposit funding levels is in line with the premise that deposit funding is a stable source of funding (BIS, 2013; BIS, 2014) and with our results indicating a positive influence of deposit funding level invariability on deposit funding levels. Closely related to the notion of stability, we found support for different studies with evidence of a negative relationship between bank risk and deposit funding levels (cf., Demirgüç-Kunt & Huizinga, 2013; Köhler, 2014). Although we are unable to conclude that negative effect of deposit funding level variability and bank riskiness with deposit funding levels are the result of regulatory action, we note that these effects are at least in line with regulatory policies focused on deposit funding as a stable source of funding.

In recent years, different studies have focused on bank business models as an important explanatory factor for bank behaviour (cf., Cavelaars & Passenier, 2012; Ayadi *et al.*, 2011; Köhler, 2014). In contrast to these studies, we found evidence for two – rather than three – distinct bank business orientations. This difference mainly stems from the use of cluster analysis as a means for differentiation between business orientations. As Ayadi *et al.* (2011, p. 23) note, "cluster analysis is an inexact science

[and] depends crucially on the choice of instruments and procedures". In line with earlier studies, the retail-oriented banks have considerably larger *relative* deposit funding levels; however, retail-oriented banks are also considerably smaller than investment banks which resulted in the counterintuitive finding that retail-oriented banks have lower deposit funding levels than investment-oriented banks. Although, bank size was an important factor for deposit funding levels, market power – i.e. the relative bank size to the country bank sector size – was not established as an explanatory variable for deposit funding levels.

The post-crisis shift of investment-oriented banks towards deposit funding is consistent with the discussion of Llewellyn (2012, pp. 45, 59-60) who argued that banks needed to refinance their balance sheet while interbank and wholesale markets were challenging and hence the cost of capital increased. As a result of these pressures, the future bank business model is likely to return to the 'originate to hold' model, be less complex due to the required 'living will' and be less reliant on wholesale funding and have a "greater reliance on traditional retail deposits" (Llewellyn, 2012, p. 65; Le Leslé, 2012, p. 14). However, economic function, regulation and business models are not the sole factors for the convergence to deposit funding. Caruana & Van Rixtel (2013, p. 14) add to these factors the changed perception of the economic environment. Indeed, we found evidence that deposit funding levels in especially Northern Euro Area banks are related to main economic indicators including housing prices, economic productivity, wealth accumulation and economic sentiment. However, on other factors relationship the relationship between deposit funding levels and the perception of the economic environment remains diffuse. Our results indicate that the level of depositor protection has little influence on deposit funding levels which supports Huizinga and Nicodème (2006) premise that competition amongst countries on the basis of deposit guarantee schemes is futile.

7.3 Limitations and further research

This study combines insights from country-level and bank-level financial statements, explores the dynamics on in a bank-level and examines the relationship of deposit funding levels with main determinants identified by a literature study. As a result, the study and its results are exploratory in nature and hence the identified relationships are not exclusive in the sense that these fully explain deposit funding levels. A fruitful direction for further research is to focus on a limited number of additional factors.[1] Especially the strength of countries governmental institutions as proposed by Kaufmann *et al.* (2009) may improve the validity of our findings.

Furthermore, we used a large sample of banks in the Euro Area. This enabled us to reach conclusions which are applicable to all deposit funded banks in the Euro Area. However, banks were selected on the basis that they reported deposit funding in each year between 2008-2013. This setup may have resulted in survivor bias[2] but more importantly excluded banks which funded reduced or did not report their deposit funding levels in any of these years. As our focus was to obtain an exploratory overview of the complete Euro Area deposit funding market, we excluded these banks; however, further research into specific dynamics and determinants of deposit funding levels for these banks may provide valuable insights in the validity of our results.

The dynamic approach to bank-level analysis is rarely used in exploratory studies of deposit funding levels. However, it provides with valuable results that not only highlight relationships at a particular point in time but also shed light on their development over time. We consider two directions of future research. First, extending the examination to the complete balance sheet dynamics will provide with better insight in causal flows of asset and funding behaviour in bank balance sheets. This broader approach inclusion of securities, wholesale funding and capital in the dynamic relationship. These examinations especially benefit from data over longer time periods or data with shorter intervals (e.g., monthly data). Second,

[1] Petersen (2009) reports a widespread use of the Fama-MacBeth approach in financial studies. In our situation with variables measured at different (country and bank) levels, this method provided with inappropriate standard errors. Future studies are advised to take these considerations into account.

[2] A control for this bias pointed out that two banks were omitted due to discontinuation of activities.

#	Bank	Deposits funding	Loans		Total assets	
1	Crédit Agricole	528,756	633,928	[1]	1,570,077	[3]
2	ING Groep	487,570	552,776	[3]	1,423,560	[4]
3	Deutsche Bank	481,289	312,721	[9]	1,862,908	[1]
4	BNP Paribas	445,553	540,429	[4]	1,799,656	[2]
5	Banco Santander	421,799	598,925	[2]	1,092,258	[6]
6	UniCredit	350,049	518,848	[5]	1,023,481	[7]
7	Société Générale	274,885	339,565	[8]	1,218,423	[5]
8	Rabobank	270,178	400,632	[6]	615,876	[9]
9	Banco Bilbao	219,195	297,804	[10]	521,462	[12]
10	Intesa Sanpaolo	208,327	355,270	[7]	915,069	[8]

Table 7.4.1: Ranking of the ten largest Euro Area deposit-funded banks based on ten-year averages. Ranking for respectively loans and and total assets in breakets.

the findings indicate that joint examination of deposit funding levels and loan levels provides with far more information than current (regulatory) focus on loan-to-deposit levels.

Finally, different scholars have emphasized on the importance of bank business models to understand bank behaviour. We agree, however, a clear typology of bank business models is not available. In line with Ayadi *et al.* (2011), Cavelaars and Passenier (2012) we developed a first attempt to harmonize different bank business model characterizations. Further research in this direction is fruitful for a better understanding of bank behaviour.

7.4 Managerial implications

The main results allow us to provide Rabobank with recommendations and reflect on the main research question "What are Rabobank's difficulties and opportunities for increased deposit funding in the Euro Area?" We first note that Rabobank has already attracted high amounts of deposit funding relative to similar banks (see Table 7.4.1; we refer to these bank as the 'peer group'). With its ten-year average deposit funding level, Rabobank ranks as eighth largest deposit-funded bank, as sixth largest lender and as ninth largest bank compared to similar banks. However, bank size is of crucial importance for deposit funding levels and therefore we recommend that Rabobank maintains its size. This is especially important since banks are drastically increasing their reliance on deposit funding: in the peer group bank on average have reduced their total assets with 111 billion euros while their deposit funding levels increased with 2.5 billion euros.

Due to the size, Rabobank is categorized as an investment bank which is beneficial for the deposit funding level. However, the results of this study indicate that it is – regardless of main business orientation – beneficial to increase involvement in the main economic function of banks and hence focus strongly on both deposit taking and lending activities. This even more important since the crisis as the dynamics between deposit funding and lending changed. Prior to the crisis Euro Area banks maintained a balance between deposit funding and loan levels; post-crisis this relationship shifted towards stronger increases of deposit funding levels for every euro lend. Hence, Euro Area banks are currently 'hoarding' deposit funding which increases scarcity. A strong presence in the deposit-lending market allows Rabobank to exploit these new dynamics and maintain and potentially increase their deposit funding levels.

Furthermore, Rabobank reports a higher deposit variability – +3.2 million euros – than its peer group and the risk profile is considerably higher than other banks. At any time between 2004-2013, Rabobank's $Z-$score is twice as high as the each other bank in the peer group which results from significant higher variability in the return on assets. Hence, in addition to improving the deposit funding level stability, it is recommended that Rabobank increases stability in the return on assets in order to decrease their risk profile.

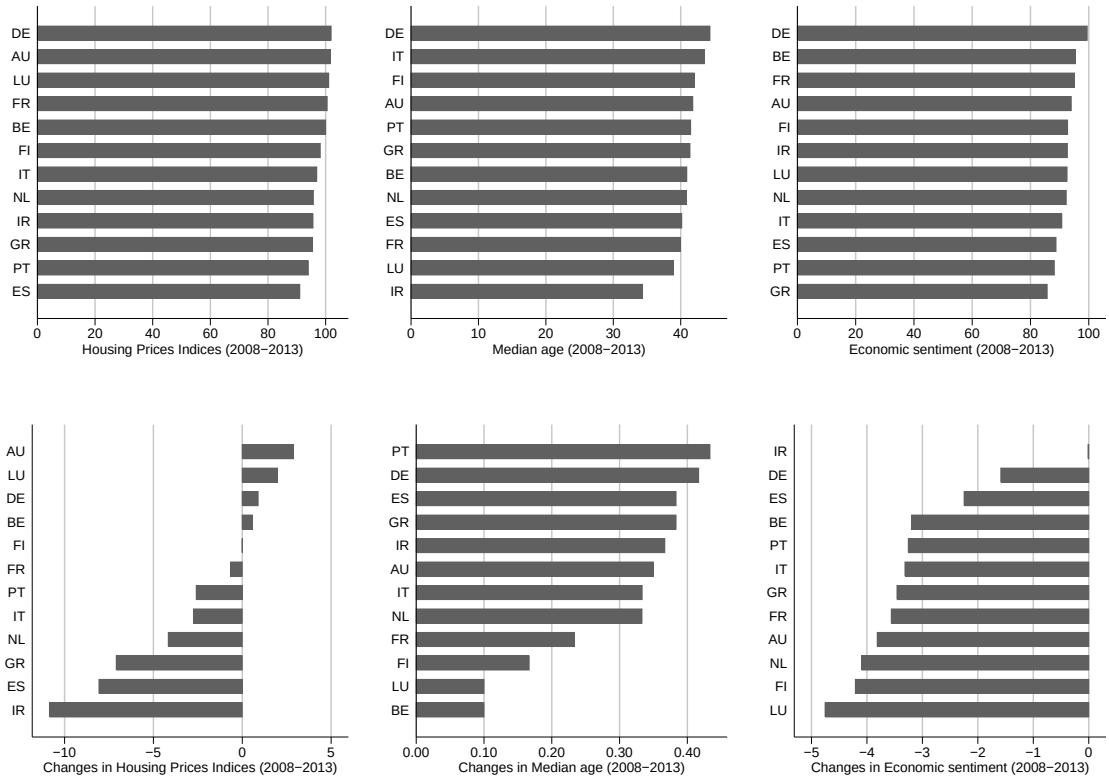


Figure 7.4.1: Average housing prices indices, median age and economic sentiment levels (above) and changes (below) between 2008 and 2013.

Rabobank's activities – at least deposit funding activities – rely heavily on the Netherlands. The housing prices in the Netherlands have decreased in recent years which shows potential for higher deposit funding levels. In 2013, the median age in the Netherlands was 41.6 and the average economic sentiment was below the many other countries in recent years (see Figure 7.4.1). Moreover, the decline in Dutch economic sentiment was amongst the sharpest of the Euro Area while the Netherlands report the fifth gross national income of Euro Area member states. These figures show that the Netherlands is a relative attractive country for deposit funding supply. However, to increase deposit funding levels Rabobank might consider expansion of their activities to other countries as well.

Figure 7.4.1 indicates that none of the countries are attractive on all determinants. Germany and Italy – in 2013 holding 34 per cent of total Euro Area bank deposit funding – show relative high median ages. However, Germany show strong economic sentiment and high housing price indices. Italy on the other hand shows lower economic sentiment and the housing price indices are comparable to the Dutch situation. Ireland shows low housing price indices which decreased on average with 11 points between 2008 and 2013 but have a young population. Greece shows low economic sentiment and low housing prices; however, expansion into uncertain economic environments is not to be advised. Portugal and Spain show low housing prices and economic sentiment and the population in both countries is ageing. Furthermore, 12 per cent of the Euro Area deposits are concentrated in these countries.

Hence, Germany and Italy are attractive sources for deposit funding as these are large ageing countries. However, we recommend Rabobank to primarily focus on Spain and Portugal for their efforts to increase their Euro Area deposit funding levels since these countries show larger ageing rates, have low housing prices and low economic sentiments.

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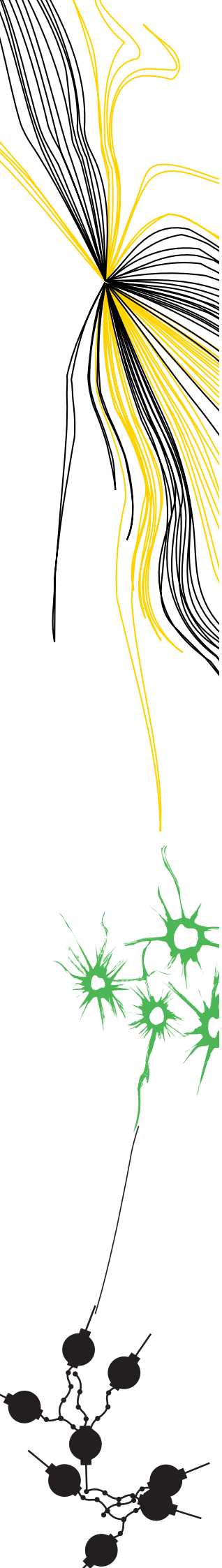

APPENDICES

APPENDIX A

METHODOLOGY

A.1 Controlling for spuriousness in panel data regressions

As we analyse deposit funding levels over time and across banks and countries, we need to consider two issues related to panel data from bank balance sheets which may induce estimation of spurious relationships: autocorrelation and heteroskedasticity and endogeneity.

Autocorrelation and heteroskedasticity – In their seminal paper, Granger and Newbold (1974, p. 112) show that in addition to inefficiency and sub-optimality of forecasts, autocorrelation in time series regression analysis result in invalid significant tests on the coefficients. Although the ordinary least square (OLS) estimator remains unbiased, bank and country specific correlations over time – i.e. the autocorrelation – and cross-section correlations influence the sample variance and hence the test statistic[1].

Controlling for heteroskedasticity and autocorrelation is necessary as these may result in underestimated covariance matrices (Petersen, 2005, p. 1). Heteroskedasticity may result in a strong focus on a subset with higher than average variance, widening the confidence interval to this subset. Autocorrelation may result in persistent levels in the time series which complicates a time-dependent analysis: it is difficult to pinpoint a specific effect to a time period t when there is autocorrelation since the current observation is influenced by prior observations in periods before time t. A number of procedures for adjusting standard errors for correlations across time or cross-sectional are proposed but there remains a debate on the correct procedure as the assumptions in terms of autocorrelation and variance structure differ[2].

In our explorative analysis we employ different unit root tests which correct for autocorrelation and heteroskedasticity. These tests are based on the wide-spread method to adjust the variance-covariance matrix which allows for an unspecified autocorrelation structure, developed by Newey and West (1987). These heteroskedastic- and autocorrelation-consistent (HAC) variance estimators have the form

$$\hat{\mathbf{S}}_{HAC} = \frac{T}{T-k}\left(\sum_{t=1}^{T} \hat{e}_t^2 \mathbf{x'}_t \mathbf{x}_t + \sum_{l=1}^{L} \left(1 - \frac{l}{L+1}\right) \sum_{t=l+1}^{T} \hat{e}_t \hat{e}_{t-l} \left(\mathbf{x'}_t \mathbf{x}_{t-l} + \mathbf{x'}_{t-l} \mathbf{x}_t\right) \right)$$

where $\mathbf{x}_t$ is a row of matrix $\mathbf{X}$ at time t, n the number of observations, k the number of predictors in the model, L the number of lags included and $\hat{e}_i = y_i - x_i \hat{\beta}_{OLS}$ the residuals of an OLS regression. The Newey-West procedure provides with slightly biased HAC-variance estimators while it allows unrestricted flexibility in the autocorrelation structure (Petersen, 2005, p. 2).

In the regression analysis we examine hypothesis 2 in an interdependent system of autoregressive regressions and for hypothesis 3 to 8 we deploy the Fama-MacBeth framework which is robust to the cross-sectional correlations[3].

[1] More precise, if (auto)correlation is not controlled for, the OLS estimates are not longer best linear unbiased estimator (BLUE), i.e. zero expectation, equal (minimum) variance and uncorrelated.

[2] See Petersen (2005), Thompson (2011) for a discussion of these procedures.

[3] Petersen (2009, p. 460) shows that due to the short number of years in our data set, adjustments for correlations across time are not beneficial to the reliability.

Endogeneity – In addition to autocorrelation and heteroskedasticity, the inherent interdependency of bank balance sheets classes may induce estimation of spurious relationship in the analysis of potential determinants of bank deposit funding levels. By construction, bank balance sheets classes are related by the equilibrium relationship,

$$0 = \sum_i A_{it} - \sum_j L_{jt}$$

where A_{it} is asset class i on time t and L_{jt} is liability class j on time t. This interdependence poses difficulties for our estimation of relationships between different balance sheet classes in an OLS regression. This is especially an issue for the analysis of banks' economic function since we expect a close interrelationship. Therefore we deploy the a vector error correction model (VECM), discussed in more detail in the next section of this appendix.

A.2 VECM methodology

A useful representation of a bank balance sheet over time is to define the different asset and liability classes as time series. In vector notation, $\mathbf{X_t}$ is the $n \times 1$ vector $\{x_{1t}, \cdots, x_{nt}\}$ containing n time series of the different asset and liability classes in the bank's balance sheet between $t = 1, \cdots, T$. The dynamic relationship between these balance sheet time series results in a vector auto regressive (VAR) model,

$$\mathbf{X_t} = \phi \mathbf{D_t} + \mathbf{\Pi_1 X_{t-1}} + \cdots + \mathbf{\Pi_p X_{t-p}} + \varepsilon_\mathbf{t} \tag{A.2.1}$$

where D_t contains the deterministic components of the time series – e.g. a constant level and trend over time – Π the $n \times n$ matrix of coefficients and ε_t the identically and independent distributed residuals. A VAR specification enables to model dynamic co-dependencies between different time series without causal assumptions. However, for (A.2.1) to generate a stable result, a number of conditions need to hold,

- The residuals are identically and independent distributed and hence not autocorrelated.
- The time series are stationary and hence show no heteroskedasticity.
- The time series are not co-integrated.

Many financial time series are not stationary themselves but the difference between two subsequent observations often is. The number of differencing operations needed to generate stationary time series indicates the order of integration (Engle & Granger, 1987, p. 252).

> **Definition 2** A time series x_t with no deterministic trend which becomes stationary after differencing d times is said to be integrated of order d, denoted by $x_t \sim I(d)$.

Many economic and financial time series are integrated of order 1 but may also follow the same common trend, i.e. co-integrated. Co-integrated variables have a long-run association follow – with local deviations – a similar trend[4]. Without major changes in bank business models, it is reasonable to assume that the balance sheet time series are moderated by an equilibrium relationship and hence are cointegrated (Zivot & Wang, 2006, p. 444).

> **Definition 3** The $n \times 1$ vector $\mathbf{X_t} \sim I(1)$ is co-integrated if there exists an $(n \times 1)$ vector β such that $\beta\, \mathbf{X_t} \sim I(0)$.

Traditional tests for co-integration are based on Johansen's (1991) framework. In panel context with cross-sectional dependence, Pedroni's (2005, p. 26) tests show better performance especially in presence of small samples (Maddala & Wu, 1999, p. 631). Presence of co-integration invalidates the VAR

[4]The result also holds for variables which are of the same order $d > 1$. The main property is a common stationary drift z_t which is the $n \times 1$ matrix with residuals from co-integration regression $z_t = \beta' \mathbf{X_t} = \beta_1 x_{1t} + \cdots + \beta_n x_{nt}$ and rank(β)= r for $r \neq 0$ indicates the number of linear stationary relationships between the time series variables.

specification (A.2.1) which is now biased by the long-run co-movements. A vector error correction model (VECM) is an adjustment to the VAR model which includes a cointegrating relationship (Zivot & Wang, 2006, p. 456),

$$\Delta \mathbf{X_t} = \phi \mathbf{D_t} + \mathbf{\Gamma X_{t-1}} + \mathbf{\Pi_1 \Delta X_{t-1}} + \cdots + \mathbf{\Pi_{p-1} \Delta X_{t-p+1}} + \varepsilon_\mathbf{t} \tag{A.2.2}$$

where $\mathbf{D_t}$ contains deterministic terms, $\mathbf{\Gamma} = \mathbf{\Gamma_1} + \cdots + \mathbf{\Gamma_p} - \mathbf{I_n}$ and $\mathbf{\Pi_k} = -\sum_{\mathbf{j=k+1}}^{\mathbf{p}} \mathbf{\Gamma_j}$, $k = 1, \cdots, p-1$. $\mathbf{\Gamma}$ contains the effects of the long-run association since $\mathbf{\Gamma} = \alpha\beta$. A VECM specification has the useful property that the cointegrating coefficients α are an indication of Granger causality (Society & Granger, 1969; Granger, 1980). Granger causality is a weak form of causality which indicate that observations in one time series $\mathbf{x_t}$ have statistical significant predictive information on another time series $\mathbf{y_t}$(i.e. $f(\mathbf{x_t}|\mathbf{x_{t-1}}, \mathbf{y_{t-1}}) = f(\mathbf{x_t}|\mathbf{x_{t-1}},)$).

A.3 Fama-MacBeth regressions

The Fama-MacBeth procedure is a panel regression approach which allows cross-section correlations. In a recent study of peer reviewed papers using finance panel dataset, Petersen (2009, pp. 435-436) found that 42 per cent of the papers did not adjust for cross-sectional or autocorrelation in the regression errors. The remainder of the papers deployed either the Fama-MacBeth (1973) procedure (20%) or included dummy variables for fixed effects (17%).

The Fama-MacBeth procedure consists of two-steps to fit panel data to a model of the form

$$y_{it} = \hat{\alpha} + \hat{\beta}_t x_{it} + \varepsilon_{it} \tag{A.3.1}$$

Since the standard errors ε_{it} in panel data are often correlated across firms, the assumption underlying standard OLS is violated. This may result in a wide variety of variance and covariance structures (see table 4.2.1 for an example). Similar correlations are expected across the time dimension which may potentially bias the standard errors in panel regression estimates further.

The Fama-MacBeth (1973) procedure adjusts for the cross-sectional correlations (e.g. across banks) by estimating equation (A.3.1) for each time t in the complete sample period T. This results in $\hat{\beta}_t$ for each time period t in T. As a second step the coefficient for the total sample period is determined by:

$$\hat{\beta}_{FM} = \sum_{t=1}^{T} \frac{\hat{\beta}_t}{T}$$

and the sample variance for the coefficient is determined:

$$S^2(\hat{\beta}_{FM}) = \frac{1}{T} \sum_{t=1}^{T} \frac{(\hat{\beta}_t - \hat{\beta}_{FM})^2}{T-1}$$

This procedure results in standard errors that are adjusted for cross-sectional correlation but not for autocorrelation. As Petersen (2009, p. 460) points out, adjusting for autocorrelation in our sample only improves the standard error estimation slightly.

Limitations – The major limitation of the Fama-MacBeth approach for our regression analysis is that it requires the same level of hierarchy of independent variables. Inclusion of different levels – the bank-level and the country-level – results in loss of information on the country-level variables due to differences in the variability of the regression residuals. Country-level variables have fewer observations and the variability in regression residuals hence depends on fewer observations which increases the confidence interval. To overcome this limitation, we deploy a standard fixed effect model where we allow for country-level clustering of the standard-error.

APPENDIX B

DATA DESCRIPTION

B.1 Description of country-level bank data

Country	N	Mean	SD	Min	Max
			Total assets		
Austria	204	749418	217466	410001	1070506
Belgium	204	978698	214472	662932	1414511
Finland	204	303462	171136	103534	707939
France	204	5902782	1938206	3147124	8804141
Germany	204	6909272	1008913	4633981	8859555
Ireland	204	994347	516078	159844	1817875
Italy	204	2830029	971525	1512999	4256202
Greece	198	323038	122445	141300	544676
Netherlands	204	1762950	556765	693004	2618667
Portugal	204	393605	121714	180459	583299
Spain	204	2283438	1026593	861452	3733042
Luxembourg	204	915016	199723	545478	1345435
			Loans		
Austria	204	291617	63845	192320	378148
Belgium	204	273158	50170	184753	364006
Finland	204	124258	52510	49140	218643
France	204	1753343	516872	1003374	2452544
Germany	204	2788213	149356	2357136	3031105
Ireland	204	244783	109420	65584	424591
Italy	204	1391279	466210	682167	2030410
Greece	198	153652	76216	41500	276391
Netherlands	204	832162	238138	378410	1143315
Portugal	204	206961	66255	68088	298591
Spain	204	1243329	581262	379612	1961866
Luxembourg	204	106973	31466	53727	160849
			Securities		
Austria	408	108723	80182	17401	271724

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Country	**N**	**Mean**	**SD**	**Min**	**Max**
Belgium	408	209655	185720	9717	484384
Finland	408	24098	20419	1871	68384
France	408	965497	751052	31833	2402904
Germany	408	1181667	916885	151163	2588118
Ireland	408	174428	213518	1763	640024
Italy	408	508744	506299	35673	1968138
Greece	396	51761	44311	3039	140710
Netherlands	408	231724	244900	11413	824424
Portugal	408	67870	81426	9571	297208
Spain	408	382528	389708	27538	1352948
Luxembourg	408	193832	196120	3241	555280
			Advances to banks		
Austria	204	165797	57822	81271	293119
Belgium	204	188754	63253	104867	372004
Finland	204	29027	23415	8187	110527
France	204	1441727	414863	822222	2143458
Germany	204	1486696	227388	943812	1951191
Ireland	204	139231	75937	31906	275978
Italy	204	421425	158414	177971	894823
Greece	198	38146	16992	14279	87320
Netherlands	204	206781	54448	62951	328787
Portugal	204	48688	7906	31848	68507
Spain	204	270925	60761	184518	405857
Luxembourg	204	289060	39608	215705	401810
			Other assets		
Austria	204	26239	9481	12938	50774
Belgium	204	111839	53494	33821	246457
Finland	204	56792	57698	4372	269923
France	204	816781	506922	230753	1859983
Germany	204	374613	391982	101534	1507380
Ireland	204	53277	29436	6686	166769
Italy	204	270511	89971	133552	474924
Greece	198	26230	12095	4798	47527
Netherlands	204	136095	99248	24436	382477
Portugal	204	25421	10981	7219	42742
Spain	204	154810	107417	33286	392824
Luxembourg	204	27117	6966	13209	48638

Table B.1: Summary statistics of the Euro Area country bank assets for each country member of the Euro Area early 2008 (September 1997-April 2014, measure A).

Country	N	Mean	SD	Min	Max
			Deposits		
Austria	204	246436	60533	159301	334800
Belgium	204	366750	107129	190665	530746
Finland	204	90525	29117	55521	152221
France	204	1350274	397235	818030	2037189
Germany	204	2498100	456983	1794936	3221880
Ireland	204	160746	61192	51325	263716
Italy	204	951241	357348	560075	1586998
Greece	198	162270	46778	79733	248293
Netherlands	204	628374	208207	312100	926786
Portugal	204	164304	46041	92942	245155
Spain	204	1077513	516455	387879	1792119
Luxembourg	204	192210	32468	136987	252185
			Interbank liabilities		
Austria	204	169061	53287	90461	301937
Belgium	204	160493	49650	97154	344087
Finland	204	21558	9279	6398	41324
France	204	1411840	389221	850769	2050236
Germany	204	1465488	165322	1067754	1913894
Ireland	204	221678	137552	38844	529360
Italy	204	547270	221816	190526	1043698
Greece	198	57603	50280	15714	187643
Netherlands	204	201226	61129	74002	373092
Portugal	204	70734	20105	31071	111296
Spain	204	383644	146796	202837	788744
Luxembourg	204	227993	46337	136801	353499
			Capital		
Austria	204	57361	29073	19998	101382
Belgium	204	43618	12901	18622	65449
Finland	204	18479	7079	5692	27671
France	204	355864	107287	185289	525903
Germany	204	322914	70082	193122	463829
Ireland	204	64422	39460	12469	136309
Italy	204	228380	104550	98294	422982
Greece	198	29299	14907	9031	71376
Netherlands	204	80157	24854	38939	120944
Portugal	204	33416	10524	15358	63598
Spain	204	199696	115968	68327	434423
Luxembourg	204	41605	13312	11154	59229
			Issued debt		

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Country	N	Mean	SD	Min	Max
Austria	392	88872	94772	0	259645
Belgium	408	36117	35245	241	91551
Finland	408	25193	24234	204	90436
France	408	569808	310689	155560	1247738
Germany	408	721770	713134	3685	1673187
Ireland	392	58486	48695	0	188684
Italy	408	299278	309489	3417	959290
Greece	396	4800	5603	179	18916
Netherlands	392	161951	181559	0	519660
Portugal	392	23263	30873	0	99689
Spain	408	135487	157099	0	452910
Luxembourg	408	72784	32642	23228	180280
			Other liabilities		
Austria	408	52893	22242	19598	106244
Belgium	408	167801	67191	47100	363450
Finland	408	61257	54807	4953	273860
France	408	822594	401532	287020	1832210
Germany	408	589614	287106	260645	1620179
Ireland	408	217514	217496	6975	786440
Italy	408	252291	98660	121725	472099
Greece	396	32133	22536	3620	91622
Netherlands	408	270997	155160	45603	582390
Portugal	408	40225	27443	4813	93559
Spain	408	175806	77130	41559	338787
Luxembourg	408	153820	132506	17544	396019

Table B.2: Summary statistics of the Euro Area country bank liabilities for each country member of the Euro Area early 2008 (September 1997-April 2014, measure A).

B.2 Description of bank-level bank data

Variable	N	Mean	SD	Min	Max
Interest Income on Loans	6214	951	3405	−2	56803
Other Interest Income	6734	572	2901	−173	94055
Dividend Income	5917	25	102	−148	2012
Gross Interest and Dividend Income	6841	1448	5539	2	108030
Interest Expense on Customer Deposits	2279	784	2284	0	24556
Other Interest Expense	6739	724	3105	−41	95797
Total Interest Expense	6813	979	4035	1	101786
Net Interest Income	6841	473	1894	−723	31215
Net Gains (Losses) on Trading and Derivatives	5228	36	689	−33818	10539
Net Gains (Losses) on Other Securities	2704	44	475	−4456	12718
Net Gains (Losses) on Assets at FV through Income Statement	1433	66	934	−10831	23477
Net Insurance Income	551	45	1064	−6982	7447
Net Fees and Commissions	6824	195	886	−1603	12308
Other Operating Income	6398	35	311	−6179	8722
Total Non Interest Operating Income	6841	290	1413	−8785	21524
Personnel Expenses	6775	263	1109	0	15248
Other Operating Expenses	6841	236	961	−82	15127
Total Non Interest Expenses	6841	497	2030	−46	28507
Equity accounted Profit/Loss : Operating	1099	54	223	−2109	2151
Pre Impairment Operating Profit	6841	275	1290	−13645	24188
Loan Impairment Charge	6744	124	641	−470	18523
Securities and Credit Impairment Charges	1877	70	447	−1675	12359
Operating Profit	6841	134	923	−16565	12466
Equity accounted Profit/Loss : Non operating	347	61	237	−900	2558
Non recurring Income	2847	43	258	−3982	5687
Non recurring Expense	2823	52	401	−107	10448
Change in Fair Value of Own Debt	238	4	312	−1617	1290
Other Non operating Income and Expenses	4869	−8	137	−3352	2581
Pre tax Profit	6841	128	968	−16101	13020
Tax expense	6788	38	226	−2757	3856
Profit/Loss from Discontinued Operations	412	121	1202	−4826	16960
Net Income before Profit Transfers	6840	98	795	−13583	9839
Profit Transfers to Parent Companies	3	172	141	13	281
Net Income	6840	98	795	−13583	9839
Change in Value of AFS Investments	1806	9	928	−18876	13421
Revaluation of Fixed Assets	155	−2	20	−161	74
Currency Translation Differences	757	−52	596	−8148	4913
Remaining OCI Gains/Losses	1355	−14	313	−5476	2961
Fitch Comprehensive Income	6846	91	918	−16681	14094

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Variable	N	Mean	SD	Min	Max
Memo: Profit Allocation to Non controlling Interests	1456	48	137	−862	1321
Memo: Net Income after Allocation to Non controlling Interests	6839	87	761	−13965	9839
Memo: Common Dividends Relating to the Period	2188	106	530	0	19213
Memo: Preferred Dividends Related to the Period	143	57	151	0	792
Residential Mortgage Loans	1988	6410	20335	0	243636
Other Mortgage Loans	129	31815	67404	0	348502
Other Consumer/Retail Loans	527	16804	47351	0	429477
Corporate & Commercial Loans	2437	5873	20212	0	248779
Other Loans	6275	13365	54399	−371	773128
Less: Reserves for Impaired Loans/NPLs	2817	1080	3285	−9	47955
Net Loans	6857	17623	62790	1	745678
Gross Loans	6857	18066	64561	1	773128
Memo: Impaired Loans & Advances to Customers included above	2113	2194	6006	0	74310
Memo: Loans at Fair Value included above	91	2732	6642	0	38556
Memo: Loans to the Public Sector	33	11672	20857	5	93075
Memo: Total Imapired Loans & Assets	2112	2195	6009	0	74310
Memo: Total Impaired Loans	2112	2195	6009	0	74310
Loans and Advances to Banks	6837	4462	19474	0	382776
Memo: Impaired Loans & Advances to Banks	20	131	239	1	925
Reverse Repos and Cash Collateral	328	18215	38882	0	234723
Trading Securities and at FV through Income	3127	8712	44305	−2	694786
Derivatives	2152	12617	60343	0	1224493
Available for Sale Securities	3384	7689	24924	0	277677
Held to Maturity Securities	1577	2381	6629	0	89794
At equity Investments in Associates	6017	309	1578	0	30327
Other Securities	4519	1697	8338	−1295	373085
Total Securities	6826	14602	79635	0	1695177
Memo: Government Securities	5315	2567	12630	0	272205
Memo: Total Securities Pledged	194	12319	23270	0	127670
Investments in Property	1343	365	1188	0	13308
Insurance Assets	443	8597	32874	0	257169
Other Earning Assets	1131	737	5595	0	138691
Total Earning Assets	6857	37356	149207	152	2029197
Cash and Due From Banks	6777	867	5509	0	127810
Memo: Mandatory Reserves Included Above	412	610	2171	0	26591
Foreclosed Real Estate	217	767	1688	0	13456
Fixed Assets	6828	267	1170	0	18278

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Variable	N	Mean	SD	Min	Max
Goodwill	1753	898	3079	0	26311
Other Intangibles	6008	76	509	0	24255
Current Tax Assets	1821	176	539	0	6473
Deferred Tax Assets	2318	544	1729	−2	21068
Discontinued Operations	287	2832	13410	0	156114
Other Assets	6858	1043	7483	−8	183638
Total Assets	6858	40186	163119	157	2202423
Customer Deposits : Current	6660	6308	24264	0	334295
Customer Deposits : Savings	5186	4695	20976	0	324581
Customer Deposits : Term	5853	4377	18636	−565	282533
Total Customer Deposits	6852	13424	51727	2	636682
Deposits from Banks	6814	5663	18679	0	260632
Repos and Cash Collateral	463	16360	36186	0	272386
Other Deposits and Short Term Borrowings	2941	3449	13874	0	166660
Total Deposits, Money Market and Short Term Funding	6856	21628	79343	11	1207062
Senior Debt Maturing after 1 Year	2565	15273	40074	0	682983
Subordinated Borrowing	5481	664	2595	0	38486
Other Funding	3672	1488	9620	−736	366319
Total Long Term Funding	6487	7442	29827	−736	717854
Derivatives	2139	13063	59749	−10	1181617
Trading Liabilities	1163	10517	38339	−74	474976
Total Funding	6857	34525	136704	104	1992986
Fair Value Portion of Debt	278	428	3857	−1021	43640
Credit Impairment Reserves	313	46	94	0	875
Reserves for Pensions and Other	6724	248	1292	0	47041
Current Tax Liabilities	5450	51	279	0	6358
Deferred Tax Liabilities	1970	249	697	−2	7265
Other Deferred Liabilities	4539	40	244	0	11591
Discontinued Operations	333	2697	12466	0	146142
Insurance Liabilities	566	24083	51619	0	278833
Other Liabilities	6847	1114	7956	−42	187816
Total Liabilities	6858	38151	156181	106	2160780
Pref, Shares and Hybrid Capital accounted for as Debt	4709	175	900	0	12344
Pref, Shares and Hybrid Capital accounted for as Equity	713	895	1990	0	17178
Common Equity	6851	1701	6184	−3063	84547
Non controlling Interest	1717	468	1296	−57	14375
Securities Revaluation Reserves	1631	60	1035	−12483	10129
Foreign Exchange Revaluation Reserves	452	−216	809	−9425	1061

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Variable	N	Mean	SD	Min	Max
Fixed Asset Revaluations and Other Accumulated OCI	1538	22	490	−6212	5549
Total Equity	6857	1822	6648	−3955	86024
Total Liabilities and Equity	6858	40186	163119	157	2202423
Memo: Fitch Core Capital	2226	2488	6386	−7310	69147
Memo: Fitch Eligible Capital	1533	2829	7120	−5960	69147

Table B.1: Summary statistics of the panel data of banks over the years 1999-2013.

Variable	N	Mean	SD	Min	Max	Q1	Median	Q3
	Cluster 1: Retail orientation							
Deposit liabilities	5638	2728	2417	0	19395	1249	1889	3394
Capital	5638	359	446	−2182	5084	117	200	401
wholesale	5638	1769	2455	−371	23873	397	821	1981
Loans	5638	2952	2796	0	19394	1135	1844	3763
Securities	5638	1108	1426	0	15311	382	685	1298
Advances to banks	5638	907	1482	0	15823	181	404	942
Total assets	5638	5144	4391	157	30038	2102	3335	6765
	Cluster 2: Investment orientation							
Deposit liabilities	1203	63471	110321	0	636682	10582	22238	54087
Capital	1203	9207	14676	−2324	94017	2061	3297	8800
wholesale	1203	64284	89360	534	898865	12988	26049	76860
Loans	1203	86316	129195	411	745678	20462	33017	87192
Securities	1203	77407	176554	0	1695177	6458	15191	61177
Advances to banks	1203	25898	46940	72	408308	3680	8273	29288
Total assets	1203	204307	344688	4128	2202423	34518	69187	198627
	All banks							
Deposit liabilities	6841	13410	51754	0	636682	1331	2268	5386
Capital	6841	1915	7026	−2324	94017	131	259	836
wholesale	6841	12762	44438	−371	898865	465	1126	4818
Loans	6841	17611	62825	0	745678	1277	2375	7229
Securities	6841	14525	79519	0	1695177	450	893	2212
Advances to banks	6841	5302	21898	0	408308	216	552	1886
Total assets	6841	40167	163230	157	2202423	2288	4410	12158

Table B.2: Key characteristics of the clusters over the total sample period (1999-2013; measure A)

B.3 Coverage between country- and bank-level data

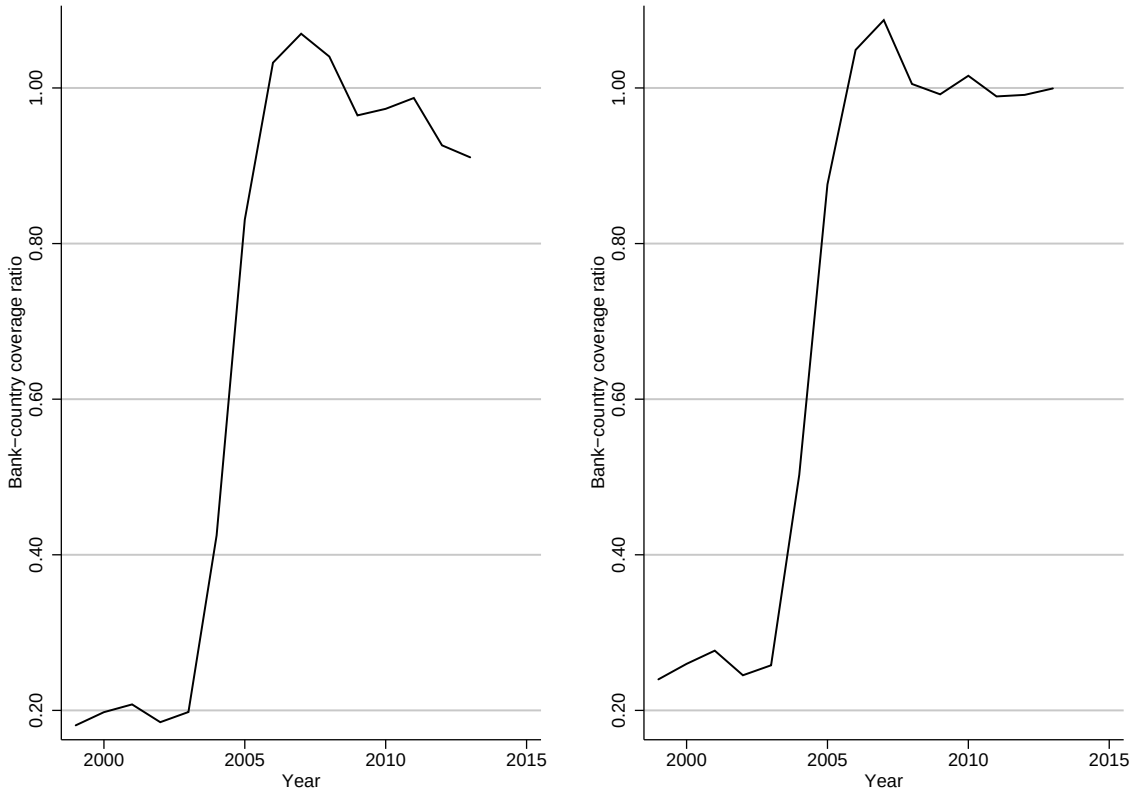

Figure B.1: Coverage in total assets and deposit funding levels between country-level data and bank-level data between 1997 and 2014. The bank-country coverage ratio demonstrates the summed total assets (left) and deposit funding levels (right) by year from the bank-level data set over the yearly average total assets from the country-level data.

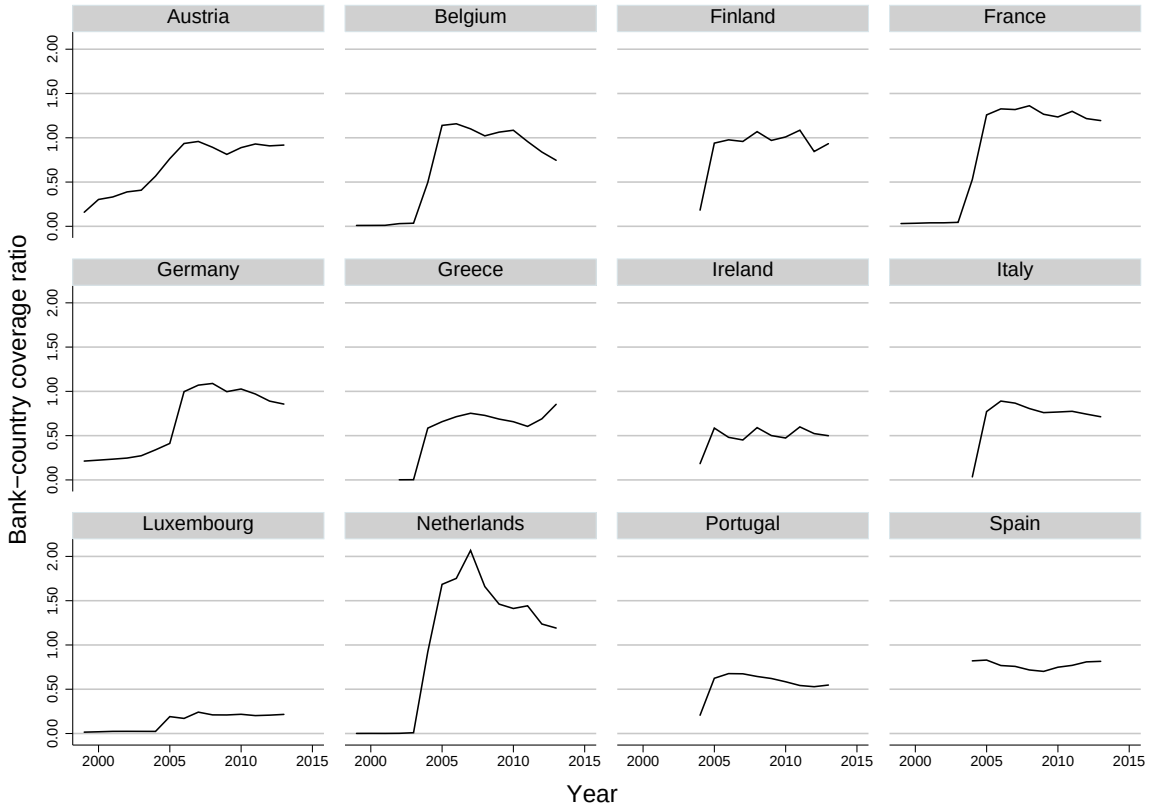

Figure B.2: Coverage in total assets between country-level data and bank-level data between 1997 and 2014. The bank-country coverage ratio demonstrates the summed total bank assets by country and year from the bank-level data set over the yearly average total assets from the country-level data.

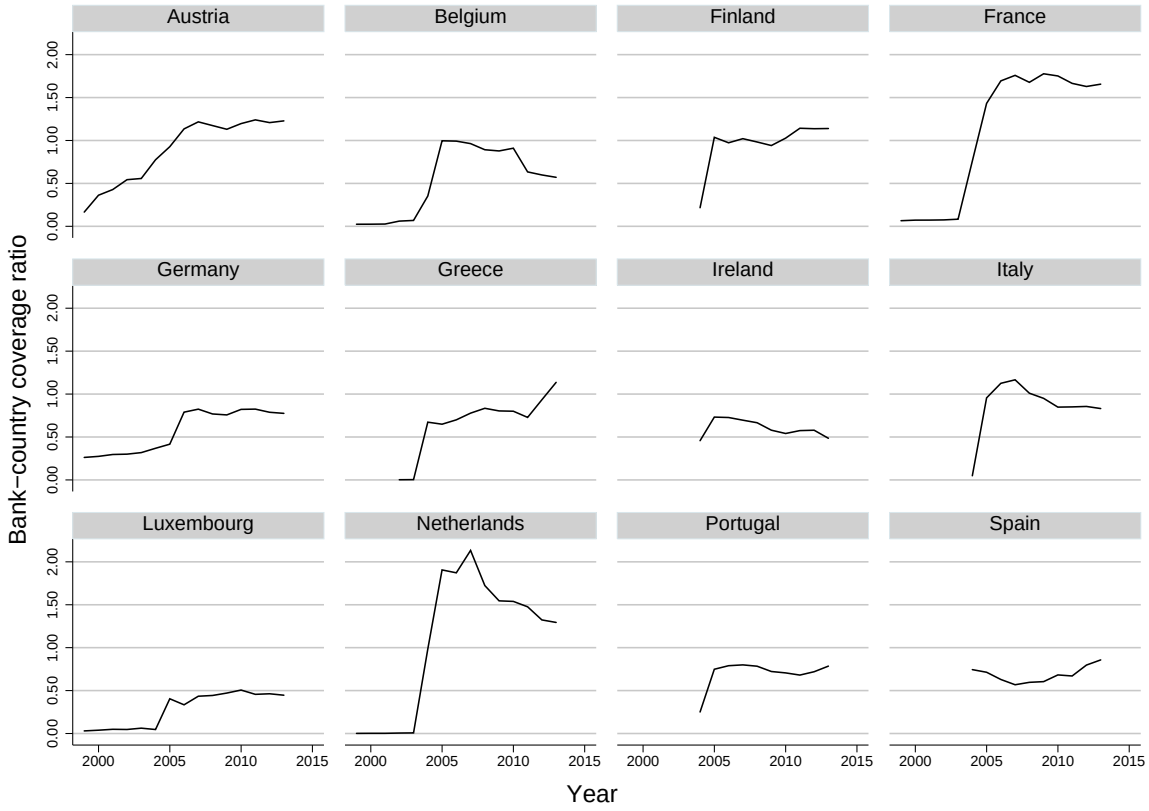

Figure B.3: Coverage in deposit funding levels between country-level data and bank-level data between 1997 and 2014. The bank-country coverage ratio demonstrates the summed deposit funding levels by country and year from the bank-level data set over the yearly average deposit funding levels from the country-level data.

B.4 Summary statistics bank business orientations

Variable	N	Mean	SD	Min	Max	Q1	Median	Q3
				Cluster 1: Retail orientation				
Deposit funding	5638	0.591	0.222	0.000	0.963	0.511	0.652	0.745
Capital	5638	0.067	0.041	−0.458	0.610	0.044	0.057	0.079
Wholesale funding	5638	0.301	0.201	−0.055	0.981	0.163	0.257	0.380
Loans	5638	0.586	0.197	0.000	0.991	0.499	0.617	0.721
Securities	5638	0.224	0.147	0.000	0.953	0.125	0.204	0.296
Advances to banks	5638	0.160	0.150	0.000	0.981	0.066	0.116	0.192
Interest income	5638	0.798	0.141	0.046	2.945	0.760	0.817	0.865
Fee and commission income	5638	0.127	0.115	−0.465	0.904	0.076	0.108	0.153
Trading income	5638	0.038	0.071	−2.086	0.825	0.014	0.025	0.045
Total assets	5638	8.248	0.755	5.056	10.310	7.650	8.112	8.820
				Cluster 2: Investment orientation				
Deposit funding	1203	0.333	0.187	0.000	0.875	0.205	0.336	0.468
Capital	1203	0.057	0.034	−0.039	0.267	0.032	0.052	0.074
Wholesale funding	1203	0.413	0.220	0.003	0.968	0.256	0.376	0.564
Loans	1203	0.533	0.199	0.008	0.932	0.393	0.554	0.680
Securities	1203	0.268	0.165	0.000	0.957	0.145	0.241	0.360
Advances to banks	1203	0.147	0.126	0.003	0.698	0.058	0.108	0.197
Interest income	1203	0.827	0.312	−6.340	3.449	0.745	0.827	0.939
Fee and commission income	1203	0.093	0.129	−2.977	0.470	0.029	0.094	0.157
Trading income	1203	0.069	0.391	−2.449	10.371	0.006	0.039	0.091
Total assets	1203	11.419	1.163	8.326	14.605	10.449	11.145	12.199
				All banks				
Deposit funding	6841	0.546	0.237	0.000	0.963	0.383	0.613	0.725
Capital	6841	0.065	0.040	−0.458	0.610	0.043	0.056	0.078
Wholesale funding	6841	0.321	0.209	−0.055	0.981	0.172	0.273	0.414
Loans	6841	0.577	0.198	0.000	0.991	0.477	0.608	0.715
Securities	6841	0.232	0.151	0.000	0.957	0.128	0.210	0.307
Advances to banks	6841	0.157	0.146	0.000	0.981	0.065	0.114	0.193
Interest income	6841	0.803	0.184	−6.340	3.449	0.757	0.818	0.872
Fee and commission income	6841	0.121	0.118	−2.977	0.904	0.070	0.107	0.153
Trading income	6841	0.044	0.177	−2.449	10.371	0.013	0.026	0.051
Total assets	6841	8.805	1.472	5.056	14.605	7.736	8.392	9.406

Table B.1: Key characteristics of the clusters over the total sample period (1999-2013; measure C)

APPENDIX C

EURO AREA AGGREGATE GRAPHS

C.1 Aggregated assets and liabilities in the Euro Area

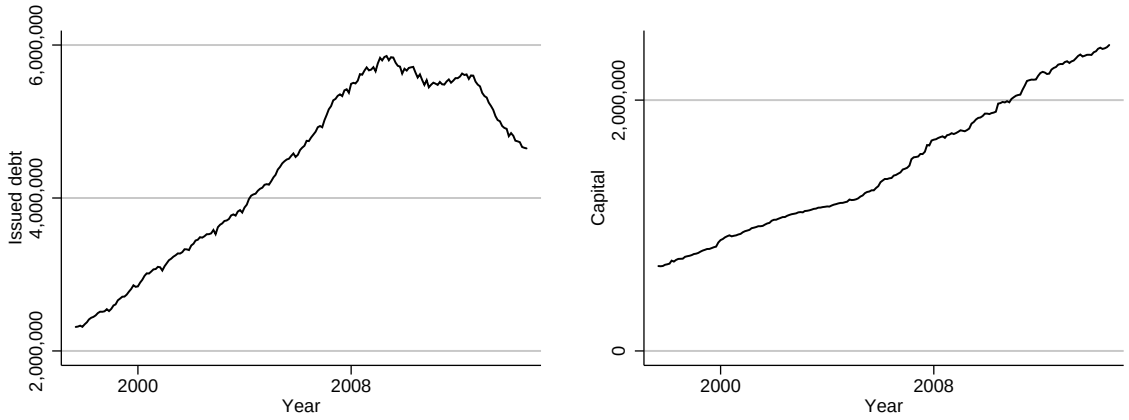

Figure C.1: Issued debt and capital in the Euro Area between 1997 and 2014.

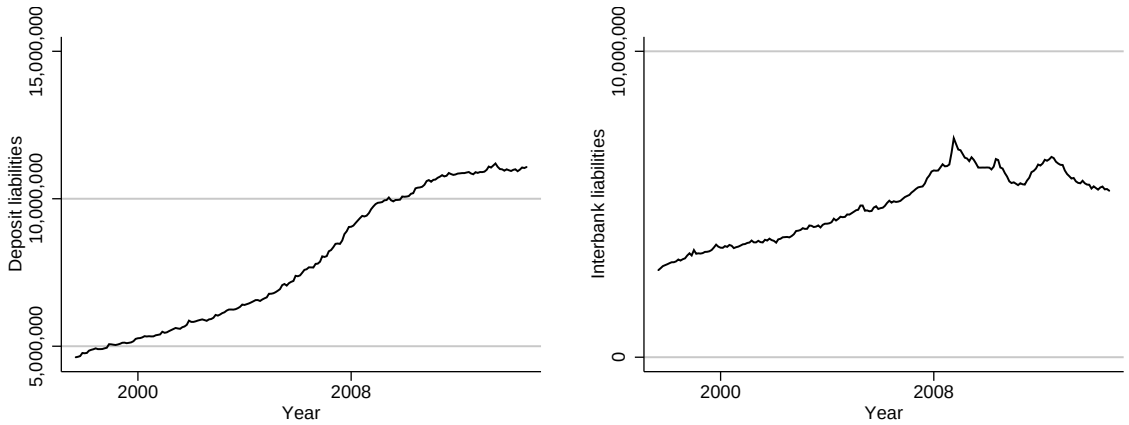

Figure C.2: Deposit funding and interbank liabilities in the Euro Area between 1997 and 2014.

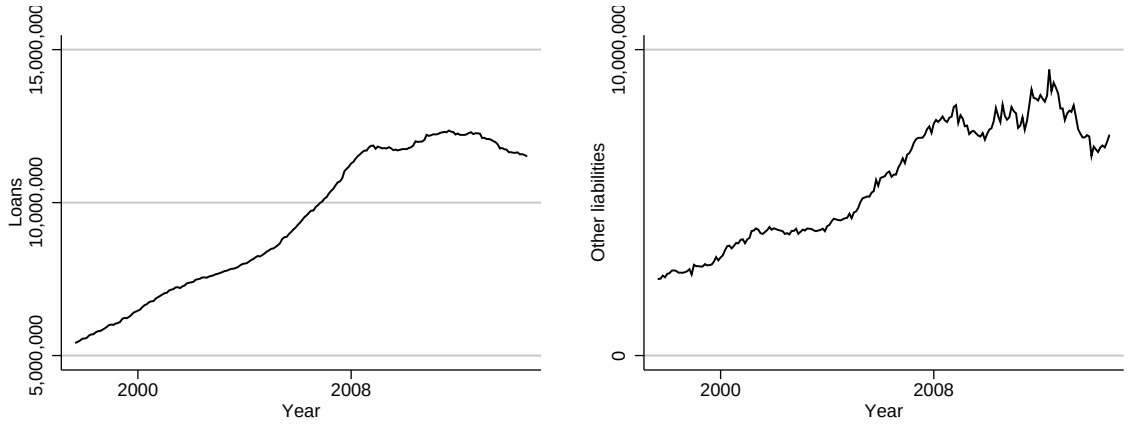

Figure C.3: Loans and other liabilities in the Euro Area between 1997 and 2014.

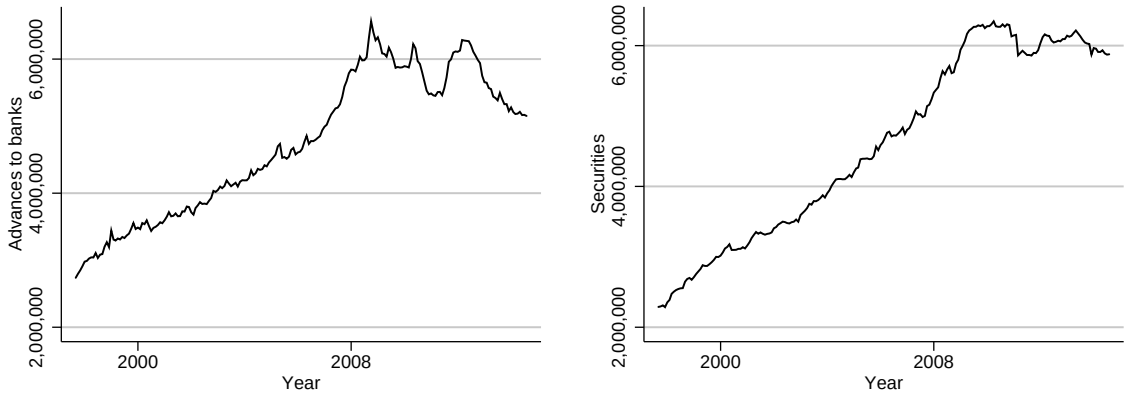

Figure C.4: Advances to banks and securities in the Euro Area between 1997 and 2014.

Figure C.5: Total assets and other assets in the Euro Area between 1997 and 2014.

APPENDIX D

EURO AREA COUNTRY GRAPHS

D.1 Balance sheets of Euro Area countries

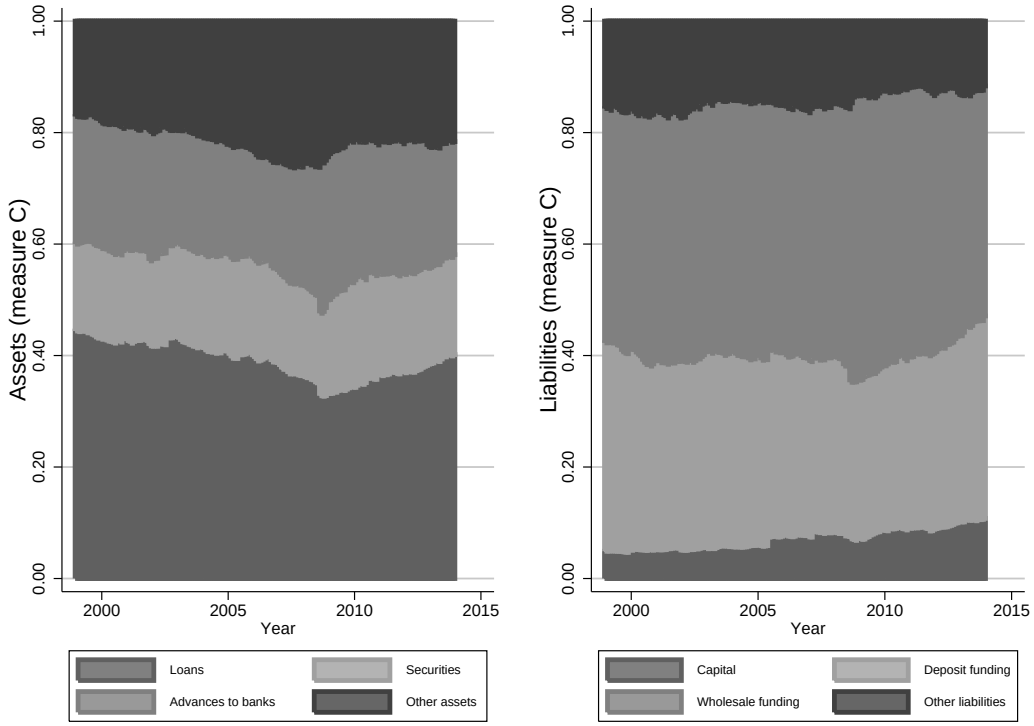

Figure D.1: Country-level balance sheet Austria between 1999 and 2013.

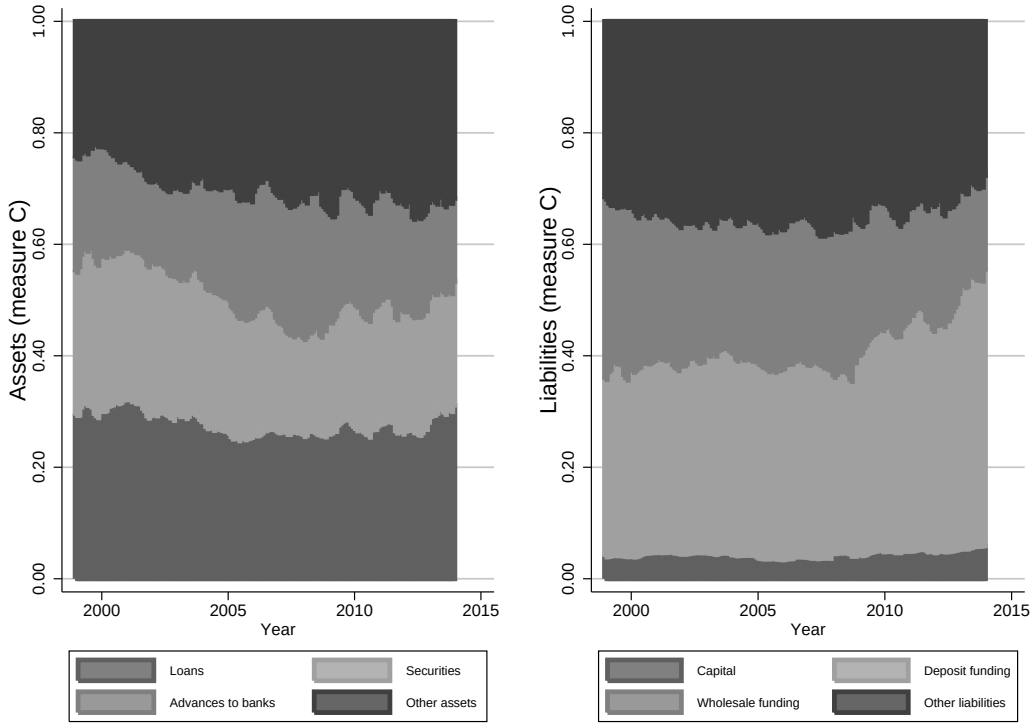

Figure D.2: Country-level balance sheet Belgium between 1999 and 2013.

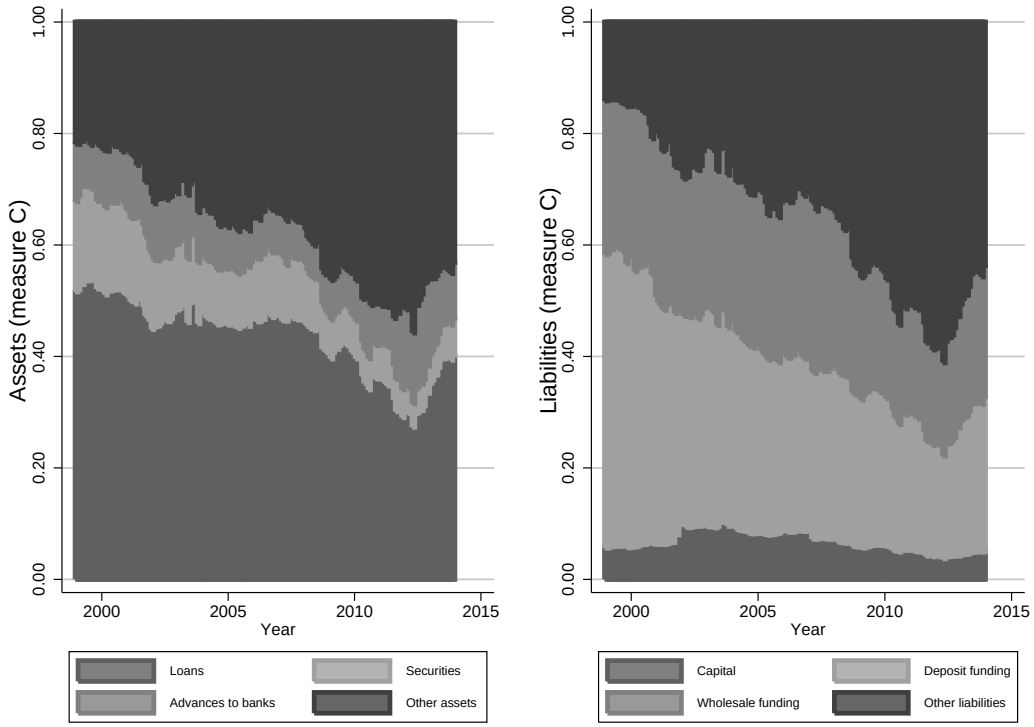

Figure D.3: Country-level balance sheet Finland between 1999 and 2013.

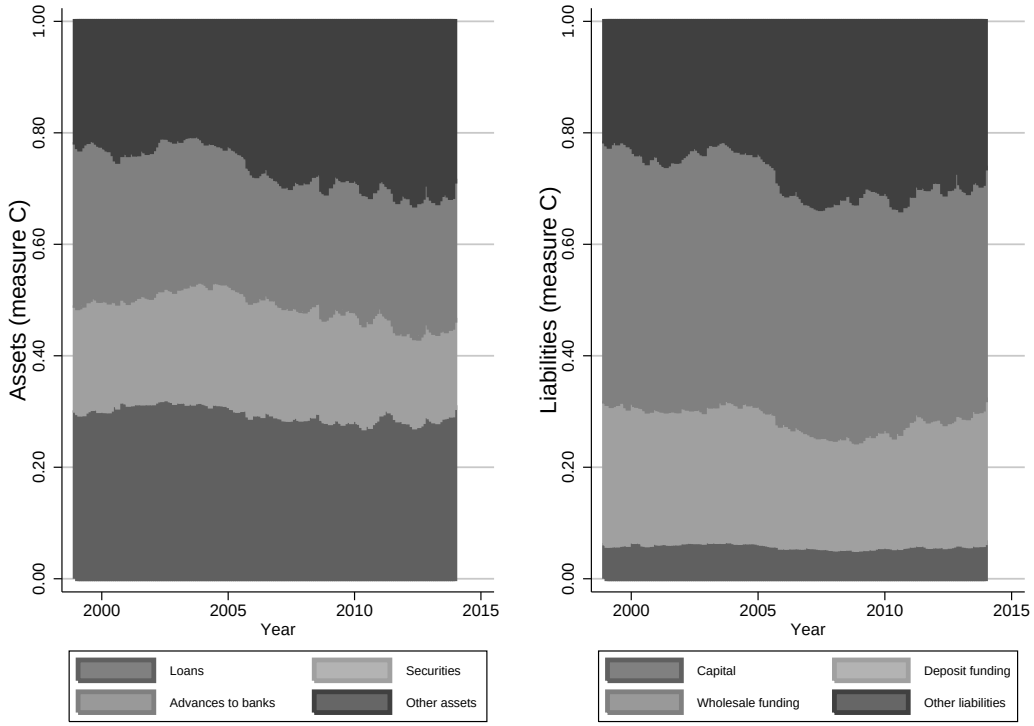

Figure D.4: Country-level balance sheet France between 1999 and 2013.

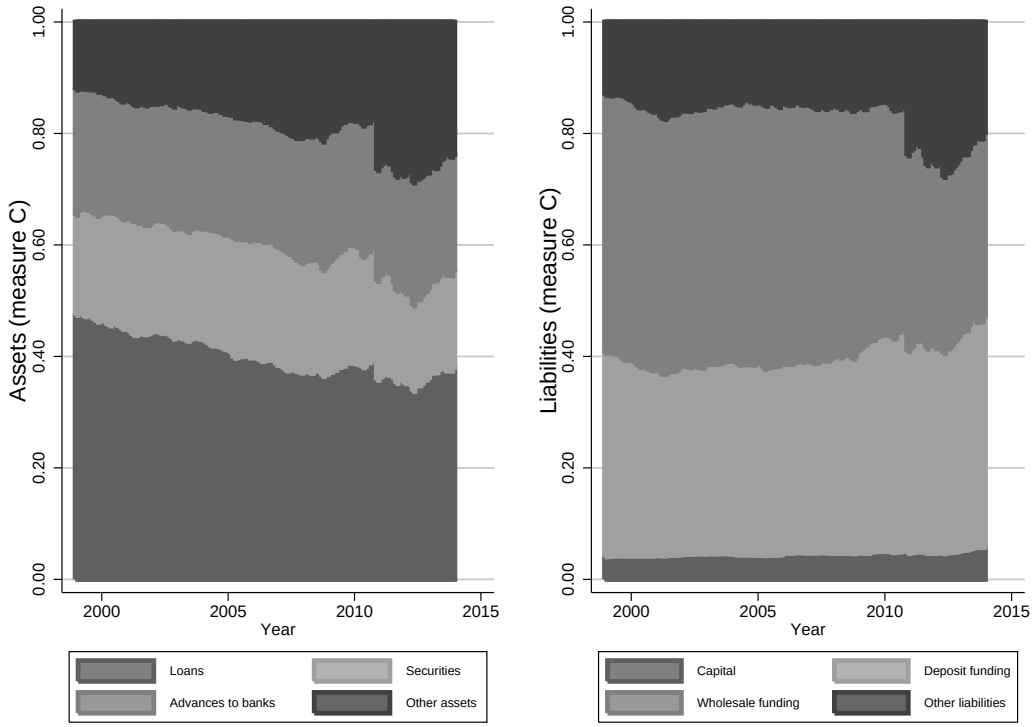

Figure D.5: Country-level balance sheet Germany between 1999 and 2013.

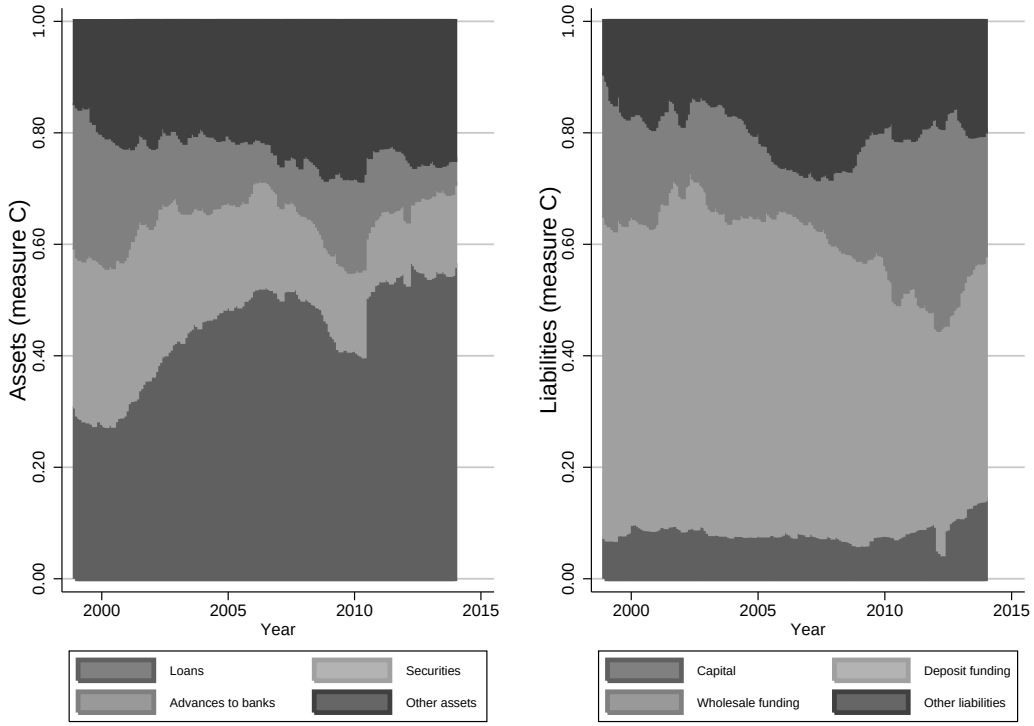

Figure D.6: Country-level balance sheet Greece between 1999 and 2013.

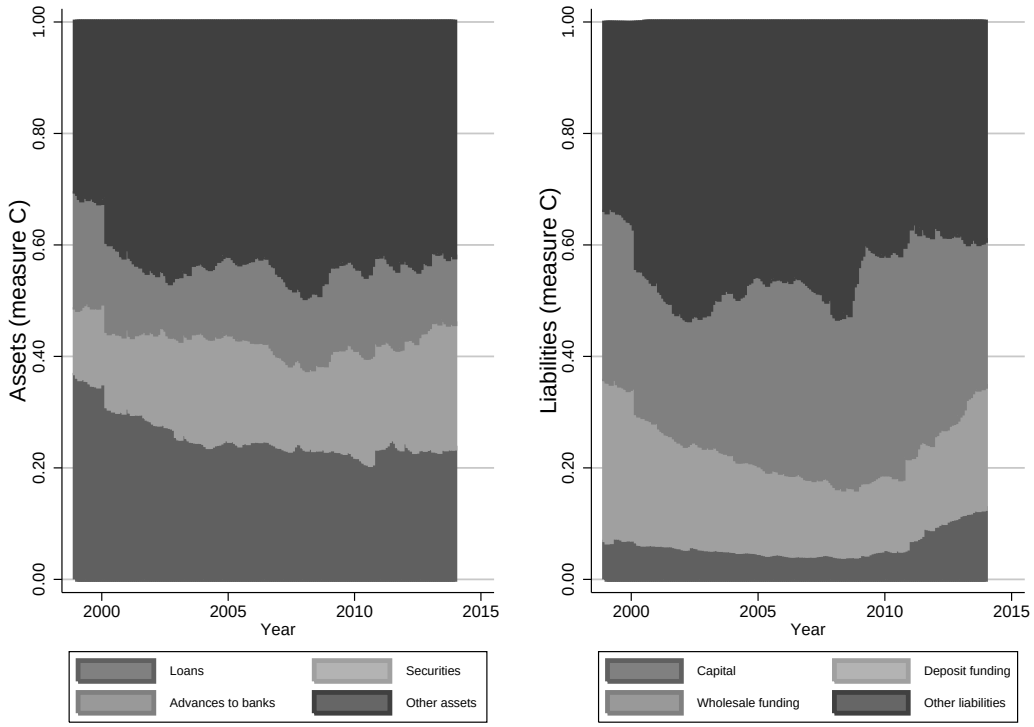

Figure D.7: Country-level balance sheet Ireland between 1999 and 2013.

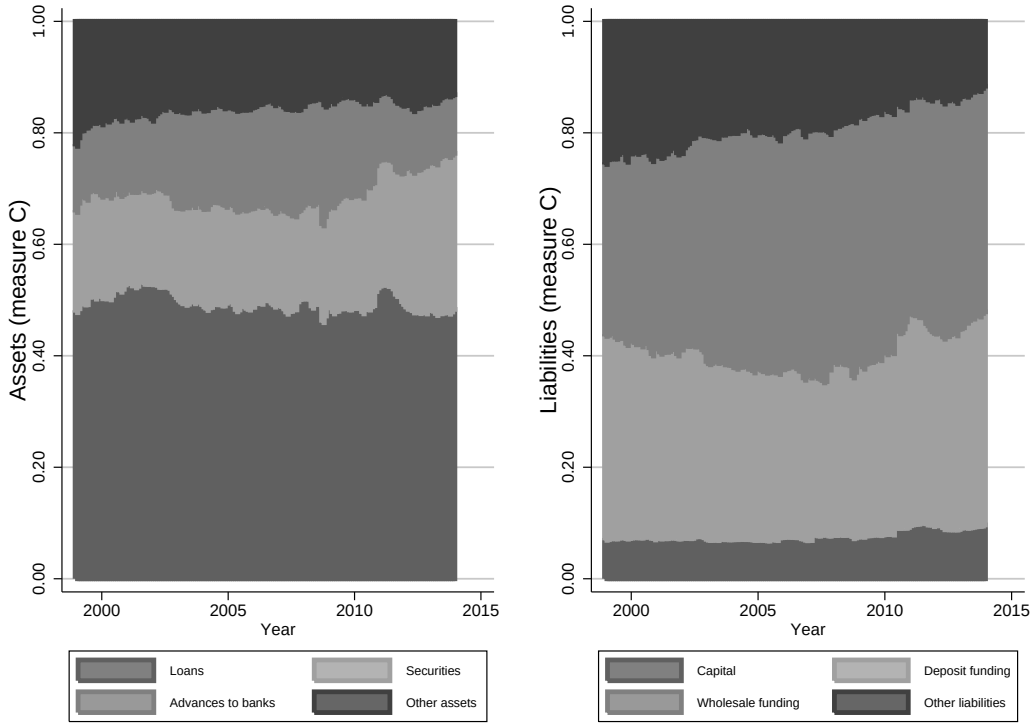

Figure D.8: Country-level balance sheet Italy between 1999 and 2013.

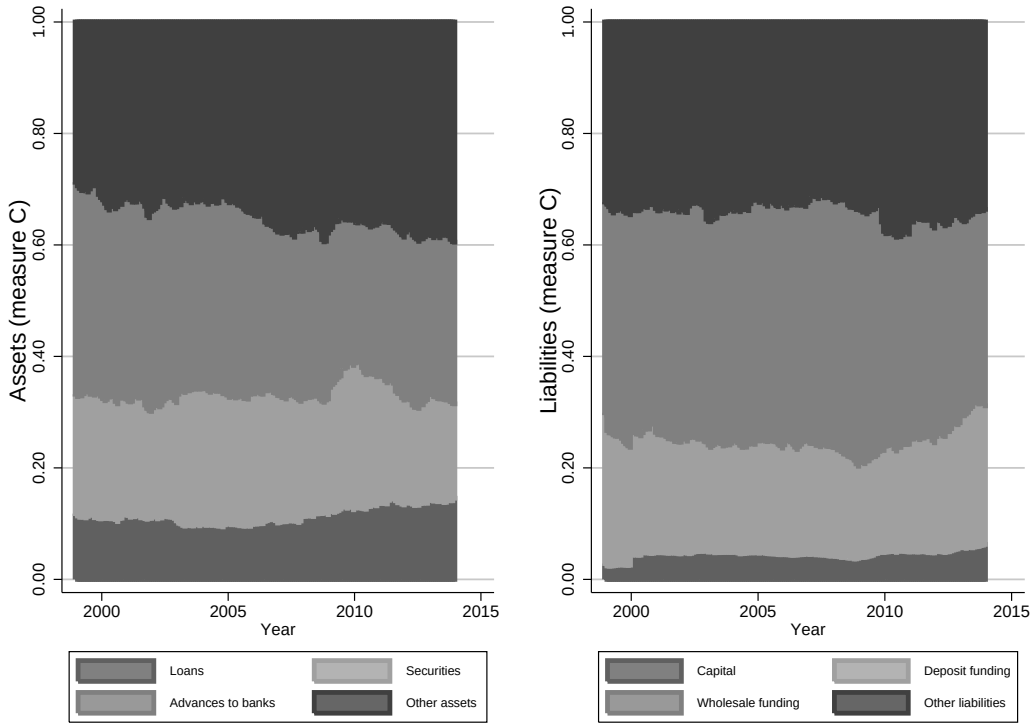

Figure D.9: Country-level balance sheet Luxembourg between 1999 and 2013.

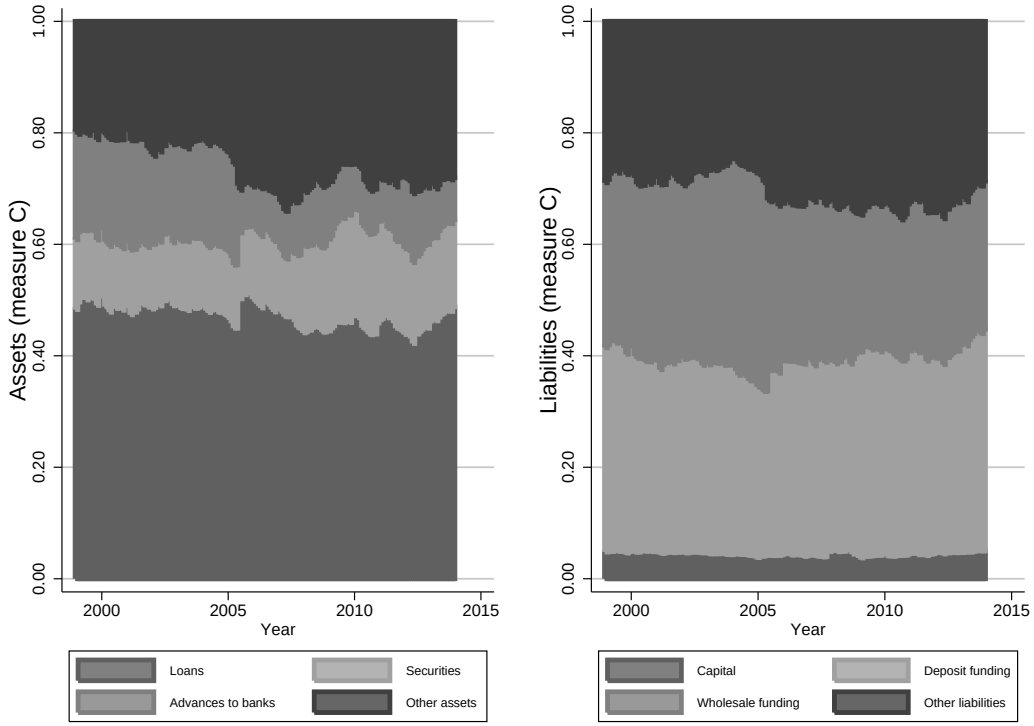

Figure D.10: Country-level balance sheet the Netherlands between 1999 and 2013.

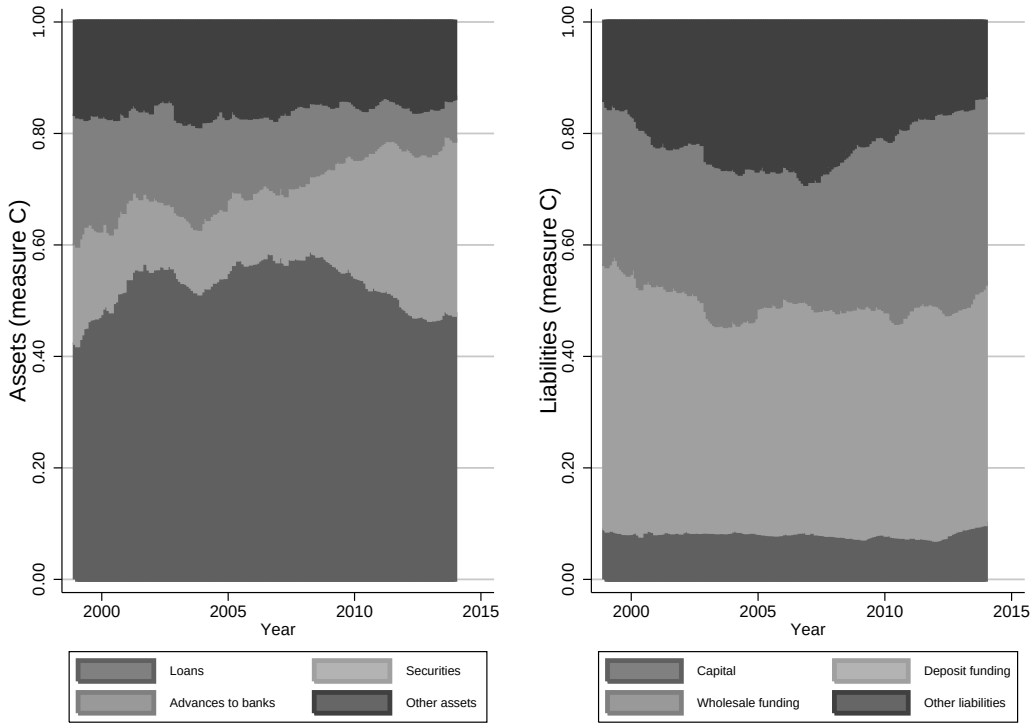

Figure D.11: Country-level balance sheet Portugal between 1999 and 2013.

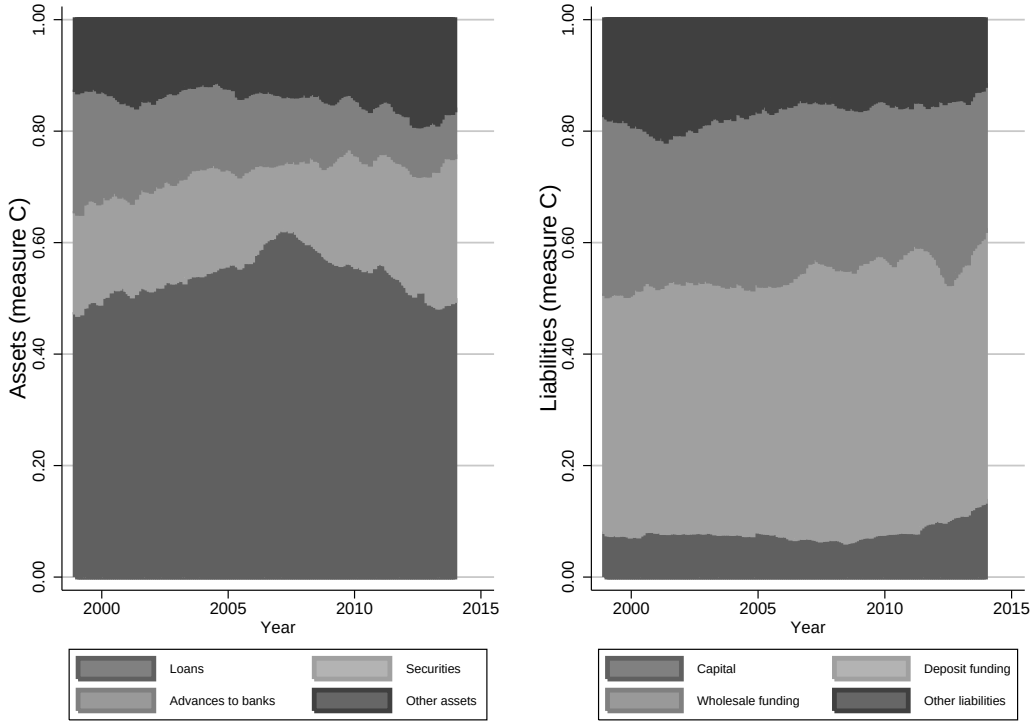

Figure D.12: Country-level balance sheet Spain between 1999 and 2013.

D.2 Balance sheets of Euro Area countries

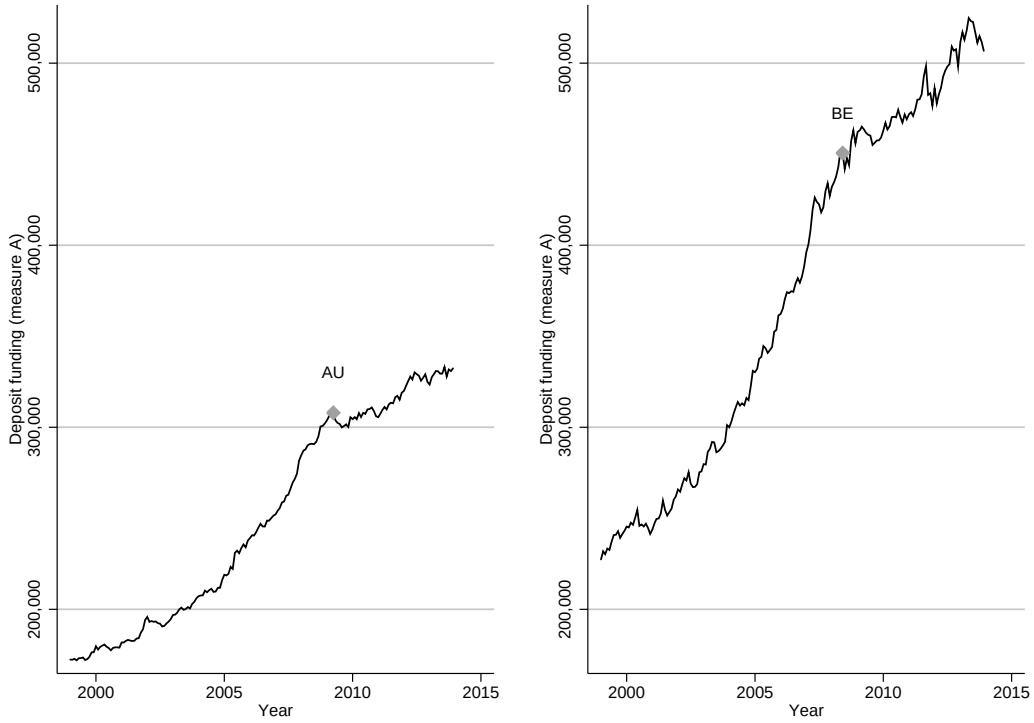

Figure D.13: Deposit funding levels Austria (left) and Belgium (right) between 1999 and 2013.

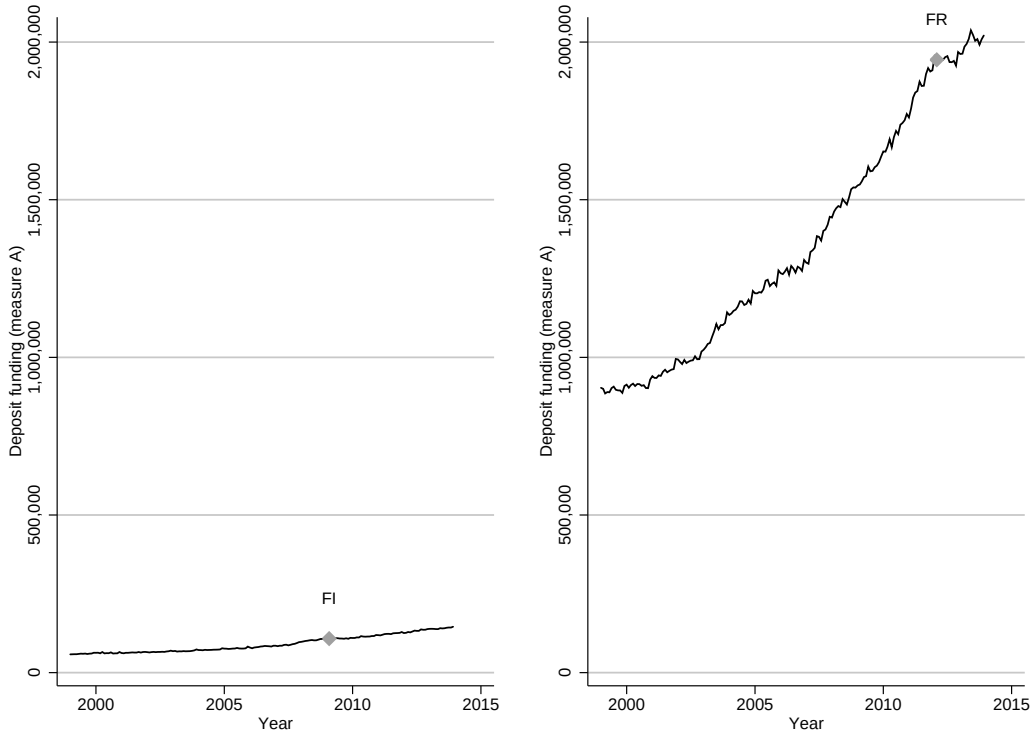

Figure D.14: Deposit funding levels Finland (left) and France (right) between 1999 and 2013.

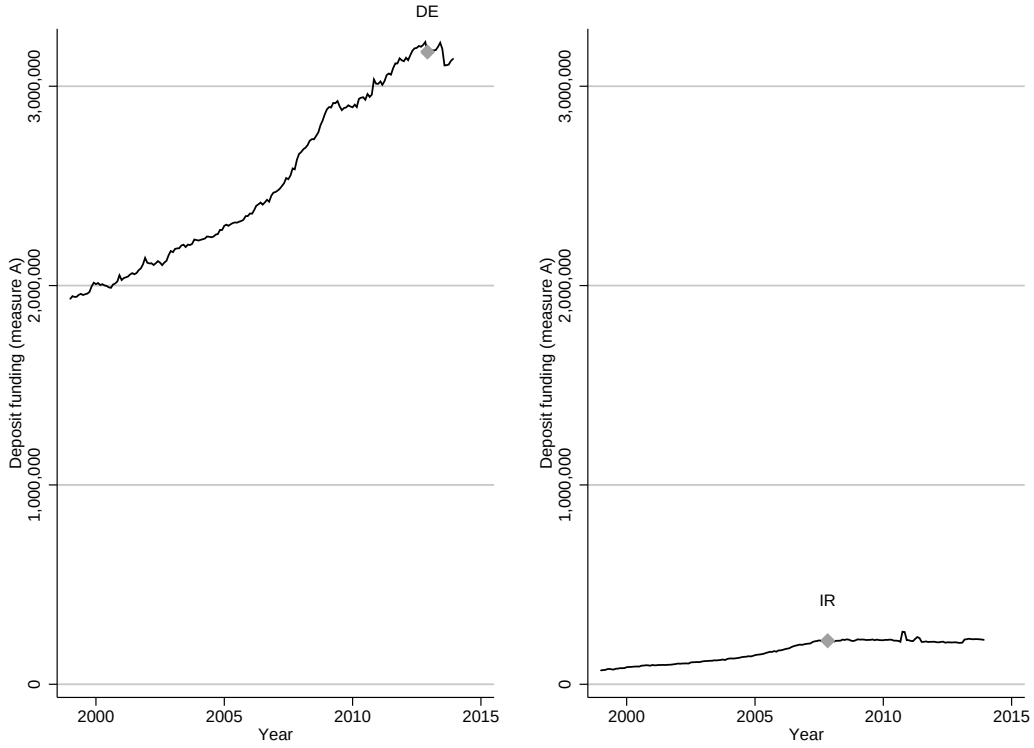

Figure D.15: Deposit funding levels Germany (left) and Ireland (right) between 1999 and 2013.

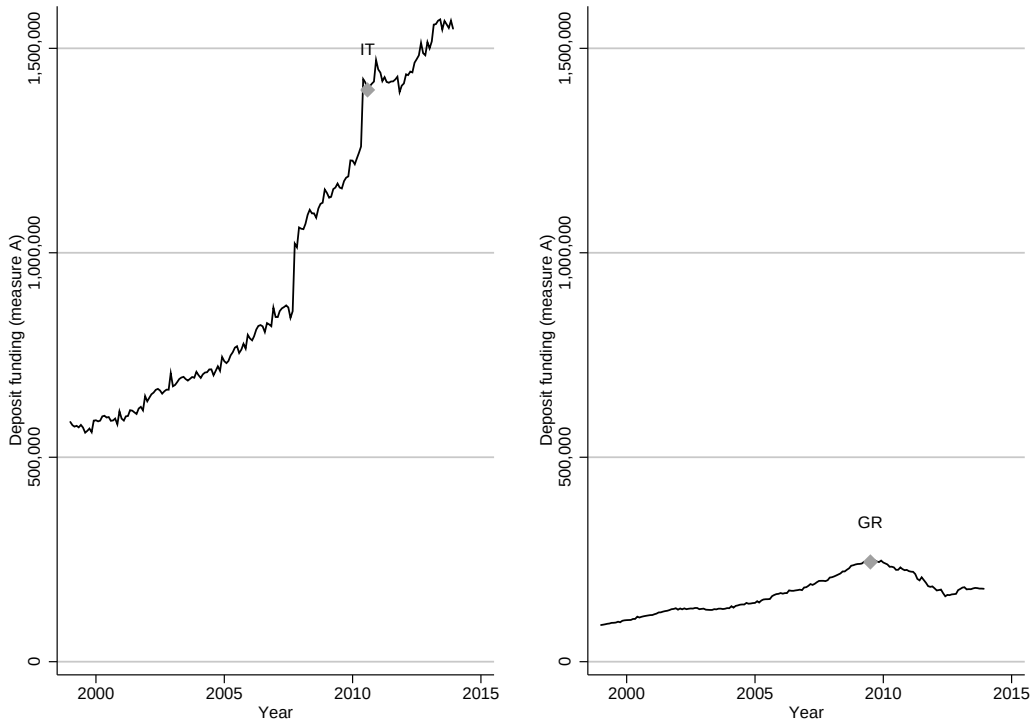

Figure D.16: Deposit funding levels Italy (left) and Greece (right) between 1999 and 2013.

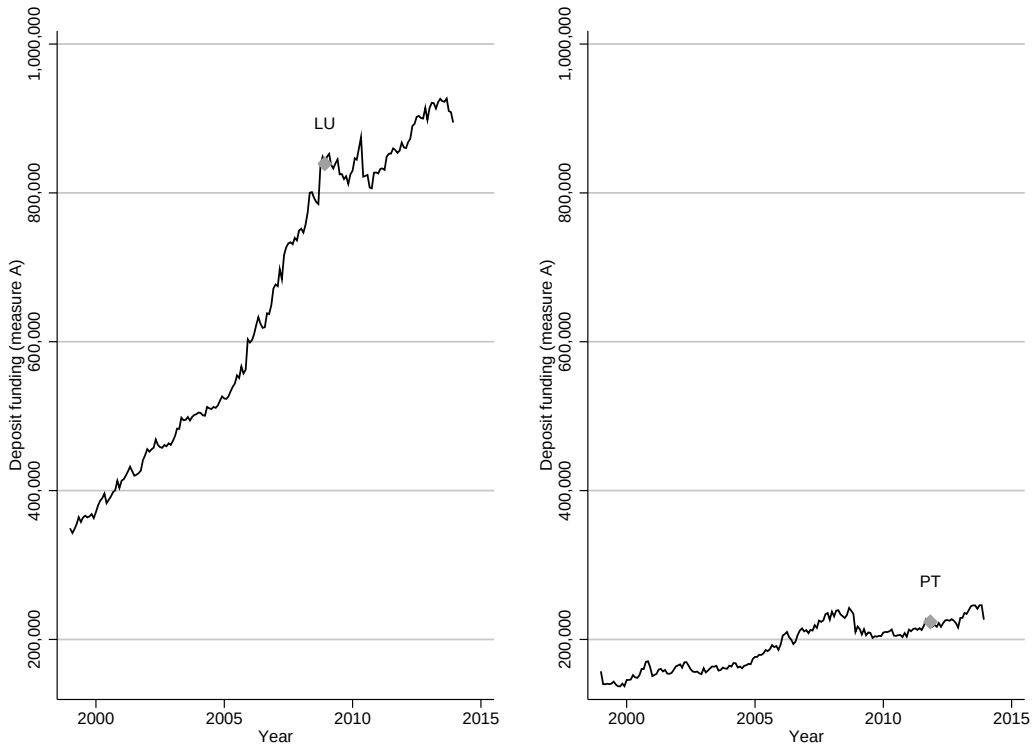

Figure D.17: Deposit funding levels the Netherlands (left) and Portugal (right) between 1999 and 2013.

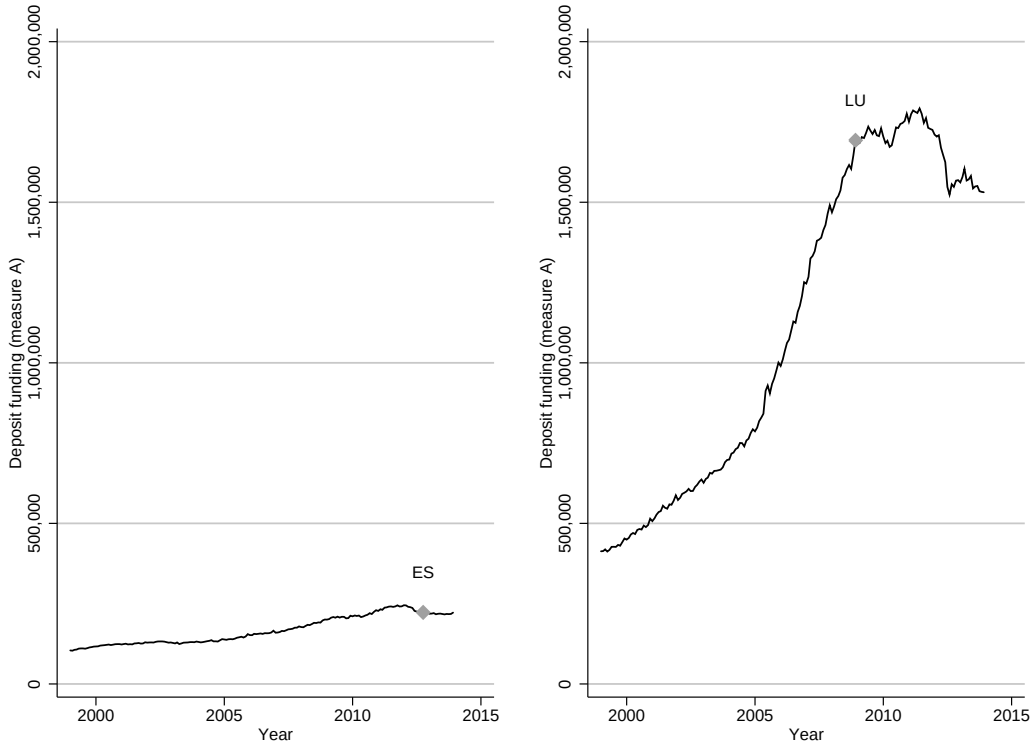

Figure D.18: Deposit funding levels Spain (left) and Luxembourg (right) between 1999 and 2013.

D.3 Loan-to-deposit ratios in the Euro Area

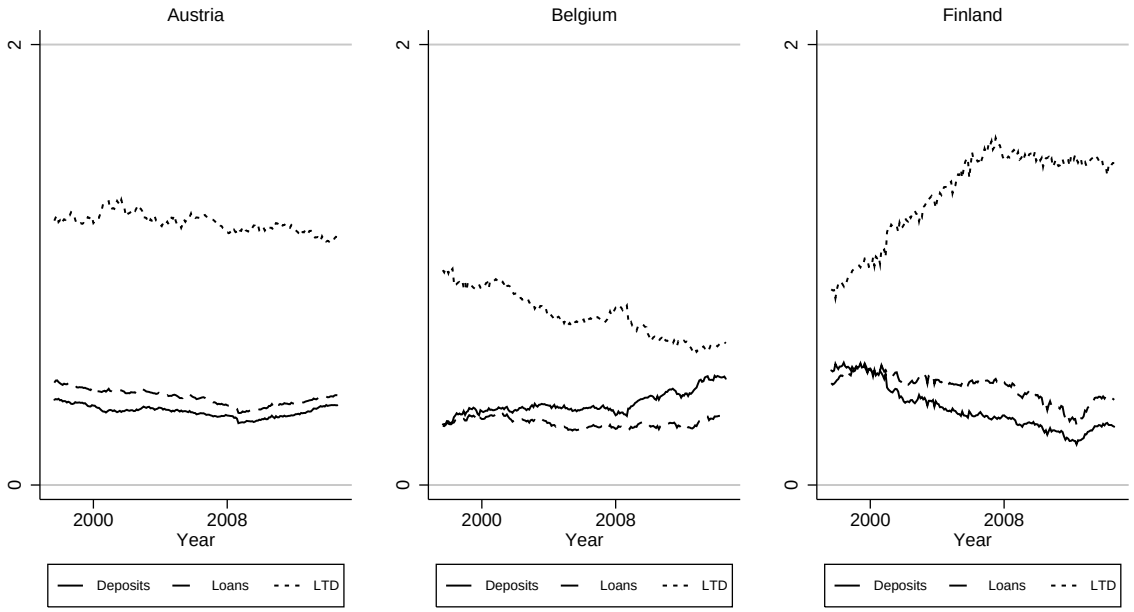

Figure D.19: Loan-to-deposit ratio in Austria, Belgium and Finland between 1999 and 2013.

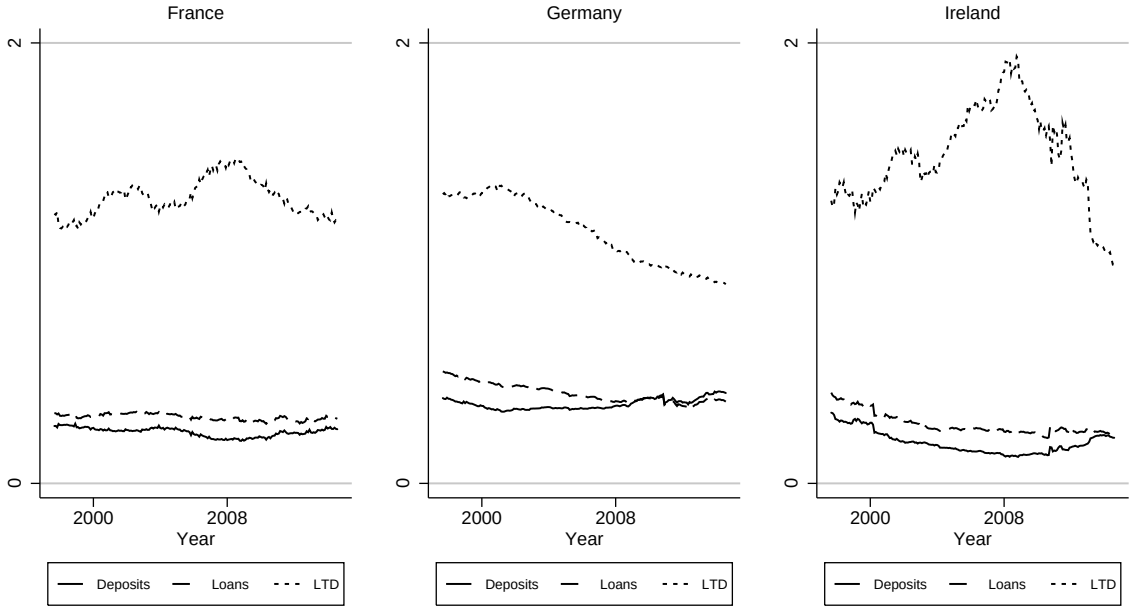

Figure D.20: Loan-to-deposit ratio in France, Germany and Ireland between 1999 and 2013.

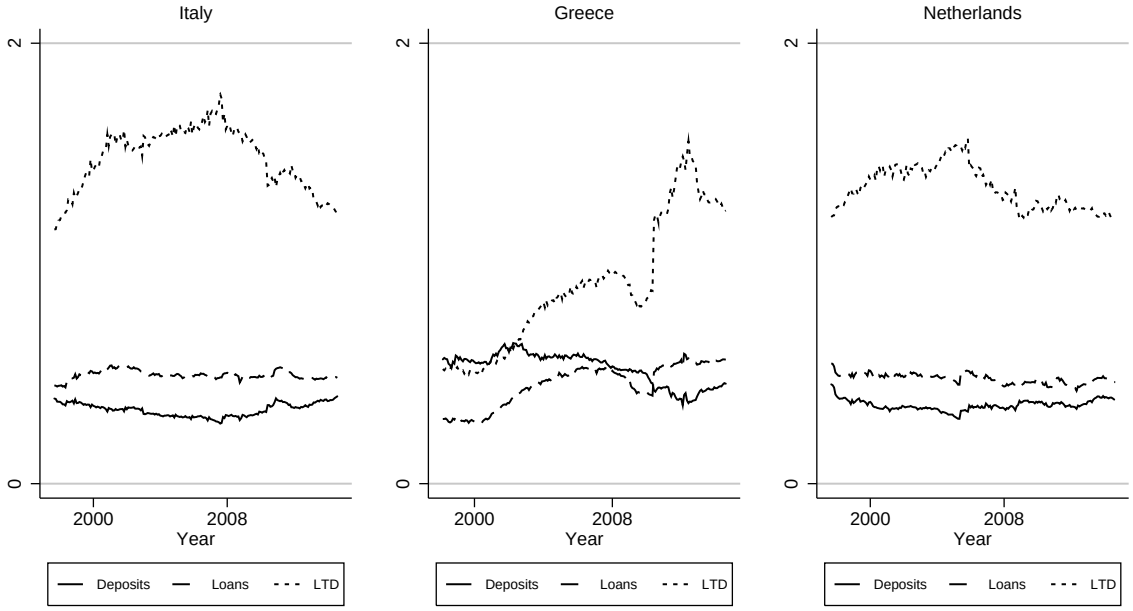

Figure D.21: Loan-to-deposit ratio in Italy, Greece and the Netherlandsbetween 1999 and 2013.

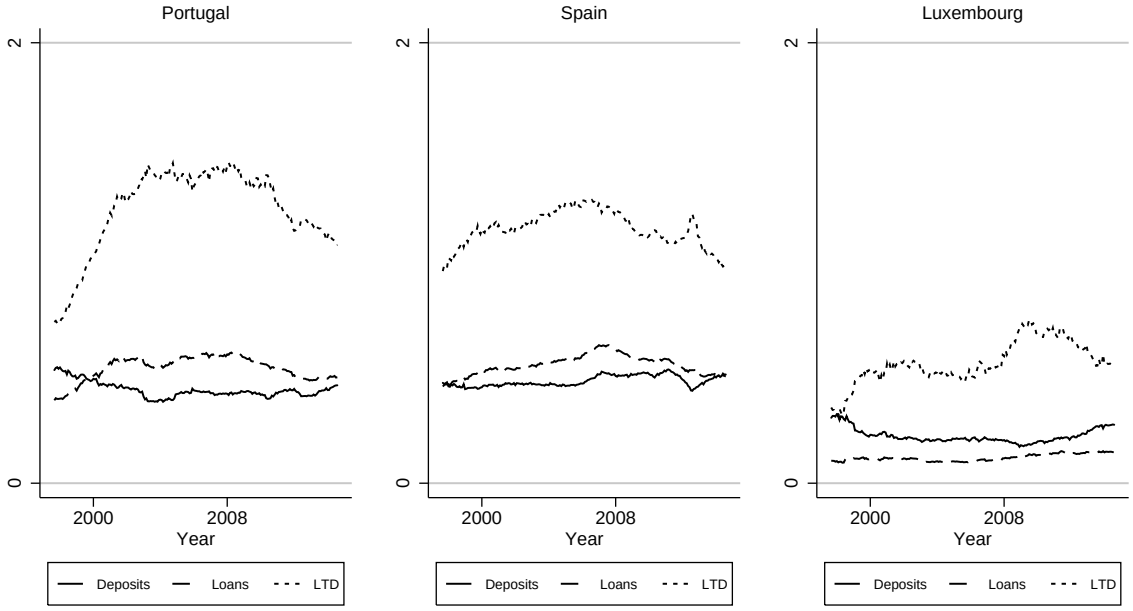

Figure D.22: Loan-to-deposit ratio in Portugal, Spain and Luxembourg between 1999 and 2013.

APPENDIX E

EURO AREA BANK-LEVEL GRAPHS

E.1 Scatter plots bank level assets and liability classes over total assets

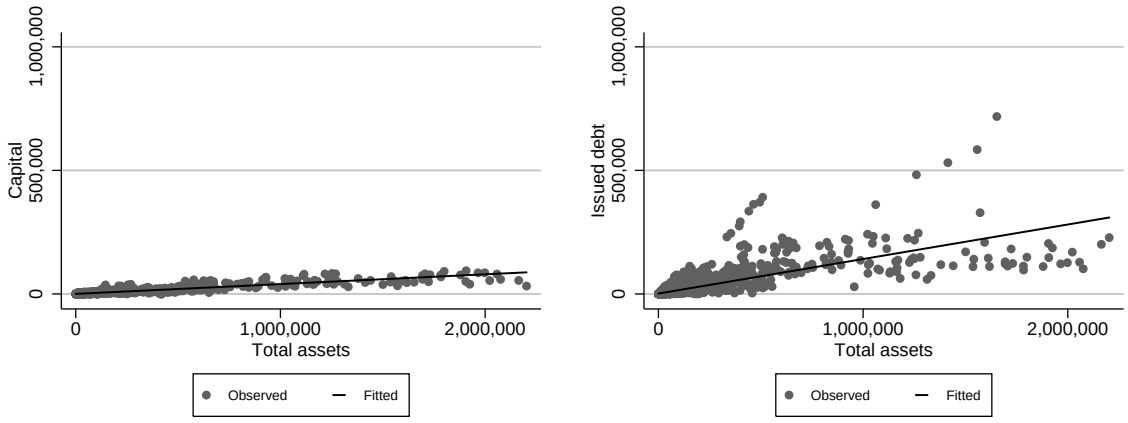

Figure E.1: Capital (left) and issued debt (right) over total assets between 1999 and 2013.

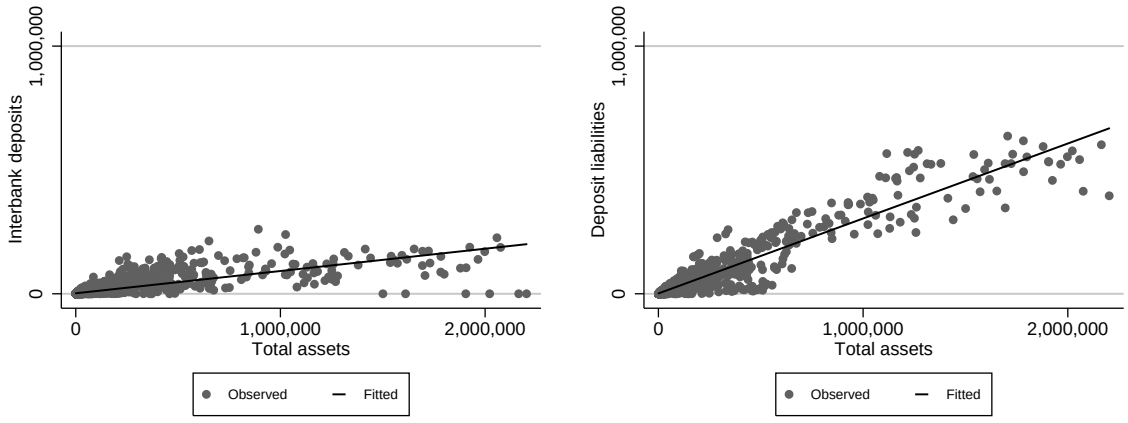

Figure E.2: Interbank (left) and deposit funding (right) over total assets between 1999 and 2013.

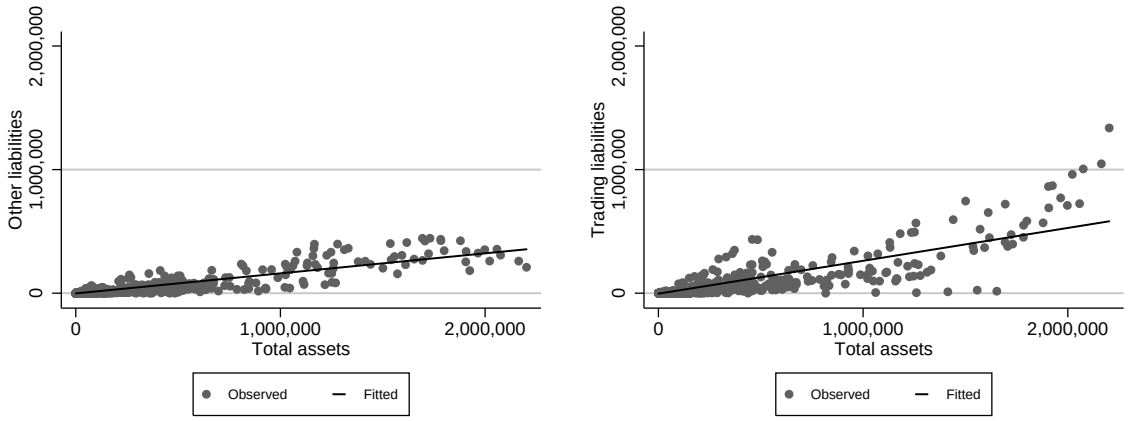

Figure E.3: Other liabilities (left) and trading liabilities (right) over total assets between 1999 and 2013.

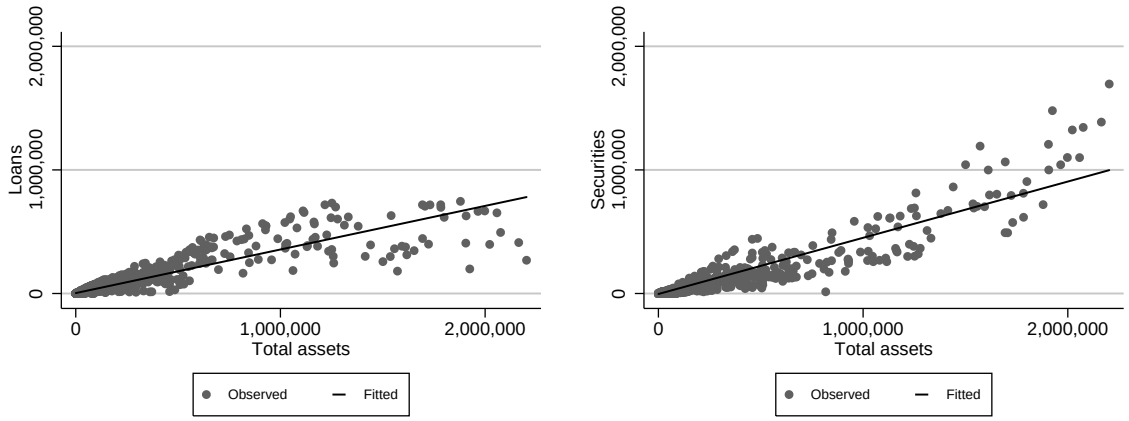

Figure E.4: Loans (left) and securities (right) over total assets between 1999 and 2013.

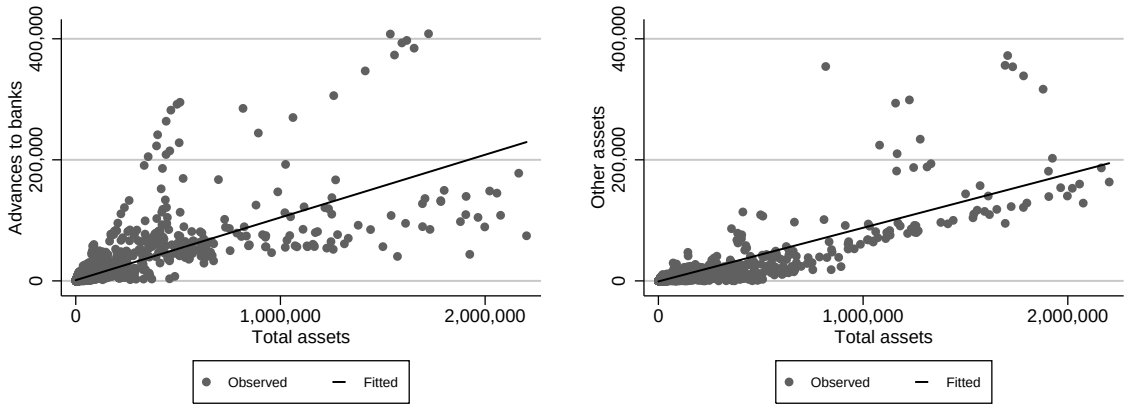

Figure E.5: Advances to banks (left) and other assets (right) over total assets between 1999 and 2013.

E.2 Histograms bank-level asset and liability classes

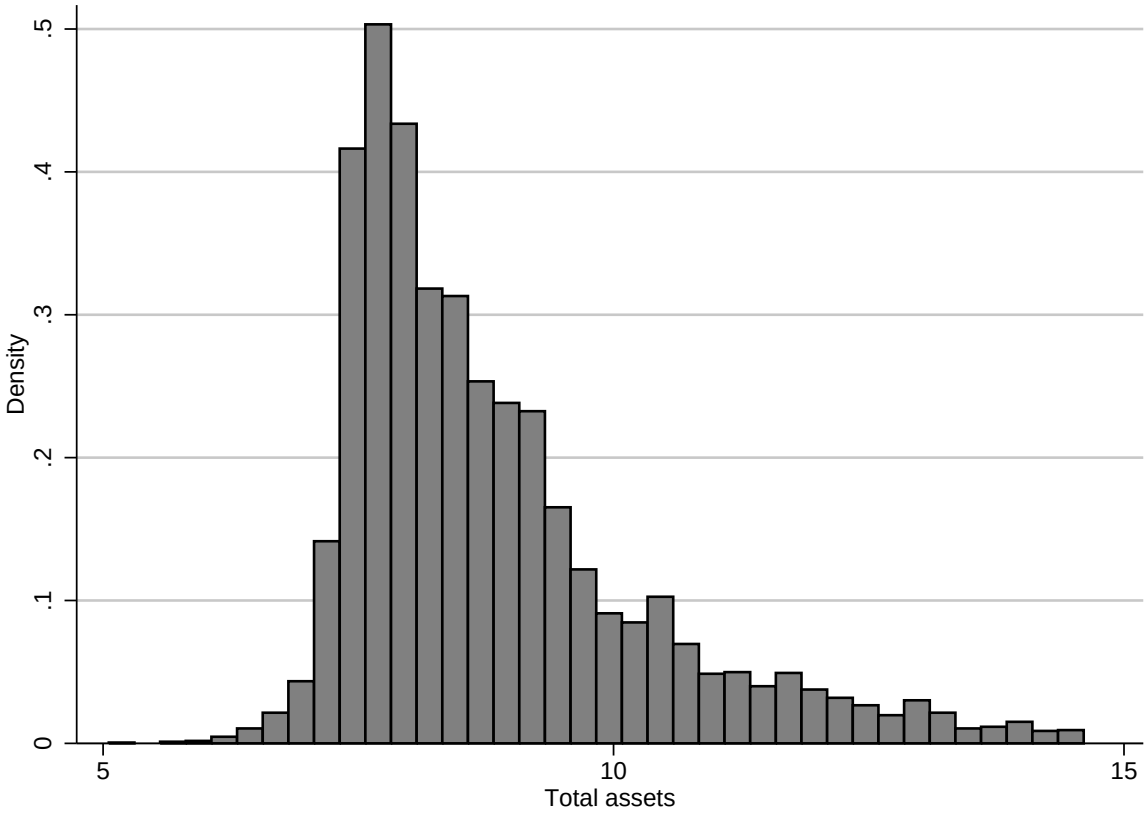

Figure E.6: Histograms bank-level total asset (measure B).

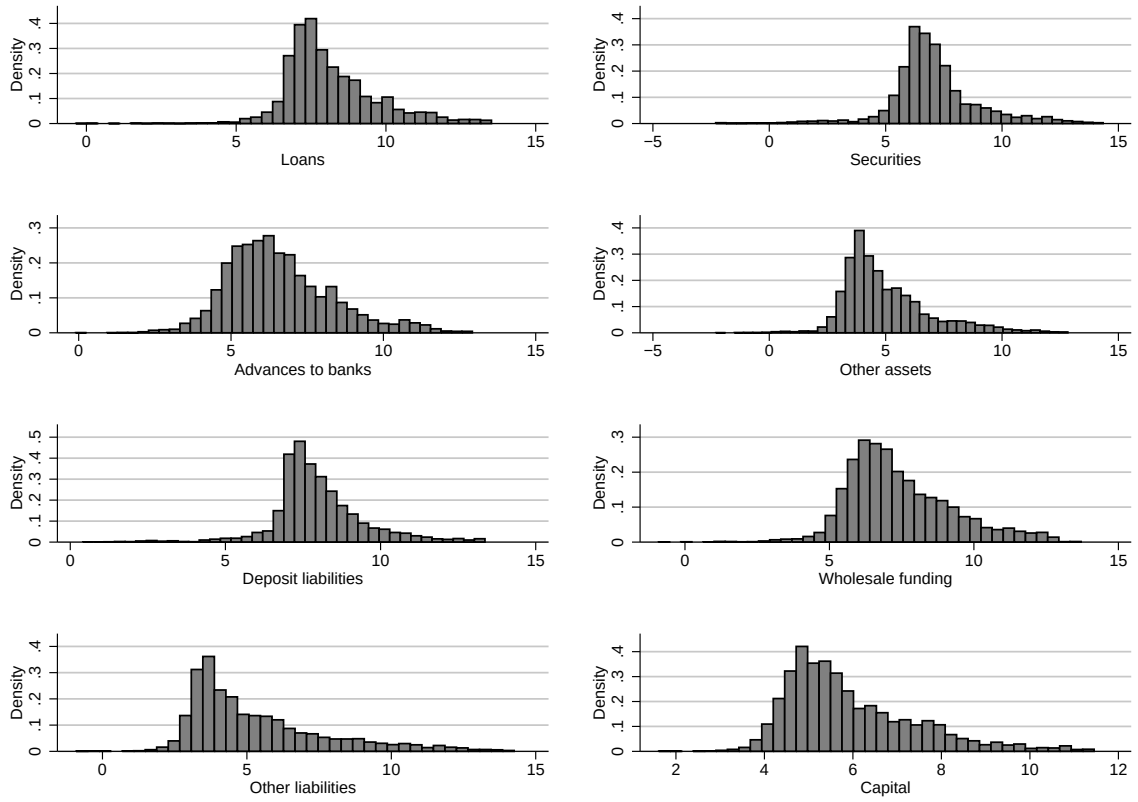

Figure E.7: Histograms bank-level asset and liability classes (measure B).

E.3 Cluster tree

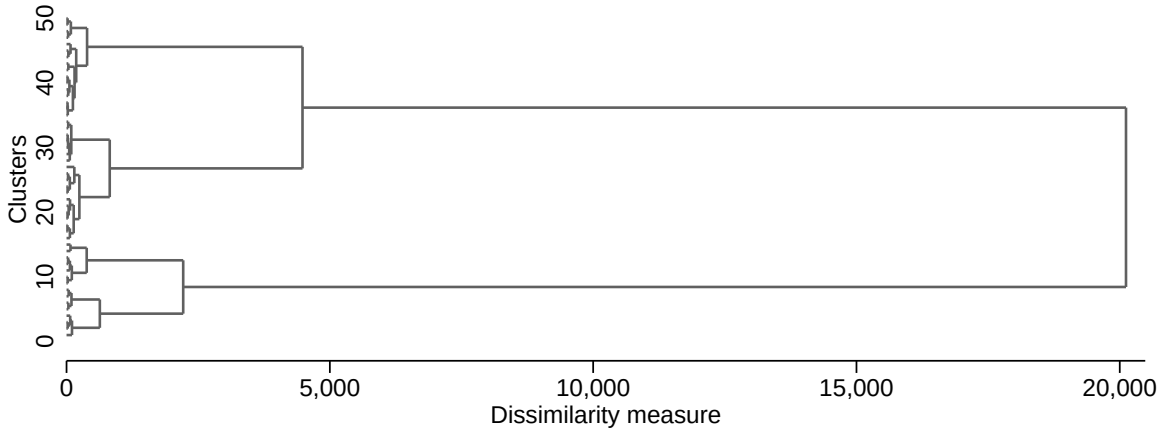

Figure E.8: Dendrogram of bank clusters in the Euro Area.

E.4 Transformation deposit funding and loan levels

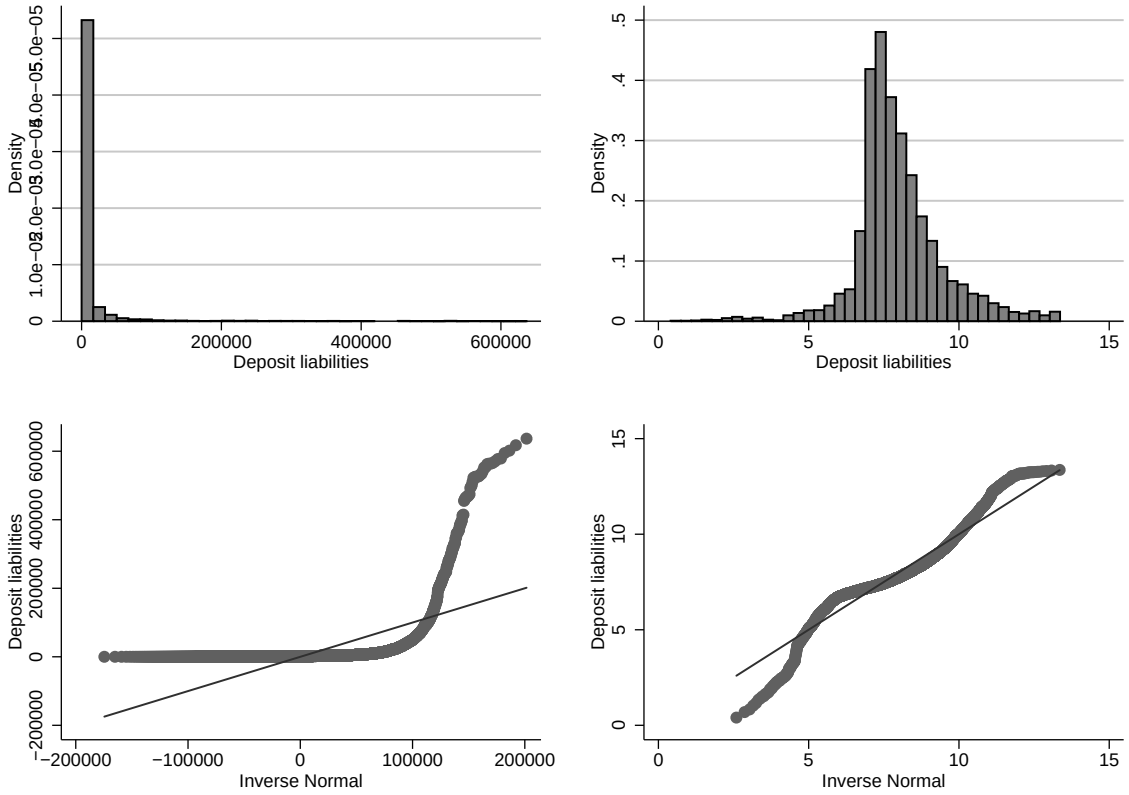

Figure E.9: Transformation of bank-level deposit funding levels (measure A; left) into natural logarithms (measure B; right) between 1999-2013.

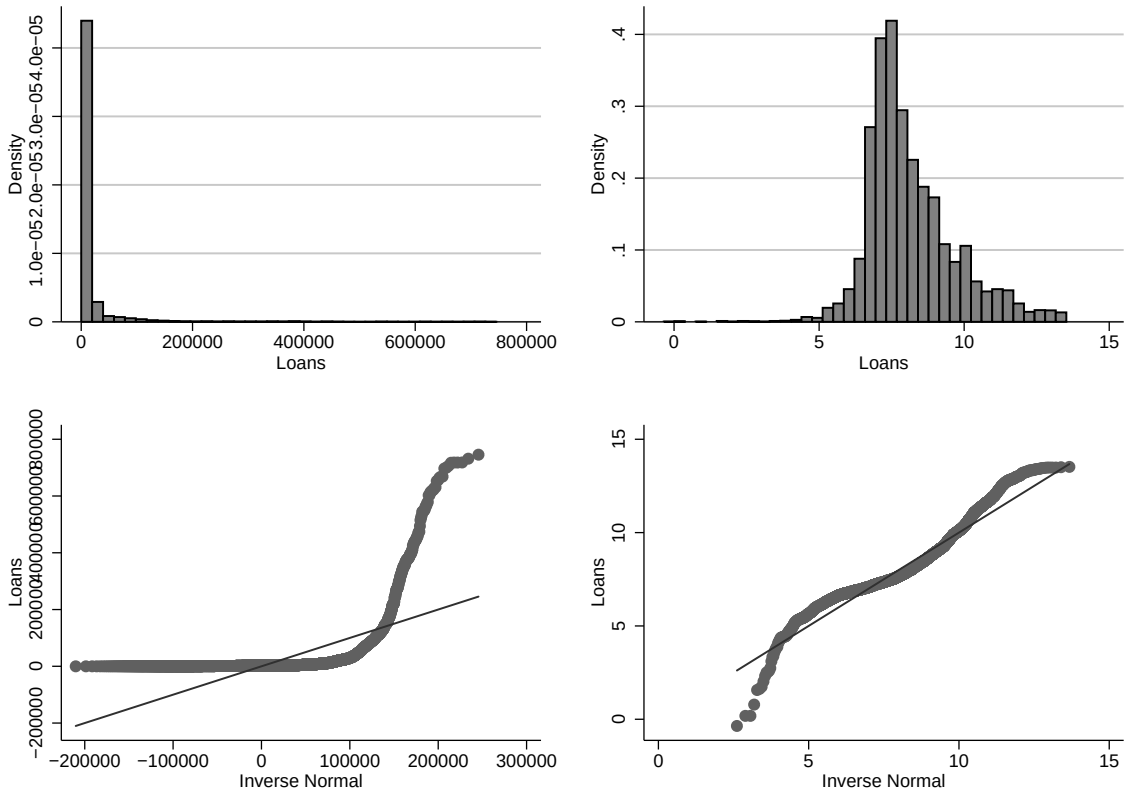

Figure E.10: Transformation of bank-level loan levels (measure A; left) into natural logarithms (measure B; right) between 1999-2013.

APPENDIX F

UNIT ROOT TEST RESULTS

F.1 Country-level unit root tests

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

	Austria	**Belgium**	**Finland**	**France**	**Germany**	**Ireland**
ρ	1.000***	1.000***	1.000***	1.000***	1.000***	1.000***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
$Z(\tau)$	5.823	5.527	5.819	7.558	5.920	4.229
N	179	179	179	179	179	179

	Italy	**Greece**	**Netherlands**	**Portugal**	**Spain**	**Luxembourg**
ρ	1.000***	1.000***	1.000***	1.000***	1.000***	1.000***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
$Z(\tau)$	4.008	2.408	5.179	1.186	4.244	5.221
N	179	179	179	179	179	179

Table F.1: Results Phillips-Perron unit root tests on country deposit funding levels at level between 1999-2013 (measure B).

$^{*}\ p < 0.10,\ ^{**}\ p < 0.05,\ ^{***}\ p < 0.01$

	Austria	**Belgium**	**Finland**	**France**	**Germany**	**Ireland**
ρ	0.148^{*}	0.065	-0.281^{***}	-0.056	0.173^{*}	0.027
	(0.07)	(0.07)	(0.07)	(0.08)	(0.07)	(0.07)
$Z(\tau)$	-11.980^{***}	-12.693^{***}	-17.474^{***}	$-14.09^{***}8$	-11.495^{***}	-13.015^{***}
N	178	178	178	178	178	178

	Italy	**Greece**	**Netherlands**	**Portugal**	**Spain**	**Luxembourg**
ρ	-0.127	0.085	0.003	-0.105	-0.020	0.221^{**}
	(0.07)	(0.07)	(0.08)	(0.07)	(0.08)	(0.07)
$Z(\tau)$	-15.044^{***}	-12.591^{***}	-13.372^{***}	-15.369^{***}	-13.615^{***}	-11.189^{***}
N	179	179	179	179	179	179

Table F.2: Results Phillips-Perron unit root tests on country deposit funding levels at first difference between 1999-2013 (measure B).

$^{*}\ p < 0.10$, $^{**}\ p < 0.05$, $^{***}\ p < 0.01$

	Austria	Belgium	Finland	France	Germany	Ireland
ρ	0.998^{***}	0.995^{***}	1.001^{***}	1.001^{***}	0.998^{***}	0.987^{***}
	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.01)
α	0.005	0.013	-0.002	-0.001	0.005	0.034^{**}
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
$Z(\tau)$	-0.754	-1.613	0.705	0.477	-0.670	-3.349^{**}
N	179	179	179	179	179	179

	Italy	Greece	Netherlands	Portugal	Spain	Luxembourg
ρ	1.000^{***}	0.986^{***}	0.994^{***}	0.987^{***}	0.994^{***}	0.993^{***}
	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)
α	-0.000	0.035^{**}	0.017	0.032	0.015	0.019^{**}
	(0.01)	(0.01)	(0.01)	(0.03)	(0.01)	(0.01)
$Z(\tau)$	0.259	-2.724^{*}	-1.952	-0.948	-1.474	-2.883^{*}
N	179	179	179	179	179	179

Table F.3: Results Phillips-Perron unit root tests with drift on country deposit funding levels at level between 1999-2013 (measure B).

$^{*}\ p < 0.10$, $^{**}\ p < 0.05$, $^{***}\ p < 0.01$

	Austria	**Belgium**	**Finland**	**France**	**Germany**	**Ireland**
ρ	-0.044	-0.074	-0.374^{***}	-0.239^{**}	0.007	-0.032
	(0.08)	(0.08)	(0.07)	(0.07)	(0.08)	(0.08)
α	0.000^{***}	0.000^{***}	0.001^{***}	0.000^{***}	0.000^{***}	0.001^{**}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
$Z(\tau)$	-13.902^{***}	-14.318^{***}	-21.590^{***}	-17.694^{***}	-13.201^{***}	-14.203^{***}
N	178	178	178	178	178	178

	Italy	**Greece**	**Netherlands**	**Portugal**	**Spain**	**Luxembourg**
ρ	-0.194^{**}	0.040	-0.122	-0.116	-0.113	0.044
	(0.07)	(0.08)	(0.07)	(0.07)	(0.07)	(0.08)
α	0.000^{***}	0.000^{**}	0.000^{***}	0.000	0.000^{***}	0.001^{***}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
$Z(\tau)$	-16.433^{***}	-13.012^{***}	-15.049^{***}	-15.633^{***}	-14.787^{***}	-12.908^{***}
N	178	178	178	178	178	178

Table F.4: Results Phillips-Perron unit root tests with drift on country deposit funding levels at first difference between 1999-2013 (measure B).

$^{*}\ p < 0.10$, $^{**}\ p < 0.05$, $^{***}\ p < 0.01$

	Austria	**Belgium**	**Finland**	**France**	**Germany**	**Ireland**
ρ	0.990^{***}	0.991^{***}	0.903^{***}	0.880^{***}	0.979^{***}	0.984^{***}
	(0.01)	(0.02)	(0.03)	(0.03)	(0.02)	(0.01)
β	0.000	0.000	0.000^{**}	0.000^{***}	0.000	0.000
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
α	0.026	0.022	0.232^{**}	0.314^{***}	0.056	0.039
	(0.04)	(0.04)	(0.07)	(0.08)	(0.05)	(0.04)
$Z(\tau)$	-0.872	-0.304	-2.543	-3.609^{**}	-1.210	-0.644
N	179	179	179	179	179	179

	Italy	**Greece**	**Netherlands**	**Portugal**	**Spain**	**Luxembourg**
ρ	0.929^{***}	1.000^{***}	0.986^{***}	0.922^{***}	0.983^{***}	1.015^{***}
	(0.02)	(0.01)	(0.02)	(0.03)	(0.02)	(0.01)
β	0.000^{**}	-0.000	0.000	0.000^{*}	0.000	-0.000^{**}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
α	0.182^{**}	0.001	0.036	0.194^{**}	0.041	-0.037
	(0.06)	(0.02)	(0.05)	(0.07)	(0.04)	(0.02)
$Z(\tau)$	-2.633	-0.171	-0.376	-2.557	-0.845	2.039
N	179	179	179	179	179	179

Table F.5: Results Phillips-Perron unit root tests with trend on country deposit funding levels at level between 1999-2013 (measure B).

$^{*}\ p < 0.10$, $^{**}\ p < 0.05$, $^{***}\ p < 0.01$

	Austria	Belgium	Finland	France	Germany	Ireland
ρ	-0.047	-0.084	-0.376^{***}	-0.241^{***}	0.005	-0.063
	(0.08)	(0.08)	(0.07)	(0.07)	(0.08)	(0.08)
β	-0.000	-0.000	0.000	0.000	-0.000	-0.000^{*}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
α	0.000^{***}	0.001^{***}	0.000	0.000^{***}	0.000^{***}	0.001^{***}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
$Z(\tau)$	-13.903^{***}	-14.444^{***}	-21.782^{***}	-17.690^{***}	-13.177^{***}	-15.187^{***}
N	178	178	178	178	178	178

	Italy	Greece	Netherlands	Portugal	Spain	Luxembourg
ρ	-0.196^{***}	-0.031	-0.139	-0.115	-0.125	-0.043
	(0.07)	(0.08)	(0.07)	(0.07)	(0.08)	(0.08)
β	0.000	-0.000^{***}	-0.000^{**}	-0.000	-0.000	-0.000^{***}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
α	0.000	0.001^{***}	0.001^{***}	0.000	0.001^{***}	0.001^{***}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
$Z(\tau)$	-16.433^{***}	-13.728^{***}	-15.416^{***}	-15.590^{***}	-14.926^{***}	-13.840^{***}
N	178	178	178	178	178	178

Table F.6: Results Phillips-Perron unit root tests with trend on country deposit funding levels at first difference between 1999-2013 (measure B).

F.2 Country-level unit root tests with structural break

$^{*}\ p < 0.10$, $^{**}\ p < 0.05$, $^{***}\ p < 0.01$

	At level			At first difference		
	Break 1	Break 2	$Z(\tau)$	Break 1	Break 2	$Z(\tau)$
Austria	$2005:6$		-2.774	$2009:4^{***}$		-9.550^{***}
	$2001:6$	$2004:10$	-3.985	$2005:4$	$2009:3$	-7.185^{***}
	$2004:7$	$2007:9$	-3.330	$2005:5$	$2009:4$	-7.251^{***}
Belgium	$2004:11$		-2.497	$2008:6^{***}$		-14.919^{***}
	$2002:9$	$2004:9$	-3.599	$2003:10$	$2007:2$	-10.5130^{***}
	$2004:6$	$2007:6$	-3.432	$2003:11$	$2007:3$	-15.294^{***}
Finland	$2007:9$		-3.978	$2009:2^{***}$		-12.150^{***}
	$2003:8$	$2007:7$	-2.762	$2000:10$	$2000:11$	-7.273^{***}
	$2007:6$	$2011:12$	-3.188	$2005:10$	$2005:11$	-11.585^{***}
France	$2011:2$		-3.447	$2012:2^{***}$		-8.975^{***}
	$2003:8$	$2009:7$	-2.859	$2000:8$	$2012:2$	-8.804^{***}
	$2002:10$	$2007:1$	-4.487	$2000:10$	$2012:3$	-8.754^{***}
Germany	$2007:8$		-3.349	$2012:12^{***}$		-8.101^{***}
	$2003:7$	$2008:1$	-3.103	$2007:9$	$2013:4$	-8.099^{***}
	$2002:7$	$2006:9$	-4.001	$2007:$	$2013:5$	-8.111^{***}
Ireland	$2010:12$		-3.558	$2007:11^{***}$		-11.201^{***}
	$2002:9$	$2005:9$	-4.299	$2007:9$	$2010:8$	-9.491^{***}
	$2002:5$	$2004:11$	-4.793	$2007:6$	$2010:9$	-11.651^{***}
Italy	$2007:10$		-7.257	$2010:8^{***}$		-16.573^{***}
	$2007:6$	$2010:7$	-2.544	$2007:8$	$2010:4$	-9.904^{***}
	$2004:8$	$2007:8$	-4.785	$2007:8$	$2007:12^{***}$	-15.591^{***}
Greece	$2011:4$		-3.351	$2009:7^{***}$		-5.757^{***}
	$2005:9$	$2011:5^{**}$	-3.220	$2009:10$	$2012:4$	-11.329^{***}
	$2005:2$	$2011:2$	-4.027	$2009:12$	$2012:5$	-5.898^{**}
Netherlands	$2006:11$		-3.964	$2008:12^{***}$		-15.775^{***}
	$2002:6$	$2007:2$	-3.405	$2005:8$	$2008:12$	-7.948^{***}
	$2001:9$	$2005:10$	-4.326	$2010:4$	$2010:9$	-16.125^{***}
Portugal	$2012:5$		-2.217	$2011:11^{***}$		-6.901^{***}
	$2005:8$	$2008:8$	-3.920	$2004:10$	$2011:12$	-12.380^{***}
	$2004:9$	$2007:2$	-4.918^{*}	$2004:9$	$2012:1^{*}$	-12.227^{***}
Spain	$2011:7$		-1.103	$2012:10^{***}$		-6.362^{***}
	$2000:12$	$2005:6$	-3.922	$2005:4$	$2009:2^{**}$	-7.282^{***}
	$2000:10$	$2005:1$	-4.797^{*}	$2005:5$	$2008:11^{**}$	-7.888^{***}
Luxembourg	$2008:12^{**}$		-4.937^{**}	$2008:5^{***}$		-8.852^{***}
	$2005:10$	$2012:10$	-3.942	$2000:11$	$2008:10$	-11.531^{***}
	$2004:10$	$2012:11$	-3.817	$2000:12$	$2008:11$	-9.209^{***}

Table F.1: Results Zivot-Andrews (ZA) and Clementes-Montanes-Reyes Additive Outlier (AO) and Innovational Outlier (IO) unit root test on country-level deposit funding levels between 1999-2013 (measure B). In line with the Phillips-Perron tests for unit root, a drift term is included and for the Netherlands and France a trend term.

APPENDIX G

VECM ESTIMATION RESULTS

		$\Delta Deposits_t$	$\Delta Loans_t$	$\Delta Deposits_t$	$\Delta Loans_t$	$\Delta Deposits_t$	$\Delta Loans_t$
Sample		**1999 - 2013**		**1999 - 2007**		**2008 - 2013**	
Observations (unbalanced)		5725		2354		3371	
Panels		565		500		565	
Periods		13		7		6	
Cointegration equation							
$Loans_{t-1}$	θ	0.7685^{***}		0.7419^{***}		0.5741^{***}	
		(0.0301)		(0.0332)		(0.0579)	
VECM							
Cointegration adjustment	γ_1, γ_2	-0.3055^{***}	0.0334^{*}	-0.6452^{***}	0.0867^{*}	-0.5885^{***}	0.0524
		(0.0611)	(0.0173)	(0.1050)	(0.0484)	(0.1015)	(0.0333)
$\Delta Deposits_{t-1}$	β_{11}, β_{21}	0.0821^{**}	0.0235	0.1524^{*}	0.0386	0.1622^{***}	0.0066
		(0.0393)	(0.0170)	(0.0794)	(0.0361)	(0.0385)	(0.0162)
$\Delta Loans_{t-1}$	β_{12}, β_{22}	-0.0605^{*}	0.0076	-0.1261^{**}	-0.0240	-0.0869^{*}	0.0261
		(0.0360)	(0.0531)	(0.0598)	(0.0698)	(0.0477)	(0.0713)
Intercept	α_1, α_2	0.0470^{***}	0.0378^{***}	0.0570^{***}	0.0547^{***}	0.0298^{***}	0.0275^{***}
		(0.0037)	(0.0042)	(0.0052)	(0.0058)	(0.0046)	(0.0055)
Adjusted R^2		0.1343	0.0045	0.2260	0.0121	0.3294	0.0052
Log-likelihood		-245.8800	844.5230	82.9925	341.9329	244.2103	525.0807
Akaike criterion		0.0873	-0.2936	-0.0671	-0.2871	-0.1425	-0.3092
Durbin-Watson statistic		2.0014	2.0684	1.7711	2.0314	1.7342	2.1407
F-statistic		29.6065	9.5951	230.0463	10.5781	552.7166	6.8227

$^{*}\ p < 0.10$, $^{**}\ p < 0.05$, $^{***}\ p < 0.01$

Table G.1: Estimation results of the VECM model (complete sample).

		$\Delta Deposits_t$	$\Delta Loans_t$	$\Delta Deposits_t$	$\Delta Loans_t$	$\Delta Deposits_t$	$\Delta Loans_t$
Sample		**1999 - 2013**		**1999 - 2007**		**2008 - 2013**	
Observations (unbalanced)		985		202		783	
Panels		138		93		138	
Periods		13		7		6	
Cointegration equation							
$Loans_{t-1}$	θ	1.0100^{***}		0.8602^{***}		0.8819^{***}	
		(0.0567)		(0.0856)		(0.0911)	
VECM							
Cointegration adjustment	γ_1, γ_2	-0.4072^{**}	0.0198	-0.5907^{**}	0.0465	-0.7293^{***}	0.0258
		(0.1620)	(0.0241)	(0.2667)	(0.0494)	(0.0924)	(0.0329)
$\Delta Deposits_{t-1}$	β_{11}, β_{21}	0.1894^{**}	0.0135	0.3786^{**}	-0.0072	0.1569^{**}	0.0219
		(0.0515)	(0.0177)	(0.1698)	(0.0544)	(0.0740)	(0.0161)
$\Delta Loans_{t-1}$	β_{12}, β_{22}	-0.0875	0.1516	-0.2609	0.2336^{**}	-0.0492	0.1065
		(0.1019)	(0.1104)	(0.1962)	(0.1136)	(0.1101)	(0.1193)
Intercept	α_1, α_2	0.0355^{***}	0.0223^{**}	0.1057^{***}	0.0974^{***}	0.0066	0.0024
		(0.0127)	0.009175	(0.0221)	(0.0178)	(0.0115)	(0.0094)
Adjusted R^2		0.1765	0.0244	0.2107	0.0265	0.5187	0.0201
Log-likelihood		-453.7861	83.9036	-12.2131	75.3581	-197.6876	42.6347
Akaike criterion		0.9300	$-.1622$	0.1605	-0.7065	0.5152	-0.0987
Durbin-Watson statistic		2.2072	2.1611	2.6230	1.6105	1.9924	2.2474
F-statistic		71.2842	9.1988	18.8885	2.8225	281.9563	5.3389

$^{*}\ p < 0.10$, $^{**}\ p < 0.05$, $^{***}\ p < 0.01$

Table G.2: Estimation results of the VECM model (investment orientation).

		$\Delta Deposits_t$	$\Delta Loans_t$	$\Delta Deposits_t$	$\Delta Loans_t$	$\Delta Deposits_t$	$\Delta Loans_t$
Sample		**1999 - 2013**		**1999 - 2007**		**2008 - 2013**	
Observations (unbalanced)		4736		2150		2586	
Panels		452		412		441	
Periods		13		7		6	
Cointegration equation							
$Loans_{t-1}$	θ	0.7311^{***}		0.7345^{***}		0.3320^{***}	
		(0.0332)		(0.0350)		(0.0425)	
VECM							
Cointegration adjustment	γ_1, γ_2	-0.2816^{***}	0.0518^{**}	-0.6548^{***}	0.0863	-0.4992^{***}	0.0290
		(0.0469)	(0.0221)	(0.1124)	(0.0538)	(0.0876)	(0.0337)
$\Delta Deposits_{t-1}$	β_{11}, β_{21}	0.0245	0.0167^{**}	0.1313	0.0434	0.0474	0.0000
		(0.0499)	(0.0213)	(0.0824)	(0.0394)	(0.0337)	(0.0187)
$\Delta Loans_{t-1}$	β_{12}, β_{22}	-0.0538	-0.0191^{*}	-0.1249^{**}	-0.0474	-0.0401	-0.0140
		(0.0346)	(0.0609)	(0.0622)	(0.0730)	(0.0359)	(0.0909)
Intercept	α_1, α_2	0.0505^{***}	0.0417^{***}	0.0534^{***}	0.0491^{***}	0.0268^{***}	0.0365^{***}
		(0.0035)	(0.0046)	(0.0052)	(0.0058)	(0.0046)	(0.0067)
Adjusted R^2		0.1361	0.0072	0.2339	0.0134	0.3288	0.0002
Log-likelihood		636.8961	784.4936	109.6637	290.2476	1101.4330	500.8135
Akaike criterion		-0.2673	-0.3296	-0.0983	-0.2663	-0.8487	-0.3842
Durbin-Watson statistic		1.9226	2.0679	1.7097	2.0044	1.9024	2.1523
F-statistic		249.7054	12.4251	219.7356	10.7576	423.1332	1.2096

$^{*}\ p < 0.10,\ ^{**}\ p < 0.05,\ ^{***}\ p < 0.01$

Table G.3: Estimation results of the VECM model (retail retail orientation.)

APPENDIX H

MULTIVARIATE REGRESSION RESULTS

	LOA	DVR	RSK	SZE	MPW	GNI	HPI	AGE	UNR	ESI	SOC	PPP	IND	GYI
LOA	1.000													
DVR	−0.035	1.000												
RSK	−0.113	−0.049	1.000											
SZE	0.916	−0.033	−0.108	1.000										
MPW	0.499	−0.043	−0.136	0.464	1.000									
GNI	−0.133	−0.017	0.293	−0.085	−0.423	1.000								
HPI	−0.057	−0.092	0.139	−0.047	−0.185	0.318	1.000							
AGE	−0.073	−0.089	0.204	−0.069	−0.241	0.557	0.133	1.000						
UNR	0.080	0.011	−0.059	0.050	0.016	0.022	−0.135	−0.198	1.000					
ESI	−0.034	0.012	0.044	−0.013	−0.020	0.096	−0.015	−0.043	−0.266	1.000				
SOC	−0.135	−0.009	0.279	−0.083	−0.432	0.992	0.317	0.512	0.145	0.006	1.000			
PPP	−0.054	0.057	−0.004	−0.005	−0.078	−0.030	0.187	−0.458	−0.290	0.057	0.040	1.000		
IND	−0.027	−0.015	0.056	−0.021	−0.023	0.074	−0.070	0.094	0.105	−0.019	0.065	−0.074	1.000	
GYI	0.007	0.003	−0.144	−0.014	0.148	−0.333	−0.108	−0.442	0.447	−0.078	−0.306	−0.072	−0.302	1.000

Table H.1: Correlation matrix linear regression variables

$^{*}\ p < 0.10$, $^{**}\ p < 0.05$, $^{***}\ p < 0.01$

	Geographical influences			
	Euro Area (excluding Germany)	Germany	Northern Euro Area	Southern Euro Area
LOA	0.181^{***}	0.164^{***}	0.182^{***}	0.091^{***}
	(0.041)	(0.049)	(0.030)	(0.018)
DVR	-0.004^{***}	-0.004^{***}	-0.004^{***}	-0.004^{***}
	(0.000)	(0.000)	(0.000)	(0.000)
RSK	-0.004^{**}	-0.002^{***}	-0.002^{***}	-0.007
	(0.002)	(0.000)	(0.000)	(0.004)
CLU	-0.012	0.002	0.003	-0.028
	(0.020)	(0.014)	(0.006)	(0.047)
MPW	0.001	-0.007^{**}	0.003	-0.006
	(0.003)	(0.003)	(0.003)	(0.007)
HPI	-0.001	-0.009^{**}	-0.004^{***}	0.002
	(0.001)	(0.004)	(0.001)	(0.001)
AGE	0.012		0.057^{*}	0.020
	(0.023)		(0.028)	(0.080)
UNR	-0.003	-0.012^{**}	0.001	0.001
	(0.004)	(0.005)	(0.005)	(0.006)
ESI	0.001	-0.001	-0.002^{*}	-0.000
	(0.001)	(0.000)	(0.001)	(0.002)
SOC	0.235		0.741^{***}	0.142
	(0.168)		(0.199)	(0.487)
PPP	0.015^{***}	0.003	0.004	0.014
	(0.002)	(0.007)	(0.003)	(0.007)
IND	-0.002	-0.000	0.001	-0.009
	(0.004)	(0.001)	(0.003)	(0.006)
GYI	-0.002	-0.029^{**}	0.047	-0.006
	(0.003)	(0.013)	(0.026)	(0.006)
α	1.196	6.068^{***}	-6.564^{*}	3.213
	(2.484)	(0.456)	(2.860)	(9.266)
Controls				
CAP	0.137	0.314^{***}	0.229^{**}	0.088
	(0.081)	(0.054)	(0.079)	(0.045)
N	2503	3486	5215	774
Overall R^2	0.689	0.827	0.867	0.827

Table H.2: The Euro Area (excluding Germany) and Germany regressions report the baseline specification for the Euro Area (as of 2008) without Germany and for Germany. These regressions are estimated with bank-specific fixed effects and standard errors are clustered by country (Euro Area without Germany specification) or by bank (Germany specification) and year-dummies are included. The other regressions also follow the baseline specification for the subsets Northern Euro Area (Austria, Belgium, Finland, France, Germany, Luxembourg and Netherlands) and Southern Euro Area (Greece, Ireland, Italy, Portugal and Spain). Standard errors are reported in parentheses; all bank-level variables are winsored at the 1- and 99-percentile level.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

	Bank business orientation		**Time period**	
	Investment	Retail	Pre-crisis	Post-crisis
LOA	0.238^{***}	0.177^{***}	0.212^{***}	0.138^{***}
	(0.057)	(0.053)	(0.038)	(0.027)
DVR	-0.004^{***}	-0.004^{***}	-0.003^{***}	-0.004^{***}
	(0.000)	(0.000)	(0.000)	(0.000)
RSK	-0.001	-0.002^{***}	-0.003^{***}	-0.001^{***}
	(0.001)	(0.000)	(0.000)	(0.000)
CLU			-0.014^{***}	-0.006
			(0.003)	(0.011)
MPW	0.001	-0.001	0.000	0.020^{***}
	(0.004)	(0.003)	(0.002)	(0.005)
HPI	-0.002	-0.003^{**}	-0.005^{***}	0.001
	(0.002)	(0.001)	(0.001)	(0.001)
AGE	0.021	0.015	-0.111	-0.017
	(0.034)	(0.017)	(0.065)	(0.029)
UNR	-0.002	-0.003	0.001	0.009^{*}
	(0.005)	(0.004)	(0.010)	(0.005)
ESI	-0.001	-0.001	-0.002	0.001
	(0.002)	(0.001)	(0.002)	(0.001)
SOC	0.035	0.468	0.060	-0.190
	(0.299)	(0.276)	(0.290)	(0.275)
PPP	0.011	0.006	0.008^{**}	0.014^{**}
	(0.007)	(0.004)	(0.003)	(0.006)
IND	0.004	-0.000	-0.001	0.001
	(0.008)	(0.003)	(0.004)	(0.003)
GYI	-0.004	-0.002	0.024	-0.003
	(0.011)	(0.004)	(0.026)	(0.009)
α	3.678	-1.618	8.390	7.543^{*}
	(4.294)	(3.313)	(5.714)	(4.190)
Controls				
CAP	0.164	0.214^{***}	0.230^{**}	0.189^{***}
	(0.092)	(0.059)	(0.092)	(0.038)
N	1845	4144	3182	2807
Overall R^2	0.862	0.849	0.849	0.784

Table H.3: The bank business orientation regressions show the results of specifications for the investment and retail orientations and are estimated with bank-specific fixed effects (dummy variable CLU excluded from specification). Standard errors are clustered by country and year-dummies are included. The other regressions show the results for identical specification (with dummy variable CLU included) for the subsets pre-crisis (1999-2007) and post-crisis (2008-2013). Standard errors are reported in parentheses; all bank-level variables are winsored at the 1- and 99-percentile level.

APPENDIX I

RESULTS RESIDUAL TESTS

Assumption	**Test**	H_0	$P-$**value**	**Outcome**
Independence	Durbin	no serial correlation	0.7668	residuals exhibit no serial correlation
Homoskedasticity	Koenker	constant variance with $\varepsilon_t \sim i.i.d.$	0.0000	residuals exhibit non-constant variance
Normality	Shapiro Wilk	normal distributed	0.0003	non-normal distributed
		($\mu = 0.0000$, $\sigma = 0.0000$, $\gamma = .6788$, $\kappa = 3.9960$)		

Table I.1: Residual tests for hypothesis 1a (executed with estat durbina, estat hettest, swilk *Stata, 2013).*

Assumption	**Test**	H_0	$P-$**value**	**Outcome**
Independence	Durbin	no serial correlation	0.0618	residuals exhibit no serial correlation
Homoskedasticity	Koenker	constant variance with $\varepsilon_t \sim i.i.d.$	0.0000	residuals exhibit non-constant variance
Normality	Shapiro Wilk	normal distributed	0.0333	non-normal distributed
		($\mu = 0.0000$, $\sigma = 0.0000$, $\gamma = .5035$, $\kappa = 3.5884$)		

Table I.2: Residual tests for hypothesis 1b (executed with estat durbina, estat hettest, swilk *Stata, 2013).*

Country	Independence	Homoskedasticity	Normality	Outcome
Austria	0.2316	0.0001	0.0022	residuals exhibit no serial correlation, non-constant variance and non-normality
Belgium	0.4338	0.0025	0.0237	residuals exhibit no serial correlation, non-constant variance and non-normality
Finland	0.0542	0.0350	0.0005	residuals exhibit no serial correlation, non-constant variance and non-normality
France	0.0001	0.0000	0.0293	residuals exhibit serial correlation, non-constant variance and non-normality
Germany	0.4112	0.0331	0.0001	residuals exhibit no serial correlation, non-constant variance and non-normality
Ireland	0.0609	0.0286	0.0000	residuals exhibit no serial correlation, non-constant variance and non-normality
Italy	0.2172	0.0000	0.0000	residuals exhibit no serial correlation, non-constant variance and non-normality
Greece	0.0360	0.0106	0.0077	residuals exhibit no serial correlation, non-constant variance and non-normality
Netherlands	0.7556	0.0495	0.0000	residuals exhibit no serial correlation, non-constant variance and non-normality
Spain	0.6226	0.0001	0.0027	residuals exhibit no serial correlation, non-constant variance and non-normality
Luxembourg	0.8055	0.4980	0.3500	residuals exhibit no serial correlation, constant variance and normality
Portugal	0.6981	0.0939	0.0010	residuals exhibit no serial correlation, constant variance and non-normality

Table I.3: Residual tests for country level unit root tests (executed with estat durbina, estat hettest, swilk *Stata, 2013).*

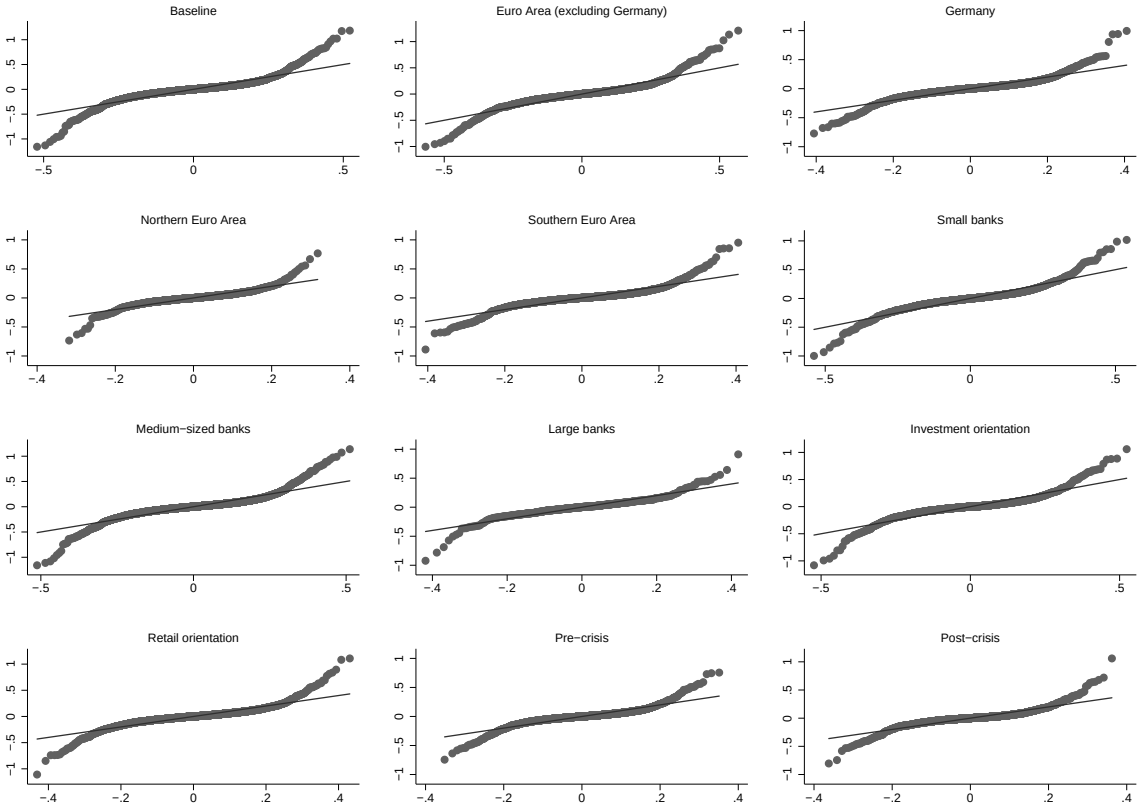

Figure I.1: Multivariate regression residual Q-Q plots for the different specifications.