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Three Essays on Bank Credit Investors and Debt Financing

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Abstract

Bank debt financing is a key element of bank capital structure and, as such, has a vital relevance for bank activity and stability. The global financial crisis and the banking reforms following it have significantly affected bank funding structure and, as a result, its cost of debt. In this context, bank credit investors have become object of interest due to their increased exposure to losses (e.g., bail-in measures), especially across Euro area banks that are the major issuers of bank bonds. This dissertation aims at analysing bank credit investor responses and investment choices, focusing on key issues – such as regulatory reforms, market discipline, and investor protection policies – that banks have recently faced. As bank bonds become riskier, understanding the drivers and the effect of bond financing contributes towards advancing knowledge in the banking literature and provides meaningful implications for bank management and supervision.

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Introduction

This introduction explains the background and the main purpose of this dissertation, along with the specific research questions addressed. This dissertation is composed of an introductory section, three research papers and overall conclusions, where the discussion on the main findings and contributions are outlined. The studies have been developed in compliance with academic standards and have been presented to several international conferences. Although they have an independent structure, these manuscripts are related to each other as they belong to a major research topic, detailed in the following. Part of the work of this dissertation has been conducted during my visiting period in Atlanta (USA) thanks to a fruitful collaboration between Ca' Foscari University of Venice and Georgia State University.

Background

Bank funding in the Euro area has evolved significantly over the past decade. This was the result of: i) the negative externalities associated to the global crisis, which magnified the contagion effect given bank interconnections and hindered the transmission channels of policy operations, with consequent effect on bank cost of funding (ECB, 2016)[1], and ii) the reforms implemented by regulators and policymakers, which aim at strengthening bank financing conditions to mitigate market shocks. More specifically, liquidity and funding risk emerged in the aftermath of the crisis as important aspects of bank stability. The relevance of these factors is

[1] ECB (European Central Bank), 2016. Recent developments in the composition and cost of bank funding in the euro area. ECB Economic Bullettin, Issue 1, pp. 26–45.

the main reason behind the introduction of the new Basel III liquidity regulation in 2010. The drivers (Dietrich, et al., 2014)[2] and impact of these liquidity standards (King, 2013; Hong, et al., 2014; Bruno, et al., 2016; Chiaramonte & Casu, 2017)[3] have been examined by a recent strand of literature with mixed results on the effectiveness of the regulation. Research clearly documents that the adoption of the liquidity requirements might influence banks either positively (Dietrich, et al., 2014) or negatively (Allen, et al., 2012)[4] due to the structural adjustments required, especially for weak banking firms, to fulfill the reform.

As the crisis intensified, this adverse environment gave rise to critically high thresholds of non-performing loans (NPL) among banking firms in the Euro area, particularly in vulnerable countries. As a result, supervisory focus has shifted to bank asset quality, with concerns on financing channels for bad loans. With the extensive banks' asset risk assessment (AQR) performed by the ECB in 2014, regulators released guidelines and recommendations to rise disclosure on risk exposures and support market discipline.

In this context of adverse market conditions and increasing weakness in bank funding structure, the figure of bondholder has emerged. The EU bail-in legislation, and some reforms that may rise asset encumbrance (e.g., Basel III), have made unsecured bondholders more exposed to losses in case of bank's failure. While the increased risk of losses should increase the cost of unsecured debt, reforms and policy interventions should reduce risk-taking and perceived

[2] Dietrich, A., Hess, K. & Wanzenried, G., 2014. The good and bad news about the new liquidity rules of Basel III in Western European countries. *Journal of Banking & Finance,* Volume 44, pp. 13–25.

[3] King, M. R., 2013. The Basel III Net Stable Funding Ratio and bank net interest margins. *Journal of Banking & Finance*. Volume 37, pp. 4144–4156.
Hong, H., Huang, J.-Z. & Wu, D., 2014. The information content of Basel III liquidity risk measures. *Journal of Financial Stability,* Volume 15, pp. 91–111.
Bruno, B., Onali, E. & Schaeck, K., 2016. Market reaction to bank liquidity regulation. *Journal of Financial and Quantitative Analysis*, forthcoming.
Chiaramonte, L. & Casu, B., 2017. Capital and liquidity ratios and financial distress. Evidence from the European banking industry. *The British Accounting Review,* Volume 49, pp. 138–161.

[4] Allen, B., Chan, K.K., Milne, A. & Thomas, S., 2012. Basel III: Is the cure worse than the disease?. *International Review of Financial Analysis*, Volume 25, pp. 159–166.

risk of TBTF financial institutions. Clearly, such changes have central importance for bank stability and are particularly relevant for Euro area banks that, compared to the largest world economies, are the major issuers of bonds (IMF, 2013)[5].

Given the importance of bond financing and the recent evolution of bondholder obligations, concerns have also emerged regarding the protection of unsophisticated retail investors, who should comprehensively understand the level of risk assumed when making investment decisions. Concentrating debt holdings of weak banking firms may indeed result in relatively risky exposures for some classes of investors. Although bank bonds have been misleadingly treated as risk-free investments in the past, one of the key lessons from the recent financial crisis is that banks can fail and unsecured bondholders can lose their money.

The three research papers have been developed considering the above-mentioned backdrop. In the following, I will outline in detail the goal and research questions of this dissertation, briefly explaining the three papers that compose it.

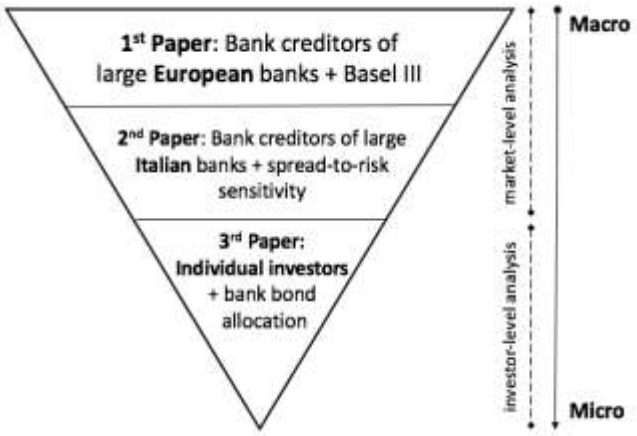
Purpose and research questions of the dissertation

In a framework of turbulent market conditions and structural reforms, the importance of bond financing for many Euro area banks and the rise of bondholders' prospective losses provide an interesting context to examine the reaction, and behavior, of bank credit investors.

The important theoretical and practical implications that stem from the understanding of the factors influencing, and behaviours emerging from, bank funding structure is a central aspect that motivates this dissertation. Each paper contributes to the literature on debt financing, providing three different yet interrelated perspectives that start with a macro and end with a micro view of

[5] IMF (International Monetary Fund), 2013. Changes in bank funding patterns and financial stability risks. Global Financial Stability Report, Chapter 3, October.

Figure 1. Dissertation key concepts and levels of analysis



the phenomenon. The first paper presents a macro perspective, examining the reaction of creditors of the largest European banks to events on Basel III liquidity regulation. Thereafter, the second paper focuses on Italian banks, testing the sensitivity of bond spreads to the major risks emerged following the financial turmoil. Finally, in the third paper, I adopt a micro-level analysis, investigating bank bond holdings of retail investors in Italy. Indeed, while the first two papers perform a market-level analysis, the third paper makes use of unique data on household investment choices (Figure 1).

More specifically, the studies of this dissertation aim at addressing the following specific research questions:

1. How have bank creditors responded to the progressive release of information concerning the liquidity standards, as part of the new Basel III regulatory framework?
2. Does the market discipline bank risk-taking during turbulent market conditions? And do bondholders price bank liquidity, funding, and asset risk in the aftermath of the crisis?
3. What determines households' propensity to concentrate their investments in bank bonds?

These empirical questions regard timely issues in the banking sector as they are grounded on the recent changes and developments that have affected the banking industries and, as a result, their credit investors. Since banking reforms are a key pillar in this respect, the first study examines the effectiveness of the liquidity portion of Basel III to limit bank credit risk. This is done through a two-stage analysis. Firstly, I conduct an event study by identifying the official

announcements that occurred over the 2007-2015 period that led to the introduction of the liquidity rules as well as use changes in bank Credit Default Swap (CDS) spreads, as proxy for bondholders' perceived credit risk. Secondly, I perform a regression analysis constructing bank-specific characteristics related to liquidity, funding, capitalization, and asset risk to test the hypothesis of a heterogeneous CDS market reaction and hence identify the attributes of banks that are more and less exposed to the rule change.

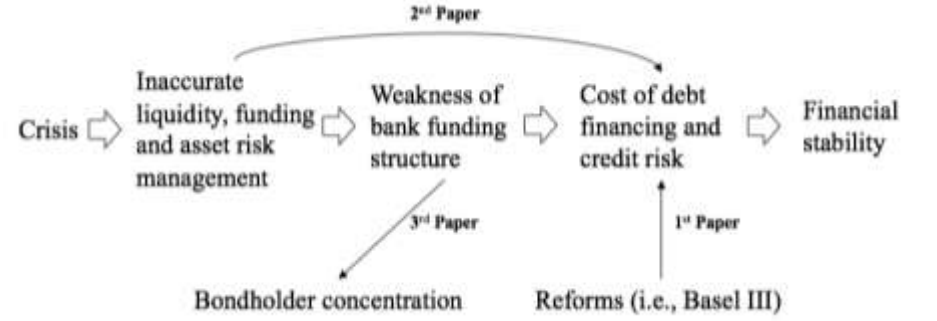
While regulators' ability to constrain risk-taking behaviour is a central aspect, it is complemented by the role of the market in disciplining banks, which becomes particularly relevant in adverse market conditions. To this regard, the second study, drawing on the market discipline literature, examines in the 2007 to mid-2014 period the spread-to-risk relationship in the Italian bank bond market. In addition to standard, easy-to-observe measures, the study uses newly proposed indicators of bank risk. These measures have both a backward- and forward-looking view, and focus on the key risk dimensions that are major drivers of bank stability. Given the aim and novel character, the research provides implications on the presence and strength of market discipline in hostile market conditions.

As funding needs raised with the onset of the financial crisis, many banks especially in Italy issued bonds targeted at retail investors in the attempt to mitigate funding concerns. However, with the increased risk of losses and potential agency problems, this prompted concerns about the accuracy and efficacy of the current regime to protect investors. To contribute shedding light on this issue, the third study investigates the factors explaining concentration of households' investments in bank bonds. A major strength of this study lies in the dataset, which includes panel year-end observations over the 2011-2015 period of roughly 25,000 investors receiving tailor-made recommendations from bank financial advisors. Relying on prior research on

household finance and agency issues in the banking sector, I develop three hypotheses based on investor attributes, bank-client relationship, bank, and branch information.

Figure 2 provides an overview of the main relationships analysed in each paper and the links between them. The three manuscripts deal with arguments, which provide either directly or indirectly information characterizing soundness and stability of banking firms. Hence, this dissertation will increase knowledge in the debt financing literature, with relevant implications for researchers, practitioners, and policymakers.

Figure 2. Overview of the dissertation



List of conference and seminar presentations sorted by paper

Paper I: "Basel Liquidity Regulation and Credit Risk Market Perception: Evidence from Large European Banks" (to be submitted to the Journal of Banking & Finance)

European Financial Management Association (EFMA) 2016 Annual Meetings in Basel, Switzerland

2016 Annual Conference of the Multinational Finance Society (MFS) in Stockholm, Sweden

2016 Annual World Finance Conference in New York, USA

2016 Mathematical and Statistical Methods for Actuarial Sciences and Finance (MAF) Conference in Paris, France

2016 Wolpertinger Conference in Verona, Italy

2016 ADEIMF Summer Conference in Varese, Italy (the paper won the ADEIMF Award Plaque 2016)

Finance Department Brown Bag Seminars at Georgia State University in Atlanta, USA (academic year 2016-2017)

Paper III: "What Drives the Concentration of Households' Investments in Bank Bonds?"

European Financial Management Association (EFMA) 2017 Annual Meetings in Athens, Greece

2017 Annual Conference of the Multinational Finance Society (MFS) in Bucharest, Romania

2017 Behavioural Finance Working Group Conference in London, UK

2017 ADEIMF Summer Conference in Rome, Italy

Paper I

Basel Liquidity Regulation and Credit Risk Market Perception: Evidence from Large European Banks

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Basel Liquidity Regulation and Credit Risk Market Perception: Evidence from Large European Banks

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Abstract

Following the recent financial crisis, the Basel Committee on Banking Supervision (BCBS) undertook a negotiation process that led to a liquidity reform package known as the new Basel III liquidity framework. This paper aims at assessing the impact of BCBS liquidity regulation announcements on bank creditors. Using an event study on Credit Default Swap (CDS) data of large European banks over the 2007-2015 period, there is evidence that creditors increase their expectations of a credit event following the regulatory events, with CDS spreads widening. Results from the regression analysis show that this effect depends on bank-specific factors. Specifically, the negative CDS market reaction weakens when banks hold higher liquidity and capital ratios. On the contrary, the negative CDS market reaction strengthens when banks hold a higher bad loan ratio. Provisions against loan losses positively moderate this effect. Although at the aggregate level credit risk increases following regulatory events on liquidity, we provide some evidence that if banks correctly adjust the quality and the mix of their assets and liabilities, they can limit the potential side effects of the adoption of the new rules. Overall, the research contributes to the understanding of the Basel III effects on bank credit risk and financial stability.

Keywords: Liquidity Regulation, Credit Default Swap, Event Study, Basel III

1. Introduction

This study examines bank creditors' reaction to announcements by the Basel Committee on Banking Supervision (BCBS) on liquidity regulation, as part of the new Basel III framework.

Since the outbreak of the financial crisis in summer 2007, liquidity and funding risk[6] have played a central role in the field of banking regulation, which until then was almost exclusively focused on capital ratios (Santos & Elliott, 2012). The lack of a regulation specifically focused on liquidity proves that this issue was not a primary interest of policymakers before the turmoil. However, following the crisis, the common idea that a well-capitalized bank would always be able to raise funds became weak: banks, despite meeting the regulatory capital requirements, experienced serious funding difficulties due to their excessive reliance on unstable, low quality sources of funding, inadequate asset-liability mismatch and risky off-balance sheet transactions (ECB, 2013).

As a response to the vulnerabilities exposed during the crisis, the BCBS undertook a negotiation process of new, international standards to address the formerly underestimated liquidity risk management. During this negotiation period, which went on from February 2008 to June 2015, several amendments were released prior to the final version of the new liquidity reform package introducing the Liquidity Coverage Ratio (LCR) and Net Stable Funding Ratio (NSFR).

This paper is the first to empirically analyse the impact of the progressive release of official documents by the BCBS concerning liquidity regulation (occurring in the period 2008-2015) on the CDS market of large European banks, which reflects creditor expectations of default risk. To this purpose, we perform an event study to estimate cumulated abnormal spread changes (CASs)

[6] Liquidity risk is the "*ability to finance cash outflows at any given point in time"* (King, 2013b, p. 4145), while funding risk "*refers to a bank's ability to raise funds in the desired amount on an ongoing basis*" (King, 2013b, p. 4145).

around announcement days, testing their statistical significance. We then run a regression analysis aimed at identifying the main determinants of CASs to investigate the heterogeneous response of investors.

In this framework, examining bank creditors in Europe provides an interesting setting for two reasons. First, they are excluded from Deposit Insurance Schemes; the lack of protection, along with the severe period that the banking system was experiencing, has likely raised creditors' concerns about bank soundness and insolvency risk. Second, European financial institutions are expected to experience the greatest impact by the liquidity requirements as compared to banks in other counties, such as the U.S.. Among the main explanations of this aspect, there is the European banks' higher amount of wholesale funding and funding gap (Ötker-Robe & Pazarbasioglu, 2010, Fig. 8), which explains the historically lower NSFR in Europe than North America (IMF, 2011, Fig. 2.1.), and the fact that most European countries had no pre-existing liquidity rules before Basel III. In contrast, in the U.S. bank liquidity standards have been established in the past (Dietrich, et al., 2014).

Several prior studies have examined regulatory events and their impact on the market (e.g., Dann & James, 1982; James, 1983; Allen & Wilhelm, 1988; Wagster, 1996; Mamun, et al., 2004; Yildirim, et al., 2006; Armstrong, et al., 2010; Bhat, et al., 2011; Kolasinski, 2011; Georgescu, 2014). However, with regards to bank liquidity regulation, we are aware of only one paper by Bruno et al. (2016) dealing with shareholders' wealth effects to announcements on Basel III. While Bruno et al. (2016) analyses the impact of the regulation on bank performance, which represents a secondary effect of the adoption, we examine one of the primary purposes of the regulation that is its impact on bank credit risk. Given the weak conditions of banks during

the financial turmoil, credit risk reduction is indeed one of the central goals of the liquidity framework (Hong et al., 2014).

Results from our analysis show that creditors perceive the introduction of tighter liquidity regulation as increasing bank default risk and that this market response is explained by bank-specific features. More specifically, banks with stronger liquidity and higher capital ratios are less sensitive to regulatory events, whereas banks with a higher bad loan ratio, not sufficiently covered by loan loss reserves, are more sensitive to liquidity regulation announcements.

The contributions of our paper to prior literature are manifold. It increases knowledge of the ongoing debate about the effectiveness of the Basel III liquidity rules in pursuing their intended objective of mitigating bank credit risk (Hong, et al., 2014). By performing both a univariate and multivariate analysis, we assess in a short-term perspective not only the aggregate credit market reaction but, importantly, the role of bank-specific characteristics in influencing such response. This aspect has a twofold implication: it may help bank managers to mitigate the negative repercussions of the adoption depending on their balance sheet structure (Härle, at al., 2010; Allen, et al., 2012) and policymakers to design regulations that are better aligned with their goals. Finally, this research complements the extant empirical literature investigating the impact of the new regulatory framework on bank performance (King, 2013b; Dietrich, et al., 2014; Bruno, et al. 2016) and financial stability (Bologna, 2011; Vazquez & Federico, 2015; Chiaramonte & Casu, 2017).

This paper is structured as follows. Section 2 provides an overview of the Basel III liquidity requirements. Section 3 briefly reviews major studies on this topic. Section 4 develops the different hypotheses to be tested. Thereafter, Section 5 describes the data and methodology used for the empirical analyses. Section 6 presents the findings. Finally, Section 7 concludes.

2. Background to Basel III liquidity requirements

Following the onset of the 2007 financial turmoil, the inaccurate liquidity management and funding structure of banks became a central issue when liquidity risk rose on banks' annual report. In that difficult period, banks experienced significant liquidity shortfalls as a result of: erroneous planning of maturity transformation, high holding of poorly liquid assets, inadequate dependence on less stable funding sources (i.e., wholesale market), and high liquidity risk exposure from off-balance sheet operations. Therefore, financial institutions started to store liquid assets for security reasons and diminished their interbank operations and lending activity to the real economy (ECB, 2013). This led to credit fall, resulting in a substantial reduction of liquidity funding in several markets (Strahan, 2012). In this context, the European Central Bank (ECB) adopted extraordinary measures, providing two Longer Term Refinancing Operations (LTROs)[7] with a maturity of three years. These non-standard monetary operations supported and helped Eurozone banks to fulfil their debt obligations and manage their liquidity needs (ECB, 2011).

Given the erroneous and ineffective risk management practices during the crisis (ECB, 2013), the BCBS released in December 2009 a preliminary document to deal with the increasing concerns on liquidity risk. This Consultative Document was published after a series of previous attempts to address this issue, which involved other press releases over the 2008-2009[8] period. This proposal is intended to strengthen the financial system stability by increasing "*the resilience of internationally active banks to liquidity stresses across the globe, as well as increasing*

[7] In this respect, the European Central Bank (ECB) carried out two three-year Longer Term Refinancing Operations (LTROs): the first one on 21st December 2011 and the second one on 29th February 2012, introducing respectively €489 billion and €529 billion in the market.
[8] Further details regarding these publications are provided in paragraph 5.2.1..

international harmonisation of liquidity risk supervision" (BCBS, 2009, p. 1). To this purpose, the Consultative Document proposed two different but related standards on bank balance sheets: the Liquidity Coverage Ratio (LCR) and the Net Stable Funding Ratio (NSFR), which concern respectively liquidity and funding risk. The LCR is conceived to support banks in facing short-term liquidity shocks, mitigating the risk of substantial liquidity outflows by requiring banks to hold a minimum liquidity buffer. In contrast, the NSFR is constructed to increase bank amount of long-term funding sources and penalizing short-term wholesale funding, a major issue during the financial crisis, to mitigate maturity mismatch between assets and liabilities.

Following this proposal, in December 2010 the final version of the new liquidity standards was released by the BCBS, in which the LCR was partially loosened and the NSFR was kept substantially unchanged. Despite amendments to the ratios, the reaction of the banking community to this press release was of enormous dissent. In that period, European banks were experiencing the severe repercussions of the sovereign debt crisis and perceived the adoption of the liquidity requirements as punitive. Overall, the publication received strong criticism, especially among European banks that, holding higher amounts of wholesale funding compared to U.S. financial institutions (Ötker-Robe & Pazarbasioglu, 2010, Fig. 8), were clearly less equipped to fulfil the new standards.

Thereafter, a series of revisions and adjustments were made by the BCBS as a response to banks' criticisms and regulatory assessments. This led to a weakening of the initial version of the documents and the progressive implementation[9] of the liquidity standards to mitigate and contain potentially negative effects on the credit market. In light of this, additional amendments were released that remained in force until June 2015, when the final document on the NSFR was published, introducing some minor revisions on the disclosure standards of the ratio. According

[9] This aspect specifically concerns the Liquidity Coverage Ratio (LCR).

to the BCBS official publications, the initial minimum level for the LCR is 60% as of January 2015. It will progressive rise until reaching the 100% requirement in 2019 (BCBS, 2013a). The NSFR instead will be adopted in January 2018, requiring banks to maintain a minimum level of 100% (BCBS, 2014d).

Overall, the new Basel III liquidity requirements will raise bank liquidity cushion and limit maturity imbalances, thereby expecting to mitigate systemic liquidity risk exposures and contagion effects (ECB, 2013).

Importantly, all member nations of the BCBS[10] have to adopt the liquidity standards. In case of non-compliance, banks will incur into financial penalties and in the worst-case scenario the cancellation of the banking licence.

3. Related literature

3.1. Bank regulation and market effect

Research on market reaction to changes in banking regulation can be dated back to the 80s, when the first single-country papers on this topic appeared in the literature. These studies are mainly oriented to the U.S. and analyse equity investors only.

Among the most important papers, Dann and James (1982) examine shareholders' wealth effects of three events that occurred over the 1973-1978 period concerning regulatory changes on deposit interest rate ceilings. By analysing a sample of U.S. saving and loan (S&L) institutions, they find a significant reduction in the market value of stocks following the rule change. Afterwards, James (1983) undertakes a similar study, including data on U.S. commercial banks,

[10] The list of Member Nations, as part of the Basel Committee of Banking Supervision (BCBS), is available here: http://www.bis.org/bcbs/membership.htm.

and documents intra-industry heterogeneous effects around events on movements in ceiling rates on deposits.

Other deregulations, following the earlier reforms, led to the 1980 Depository Institutions Deregulation and Monetary Control Act (DIDMCA) analysed by Allen and Wilhelm (1988). The authors find that the regulation substantially effected the bank competitive environment: institutions member of the Federal Reserve System (FRS) gain from the adoption, whereas non-FRS and S&L institutions lose their stock market value owing to DIDMCA announcements.

Shifting to a more international environment, the first multi-country study is that of Wagster in 1996. He conducts an event study using data on seven countries to examine how the competitiveness of worldwide banks was influenced by the introduction of the 1988 Basel Capital Accord. His empirical results reveal a positive market reaction to all regulatory events only for Japanese banks, concluding that the regulation fails to reduce the competitive disparities among nations within the banking industry stemming from an advantageous position of Japanese banks.

Since the beginning of the 21st century, a series of management studies started to examine the key events leading to the introduction of the U.S. Gramm-Leach-Bliley-Act (GLB)[11] in 1999. Among others, the most important works are those by Mamun et al. (2004) and Yildirim et al. (2006) who find a significant reduction in the systematic riskiness of the financial industry during the days in which the GLB was introduced.

In addition to U.S.-based research, more recent studies focus on the European market and banking system. Armstrong et al. (2010) analyse a series of announcements (2002-2005) related to the introduction of IFRS standards in the European stock market. The authors discover that

[11] "*The GBL Act repealed the Glass-Steagall Act of 1933 and the Bank Holding Company Act of 1956 and allowed banks, brokerage firms, and insurance companies to merge*" (Mamun, et al., 2004, p. 333).

banks with lower disclosure quality and higher bank-investor asymmetric information prior to the adoption react positively to IFRS events, consistently with the expected rise in reporting quality following IFRS.

Thereafter, in the face of the 2007-2008 turmoil and consequent weakening of the financial system, which led shareholders and creditors to question about bank solvency, research began to examine bondholders as well. This was motivated by the fact that creditors became increasingly exposed to losses and, as a result, more sensitive to credit risk compared to the pre-crisis period.

Among these studies, Georgescu (2014) examines how credit and equity market participants responded to the relaxation of fair value accounting in 2008. By conducting an event study on stocks, bonds, and CDSs of European banks, Georgescu (2014) finds that bondholders and shareholders display heterogeneous responses. Another recent paper is that by Bhat et al. (2011), who investigate how bond and stock prices react to a series of announcements on the rule change about mark-to-market accounting. They find that, to different extent, both bondholders and shareholders benefitted from the loosening of the accounting rule.

Overall, the literature highlights significant redistribution of resources owing to rule changes. The purpose of this paper is to analyse how bank creditors respond to the introduction of the new liquidity rules. For this reason, we next turn our attention to research on the Basel III effects.

3.2. Recent studies on Basel III liquidity standards

One of the central issues discussed in the literature is the impact of the new liquidity standards on bank asset-liability management, since long-term sources[12] are costly and holding high quality liquid assets yields low returns to banks (Dietrich, et al., 2014). Constructing the typical bank in 15 countries, King (2013b) estimates compliance with the NSFR at the end of

[12] Under the assumption of a positively sloped yield curve.

2009, outlining the most cost-efficient procedures to meet the index in case the ratio falls below the minimum threshold. By analysing various strategies, he argues that the most effective requires raising the maturity of wholesale funding and the stock of higher-rated financial instruments. However, these adjustments will narrow down net interest margins (NIMs) "*by 70-88 basis points on average*" (King, 2013, p. 4155).

As a result of the downward pressures on lending margins, banks' return on equity (ROE), a standard measure of bank profitability, is expected to decrease (Härle, at al., 2010). Nevertheless, research also points out the beneficial effects of the adoption. Examining the drivers and outcomes of the NSFR prior to its introduction (1996-2010), Dietrich et al. (2014) show that this ratio does not influence a set of bank profitability variables. The authors interpret this result as evidence of the existence of well-balanced business models able to raise profits despite potentially disadvantageous high costs related to the implementation of the index.

Business models are in fact another relevant topic analysed by prior research. Allen et al. (2012) state that the Basel III effects can be less harmful than fears in the banking community. However, to have such a favourable result, substantial structural changes are required, which represent a significant challenge for financial institutions in the transition period towards the adoption. The authors claim that bank business models will shift toward a liability-oriented asset management, primarily focused on stable and long-term funding sources, and point out that bank failure to implement these necessary changes may make the *"cure […] worse than the disease*" (Allen, et al. 2012, p.160).

It is generally agreed that banks with a more heterogeneous funding structure, as is the case of investment banks, are more likely to experience difficulties in meeting the liquidity standards,

since they generally rely on funding sources (e.g., wholesale debt) penalized by Basel III criteria (Dietrich, et al., 2014)[13].

A more recent and relatively limited strand of literature focuses on the relation between Basel III liquidity standards and bank failures. Using data on U.S. commercial banks over the 2001-2011 period, Hong et al. (2014) perform a comprehensive estimate of the NSFR and the LCR to investigate the effect of these ratios in explaining bank failures. They find marginal effects of the liquidity standards on bank failures, concluding that the idiosyncratic liquidity risk plays a minor role. Results of Vazquez and Federico (2015), based on a 2001-2009 dataset of U.S. and European banks, document instead that holding a higher level of NSFR in the pre-crisis years reduces bank likelihood to failure during the global turmoil. Similarly, Chiaramonte and Casu (2017) show, from a dataset of European banks during the 2004-2013 period, that a higher NSFR decreases bank probability to fail and experience financial distress, in line with the targeted goal of the regulator.

Drawing upon this literature, we take a different view on this phenomenon examining the short-term effect of Basel III liquidity regulation on market expectations of bank default risk. Because the regulation has developed over a series of years with revisions to the initial proposal and has not been fully adopted yet, an event study perspective provides an accurate and effective framework to capture the evolving nature of this regulatory process. Therefore, consistently with King (2009), we adopt a market approach using CDS data to look at the credit market reaction to events on liquidity regulation.

To the best of our knowledge, the work by Bruno et al. (2016) is the closest to ours. They examine the stock market response to liquidity regulation announcements and find a negative

[13] Prior empirical studies document that investment banks exhibit lower NSFR than commercial and universal banks (Ötker-Robe and Pazarbasioglu, 2010, Fig. 7; IMF, 2011, Fig. 2.2.).

share price reaction around the days leading to the reform, indicating that shareholders view the adoption as decreasing bank profitability. They further report heterogeneous reactions based on the country of origin and bank-specific characteristics. Differently from Bruno et al. (2016) who investigate a consequent regulatory effect, by means of credit derivatives we explore one of the main goals of the regulation that is credit risk reduction.

4. Hypotheses development

To the extent that liquidity regulation provides new information to investors, we expect a significant market reaction to the rule change. A positive reaction would suggest that creditors view the introduction of the liquidity rules as reducing bank default risk, with CDS spreads narrowing around the event days. A negative reaction would instead indicate that creditors perceive the standards as increasing default risk, with CDS spreads widening following the regulatory events (King, 2009).

There are several arguments in favour of the former hypothesis of a positive response. The regulation is indeed designed to strengthen banks' liquidity conditions, improving banking system soundness and ultimately reduce bank credit risk (BCBS, 2010). In line with this view, Banerjee and Mio (2014) claim that tighter liquidity rules decrease bank interdependence, mitigating contagion risk. Consistently, Chiaramonte and Casu (2017) find a negative relationship between NSFR and bank likelihood to fail and distress. Finally, Dietrich et al. (2014) show a positive impact of the liquidity standard, since high NSFR banks display lower earnings volatility.

The above research supports the beneficial effects of liquidity regulation on bank soundness and explains why creditors may respond positively, reducing their perceived default risk.

Nevertheless, other research supports the latter hypothesis of a negative response. Liquidity risk hits bank solvency through a bank-specific and a market systemic channel. While the former effect is clearly intuitive; *ceteris paribus* more liquid banks are less exposed to insolvency risk, the latter may appear more elusive. This aspect can be better understood considering that liquidity risk has a systemic nature where contagion effects play an important role (Allen & Gale, 2000, Diamond & Rajan, 2005): when a significant fraction of banks hoard liquidity reserves market liquidity is drained, raising negative externalities that can make the overall banking system worse off (Hong, et al., 2014).

Since the literature is inconclusive about the market reaction, it is necessary to shed light on the factors that can cause and explain such response. Because the liquidity rules are first put into practice at the bank level (BCBS, 2016), it is worth examining whether bank-specific characteristics, especially the risk dimensions closely related to the liquidity standards, influence the CDS market reaction.

More specifically, we develop three testable hypotheses about the heterogeneity of creditor response:

H1. Creditors of banks with higher liquidity and funding ratios are less sensitive to liquidity regulation announcements.

The idea that banks with liquid assets and stable funding sources better withstand liquidity shocks stands at the heart of the liquidity reform (BCBS, 2010) and is further confirmed by prior literature (Cornett, et al., 2011). Research on the recent financial crisis supports this argument, highlighting that bank liquidity funding structure is a central factor in explaining bank default

risk and showing that financial institutions with stronger structural liquidity in the pre-turmoil period are less likely to subsequently fail (Bologna, 2011; Vazquez & Federico, 2015). Holding more liquid assets also improves bank creditworthiness, increases access to external funds and reduces bank funding costs. The above arguments match the intuition behind the implementation of the LCR and the NSFR. We therefore claim that banks characterized by a stronger funding system and more liquid assets are more likely to fulfil the new standards. Consequently, their creditors should be less sensitive to the introduction of stricter liquidity regulations.

H2. Creditors of banks with higher capital ratios are less sensitive to liquidity regulation announcements.

Whereas examining the exposure of well-capitalized banks to regulatory policies on liquidity is a relatively scant research topic[14], several studies test the impact of leverage on bank CDS spread and cost of debt (Flannery & Sorescu, 1996; Sironi, 2003; Annaert, et al., 2013). It is commonly agreed that higher capital ratios decrease leverage, lower funding costs, thereby reducing the probability of bank failure. Highly capitalized banks thus hold an advantageous position to meet the liquidity standards without facing financial distress. There are several reasons which further support this argument: i) capitalized banks are less likely to suffer from increased funding costs as a result of the adoption of the new rules, since they reasonably have a more resilient and stable funding structure (Dietrich, et al., 2014); ii) they signal solvency (Lindquist, 2004) and therefore have more easily accessible funds; and iii) they automatically

[14] To the best of our knowledge there is only one empirical paper by Dietrich et al. (2014) that finds a positive effect of banks' capital ratio on NSFR.

increase bank NSFR through more equity[15], so that they have less need for costly balance sheet adjustments.

Overall, we expect creditors' reaction to be weaker for banks with higher capital ratios because investors, anticipating the benefits of lower leverage, reduce more expectations of a credit event.

H3. Creditors of banks with higher impaired loans are more sensitive to liquidity regulation announcements. This effect is positively moderated by loan loss reserves.

Low-quality asset banks are clearly in a weaker position to accommodate the new standards. Bad loans are in fact penalized by Basel III criteria as they automatically lower the NSFR[16] (BCBS, 2014c). Hence, these banks are expected to face higher pressures to adjust their asset-liability portfolio composition and greater uncertainty on future performance. Because they are perceived as riskier, they also face higher funding costs and fund-raising problems, thus making the adjustment process toward the adoption more challenging. Overall, creditors of banks with a higher bad loan ratio are expected to raise more their perceived default risk following the regulatory events as compared to creditors of financial institutions with lower level of the ratio. Nevertheless, we believe that this effect is positively moderated by the amount of reserves set aside by banks to cover bad loans. Indeed, the risk of a credit event decreases as the coverage against losses increases. If investors correctly evaluate this information, the market reaction should be less pronounced for banks with a higher bad loan coverage ratio.

[15] Equity stands at the numerator of NSFR and has a ASF-factor of 100%.
[16] Non-performing loans have a RSF-factor of 100%.

5. Data and methodology

5.1. Data collection and source

As a measure of the impact on creditors, we use the daily change in banks' CDS spreads. A growing body of research supports this choice, employing CDS data instead of bond data to capture the effect of corporate and regulatory events on bondholders (e.g., Callen, et al., 2009; Panetta, et al., 2009; Veronesi & Zingales, 2010; King, 2013a; Horvát & Huizinga, 2015). This provides several advantages. Firstly, banks issue multiple types of bonds, and each has its own characteristics (e.g., liquidity). Contrary to the bond market, only one derivative contract is required for each bank (Andres, et al., 2016). Secondly, CDS are typically more liquid than bonds (Veronesi & Zingales, 2010), and thus capture changes in credit risk in a more accurate and timely manner (Shivakumar, et al., 2011). Finally, whereas bond spreads incorporate information irrelevant to credit risk, CDS spreads provides a direct measure of default risk of the reference entity (Longstaff, et al., 2005; Callen, et al., 2009).

For these reasons, we gather individual CDS contracts from Markit Ltd., one of the most reliable and widely used data provider on CDS, which employs precise data cleaning proceedings to compute composite spreads. Over the July 2007-June 2015 period[17], we collect daily observations on 5-year CDS contracts[18] denominated in Euro and written on senior unsecured debt with mod-modified restructuring clause[19].

[17] Not all the banks have observations for the whole investigated period. More in details, Deutsche Apotheker- und Ärztebank EG has available data from September 2007 until September 2014. DNB Bank ASA from November 2011 onward. DZ Bank AG Deutsche Zentral- Genossenschaftsbank has observable CDS until September 2014. Erste Group Bk AG from August 2008 onward. Eurobank Ergasias, S.A. from August 2008 onward. Lloyds Bank Plc until October 2013. Piraeus Bank SA until September 2014. Finally, Permanents TSB Plc from July 2007 onward.

[18] 5-year CDS contracts are the most liquid derivative contracts, commonly used in prior related research.

[19] CDS derivative contracts are traded over the counter (OTC). The International Swap and Derivative Association (ISDA) determines the restructuring clause, i.e. which form of bank debt restructuring is classified as credit event. CDSs on European banks currently follow the Modified-Modified Restructuring convention.

We select banks among the largest European financial institutions according to their asset size. More specifically, we first look at the list of significant banking firms under the Single Supervisory Mechanism (SSM) Framework Regulation. This has allowed us to classify, based on size, the most representative financial institutions under the SSM. Thereafter, we integrate the above list with that of the remaining countries, which do not participate in the SSM.

To be included in the final database, banks' CDS data must satisfy a series of liquidity criteria. We select the threshold according to prior research, with the main goal of obtaining a correct balance between the need of having a representative dataset and reliable observations. The selection criteria we apply are the following: i) non-missing values for each day of the event window, ii) non-missing values for more than 50 per cent of the trading days of the estimation window[20]; iii) and the percentage of zero inter-day changes in spread cannot be greater than 50 per cent of the observations in the estimation window.

The data collection process results in an unbalanced[21] panel of 48 banks from 15 European countries, i.e. Austria, Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Norway, Portugal, Spain, Sweden, Switzerland, the Netherland, and the UK. The list of banks, along with their number of observations is reported in Table 1, which further indicates whether banks belong to a peripheral European country and have received bailout funding. To check the representativeness of our dataset, we also compute for each country the ratio of total assets held by banks over the total assets held by the banking system[22]. Coverage (Table 1, column 5) ranges between 16% to 98% in terms of total assets as of 2014.

[20] These time intervals are defined in paragraph 5.2.2.
[21] Because of the liquidity criteria we set, the number of financial institutions varies among event dates.
[22] We measure total banking system assets as of 2014 using data on consolidated balance sheets obtained from Bankscope database.

In the same time frame, we also collect from Thomson Reuters information on market indices and swap curves. More specifically, we gather daily data on the iTraxx Europe 5-year index[23], which is made up of the most liquid 5-year CDS contracts of European financial and non-financial institutions, Dow Jones Euro Stock Index, ten-, five- and one-year swap rates.

Finally, to construct bank-specific variables, we retrieve accounting data on bank consolidated financial statements from Bankscope, a data provider by *Bureau Van Dijk*.

[insert Table 1 here]

5.2. Methodology

5.2.1 Event dates

Although the introduction of Basel III has been a process of involved discussions, we select 12 events related to the introduction of the new regulation, covering the period between February 2008 and June 2015. Following Yildirim et al. (2006), we determine an event date as the specific day on which novel information about bank liquidity regulation is disclosed to the market. In line with this statement and previous studies on regulatory events (Bruno, et al., 2016) each date corresponds to the release of an official document by the BCBS concerning liquidity regulation[24]. If the publication occurred on public holidays, the first available trading day is selected as an event date. Specifically, we apply the following procedure. Based on the publicly available information on the Bank for International Settlements (BIS) website, we select all the documents classified by the BIS in the "Basel Committee - Liquidity"[25] category, which includes all publications of the BCBS concerning liquidity since 1992. Thereafter, we screen the above list by identifying the proposals, amendments and final documents on liquidity regulation

[23] Specifically, we use the series 23, version 1 of the iTraxx Europe 5-year index.
[24] If two documents on liquidity regulation are released on the same day, these two publications belong to the same event.
[25] Available here: http://www.bis.org/list/bcbs/tid_128/index.htm.

exclusively related to the Basel III framework. Through this process, we identify 11 events in the period 2008-2015.

We further examine all the BCBS press releases available on the BIS website[26] to check that significant publications on liquidity are not missing in the analysis. This has led us to include an additional event concerning the release of an Annex in July 2010, which contains key agreements on the liquidity reform. Table 2 lists the resulting 12 event dates and provides a brief description.

To complete the selection of the event dates, following Bruno et al. (2016), we carry out a research on Lexis Nexis Academic to verify that the events we focus on have effectively provided new information to the public, thus making investors informed about the liquidity rule. This procedure has also allowed us to identify potential anticipatory and postponed news publications. In more detail, we conduct a search on both international magazines (Financial Times, International New York Times, International Herald Tribune) and specialised news sites (Banking Newslink, Thomson Financial News, ENP newswire, Total Securitization, Global Capital Euroweek) over a span of two weeks before and after each selected event, using the terms "Basel III", "Basel Committee", "liquidity", "liquidity management", to assess worldwide diffusion of the Basel III liquidity framework. This search provides a listing of approximately 62 documents, which have been carefully read to verify their relevance. Our analysis of each document reflects our assessment of the role played by the news regarding the liquidity rule change, as well as the likelihood that such documents provide significant information to investors.

[26] Available here: http://www.bis.org/list/press_releases/said_7/index.htm.

This process confirms our selection and reveals neither the release of information prior to the BCBS official announcements nor the postponed disclosure of information for more than 3 days from the selected event dates.

Finally, each author has separately categorized the events in two classes (Armstrong et al., 2010): i) those that tightens the liquidity requirements; and ii) those that loosen them conditional to previous announcements and disclosed information. Table 3 documents our classification of events. We define nine events as tightening the liquidity regulation and three events as loosening it.

[insert Table 2 here]

[insert Table 3 here]

5.2.2. Event study

To investigate creditors' reaction to regulatory events on liquidity, we adopt an event study methodology. This technique allows us to quantify the impact of liquidity regulation announcements on CDS spreads.

Based on prior literature (MacKinlay, 1997; King, 2009; Shivakumar et al., 2011), we estimate abnormal CDS spread changes (ASC) following a series of steps. First, we compute spread changes, which reflect the inter-day variation in the premium, by taking the difference in the logarithm of the CDS spread between two consecutive trading days. Formally, this can be represented as:

$$\Delta S_{i,t} = ln(S_{i,t}) - ln\,(S_{i,t-1}) \quad (1)$$

where $S_{i,t}$ and $S_{i,t-1}$ are the spread level (in basis points) at time t and $t-1$, respectively.[27] Thereafter, we define abnormal changes in CDS spreads as the difference between the realized and the normal spread change over the event window:

$$AS_{i,t} = \Delta S_{i,t} - E[\Delta S_{i,t} \mid X_t] \quad (2)$$

where $AS_{i,t}$, $\Delta S_{i,t}$ and $E[\Delta S_{i,t} \mid X_t]$ correspond to the abnormal, actual and normal spread variations for contract i at time t, respectively. Note that the normal spread change, i.e. the spread that would be observed if the event did not occur, is conditioned by past CDS changes, identified by the information set X at time t.

While the actual spread change is obtained from Equation (1), the normal spread change is estimated applying factor model, after carefully identifying the major drivers of CDS changes according to prior literature (Collin-Dufresne, et al., 2001; Ericsson, et al., 2009). This is expressed by the following equation:

$$\Delta S_{i,t} = \alpha_i + \beta_{1,i}\Delta S_{index,t} + \beta_{2,i}\Delta Level_t + \beta_{3,i}\Delta Slope_t + \beta_{4,i}\Delta Volatility_t + \\ + \beta_{5,i}Performance_t + \epsilon_{i,t} \quad (3)$$

where $\Delta S_{index,t}$ is the spread change of the CDS market index, proxied by the iTraxx Europe 5-year index, $\Delta Level_t$ is the risk-free curve expressed by the five-year swap rates, $\Delta Slope_t$ is the slope of the risk-free curve computed as the difference between ten- and one-year swap rates (Andres et al., 2016). $\Delta Volatility_t$ is the equity implied volatility proxied by the VSTOXX, which is the European volatility index. This factor is particularly important to adjust for crisis-related events that have likely boosted market volatility. Finally, $Performance_t$ is the stock market performance proxied by the Dow Jones Euro Stock Index and $\epsilon_{i,t}$ is the error term. We

[27] According to Andres et al. (2016), we use the difference in the logarithm instead of the absolute difference. This choice is driven by the fact that we expect banks' CDS reaction to announcements on liquidity rules to be proportional to banks' initial CDS level. In such circumstances, the absolute difference is considered as a less appropriate measure.

then estimate the parameters α_i, β_i and $\sigma_{\epsilon_i}^2$ of Equation (3) using an OLS regression over a 150-day estimation window, ending 3 days before the announcement.

Finally, according to Equation (2), we compute the abnormal spread change (ASC) of contract *i* on the event date *t* as follows:

$$\Delta AS_{i,t} = \Delta S_{i,t} - \widehat{\alpha_i} - \widehat{\beta_{1,i}}\Delta S_{index,t} - \widehat{\beta_{2,i}}\Delta Level_t - \widehat{\beta_{3,i}}\Delta Slope_t - \widehat{\beta_{4,i}}\Delta Volatility_t - \\ + \widehat{\beta_{5,i}} Performance_t \quad (4)$$

To capture potential anticipated or postponed market reaction, we use the following event windows: 5-day (-2,2), 3-day (–1,1), 2-day (0,1) and one-day (0,0). For robustness purposes, we also estimate CASs over the (-1,0) window. We further check the existence of any other anticipation effect by including placebo events, which we set 4 days before the actual event.

Cumulative abnormal CDS spread changes (CASs) are then computed by adding abnormal CDS spreads, obtained via Equation (4), within the event window. After estimating CASs for each bank-event combination, we test their statistical significance using the standard parametric t-test and the non-parametric Wilcoxon sign rank (1945) test.

Since the introduction of the liquidity standards stems from a series of publications that occurred over many years, we conduct the analysis on all 12 events collectively. To this aim, we construct equally-weighted CDS portfolios. Aggregating the events provides two main benefits. Firstly, they are free from potential cross-sectional correlation due to the clustering of events (MacKinlay, 1997) and portfolios obtained from distinct events should be independent (Armstrong et al., 2010). Secondly, it allows for a more comprehensive interpretation on the regulatory impact.

As we recognize that some events tighten and others loosen liquidity regulation, in the same spirit of Armstrong et al. (2010), we change sign of announcements associated with a weakening

in the liquidity rules, multiply by -1. Applying this technique, we correctly estimate the overall CDS market reaction, reinforcing our inference of the aggregate effect. The intuition behind this procedure is simple: if we observe a positive reaction to events that reduce liquidity requirements, this would signal that creditors take advantage from more relaxed regulation. Instead, if we observe a positive reaction to events that strengthen liquidity requirements, this would signal that creditors take advantage from tighter regulation. Consequently, it would be inappropriate to interpret the CASs without accounting for the different event categorizations. Once we change sign, we aggregate all CASs to accurately estimate the CDS market reaction to tighter liquidity regulation.

5.3. Regression analysis

As a second step, we perform a regression analysis to examine the determinants of heterogeneous market reaction to regulatory events on liquidity:

$$CAS_{i,j}^{t_1 t_2} = \alpha + \sum_k \beta_k BANK_{i,k} + \sum_n \gamma_n time\_dummy_n + \sum_j \lambda_j CONTROLS_{i,j} + \varepsilon_{i,j}^{t_1 t_2} \quad (5)$$

where $CAS_{i,j}^{t_1 t_2}$ is the cumulated abnormal spread change for bank *i* and event *j* referring to the event window $(t_1; t_2)$ and $BANK_{i,k}$ is a set of bank-specific accounting variables. In line with prior literature (Ricci, 2015), for each event we match the latest available accounting variables[28]. Finally, we use a series of time dummies to capture different phases of the financial crisis ($time\_dummy_n$) and include a comprehensive range of control variables ($CONTROLS_{i,j}$).

[28] For example, considering an event occurred in 2008, we associate accounting variables measured from bank annual report of 2007.

With regards to bank liquidity and funding, we use two indicators: the liquidity ratio (*LIQ*) defined as liquid assets[29] to deposits and short-term funding and the funding ratio (*FUN*) obtained similarly to Bruno et al. (2016) by dividing the numerator, computed as the sum of equity[30], long term funding[31] and customer deposits, by the denominator, defined as total year-end assets. We have also estimated the ratios based on a more rigorous definition of the Basel III liquidity requirements. However, since some accounting items are not available in Bankscope for all the banks in the dataset and for the whole period of analysis, we decided to adopt a simplified but reasonable interpretation of the standards, which allows for a comprehensive comparison among all banks.

Based on our first hypothesis, creditors of banks with higher liquidity and funding ratios are less sensitive to liquidity regulation announcements, i.e. they should decrease more their expectations of a credit event than investors in less liquid banks do. Consequently, H1 is confirmed if the *LIQ* and *FUN* coefficients are statistically significant, with a negative sign.

With regards to bank capitalization, we use the *TIER1* regulatory capital ratio, i.e. the ratio between regulatory bank equity capital and total risk-weighted assets. According to our second hypothesis, creditors of banks with higher capital ratios are less sensitive to regulatory announcements, thus benefitting more from the rule change. Therefore, H2 is confirmed if the *TIER1* coefficient is negative and statistically significant, reflecting a narrowing in CDS spreads.

With reference to asset quality, we construct the ratio of impaired loans to gross loans (*NPL_GL*) and the ratio of loan loss reserves to impaired loans (*LLR_NPL*) to capture the moderating effect of impaired loans coverage. We expect creditors of banks with higher bad

[29] Liquid assets include: trading securities and at FV through income, loans and advances to banks, reverse repos and cash collateral, cash and due from banks and mandatory reserves.
[30] Equity includes also pref. shares and hybrid capital accounted for as equity.
[31] Total long term funding includes pref. shares and hybrid capital accounted for as debt, senior debt maturing after 1 year, subordinated borrowing and other funding.

loans ratios to be more sensitive to liquidity regulation announcements, increasing more their perceived default risk as compared to creditors of banks with lower level of the ratio. However, this effect should be positively moderated by the amount of reserves set aside to cover expected losses. In line with this argument, H3 is confirmed if the coefficients of the *NPL_GL* and the interaction term between *NPL_GL* and *LLR_NPL* are significant, with a positive and negative sign, respectively.

In addition to our variables of interest, we add three time dummies: *GLOBAL* indicates the period following the Lehman Brothers collapse (Sep. 15, 2008 – May 1, 2010)[32], *SOVEREIGN* captures the sovereign debt crisis (May 2, 2010 – Dec. 21, 2011) and finally *post_LTRO* reflects the period after the two Longer Term Refinancing Operations (from Dec. 22, 2011 onward) by the European Central Bank (ECB) that provided huge capital injection to financial institutions.

We further include the following control variables: the return on average assets (*ROAA*) and the logarithmic transformation of total year-end assets (*ASSETS*), which are standard measures of bank risk (Sironi, 2003). A dummy variable (*GIIPS*) to account for banks in peripheral countries, i.e. Greece, Ireland, Italy, Portugal and Spain, that have been affected the most by the financial crisis. We control for banks that received bailout funding during the examined period (*Intervened*), assigning value 1 after they received government support. Following Acharya and Steffen (2015), we collect information on bailouts through the official website of the European Union (EU), which publishes all state aid cases approved by the European Commission[33]. We also construct *LISTED*, a dummy variable indicating whether a bank is publicly listed, and *TYPE*, a dummy variable taking the value of 1 for commercial, saving and cooperative banks to

[32] This time dummy is constructed according to Ricci (2015).
[33] Information on state aid cases is available here: http://ec.europa.eu/competition/elojade/isef/index.cfm?clear=1&policy_area_id=3.

differentiate them from other type of financial institutions, e.g. specialized government credit institutions, which have typically different characteristics.

Finally, to account for the different event classification, we use a dummy variable (*STR_REG*) with the value 1 when the announcement tightens liquidity regulation and zero otherwise.

Equation (5) is estimated using OLS regression with clustered standard errors based on bank country of origin (Armstrong, et al., 2010). We further examine for possible multicollinearity issues by checking both cross correlation coefficients between regressors and their Variance Inflation Factors (VIFs). As shown in Table 6, independent variables exhibit low correlation and their corresponding VIFs are far below the 10 threshold, generally used to detect severe multicollinearity. Correlation signs in Table 6 follow our expectations except for *FUN* and *Tier1*, which document a negative coefficient. As both ratios include equity in the numerator, we would expect a positive coefficient between these variables. However, by decomposition these indexes, we discover that this outcome is driven by the negative correlation between risk weighted assets (RWA) and total assets in the period under examination.

Table 4 reports descriptive statistics for regressors used in Equation (5), while Table 5 displays mean value and standard deviation for our main variables of interest divided by country of origin. We observe that banks from peripheral countries have, on average, weaker balance sheets than those from non-peripheral countries, where the highest variation emerges from the liquidity, capital, and asset risk dimensions. On average, GIIPS banks hold a *LIQ* and *TIER1* that is about 46% and 12% lower than that of non-GIIPS banks, respectively. Regarding asset quality, the gap is even more remarkable: GIIPS banks have an average *NPL_GL* that is 133% higher

than that of non-GIIPS banks. As expected, banking firms from Germany and France have on average the strongest balance sheets.

[insert Table 4 here]

[insert Table 5 here]

[insert Table 6 here]

6. Results

6.1. Event study analysis

6.1.1. Aggregated events

Table 7 shows the results of the event study conducted first on the aggregated events under examination and second on the subset of events exclusively related to liquidity. Because the Basel Committee's reform introduces both capital and liquidity rules, some announcements on liquidity occurred the same day on which documents on capital were released. Following Bruno et al. (2016), we account for this potentially confounding effect by running the analysis over the event days referring to liquidity only and not to capital. The liquidity only events are the following: Event 1, 2, 3, 7, 8, 10, 12[34].

Referring to event window (0,0), the coefficient of cumulative average abnormal CDS spread changes (CAAS) is positive and always statistically significant (at the 1% confidence level) both when using the parametric and the more robust non-parametric statistical test. This result holds in the subset of events related to liquidity rules only, suggesting that the effect is not driven by potentially confounding announcements on capital regulation[35]. As we widen the event window,

[34] We also exclude Event 11 (December 9, 2014) because it occurred very close to the release of a document on capital regulation, which was published on December 11, 2014.

[35] Since we have an unbalanced panel, the portfolio analysis is also conducted on the 36 banks for which we have observations for all events. Results remain substantially unchanged with respect to those from the whole sample analysis.

the CAASs loose explanatory power. This may be explained by three main reasons: i) the main effect occurs on the event day (i.e., day zero): ii) the univariate analysis hides potential bank heterogeneous reactions; and iii) concerning the liquidity only events, the exclusion of relevant announcements that had extensive international news coverage has likely weakened the aggregate impact on the market.

As far as the economic magnitude of the aggregated reaction is concerned, we document that the average CDS spread rises by 1.21% for all events and 1.57% for the liquidity only events regarding the 1-day window. These values are relatively similar, indicating that the size of the effect is confirmed for both subsets of events. Considering that the average CDS spread over the 2007-2015 period stands around 220 bp for our dataset of banks, these percentages correspond respectively to an increase of 2.66 bp and 3.45 bp. Although these effects are relatively small, they are consistent with results by Jorion and Zhang (2009) examining CDS market reaction to bankruptcy events in the U.S. Thereafter, we will perform a sensitivity analysis showing how the magnitude of the effect could vary depending on bank attributes.

Table 8 instead documents results for CASs estimated using placebo events that we set four days before the real announcement[36]. All CAASs are not statistically significant, suggesting that the market did not anticipate information about liquidity requirements.

Overall, there is some evidence of a significant negative market reaction to tighter liquidity regulation, indicating that creditors perceived the new rules as increasing the probability of a bank default.

[insert Table 7 here]

[insert Table 8 here]

6.1.2. Individual events

[36] The event window (-2,2) is not included in Table 8 due data limitations.

As previously stated, the purpose of this research is to examine the impact of the aggregated events on liquidity regulation. However, for completeness purposes, we also report in Table A1 of the supplementary appendix the CDS market reaction to the individual events. Since announcements are clustered, standard statistical tests are not appropriate, we therefore limit our brief discussion to the sign of the reaction, comparing our predictions with empirical estimates.

Most events document estimates for CAASs that follow our predicted signs. More specifically, coherently with our event classification and with the results of Bruno et al. (2016), Event 5 and 7 lead to a positive market reaction. Events 3, 4, 6, 10 and 11 also confirm our expectation generating a negative market reaction. The remaining events instead display variation among event windows.

6.2. Regression analysis

Table 9 displays the results from the multivariate analysis explaining the CASs estimated over several event windows.

Regarding liquidity, the coefficient for *LIQ* is negative and always statistically significant, whereas the *FUN* variable does not affect CASs. This means that creditors of banks with higher liquidity holdings benefit more from tighter liquidity regulations, with CDS spreads narrowing. Nevertheless, creditors' reaction does not seem to be influenced by banks' amount of stable funding sources. These results partially confirm our first hypothesis and are consistent with prior research illustrating the beneficial effects of higher liquidity buffers (BCBS, 2016).

With reference to capitalization, the coefficient for *TIER1* is always negative and statistically significant. This result suggests that creditors of well-capitalized banks reduce more their perception of credit risk following the regulatory events than creditors of poorly capitalized

banks do. This outcome provides strong support for our second hypothesis, in line with past studies (Dietrich et al., 2014). Benefiting from low leverage, highly capitalized banks are in fact in a stronger condition to meet the liquidity standards and, as a result, are less sensitive to liquidity regulation announcements.

With reference to asset quality, the coefficient for the impaired loans ratio, i.e. *NPL_GL*, is positive and statistically significant in all event windows. This finding indicates that creditors of banks with a higher exposure to impaired loans perceived the liquidity requirements as detrimental for bank soundness than creditors of banks with higher asset quality, as expressed by widening in CDS spreads. In the shortest event windows, the coefficient of the interaction term (the product of *NPL_GL* and *LLR_NPL*) is negative and statistically significant, suggesting that the higher sensitivity of impaired loans on CDS spreads decreases as the amount of reserves on impaired loans increase. This finding supports our third hypothesis and shows the importance of loan loss coverage to mitigate potentially negative effects of the liquidity rules.

Focusing on time dummies, it is worth noting that the coefficient of *Post_LTRO* is always lower than that of *GLOBAL*. After the first LTRO, financial institutions have received huge capital injections, which helped them to fulfil the standards. Consistently with this argument, we observe a less pronounced widening of CDS spreads following the adoption of extraordinary measures by the ECB.

With reference to our control variables, abnormal spread changes are larger for more profitable banks (coefficients for *ROAA* are positive and statistically significant in two out of four event windows), probably reflecting higher bank-risk taking (Sironi, 2003), and for larger financial institutions.

Surprisingly, banks located in the periphery of the Eurozone (i.e., GIIPS banks) benefit more, *ceteris paribus*, from liquidity regulation than banks located in the core of the Eurozone, with CDS spreads narrowing. Although marginally significant, this result runs counter with our expectations that investors in these crisis-affected countries should have increased concerns on bank credit risk. To provide further insight into GIIPS banks, referring to the estimated coefficients in column 4 of Table 9, we design one graph per each variable of interest (Figure 1), where we plot the predicted CDS spread change for our dataset of GIIPS banks against the mean value of the respective variable[37]. The horizontal lines in the plots indicate the zero threshold and the mean predicted CDS spread change across all banks, while the vertical line shows the mean of the variable across all banks in the dataset. We observe that peripheral banks' level of *LIQ* and *FUN* is respectively clustered below and above the mean for the whole dataset, while observations of *TIER1* and *NPL_GL* are more heterogeneously distributed. There is further evidence that banks located in Portugal and Ireland document on average predicted CASs below the zero level, reflecting a positive market response. Liquidity announcements have likely provided a positive market signal for creditors in these countries. In contrast, banks located in Italy, Greece, and Spain have on average positive predicted CASs. Given the widening in CDS spreads, creditors have likely perceived the liquidity announcements as a negative market signal and thus detrimental for banks in these countries.

In Table 9*, Intervened* and *LISTED* do not seem to explain CDS spreads, whereas *TYPE* is negative in all equations, indicating that conventional banks are less risky than non-conventional financial institutions. The dummy variable for tighter liquidity requirements (*STR_LIQ*) is

[37] More specifically, we construct one plot per each variable of interest. In these plots (Figure 1), the horizontal axis displays the mean value for the variable, while the vertical axis shows the predicted CDS spread change with respect to the (-2,2) window when all regressors are at their mean value. Hence, observations provide information on the mean value of the variable and predicted CDS spread change for each GIIPS bank in the dataset.

positive and always statistically significant, confirming our findings from the univariate analysis (Table 7).

As an interesting result, the constant term is not significant in almost all the event windows. We interpret this finding as evidence that the liquidity announcements do not have a systematic effect on the CDS market in addition to that which is explained by our bank-specific variables. The negative aggregate market reaction, as expressed in Table 7, thus depends on bank characteristics, such as liquidity, capital, and asset quality. This result is consistent with Allen et al. (2012), stating that the main concerns about the regulation are not due to the structure of the indices, but on the required adjustments to fulfil them, which include, among others, an accurate banks' balance sheet management.

To account for potential confounding effects, the regression analysis is then repeated for the event dates related to liquidity only. Results for this subset of events are reported in Table 11. We observe that the effect of our variables of interest remains broadly unchanged, although some regressors lose explanatory power. This can be reasonably explained by the loss of information due to the exclusion of some important announcements on liquidity. Overall, we find qualitatively similar results, further confirming prior evidence and suggesting that the effect is not driven by potentially confounding events on capital.

[insert Table 9 here]

[insert Table 11 here]

[insert Figure 1 here]

6.3. Sensitivity analysis

To increase knowledge on the role of bank-specific information, we further conduct a sensitivity analysis of Equation (5), reported in Table 10. More specifically, we first compute the predicted CDS spread change when all regressors are at their mean value (i.e., predicted *CAS*). The predicted CDS reflects the market reaction for a representative bank in the dataset (e.g., the "average bank"). Secondly, for each accounting variable that is statistically significant in Table 9, we estimate the incremental effect on the predicted CDS spread change of a one-standard-deviation increase in the regressor by taking the product of the variable's estimated coefficient and its corresponding standard deviation. We then repeat this computation for each time window.

The sensitivity analysis assesses the economic impact of balance sheet conditions on the CDS market reaction. Considering the shortest event window (i.e., day zero), we observe that the average bank documents a 0.78% increase in its CDS spread following liquidity regulation announcements. Given that the average bank's CDS spread is 220 bp, it raises by almost 2 bp. However, if the bank holds a one-standard-deviation increase in *NPL_GL,* the market response quadruples reaching 3.35%, which is associated to a 7.37 bp increase in the average CDS spread. Credit investors thus impose a greater burden to financial institutions with lower asset quality. On the one hand, if the bank exhibits, for instance, a one-standard-deviation increase in *TIER1*, the negative market response marginally weakens from a 0.78% to a 0.3% rise in the CDS spread around the announcement days. Analogously, if *LIQ* increases of a one-standard-deviation, the predicted CDS spread change for the average bank is 0.42%. Finally, a worsening in all risk dimension variables would cause an almost 10 bp increase for the representative bank's CDS spread. Similar arguments can be made for the other event windows.

Although significant, the impact of liquidity regulation announcements appears economically small for creditors, which is consistent with prior research on the CDS market (Jorion & Zhang,

2009). However, depending on the level of bank liquidity, capital, and asset quality ratios, the market response changes and this may in turn generate a greater magnitude of reaction. The variables reducing (i.e., *LIQ* and *TIER1*) and increasing (i.e., *NPL_GL*) market sensitivity are thus determinant to explain creditors' response, as highlighted in Table 9.

To gauge the managerial implications of the above-mentioned quantities on bank profitability, we construct a representative balance sheet for Eurozone banks, retrieving data over the 2007-2015 period from ECB Statistical Data Warehouse[38]. This procedure has allowed us to compute the average amount of unsecured debt held by Eurozone banks[39]. Under the scenario of a 10 bp rise in the CDS spread, we compute the impact of such increase in the cost of unsecured debt on banks' average return on equity (ROE), which we estimate equal to 0.93%. Given an average ROE of -12.45% in the examined years, liquidity regulation announcements can reduce it to -13.38% for a bank with liquidity, capital, and asset quality ratios one-standard-deviation below the average in our dataset. This effect is an approximate measure of the potential damage these regulatory events on liquidity may cause to weaker financial institutions. In the opposite scenario of a relatively strong bank with liquidity, capital, and asset quality ratios one-standard-deviation above the average in our dataset, we predict that ROE increases by 0.47%, thus reaching -11.98%.

[insert Table 10 here]

6.4. Further test for confounding events

In our event study, we account, among others, for several market-wide elements and stock movements that might bias our inference on the impact of liquidity regulation announcements.

[38] Data are available here: http://sdw.ecb.europa.eu.
[39] We use ECB Statistical Data Warehouse because information from Bankscope database is not available.

This is done by adjusting CDS spreads to a comprehensive set of factors given the timing of our events. However, bank-specific events – such as rating variations, mergers and acquisitions, restructurings, turnover, report disclosure – might have occurred during our event windows. If this is the case, the CASs we observe might be driven by these specific events. To rule out this possibility, similarly to Bruno et al. (2016), we identify through Lexis Nexis Academic, potential confounding events over three days before and after each event on liquidity regulation, with a deepened research on peripheral banks[40]. We then rerun the analysis excluding from each announcement on liquidity regulation those banks subject to these potential confounding events. Findings from both the univariate and multivariate analysis, displayed in Tables A2-A4 of the supplementary appendix, remain broadly unchanged, further supporting previous interpretations.

7. Conclusions

The Basel III liquidity framework is a key turning point in the field of banking regulation as it represents an important regulatory attempt to achieve, for the first time, harmonization in liquidity regulation among worldwide banks. As far as we are aware, this is the first study examining the reaction of bank creditors in Europe to the progressive publication of information by the regulator on the new liquidity rules that occurred over the 2008-2015 period.

Our event study analysis shows that liquidity regulation announcements have conveyed new information to credit investors, but this information was received as bad news by the market of creditors, which increased their perceived credit risk around the event days. The negative CDS

[40] We use several key words on Lexis Nexis Academic such as: "M&A", "restructuring", "takeover", "rating", "downgrades", "credit risk", "losses", "failure", "report", "turnover".

market reaction is indeed robustly significant, although relatively small in magnitude. As it emerges from the regression analysis, this aggregate market reaction reflects the heterogeneous response in the market of creditors based on bank-specific factors, such as liquidity, capital, and asset quality. More specifically, our results document that creditors of banks with higher liquid assets and capital ratios, are less sensitive to liquidity regulation announcements. In contrast, creditors of banks with a higher bad loan ratio are more sensitive to regulatory events. This impact is positively moderated by loan loss reserves.

In line with Allen et al. (2012), these findings from the multivariate analysis highlight that the negative market response depends on bank-specific characteristics that can constrain or favour the transition period toward the adoption. As pointed out by Hong et al. (2014), the liquidity standards have been designed to protect solid banks against liquidity shocks. If banks experience issues of stability, the liquidity requirements cannot reduce the risk taken and, to some extent, may generate unintended consequences. Therefore, it is not surprising that a stronger and more negative reaction to tighter regulation has been registered for weaker banks, whereas the strongest banks can reverse this negative market response, benefitting from the rule change.

This research has some important theoretical and practical implications. From a theoretical perspective, it provides greater insight into the market effect of liquidity regulation, an area that is relatively unexplored in the literature on banking regulation. Moreover, it sheds light on the increasingly important relationship between bank liquidity and insolvency risk (Hong, et al., 2014; Chiaramonte & Casu, 2017), pointing out the lack of theoretical banking models estimating the effect of liquidity regulation.

From a managerial point of view, our results indicate that, to mitigate potential unintended consequences of the index implementation, banks are required to manage their asset-liability mix (Härle, at al., 2010). Furthermore, since results show that the market was able to discriminate among banks' risk profiles, this paper also provides evidence for the existence of market discipline, with creditors perceiving banks with stronger balance sheets as less risky and likely to fail.

Finally, concerning policy applications, this analysis increases knowledge on the effects of Basel III. Considering that the liquidity standards represent the first attempt by regulators to implement international harmonized requirements on liquidity, this research is relevant to assess the effectiveness of the liquidity rules to pursue their intended purpose.

References

Acharya, V. & Steffen, S., 2015. The "greatest" carry trade ever? Understanding eurozone bank risks. *Journal of Financial Economics*, Volume 115, pp. 215–236.

Allen, B., Chan, K.K., Milne, A. & Thomas, S., 2012. Basel III: Is the cure worse than the disease?. *International Review of Financial Analysis*, Volume 25, pp. 159–166.

Allen, F. & Gale, D., 2000. Financial contagion. *Journal of Political Economy*, Volume 108, pp. 1–33.

Allen, P.R. & Wilhelm, W. J., 1988, The impact of the 1980 Depository Institutions Deregulation and Monetary Control Act on market value and risk: Evidence from the capital market. *Journal of Money, Credit and Banking*, Volume 20, pp. 364–380.

Andres, C., Betzer, A. & Doumet, M., 2016. Measuring Abnormal Credit Default Swap Spreads. SSRN Working Paper Series.

Annaert, J., De Ceuster, M., Van Roy, P. & Vespro, C., 2013, What determines Euro area bank CDS

spreads?. *Journal of International Money and Finance*, Volume 32, pp. 444–461.

Armstrong, C., Marth, M. E. & Rield, E. J., 2010. Market reaction to the Adoption of IFRS in Europe. *The Accounting Review*, Volume 85, pp. 31–61.

Banerjee, R. & Mio, H., 2014. The impact of liquidity regulation on banks. BIS, Working Paper.

BCBS (Basel Committee on Banking Supervision), 2008a. Liquidity risk: management and supervisory challenges. Bank for International Settlements, February.

BCBS (Basel Committee on Banking Supervision), 2008b. Principles for sound liquidity risk management and supervision. Bank for International Settlements, Draft for Consultation, June.

BCBS (Basel Committee on Banking Supervision), 2008c. Principles for sound liquidity risk management and supervision. Bank for International Settlements, September.

BCBS (Basel Committee on Banking Supervision), 2009. International framework for liquidity risk measurement, standards, and monitoring. Bank for International Settlements, December.

BCBS (Basel Committee on Banking Supervision), 2010. Basel III: international framework for liquidity risk measurement, standards and monitoring. Bank for International Settlements, December.

BCBS (Basel Committee on Banking Supervision), 2013a. Basel III: the liquidity coverage ratio and liquidity risk monitoring tools. Bank for International Settlements, January.

BCBS (Basel Committee on Banking Supervision), 2013b. Liquidity coverage ratio disclosure standards. Bank for International Settlements, Consultative Document, July.

BCBS (Basel Committee on Banking Supervision), 2014a. Liquidity coverage ratio disclosure standards. Bank for International Settlements, January.

BCBS (Basel Committee on Banking Supervision), 2014b. Basel III: the net stable funding ratio. Bank for International Settlements, Consultative Document, January.

BCBS (Basel Committee on Banking Supervision), 2014c. Basel III: the net stable funding ratio. Bank for International Settlements, October.

BCBS (Basel Committee on Banking Supervision), 2014d. Net stable funding ratio disclosure standards. Bank for International Settlements, Consultative Document, December.

BCBS (Basel Committee on Banking Supervision), 2015. Net stable funding ratio disclosure standards. Bank for International Settlements, June.

BCBS (Basel Committee on Banking Supervision), 2016. Literature review on integration of regulatory capital and liquidity instruments. Bank for International Settlements, March.

Bhat, G., Franken, R. & Martin, X., 2011. Panacea, Pandora's box, or placebo: Feedback in bank mortgage-backed security holding and fair value accounting. *Journal of Accounting and Economics*, Volume 52, pp.153–173.

Bologna, P., 2011. Is there a role for funding in explaining recent U.S. banks' failures?. IMF Working Paper No. 11/180.

Bruno, B., Onali, E. & Schaeck, K., 2016. Market reaction to bank liquidity regulation. *Journal of Financial and Quantitative Analysis*, forthcoming.

Callen, J.L., Livnat, J. & Segal, D., 2009. The Impact of Earnings on the Pricing of Credit Default Swaps. *The Accounting Review*, Volume 84, pp. 1363–1394.

Chiaramonte, L. & Casu, B., 2017. Capital and liquidity ratios and financial distress. Evidence from the European banking industry. *The British Accounting Review*, Volume 49, pp. 138-161.

Collin-Dufresne, P., Goldstein, R. & Martin, S., 2001. The determinants of credit spread changes. *Journal of Finance*, Volume 56, pp. 2177–2207.

Cornett, M. M., McNutt, J. J., Strahan, P. E. & Tehranian, H., 2011. Liquidity risk management and credit supply in the financial crisis. *Journal of Financial Economics*, Volume 101, pp. 297–312.

Dann, L. & James, C., 1982. An analysis of the impact of deposit rate ceiling on the market values of thrift institutions. *The Journal of Finance*, Volume 37, pp. 1259–1275.

Diamond, D.W., & Rajan, R.G., 2005. Liquidity shortages and banking crises. *Journal of Finance*, Volume 60, pp. 615–647.

Dietrich, A., Hess, K. & Wanzenried, G., 2014. The good and bad news about the new liquidity rules of Basel III in Western European countries. *Journal of Banking & Finance*, Volume 44, pp. 13–25.

ECB (European Central Bank), 2011. Extraordinary measures in extraordinary times. Public measures in support of the financial sector in the EU and the United States. Occasional Paper Series, July.

ECB (European Central Bank), 2013. Liquidity regulation and monetary policy implementation. Monthly Bulletin, April.

Ericsson, J., Jacobs, K. & Oviedo, R., 2009. The determinants of credit default swap premia. *Journal of Financial and Quantitative Analysis*, Volume 44, pp. 109–132.

Flannery, M. J. & Sorescu, S. M., 1996. Evidence of Bank Market Discipline in Subordinated Debenture Yields: 1983-1991. *Journal of Finance,* Volume 51, pp. 1347–1377.

Georgescu, O. M., 2014. Effects of Fair Value Relaxation during a Crisis: What are the costs and benefits? Evidence from the Reclassification of Financial Securities. SSRN Working Paper Series.

Härle, P., Lüders, E., Pepanides, T., Pfetsch, S., Poppensieker, T. & Stegemann, U., 2010. Basel III and European Banking: Its Impact, how banks might respond and the challenges of implementation. EMEA Banking, McKinsey & Company.

Hong, H., Huang, J-Z. & Wu, D., 2014. The information content of Basel III liquidity risk measures. *Journal of Financial Stability*, Volume 15, pp. 91–111.

Horvát, B. L. & Huizinga, H., 2015. Does the European Financial Stability Facility Bail Out Sovereigns or Banks? An Event Study. *The Journal of Money, Credit and Banking*, Volume 47, pp. 176–206.

IMF (International Monetary Fund), 2011. How to address the systemic part of liquidity risk. Global Financial Stability Report, Chapter 2, April.

James, C. M., 1983. An analysis of intra-industry differences in the effect of regulation: the case of deposit rate ceilings, *Journal of Monetary Economics*, Volume 12, pp. 417–32.

Jorion, P. & Zhang, G., 2009. Credit Contagion from Counterparty Risk. *Journal of Finance*, Volume 64, pp. 2053–2087.

King, M. R., 2009. Time to Buy or Just Buying Time? The Market Reaction to Bank Rescue Packages. Working Paper No. 288. Bank for International Settlements, Basel.

King, M. R., 2013a. The contagion and competition effects of bank bailout announced in October 2008. SSRN Working Paper Series.

King, M. R., 2013b. The Basel III Net Stable Funding Ratio and bank net interest margins. *Journal of Banking & Finance*, Volume 37, pp. 4144–4156.

Kolasinski, A. C., 2011. Mark-to-market regulatory accounting when securities markets are stressed: Lesson from the financial crisis of 2007-2009. *Journal of Accounting and Economics*, Volume 52, pp. 174–177.

Lindquist, K.-G., 2004. Banks' buffer capital: how important is risk. *Journal of International Money and Finance*, Volume 23, pp. 493–513.

Longstaff, F. A., Mithal, S. & Neis, E., 2005. Corporate yields spreads: default risk or liquidity? New evidence for the Credit Default Swap market. *Journal of Finance*, Volume 55, pp. 2213–2253.

MacKinlay, C., 1997. Event studies in economics and finance. *Journal of Economic Literature*, Volume 35, pp. 13–39.

Mamun, A. L., Hassan, M. K. & Lai, V. S., 2004. The impact of the Gramm-Leach-Bliley act on the financial services industry. *Journal of Economics and Finance*, Volume 28, pp. 333–347.

Ötker-Robe, I. & Pazarbasioglu, C., 2010. Impact of Regulatory Reforms on Large and Complex Financial Institutions. IMF Staff Position Note.

Panetta, F., Faeh, T., Grande, G., Ho, C., King, M., Levy, A., Signoretti, F. M., Taboga, M. & Zaghini A., 2009. An assessment of financial sector rescue programmes. Occasional paper 47, Bank of Italy.

Ricci, O., 2015. The impact of monetary policy announcements on the stock price of large European banks during the financial crisis. *Journal of Banking & Finance*, Volume 52, pp. 245–255.

Santos, A. O. & Elliott, D., 2012. Estimating the costs of financial regulation. IMF Staff Discussion Note, 11 September.

Shivakumar, L., Urcan, O., Vasvari, F.P. & Zhang, L., 2011. The debt market relevance of management earnings forecasts: Evidence from before and during the credit crisis. *Review of Accounting Studies*, Volume 16, pp. 464–486.

Sironi, A., 2003. Testing for market discipline in the European banking industry: evidence from subordinated debt issues. *Money, Credit and Banking*, Volume 35, pp. 443–472.

Strahan, P.E., 2012. Liquidity Risk and Credit in the Financial Crisis. FRBSF Economics Letter 15.

Vazquez, F. & Federico, P., 2015. Bank funding structure and risk: evidence from the global financial crisis. *Journal of Banking & Finance*, Volume 61, pp. 1–14.

Veronesi, P. & Zingales, L., 2010. Paulson's gift. *Journal of Financial Economics,* Volume 97, pp. 339–368.

Wagster, J. D., 1996. Impact of the 1988 Basle Accord on International Banks. *Journal of Finance*, Volume 51, pp. 1321–1346.

Wilcoxon, F., 1945. Individual comparison by ranking methods. *Biometrics Bulletin*, Volume 1, pp. 80–83.

Yildirim, H. S., Kwag, S. A. & Collins, M. C., 2006. An examination of the equity market response to the Gramm-Leach-Bliley Act across commercial banking, investment banking, and insurance firms. *Journal of Business Finance and Accounting*, Volume 33, pp. 1629–1649.

Appendix

Table 1. List of European banks sorted by country

Country	Bank Name	GIIPS	Intervened	Bank assets in total banking system assets (%)	Tot. obs.
AUSTRIA	Erste Group Bank AG	No	Yes	32.20%	1,774
	Raiffeisen Zentralbank Österreich Aktiengesellschaft	No	No		2,065
BELGIUM	KBC Bank NV	No	Yes	16.11%	2,065
DENMARK	Danske Bank A/S	No	Yes	32.57%	2,065
FRANCE	BNP Paribas	No	Yes	45.37%	2,065
	Crédit Agricole SA	No	Yes		2,065
	Société Générale SA	No	Yes		2,065
	Dexia Credit Local SA	No	Yes		2,065
GERMANY	Bayerische Landesbank	No	Yes	57.67%	2,065
	Commerzbank AG	No	Yes		2,065
	Deutsche Apotheker- und Ärztebank EG	No	No		1,748
	Deutsche Bank AG	No	No		2,065
	DZ Bank AG- Deutsche Zentral-Genossenschaftsbank	No	No		1,885
	Landesbank Baden-Württemberg	No	Yes		2,065
	Landesbank Hessen-Thüringen Girozentrale	No	No		2,065
GREECE	Alpha Bank SA	Yes	Yes	98.06%	2,065
	Eurobank Ergasias SA	Yes	Yes		690
	National Bank of Greece SA	Yes	Yes		2,065
	Piraeus Bank SA	Yes	Yes		1,864
IRELAND	Permanent TSB Plc	Yes	Yes	64.41%	760
	Bank of Ireland – Governor and Company of the Bank of Ireland	Yes	Yes		2,056
	Allied Irish Bank	Yes	Yes		1,259
ITALY	Intesa SanPaolo	Yes	No	56.23%	2,065
	Banca Monte dei Paschi di Siena	Yes	Yes		2,065
	Banco Popolare SC	Yes	Yes		2,064
	Banca Popolare di Milano SCarL	Yes	Yes		2,065
	Mediobanca – Banca di Credito Finanziario SpA	Yes	No		2,065
	UniCredit SpA	Yes	No		1,832

NORWAY	DNB Bank ASA	No	No	30.92%	925
PORTUGAL	Banco Comercial Português SA	Yes	Yes	40.67%	2,065
	Caixa Geral de Depósitos, SA	Yes	Yes		2,061
SPAIN	Banco de Sabadell SA	Yes	No	67.31%	2,065
	Banco Bilbao Vizcaya Argentaria SA	Yes	No		2,065
	Banco Popular Español SA	Yes	Yes		1,984
	Banco Santander SA	Yes	No		2,025
	Bankinter SA	Yes	Yes		2,065
SWEDEN	Swedbank AB	No	Yes	67.64%	2,060
	Nordea Bank AB	No	No		2,065
	Svenska Handelsbaken AB	No	No		2,065
SWITZERLAND	Credit Suisse Group AG	No	No	37.13%	2,065
	UBS AG	No	Yes		2,065
THE NETHERLANDS	Rabobank Nederland	No	No	41.65%	2,065
	ING Bank NV	No	Yes		2,065
UK	HSBC Bank Plc	No	No	33.78%	2,065
	Barclays Bank Plc	No	Yes		2,065
	Standard Chartered Bank	No	No		2,065
	Royal Bank of Scotland Plc	No	Yes		2,065
	Lloyds Bank Plc	No	Yes		1,634

This table shows the banks in the study divided by country. Yes/No in the third column denotes whether a financial institution is located in a GIIPS (i.e. Greece, Italy, Ireland, Portugal and Spain) country or not. Yes/No in the fourth column denotes whether a financial institution has received state aid or not. The fifth column displays the percentage of total assets held by our banks in a country with respect to the total banking system assets of that country. For each bank is reported the number of observations (daily CDS spreads) available in the period from July 2007 to June 2015.

Table 2. Key events leading to the introduction of liquidity regulation as part of Basel III

Event	*Calendar Date*	*Event description*
1	February 21, 2008	The "*Liquidity Risk: Management and Supervisory Challenge"* document is published by the BCBS. It outlines the main results of the Working Group of Liquidity (WGL)'s report, which includes preliminary observations on bank criticalities to manage liquidity risk in stress scenarios.
2	June 17, 2008	In response to banks' lack of basic principles of liquidity risk management during the crisis, the BCBS issues "*Principles for Sound Liquidity Management and Supervision"* (Consultative Document), which provides instructions for correct management and control of liquidity risk. This proposal is an expansion of a previous version published in 2000. The key features of the guidance include: the definition of a liquidity risk tolerance, the development of accurate and effective funding plans, tests for banks under liquidity stress scenarios, a regular assessment of liquidity risk by supervisors, an appropriate liquidity buffers and the increase in public disclosure.
3	September 25, 2008	The final version of "*Principles for Sound Liquidity Risk Management and Supervision"* is released by the BCBS. This final guidance does not present substantial changes from the proposal.
4	December 17, 2009	The "*International Framework for Liquidity Risk Management Standards and Monitoring"* Consultative Document is issued by the BCBS. This publication aims to increase banks' ability to face liquidity stress conditions and promote the international harmonization of liquidity rules. To this purpose, two liquidity standards are presented, the Liquidity Coverage Ratio (LCR) and the Net Stable Funding Ratio (NSFR).
5	July 26, 2010	The Group of Governors and Heads of Supervision (GHOS) reviews the capital and liquidity reform package presented in the 2009 Consultative Document. The agreements reached by the oversight body are summarized in an "*Annex"*, which includes a more favourable definition of qualifying liquid assets and a recalibration of some liability items related to the LCR. Concerning instead the NSFR, a more favourable treatment of retail vs. wholesale funding is included.
6	December 16, 2010	The BCBS publishes "*Basel III: International Framework for Liquidity Risk Measurement, Standards and Monitoring"*, which sets out the rules and schedules agreed with the GHOS to implement the new Basel III liquidity framework. Importantly, the LCR is partially relaxed in accordance with the previously released *Annex*, while the NSFR maintained substantially unaffected.
7	January 07, 2013	The BCBS publishes "*Basel III: The Liquidity Coverage Ratio and liquidity risk monitoring tools"*. This document presents the full text of the revised LCR. Main changes include the enlargement of the assets eligible as HQLA, which are in the numerator of the ratio, and some recalibrations of the rates related to cash inflow and outflows, which instead are in the denominator of the index.
8	July 19, 2013	The BCBS releases "*Liquidity coverage ratio disclosure standards"* (Consultative Document). This proposal develops disclosure requirements for the LCR. All banks of countries member of the BCBS are expected to apply these disclosure requirements, adopting to a common template.
9	January 13, 2014	Two important documents are published by the BCBS: "*Liquidity Coverage Ratio disclosure standards"*, which finalises the disclosure requirements for the LCR and the consultative document "*Basel III: the Net Stable Funding Ratio"*. This latter proposes some revisions on the NSFR to avoid adverse effect on banks, changing the weighting factor of some items in the ratio by putting more attention to short-term, volatile sources of funding. Furthermore, more consistency between the two liquidity standards, i.e. LCR and NSFR, is provided.
10	October 31, 2014	The final version of the revised NSFR is issued by the BCBS. The "*Basel III: the Net Stable Funding Ratio"* maintains the main features of the proposal framework with some minor changes related to the categories of the Required Stable Funding (RSF), which are in the denominator of the ratio.
11	December 9, 2014	The BCBS releases "*Net Stable Funding Ratio disclosure standards"* (Consultative Document). Based on this proposal all banks of countries member of the BCBS are expected to apply these disclosure requirements, adopting to a common template. This should support market participants to correctly understand the level of bank funding risk.
12	June 22, 2015	The final document *Net Stable Funding Ratio disclosure standards* is issued by the BCBS. This document present minor changes from the proposal framework.

This table provides a brief description of the events under examination. Information is taken from the official website of the Bank of International Settlements (BIS) (http://www.bis.org/index.htm) and a series of documents issued by the BCBS (i.e., BCBS 2008a, 2008b, 2008c, 2009, 2010, 2013a, 2013b, 2014a, 2014b, 2014c, 2014d, 2015).

Table 3. Regulatory events and classification

Event	*Date*	*Tightened/ Loosed liquidity requirements*
1	February 21, 2008	Tightened
2	June 17, 2008	Tightened
3	September 25, 2008	Tightened
4	December 17, 2009	Tightened
5	July 26, 2010	Loosed
6	December 16, 2010	Tightened
7	January 07, 2013	Loosed
8	July 19, 2013	Tightened
9	January 13, 2014	Loosed
10	October 31, 2014	Tightened
11	December 9, 2014	Tightened
12	June 22, 2015	Tightened

This table displays the event dates and classifies them between events that tightened and loosened liquidity requirements.

Table 4. Descriptive statistics for the whole dataset

	Mean	*Median*	*Max*	*Min*	*Standard deviation*
LIQ (%)	33.94	24.19	81.38	11.79	23.067
FUN (%)	62.43	65.97	78.15	41.23	12.270
TIER1 (%)	10.66	10.50	15.80	6.90	2.810
NPL_GL (%)	5.452	3.820	16.409	0.697	4.892
LLR_NPL (%)	58.09	55.83	87.09	39.91	14.435
NPL_GL LLR_NPL*	2.968	2.159	10.390	1.008	2.522
GLOBAL	0.1667	0.000	1.000	0.000	0.373
SOVEREIGN	0.1667	0.000	1.000	0.000	0.373
Post_LTRO	0.500	0.500	1.000	0.000	0.500
ROAA (%)	0.002	0.003	0.009	-0.007	0.005
ASSETS	19.49	19.43	21.51	17.36	1.117
GIIPS	0.400	0.000	1.000	0.000	0.490
Intervened	0.4479	0.000	1.000	0.000	0.498
LISTED	0.6111	1.0000	1.000	0.000	0.488
TYPE	0.875	1.0000	1.000	0.000	0.331
STR_REG	0.750	1.000	1.000	0.000	0.433

This table reports descriptive statistics of the explanatory variables of Equation (5). Accounting variables are all winsorized at the 10% level. *NPL_GL* LLR_NPL* is divided by 100.

Table 5. Descriptive statistics by country

	AUSTRIA		BELGIUM		DENMARK		FRANCE		GERMANY	
	Mean	*Standard deviation*	*Mean*	*Standard deviation*	*Mean*	*Standard deviation*	*Mean*	*Standard deviation*	*Mean*	*Standard deviation*
LIQ (%)	25.38	12.13	26.20	8.88	43.85	15.52	50.49	27.62	47.56	26.128
FUN (%)	69.86	7.59	68.46	8.91	59.89	3.65	47.17	10.15	52.74	10.58
TIER1 (%)	9.68	1.71	11.03	2.33	12.74	3.99	10.55	2.73	11.41	3.35
NPL_GL (%)	7.30	2.74	6.82	3.75	3.81	2.10	4.27	2.46	3.49	1.43
LLR_NPL (%)	65.35	6.13	48.35	8.96	46.17	6.77	67.65	9.47	52.92	9.93
	GREECE		**IRELAND**		**ITALY**		**NORWAY**		**PORTUGAL**	
	Mean	*Standard deviation*	*Mean*	*Standard deviation*	*Mean*	*Standard deviation*	*Mean*	*Standard deviation*	*Mean*	*Standard deviation*
LIQ (%)	15.81	5.96	26.98	24.46	30.91	17.69	24.38	10.49	15.54	3.79
FUN (%)	67.82	9.31	67.22	12.30	70.58	5.71	68.60	4.60	75.11	2.80
TIER1 (%)	10.95	2.24	9.94	2.37	9.41	2.06	9.77	2.07	9.68	2.30
NPL_GL (%)	10.54	6.02	9.30	7.26	8.88	5.23	1.69	0.67	4.36	2.59
LLR_NPL (%)	49.84	9.17	56.83	10.21	60.64	14.16	43.72	3.60	85.66	3.32
	SPAIN		**SWEDEN**		**SWITZERLAND**		**NETHERLANDS**		**UK**	
	Mean	*Standard deviation*	*Mean*	*Standard deviation*	*Mean*	*Standard deviation*	*Mean*	*Standard deviation*	*Mean*	*Standard deviation*
LIQ (%)	18.75	7.53	32.75	14.20	66.02	26.35	21.85	4.711	44.08	20.67
FUN (%)	69.68	5.81	63.57	8.29	47.92	5.76	69.00	5.98	56.55	11.94
TIER1 (%)	9.73	1.98	9.84	2.53	13.95	2.65	12.37	3.12	11.40	2.92
NPL_GL (%)	5.95	5.32	1.14	0.71	0.99	0.69	2.281	0.94	3.79	2.35
LLR_NPL (%)	67.68	16.53	59.46	13.07	53.12	8.87	45.18	6.79	51.93	12.40

This table reports descriptive statistics by country of the bank-specific variables related to our testable hypotheses. Variables are all winsorized at the 10% level.

Table 6. Correlation matrix

	LIQ	*FUN*	*TIER1*	*NPL_GL*	*LLR_NPL*	*GLOBAL*	*SOVEREIGN*	*Post_ LTRO*	*ROAA*	*ASSETS*	*GIIPS*	*Intervened*	*LISTED*	*TYPE*	*STR_REG*
LIQ	1	-0.6	-0.03	-0.38	-0.04	0.12	0.09	-0.3	0.01	0.41	-0.42	-0.27	-0.13	-0.4	0.07
FUN	-0.6	1	-0.2	0.22	0.15	-0.02	0.04	-0.03	0.21	-0.58	0.57	0.01	0.19	0.26	0.01
TIER1	-0.03	-0.2	1	0.18	-0.34	-0.41	-0.08	0.7	-0.27	0.21	-0.24	0.27	-0.08	-0.21	-0.22
NPL_GL	-0.38	0.22	0.18	1	-0.29	-0.27	-0.08	0.48	-0.44	-0.22	0.43	0.42	0.35	0.26	-0.15
LLR_NPL	-0.04	0.15	-0.34	-0.29	1	0.18	-0.08	-0.25	0.21	-0.18	0.27	-0.22	0.13	-0.04	0.13
GLOBAL	0.12	-0.02	-0.41	-0.27	0.18	1	-0.2	-0.45	0.19	-0.02	0.02	-0.14	0.01	0	0.26
SOVEREIGN	0.09	0.04	-0.08	-0.08	-0.08	-0.2	1	-0.45	-0.08	-0.02	0.01	0.13	-0.02	0	-0.26
Post_LTRO	-0.3	-0.03	0.7	0.48	-0.25	-0.45	-0.45	1	-0.37	0.06	-0.04	0.31	-0.01	0	-0.19
ROAA	0.01	0.21	-0.27	-0.44	0.21	0.19	-0.08	-0.37	1	-0.07	0.03	-0.48	0.05	0.12	0.2
ASSETS	0.41	-0.58	0.21	-0.22	-0.18	-0.02	-0.02	0.06	-0.07	1	-0.59	-0.14	-0.19	-0.02	-0.02
GIIPS	-0.42	0.57	-0.24	0.43	0.27	0.02	0.01	-0.04	0.03	-0.59	1	0.05	0.54	0.21	0.01
Intervened	-0.27	0.01	0.27	0.42	-0.22	-0.14	0.13	0.31	-0.48	-0.14	0.05	1	-0.01	0.16	-0.18
LISTED	-0.13	0.19	-0.08	0.35	0.13	0.01	-0.02	-0.01	0.05	-0.19	0.54	-0.01	1	0.12	0.01
TYPE	-0.4	0.26	-0.21	0.26	-0.04	0	0	0	0.12	-0.02	0.21	0.16	0.12	1	0
STR_REG	0.07	0.01	-0.22	-0.15	0.13	0.26	-0.26	-0.19	0.2	-0.02	0.01	-0.18	0.01	0	1
VIF	2.38	2.7	3.09	3.07	1.5	1.83	2.78	6.43	1.85	2.3	3.29	1.77	1.56	1.7	1.22

This table reports correlation coefficients and VIFs of the explanatory variables of Equation (5). Accounting variables are all winsorized at the 10% level.

Table 7. Aggregate CDS market reaction

ALL EVENTS	*CAAS*	*t-test*	*Median*	*p-Value Wilcoxon sign-rank test*
(-2,2)	0.0238	0.1637	0.0174	0.1514
(0,1)	0.0188	0.088*	0.0167	0.1099
(0,0)	0.0121	0.0080***	0.0106	0.0050***
(-1,0)	0.0091	0.0658*	0.0073	0.0639*
(-1,1)	0.0159	0.1517	0.0110	0.1763
LIQUIDITY ONLY EVENTS				
(-2, 2)	0.0192	0.492	0.0062	0.8130
(0,1)	0.0139	0.397	0.0063	0.5781
(0,0)	0.0155	0.031**	0.0136	0.031**
(-1,0)	0.0129	0.111	0.0128	0.1563
(-1,1)	0.0113	0.490	0.0075	0.8120

This table displays the results from the event study over a series of event windows for all events on liquidity regulation taken together. CASs are estimated adopting factor model. *ALL EVENTS* denotes all 12 announcements concerning liquidity regulation. *LIQUIDITY ONLY EVENTS* denotes Event 1, 2, 3, 7, 8, 10, 12. The statistical significance of cumulated average abnormal spread changes (CAAS) is tested using the standard t-test and the Wilcoxon signed-rank (1945) test. Under the null hypothesis of the test, the CAAS change equals zero, whereas under the alternative hypothesis the average diverges from zero. ***,**,* denote that estimates are statistically significant at the 1, 5 and 10% levels.

Table 8. Placebo events – 4 days earlier

ALL EVENTS	*CAAS*	*t-test*	*Median*	*p-Value Wilcoxon sign-rank test*
(0,1)	-0.0030	0.776	0.0006	0.8984
(0,0)	-0.0004	0.9231	0.0006	0.9658
(-1,0)	0.0004	0.950	0.0008	0.8984
(-1,1)	-0.0017	0.8361	0.0005	0.9658
LIQUIDITY ONLY EVENTS				
(0,1)	-0.0062	0.7508	-0.0006	0.999
(0,0)	-0.0031	0.7175	-0.0033	0.6875
(-1,0)	-0.0087	0.448	-0.0099	0.5625
(-1,1)	-0.0085	0.4864	-0.0081	0.6875

This table displays the results of the placebo test where CASs are estimated four days before the actual announcement. CASs are estimated adopting factor model. *ALL EVENTS* denotes all 12 announcements concerning liquidity regulation. *LIQUIDITY ONLY EVENTS* denotes Event 1, 2, 3, 7, 8, 10, 12. The statistical significance of cumulated average abnormal spread changes (CAAS) is tested using the standard t-test and the Wilcoxon signed-rank (1945) test. Under the null hypothesis of the test, the CAAS change equals zero, whereas under the alternative hypothesis the average diverges from zero. ***,**,* denote that estimates are statistically significant at the 1, 5 and 10% levels.

Table 9. Bank CDS market reaction to liquidity regulation announcements – All events

ALL EVENTS	(1) *CAS(0,0)*	(2) *CAS(0,1)*	(3) *CAS(-1,1)*	(4) *CAS(-2,2)*
Constant	-0.1068*	-0.1068	-0.0631	-0.2667
	[0.0790]	[0.0790]	[0.0918]	[0.1703]
LIQ	-0.0004*	-0.0004**	-0.0006***	-0.0005**
	[0.0002]	[0.0002]	[0.0002]	[0.0002]
FUN	-0.0003	-0.0003	-0.0002	0.0002
	[0.0003]	[0.0003]	[0.0004]	[0.0006]
TIER1	-0.0035**	-0.0035***	-0.0027**	-0.0032***
	[0.0011]	[0.0011]	[0.0012]	[0.0010]
NPL_GL	0.0074***	0.0074**	0.0062*	0.0091*
	[0.0030]	[0.0030]	[0.0032]	[0.0047]
LLR_NPL	0.0001	0.0001	-0.0001	0.0002
	[0.0002]	[0.0002]	[0.0003]	[0.0007]
*NPL_GL*LLR_NPL*	-0.0001**	-0.0001**	-0.0001	-0.0001
	[0.0001]	[0.0001]	[0.0001]	[0.0001]
GLOBAL	0.0596*	0.0596***	0.0713***	0.1267***
	[0.0146]	[0.0146]	[0.0140]	[0.0200]
SOVEREIGN	0.0071	0.0071	0.0047	0.0343*
	[0.0088]	[0.0088]	[0.0063]	[0.0135]
Post_LTRO	0.0208	0.0208***	0.0233***	0.0651***
	[0.0073]	[0.0073]	[0.0076]	[0.0110]
ROAA	1.9544	1.9544**	1.7352	3.0367*
	[0.8817]	[0.8817]	[1.0810]	[1.6895]
ASSETS	0.0069***	0.0069**	0.0051**	0.0115**
	[0.0027]	[0.0027]	[0.0026]	[0.0059]
GIIPS	-0.0069*	-0.0069	-0.0100*	-0.0188
	[0.0054]	[0.0054]	[0.0055]	[0.0137]
Intervened	-0.0095	-0.0095	-0.0065	-0.0131
	[0.0070]	[0.0070]	[0.0080]	[0.0106]
LISTED	-0.0022	-0.0022	-0.0001	-0.0003
	[0.0045]	[0.0045]	[0.0032]	[0.0069]
TYPE	-0.0113**	-0.0113	-0.0185***	-0.0199**
	[0.0080]	[0.0080]	[0.0069]	[0.0078]
STR_REG	0.0305***	0.0305***	0.0270***	0.0384***
	[0.0079]	[0.0079]	[0.0089]	[0.0105]

# of observations	491	491	491	491
Adjusted R-squared	0.1263	0.2051	0.1928	0.2565

This table reports the results from the regression analysis for the 12 events concerning liquidity regulation. The estimation is an OLS regression with clustered standard errors at the country level. CASs are estimated adopting factor model. *LIQ* is the ratio of liquid assets to deposits and short-term funding; *FUN* is the ratio of equity, long-term funding and customer deposits in total assets; *TIER1* is the ratio between primary regulatory capital and risk weighted assets; *NPL_GL* is the ratio between impaired loans and gross loans; *LLR_NPL* is the ratio between loan loss reserves and non-performing loans; *GLOBAL* is a dummy variable for the global crisis period (15/09/2008-01/05/2010); *SOVEREIGN* is a dummy variable for the sovereign debt crisis period (02/05/2010-21/12/2011); *Post_LTRO* is a dummy variable for the period following the two LTROs by the ECB (after 22/12/2011); *ROAA* is the return on average assets; *ASSETS* is the logarithmic transformation of total year-end assets; *GIIPS* is a dummy variable for banks located in Greece, Ireland, Italy, Portugal and Spain; *Intervened* is a dummy variable for banks that received bailout funding; *LISTED* is a dummy variable for publicly listed banks; *TYPE* is a dummy variable for traditional financial institutions; *STR_REG* is a dummy variable indicating the events that strengthen the regulation on liquidity. Accounting variables are all winsorized at the 10% level. Standard errors clustered at the country level are reported in parenthesis. ***, **, and * indicate statistical significance at 1%, 5%, and 10%.

Table 10. Sensitivity analysis– All events

	Change in CAS			
Regressors	(1) (0,0)	(2) (0,1)	(3) (-1,1)	(4) (-2,2)
LIQ	-0.0036	-0.0082	-0.0135	-0.0112
TIER1	-0.0048	-0.0098	-0.0077	-0.0089
NPL_GL	0.0252	0.0363	0.0303	0.0444
ROAA		0.0096		0.0149
Predicted *CAS*	0.0078	0.0057	0.0031	0.0086

This table reports the sensitivity analysis from Equation (5) when CASs are estimated using factor model. For each accounting variable that is statistically significant in Table 9, we compute the product of the variable's estimated coefficient from Equation (5) and its corresponding standard deviation. This procedure is then repeated for each event window. The predicted CAS is the predicted outcome from Equation (5) when all regressors are at their mean value.

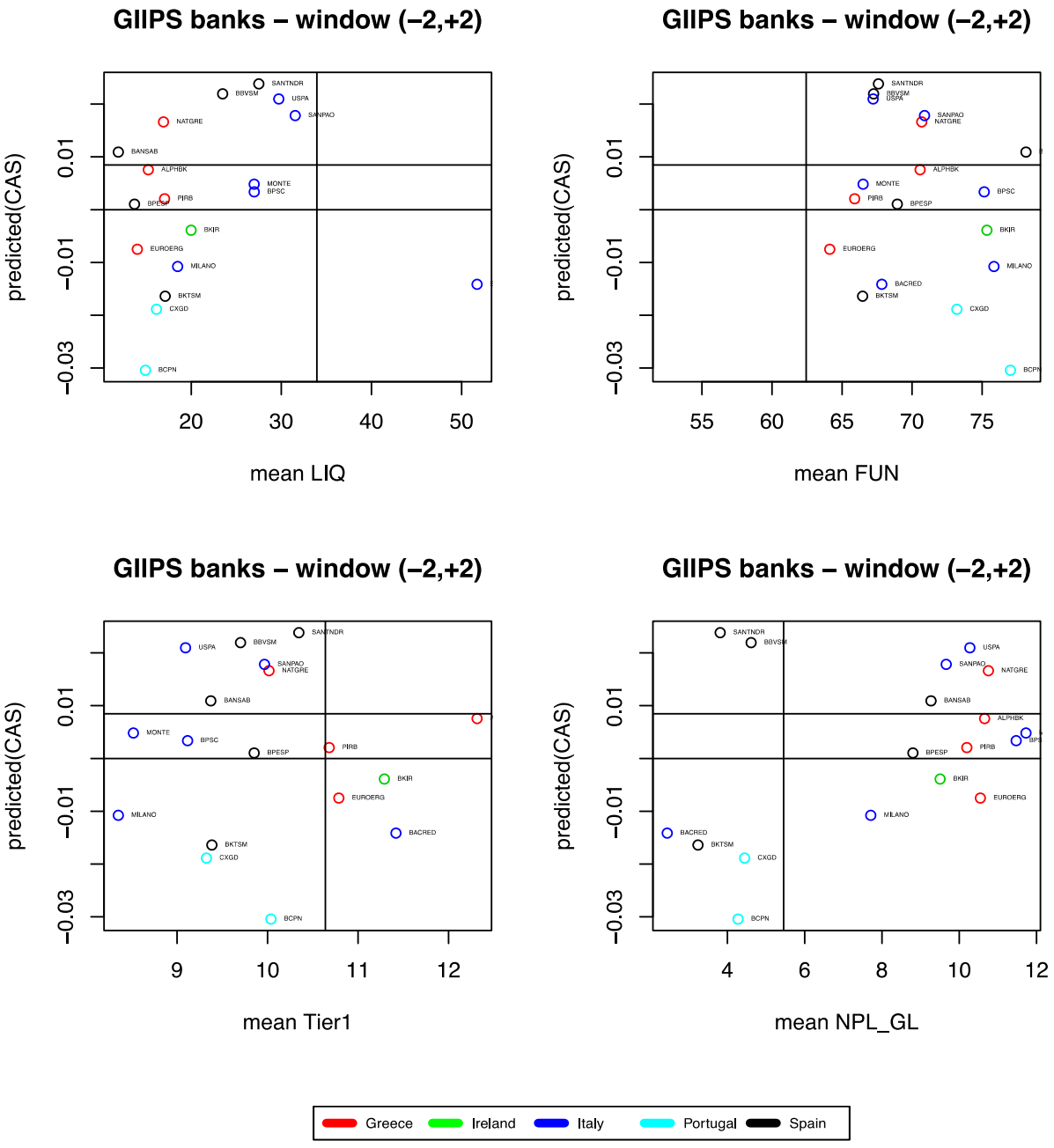
Table 11. Bank CDS market reaction to liquidity regulation announcements– Liquidity only

events

LIQUIDITY ONLY EVENTS	(1) *CAS(0,0)*	(2) *CAS(0,1)*	(3) *CAS(-1,1)*	(4) *CAS(-2,2)*
Constant	-0.0854**	-0.0842	-0.0130	-0.3146**
	[0.0385]	[0.0647]	[0.0882]	[0.1542]
LIQ	-0.0001	-0.0004*	-0.0007***	-0.0008***
	[0.0001]	[0.0002]	[0.0002]	[0.0002]
FUN	0.0001	-0.0002	-0.0002	0.0002
	[0.0003]	[0.0005]	[0.0005]	[0.0007]
TIER1	-0.0022**	-0.0046*	-0.0036	-0.0015
	[0.0009]	[0.0024]	[0.0031]	[0.0019]
NPL_GL	0.0047**	0.0067*	0.0059	0.0040
	[0.0021]	[0.0037]	[0.0047]	[0.0047]
LLR_NPL	0.0001	-0.0001	-0.0003	-0.0003
	[0.0002]	[0.0003]	[0.0004]	[0.0006]
*NPL_GL*LLR_NPL*	-0.0001**	-0.0001*	-0.0001	0.0001
	[0.0001]	[0.0001]	[0.0001]	[0.0001]
GLOBAL	0.0329***	0.0960***	0.1022***	0.1921***
	[0.0117]	[0.0255]	[0.0281]	[0.0331]
Post_LTRO	-0.0030	0.0035	0.0085	0.0207
	[0.0063]	[0.0151]	[0.0202]	[0.0164]
ROAA	0.4995	1.7615	0.9530	2.4338
	[0.7007]	[1.3052]	[1.6157]	[2.0594]
ASSETS	0.0048***	0.0078***	0.0050*	0.0174***
	[0.0012]	[0.0021]	[0.0030]	[0.0051]
GIIPS	-0.0087**	-0.0149*	-0.0194**	-0.0284*
	[0.0037]	[0.0078]	[0.0082]	[0.0155]
Intervened	0.0038	0.0048	-0.0003	0.0070
	[0.0032]	[0.0064]	[0.0083]	[0.0093]
LISTED	0.0029	-0.0013	0.0022	0.0020
	[0.0018]	[0.0078]	[0.0055]	[0.0112]
TYPE	-0.0039	-0.0070	-0.0155*	-0.0202***
	[0.0040]	[0.0095]	[0.0085]	[0.0072]
STR_REG	0.0201**	0.0094	0.0130	0.0106
	[0.0079]	[0.0130]	[0.0128]	[0.0146]
# of observations	281	281	281	281
Adjusted R-squared	0.2930	0.300	0.2362	0.400

This table reports the results from the regression analysis for the subset of events exclusively related to liquidity (Event 1, 2, 3, 7, 8, 10, 12). The estimation is an OLS regression with clustered standard errors at the country level. CASs are estimated adopting a factor model. *LIQ* is the ratio of liquid assets to deposits and short-term funding; *FUN* is the ratio of equity, long-term funding and customer deposits in total assets; *TIER1* is the ratio between primary regulatory capital and risk weighted assets; *NPL_GL* is the ratio between impaired loans and gross loans; *LLR_NPL* is the ratio between loan loss reserves and non-performing loans; *GLOBAL* is a dummy variable for the global crisis period (15/09/2008-01/05/2010); *SOVEREIGN* is a dummy variable for the sovereign debt crisis period (02/05/2010-21/12/2011); *Post_LTRO* is a dummy variable for the period following the two LTROs by the ECB (after 22/12/2011); *ROAA* is the return on average assets; *ASSETS* is the logarithmic transformation of total year-end assets; *GIIPS* is a dummy variable for banks located in Greece, Ireland, Italy, Portugal and Spain; *Intervened* is a dummy variable for banks that received bailout funding; *LISTED* is a dummy variable for publicly listed banks; *TYPE* is a dummy variable for traditional financial institutions; *STR_REG* is a dummy variable indicating the events that strengthen the regulation on liquidity. Accounting variables are all winsorized at the 10% level. Standard errors clustered at the country level are reported in parenthesis. ***, **, and * indicate statistical significance at 1%, 5%, and 10%.

Figure 1. Predicted CDS spread change of GIIPS banks against the mean value of liquidity, funding, capital, and asset quality ratios



Supplementary appendix

Table A1. CDS market reaction by individual event

Event Date	*Predicted sign*	*CAAS*				
		(-2,2)	(0,1)	(0,0)	(-1,0)	(-1,1)
February 21, 2008	+	-0.0525	0.0155	0.0131	-0.0079	-0.0055
June 17, 2008	+	-0.004	-0.0118	0.0087	0.0051	-0.0155
September 25, 2008	+	0.1659	0.0964	0.0443	0.0374	0.0895
December 17, 2009	+	0.0211	0.0177	0.0022	0.0111	0.0266
July 26, 2010	–	-0.0794	-0.0668	-0.0100	-0.0111	-0.068
December 16, 2010	+	0.0166	0.0287	0.0101	-0.003	0.0156
January 07, 2013	–	-0.0200	-0.022	-0.0150	-0.0166	-0.0235
July 19, 2013	+	-0.0076	-0.0067	-0.0031	-0.0022	-0.0058
January 13, 2014	–	0.0102	0.0119	0.0046	0.0096	0.0169
October 31, 2014	+	0.0233	0.0115	0.0213	0.0373	0.0275
December 9, 2014	+	0.0453	0.027	0.0183	0.0093	0.018
June 22, 2015	+	-0.0107	-0.0292	0.0094	0.0038	-0.0348

This table documents for each event date the CAAS estimated using factor model over a series of event windows.

Table A2. Test for confounding events: aggregate CDS market reaction

ALL EVENTS	*CAAS*	*t-test*	*Median*	*p-Value Wilcoxon sign-rank test*
(-2,2)	0.0228	0.179	0.0163	0.1514
(0,1)	0.0184	0.0934*	0.0159	0.1099
(0,0)	0.0116	0.0068***	0.0101	0.0068***
(-1,0)	0.0080	0.1032	0.0057	0.1514
(-1,1)	0.0148	0.1739	0.0110	0.2036
LIQUIDITY ONLY EVENTS				
(-2, 2)	0.0186	0.5028	0.0062	0.8125
(0,1)	0.0142	0.3896	0.0063	0.5781
(0,0)	0.0157	0.03102**	0.0140	0.0313**
(-1,0)	0.0127	0.1168	0.0124	0.1563
(-1,1)	0.0111	0.4949	0.0075	0.8125

This table displays the results from the event study over a series of event windows for all events on liquidity regulation taken together, after omitting potential bank-specific confounding announcements, as defined in paragraph 6.4.. CASs are estimated adopting factor model. *ALL EVENTS* denotes all 12 announcements concerning liquidity regulation. *LIQUIDITY ONLY EVENTS* denotes Event 1, 2, 3, 7, 8, 10, 12. The statistical significance of cumulated average abnormal spread changes (CAAS) is tested using the standard t-test and the Wilcoxon signed-rank (1945) test. Under the null hypothesis of the test, the CAAS change equals zero, whereas under the alternative hypothesis the average diverges from zero. ***,**,* denote that estimates are statistically significant at the 1, 5 and 10% levels.

Table A3. Test for confounding events: bank CDS market reaction to liquidity regulation

announcements – All events

ALL EVENTS	(1) *CAS(0,0)*	(2) *CAS(0,1)*	(3) *CAS(-1,1)*	(4) *CAS(-2,2)*
Constant	-0.0613	-0.1018	-0.0631	-0.2644**
	[0.0363]	[0.0817]	[0.0918]	[0.1774]
LIQ	-0.0001	-0.0003**	-0.0006***	-0.0005**
	[0.0001]	[0.0002]	[0.0002]	[0.0002]
FUN	0.00003	-0.0003	-0.0002	0.0001
	[0.0002]	[0.0003]	[0.0004]	[0.0006]
TIER1	-0.0018**	-0.0033***	-0.0027**	-0.0035
	[0.0005]	[0.0012]	[0.0012]	[0.0011]
NPL_GL	0.0058***	0.0074**	0.0062*	0.0094**
	[0.0021]	[0.0031]	[0.0032]	[0.0049]
LLR_NPL	0.0002	0.0001	-0.0001	0.0003
	[0.0002]	[0.0003]	[0.0003]	[0.0007]
*NPL_GL*LLR_NPL*	-0.0001**	-0.0001**	-0.0001	-0.0001
	[0.00003]	[0.0001]	[0.0001]	[0.0001]
GLOBAL	0.0115	0.0588***	0.0713***	0.1247***
	[0.0079]	[0.0153]	[0.0140]	[0.0204]
SOVEREIGN	0.0013	0.0061	0.0047	0.0374
	[0.0045]	[0.0086]	[0.0063]	[0.0131]
Post_LTRO	0.0025	0.0196***	0.0233***	0.0674***
	[0.0052]	[0.0072]	[0.0076]	[0.0110]
ROAA	0.4404	2.0775**	1.7352	2.9201***
	[0.3767]	[0.8423]	[1.0810]	[1.6871]
ASSETS	0.0034*	0.0066**	0.0051	0.0116**
	[0.0013]	[0.0028]	[0.0026]	[0.0060]
GIIPS	-0.0079	-0.0069	-0.0100*	-0.0185
	[0.0031]	[0.0052]	[0.0055]	[0.0134]
Intervened	-0.0071*	-0.0102	-0.0065	-0.0140
	[0.0031]	[0.0069]	[0.0080]	[0.0102]
LISTED	0.0024	-0.0026	-0.0001	-0.0015
	[0.0019]	[0.0046]	[0.0032]	[0.0070]
TYPE	-0.0047	-0.0108	-0.0185***	-0.0182
	[0.0021]	[0.0077]	[0.0069]	[0.0075]
STR_REG	0.0160***	0.0285***	0.0270***	0.0369***
	[0.0052]	[0.0078]	[0.0089]	[0.0107]

# of observations	478	478	478	478
Adjusted R-squared	0.1279	0.1992	0.1818	0.2671

This table reports the results from the regression analysis for the 12 events concerning liquidity regulation, after omitting potential bank-specific confounding announcements, as defined in paragraph 6.4.. The estimation is an OLS regression with clustered standard errors at the country level. CASs are estimated adopting factor model. *LIQ* is the ratio of liquid assets to deposits and short-term funding; *FUN* is the ratio of equity, long-term funding and customer deposits in total assets; *TIER1* is the ratio between primary regulatory capital and risk weighted assets; *NPL_GL* is the ratio between impaired loans and gross loans; *LLR_NPL* is the ratio between loan loss reserves and non-performing loans; *GLOBAL* is a dummy variable for the global crisis period (15/09/2008-01/05/2010); *SOVEREIGN* is a dummy variable for the sovereign debt crisis period (02/05/2010-21/12/2011); *Post_LTRO* is a dummy variable for the period following the two LTROs by the ECB (after 22/12/2011); *ROAA* is the return on average assets; *ASSETS* is the logarithmic transformation of total year-end assets; *GIIPS* is a dummy variable for banks located in Greece, Ireland, Italy, Portugal and Spain; *Intervened* is a dummy variable for banks that received bailout funding; *LISTED* is a dummy variable for publicly listed banks; *TYPE* is a dummy variable for traditional financial institutions; *STR_REG* is a dummy variable indicating the events that strengthen the regulation on liquidity. Accounting variables are all winsorized at the 10% level. Standard errors clustered at the country level are reported in parenthesis. ***, **, and * indicate statistical significance at 1%, 5%, and 10%.

Table A4. Test for confounding events: bank CDS market reaction to liquidity regulation announcements – Liquidity only events

ALL EVENTS	(1)	(2)	(3)	(4)

	CAS(0,0)	*CAS(0,1)*	*CAS(-1,1)*	*CAS(-2,2)*
Constant	-0.0863**	-0.0844	-0.0116	-0.3144**
	[0.0388]	[0.0645]	[0.0899]	[0.1578]
LIQ	-0.0001	-0.0004*	-0.0007***	-0.0008***
	[0.0001]	[0.0002]	[0.0002]	[0.0645]
FUN	0.0001	-0.0002	-0.0003	0.0002
	[0.0003]	[0.0005]	[0.0005]	[0.0645]
TIER1	-0.0022**	-0.0047*	-0.0036	-0.0019
	[0.0009]	[0.0024]	[0.0031]	[0.0645]
NPL_GL	0.0046**	0.0066*	0.0061	0.0043
	[0.0021]	[0.0038]	[0.0047]	[0.0645]
LLR_NPL	0.00005	-0.0001	-0.0003	-0.0002
	[0.0002]	[0.0003]	[0.0004]	[0.0645]
*NPL_GL*LLR_NPL*	-0.0001*	-0.0001*	-0.0001	0.0000
	[0.0000]	[0.0001]	[0.0001]	[0.0645]
GLOBAL	0.0331***	0.0956	0.1017***	0.1908***
	[0.0121]	[0.0263]	[0.0290]	[0.0645]
Post_LTRO	-0.0030	0.0034	0.0090	0.0230
	[0.0064]	[0.0151]	[0.0198]	[0.0645]
ROAA	0.4910	1.7506	0.9566	2.3914
	[0.6985]	[1.3062]	[1.6320]	[0.0645]
ASSETS	0.0049***	0.0078***	0.0049	0.0174***
	[0.0012]	[0.0020]	[0.0030]	[0.0645]
GIIPS	-0.0079**	-0.0143*	-0.0204**	-0.0283
	[0.0038]	[0.0079]	[0.0081]	[0.0645]
Intervened	0.0039	0.0048	-0.0006	0.0065
	[0.0032]	[0.0063]	[0.0083]	[0.0645]
LISTED	0.0028*	-0.0013	0.0015	-0.0007
	[0.0017]	[0.0078]	[0.0056]	[0.0645]
TYPE	-0.0035	-0.0066	-0.0154*	-0.0175**
	[0.0038]	[0.0093]	[0.0087]	[0.0645]
STR_REG	0.0203**	0.0096	0.0128	0.0101
	[0.0079]	[0.0130]	[0.0130]	[0.0645]
# of observations	275	275	275	275
Adjusted R-squared	0.2536	0.2949	0.2285	0.3928

This table reports the results from the regression analysis for the subset of events exclusively related to liquidity (Event 1, 2, 3, 7, 8, 10, 12), after omitting potential bank-specific confounding announcements, as defined in paragraph 6.4.. The estimation is an OLS regression with clustered standard errors at the country level. CASs are estimated adopting factor model. *LIQ* is the ratio of liquid assets to deposits and short-term funding; *FUN* is the ratio of equity, long-term funding and customer deposits in total assets; *TIER1* is the ratio between primary regulatory capital and risk weighted assets; *NPL_GL* is the ratio between impaired loans and gross loans; *LLR_NPL* is the ratio between loan loss reserves and non-performing loans; *GLOBAL* is a dummy variable for the global crisis period (15/09/2008-01/05/2010); *SOVEREIGN* is a dummy variable for the sovereign debt crisis period (02/05/2010-21/12/2011); *Post_LTRO* is a dummy variable for the period following the two LTROs by the ECB (after 22/12/2011); *ROAA* is the return on average assets; *ASSETS* is the logarithmic transformation of total year-end assets; *GIIPS* is a dummy variable for banks located in Greece, Ireland, Italy, Portugal and Spain; *Intervened* is a dummy variable for banks that received bailout funding; *LISTED* is a dummy variable for publicly listed banks; *TYPE* is a dummy variable for traditional financial institutions; *STR_REG* is a dummy variable indicating the events that strengthen the regulation on liquidity. Accounting variables are all winsorized at the 10% level. Standard errors clustered at the country level are reported in parenthesis. ***, **, and * indicate statistical significance at 1%, 5%, and 10%.

Paper II

Market Discipline in Italian Bank Bond Issues: Do Investors Price Liquidity, Funding, and Asset Risk?

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Abstract

The global financial crisis has clearly increased concerns about bank liquidity, funding, and asset quality, especially among European peripheral countries. These issues have prompted regulators to introduce new standards and guidelines aimed at strengthening bank soundness, improve risk management and reinforce transparency of bank risk-taking activities. Using country-specific accounting data and bond spreads over the 2007 to mid-2014 period, we test investors' ability to timely recognize and price bank liquidity and funding risk, as defined by Basel III, together with bank asset risk, measured through forward- and backward-looking indicators of loan risk. Our analysis focuses on the 15 largest Italian banks because in the notes to the accounts, they provide a unique insight to compute our bank risk variables. Regression estimates show strong sensitivity of bond spreads to liquidity, whereas funding risk does not seem to play a role. Interestingly, investors' perspective on asset quality takes both a backward- and forward-looking focus. Our results provide two main contributions to the market discipline literature. First, we extend the relatively scarce studies examining market discipline in adverse market conditions, thus increasing regulators' knowledge on its complementary role in disciplining banks and on the necessary policy interventions to enhance it. Second, we introduce novel indicators on banks' risk profile, shedding light on investors' ability to account for characteristics other than easy-to-observe ones.

Keywords: Market Discipline, Banks, Unsecured Bond Issues

1. Introduction

It is well recognized by scholars and policymakers that market discipline can reduce banks' incentives to take excessive risk and provide important signals to regulators on the soundness of banking firms. The Basel Committee of Banking Supervision (BCBS) explicitly recognizes market discipline as a key pillar to enhance and promote financial stability. However, the recent financial crisis and the high liquidity, funding[41], and asset risk exposure, especially among European peripheral countries (Greece, Italy, Ireland, Portugal, Spain, or GIIPS), have prompted a debate on investors' ability to discipline banks. Given the priority of these risk dimensions to ensure banking system soundness, we address this issue by examining the sensitivity of unsecured debt to liquidity, funding, and asset risk using Italian bank bond issues over the 2007 to mid-2014 period.

Italy proves to be an accurate setting for this research: the current level of disclosure on Italian banks' balance sheets allows to efficiently construct our risk variables using detailed accounting items that would otherwise not be available. Furthermore, market discipline is expected to be particularly relevant among Italian banks, since they have been adversely affected by the crisis and in Europe were among major issuers on bonds (Grasso, et al., 2010).

An extensive stream of research has questioned whether investors are sensitive to bank risk-taking behaviour, typically adopting traditional accounting-based measures of risk and focusing on relatively stable market periods (Flannery & Sorescu, 1996; Jagtiani, et al., 2002; Sironi, 2003; Acharya, et al., 2016). To the best of our knowledge, only a handful of works have investigated market discipline during banking crises (Martinez Peria & Schmukler, 2001; Hadad, et al., 2011; Cubillas, et al., 2012), looking mainly at uninsured depositors before the recent

[41] Liquidity risk is the "*ability to finance cash outflows at any given point in time"* (King, 2013, p. 4145), while funding risk "*refers to a bank's ability to raise funds in the desired amount on an ongoing basis*" (King, 2013, p. 4145).

turmoil. Differently from prior studies, we employ risk indicators with both a backward- and forward-looking focus and perform the analysis in the post-2007 period, subject to adverse market conditions. To measure liquidity and funding risk, we follow the Basel III definition, estimating the Net Stable Funding Ratio (NSFR) and the Liquidity Coverage Ratio (LCR). These standards were implemented by the BCBS, as part of the new regulatory framework, to strengthen banks' liquidity risk management. To measure asset risk instead, we employ a comprehensive set of both backward- and forward-looking indicators on bank activities using, among others, loan ratings.

From the empirical analysis, four main results emerge: (i) investors are sensitive to liquidity risk and, as a result, financial institutions more exposed to liquidity issues pay higher spreads as compared to those less subject to liquidity concerns, (ii) our funding risk variable does not explain the cross-sectional variation in bond spreads, (iii) whereas asset risk measures are strongly related to bank cost of funding. Finally, we document that (iv) investors price the forward-looking information reflected in loan portfolios.

This research contributes to prior literature in multiple aspects. First, it examines market discipline during a turbulent market period, when firms are more likely to experience financial problems. By investigating the spread-to-risk sensitivity of Italian unsecured bonds in the post-2007 period, we provide meaningful insight for banking regulators in establishing policy actions as a response to a financial crisis.

Second, we are among the few studies accurately estimating the NSFR using public data and relying on BCBS guidelines (King, 2013; Dietrich, et al., 2014; Hong, et al., 2014; Vazquez & Federico, 2015; Chiaramonte & Casu, 2017). As reported in IMF's Global Financial Stability Report "*data issues remain a challenge in the analysis of the NSFR*" (IMF, 2011, p.78). Specific

accounting information to measure it is indeed available for a limited period and number of banks, since it is not historically present on bank balance sheets.

Third, the positive impact of liquidity risk, our proxy for the LCR, on bank cost of funding sheds some light on the impact of liquidity regulation on bank risk-taking (King, 2013). Indeed, market's ability to price the liquidity index can, at the margin, influence risky activities.

Finally, we investigate whether investors look beyond standard measures of bank risk. In addition to commonly used variables, we make use of previously unexplored indicators of asset quality. This was possible because of homogeneous forward-looking information on loan portfolios disclosed by Italian banks. Including future expectations appears particularly relevant to increase knowledge on the strength of market discipline and provide interesting policy implications considering IFRS 9.

The International Accounting Standards Board (IASB) released IFRS 9 in July 2014, which will substitute IAS 39 starting from January 2018. Among the major improvements, the IFRS 9 introduces an "*expected-loss impairment model that will require more timely recognition of expected credit losses*" (IFRS, 2014), thus overcoming the limits of the incurred loss approach of IAS 39. Under the new regulatory framework, an allowance is recorded after estimating forecasted credit losses over one-year or the entire loan life horizons, based on the level and variation in credit risk. In view of IFRS 9, this research represents an important step in this direction, since it provides empirical evidence that unsecured bondholders price a forward-looking indicator of loan portfolio risk. Given this result, we expect that IFRS 9 will, *ceteris paribus*, foster market discipline.

The rest of the paper is structured as follows. In Section 2, we discuss the related literature and purpose of the research. Data and methodology are described in Section 3. Our results are reported in Section 4. Section 5 contains robustness check. Finally, Section 6 concludes.

2. Related literature

A large body of literature investigates the market's ability to discipline bank risk-taking (Flannery & Sorescu, 1996; Morgan & Stiroh, 2000; Jagtiani, et al., 2002; Sironi, 2003) by analysing whether there is a relation between bank's risk measures, generally expressed through easy-to-observe accounting ratios, and its cost of funding, after controlling for economy wide factors. To date, prior research on market discipline shows mixed results. Several conditions are indeed required for market discipline to be effective: investors need to perceive themselves at risk of losses in the event of bank failure, they must observe and correctly understand bank financial conditions, promptly enclosing such information into the prices of risky bank debt (market monitoring). Furthermore, market signals must influence, either directly or through regulators, bank risk-taking behaviour (market influencing). It is evident that these conditions are strongly related to the regulatory environment in which banks operate.

Research conducted on U.S. banking firms prior to mid-1980 fail to find significant spread-to-risk relationship (Avery, et al., 1988; Gorton & Santomero, 1990). However, as the regulation on bondholders' protection weakened in the late 80s, investors became more sensitive to bank's risk profile and, consequently, later studies present some evidence that bond spreads reflect the issuing bank's financial profile. Using subordinated bond data over the 1983-1991 period, Flannery and Sorescu (1996) document that yield spreads are influenced by bank accounting

measures of risk and that this relation strengthens in the last years of the analysis, during which government guarantees were partially reduced. Jastiani et al. (2002) reach similar results for the period following the passage of the Federal Deposit Insurance Corporation Improvement Act (FDICIA) of 1991, showing that the market prices credit risk, especially for less capitalized financial institutions.

Later research extends the spread-to-risk analysis to the European banking industry. Among these relatively scant studies, Sironi (2003) shows that subordinated bond spreads issued from 1991 to 2000 are sensitive to accounting measures of risk and more prominently in the second part of the examined period. He argues that this increase in the bond risk sensitivity is driven by a progressive reduction in the perceived too-big-to-fail (TBTF) policies. At the country level, Gropp et al. (2014) use the removal of government guarantees for German saving banks in 2001 as a natural experiment to test the impact of public guarantees on bank risk-taking behaviour. They find that when explicit guarantees are in force, moral hazard effects occur, which may harm bank financial stability and increase the likelihood of future banking crises.

In addition to research investigating whether investors can discriminate or not between firm-specific risk, a related literature focuses on the strength of market discipline. Morgan and Stiroh (2001) examine the relationship between subordinated bond spreads and banks' asset composition to test whether investors price "*the ex ante risks implicit in the entire mix of loans and other assets at a bank*" (Morgan and Stiroh, 2001, p. 196). Results based on U.S. banks over the 1993-1998 period document that accounting measures of asset risk jointly explain bond spreads, suggesting that market discipline can limit excessive risk-taking of banks. Subsequent studies further test the effectiveness of market discipline by analyzing regulatory changes (Balasubramnian & Cyree, 2014) and implicit government guarantees (Acharya, et al., 2016).

This research overall documents the presence of TBTF discount on yields spreads, concluding that market discipline is less tough for the largest financial institutions.

Another strand of literature concerns the timeliness and accuracy of bank regulators and investors in evaluating the soundness of banking firms. Empirical research on U.S. banks by Berger et al. (2000) and DeYoung et al. (2001) show that both market and regulators produce useful information about the future financial conditions of banking firms but none of them have complete information on bank's risk profile.

Whereas the literature on market discipline is vast and mainly U.S.-oriented, there are very few papers examining the spread-to-risk relationship during turbulent market conditions. Most studies indeed include time frames where the banking system is relatively sound and financial institutions operate without bearing the burden of preserving stability. The only papers on this subject investigate market discipline from uninsured depositors during banking crises before the recent financial turmoil (Martinez Peria & Schmukler, 2001; Hadad, et al., 2011; Cubillas, et al., 2012). However, the outbreak of the crisis, during which several banks experienced financial difficulties, especially those in the periphery of Europe, provides an opportunity to extend prior research. Furthermore, considering that most of the market discipline literature focuses on standard measures of bank risk, including novel indicators, would certainly provide further insight into the role of the market in disciplining banks.

In this paper, we investigate whether, following the financial turmoil, investors price the key risks taken by banks, which became central issues to ensure the safety and soundness of the European banking system: liquidity, funding, and asset risk. More specifically, to capture liquidity and funding risk we use the liquidity ratios proposed by the BCBS, thus contributing to the few studies on the impact of the new liquidity standards (Allen, et al., 2012; King, 2013;

Dietrich, et al., 2014; Hong, et al., 2014; Vazquez & Federico, 2015; Chiaramonte & Casu, 2017). To capture asset quality instead, we introduce several indicators on bank's loan risk using both a backward- and forward-looking perspective, thus extending prior papers mainly focused on *ex post* performance variables. Morgan and Stiroh (2001) support this approach, highlighting that *ex ante* risk measures of banks' asset portfolio composition provide a strong framework to test market discipline.

3. Data and methodology

3.1. Bank bond data

Using Thomson Reuters, we collect data on all bond issues from the 15 largest Italian banks over the 2006-2014 period characterized by a relatively large quantity of issues.

We screen banks from the comprehensive list of significant financial institutions target of the first Asset Quality Review (AQR). Importantly, most institutions are also subject to the Single Supervisory Mechanism (SSM) established by the ECB, which aims at monitoring the stability of important banking groups.

To be included in the final dataset, bonds must satisfy a series of selection criteria common in prior related research: we exclude all callable, puttable, convertible, covered, complex floating rate bonds and ultimately, we drop bonds with warrants and less than one year to maturity. The resulting procedure leads to a final dataset of 5,997 unsecured bond issues.

For each fixed-rate coupon issue, we then compute the spread (*Spread*) at issuance defined as the difference between the yield to maturity and that of the corresponding maturity-match Interest Rate Swap (IRS). The decision to use the swap zero curve as a benchmark risk-free rate, instead of the common Treasury zero curve, is explained by three main reasons. First, Italian

Treasury bonds cannot be considered truly risk-free during the period under investigation as Italy, together with the other peripheral countries, has been strongly hit by the recent financial crisis, as clearly expressed by the unprecedented high 10-year BTP-Bund spread rates. Second, it allows for a better comparison of the two yields and thus to a more accurate spread estimate because both instruments have par value at the bond issuance date[42]. On the contrary, if bond issue date does not match that of a Treasury bond, the latter is hardly having par value at bond issuance[43] due to the oscillation of market prices. Third, prior literature provides empirical support for the use of the zero-swap curve as risk-free benchmark (Hull, et al., 2004; Blanco, et al., 2005).

Contrary to most related studies, this research is based on primary market data. We avoid including secondary market data because the market for European and Italian bond issues is poorly liquid. Moreover, bond yields at issuance express the real transaction prices and not "approximate prices" computed by brokers or obtained from pricing metrics (Sironi, 2003). Finally, from a bank perspective, bond spreads at launch are an accurate estimate of the true cost paid by financial institutions.

3.2. Measures of liquidity, funding, and asset risk

Starting from the financial statement of December 2006, Italian banks adopt International Financial Reporting Standards (IFRS). This accounting harmonization was introduced with the Legislative Decree N. 38 of 28 February 2005. Given these mandatory disclosure rules, accounting information from 2006 onwards is homogeneous among banks, thereby allowing us to design perfectly comparable accounting risk indicators.

[42] 99% of bonds in our dataset are issued at par.
[43] Except if they are both issued on the same day, which is generally unlikely.

Our bank liquidity, funding, and asset risk variables are gathered from the 2006-2012 period. Because our dataset includes both listed and unlisted banks, these variables are estimated at year end[44]. More specifically, to construct them, we rely on two sources. First, we use Bankscope, a commercial database produced by *Bureau Van Dijk*. Second, when information from this latter is missing, we hand-collect data from the notes to the accounts to obtain accounting items with a level of detail not available from standard data providers.

We target the liquidity and funding risk ratios set by the BCBS under the new Basel III regulatory framework, namely the LCR and the NSFR. It is important to highlight that before the release of Basel III, formally occurred in 2010, in Italy there were no liquidity rules in force at the national level. However, principles and guidelines were issued by the BCBS in the pre-2010 phase to support banks in managing liquidity risk. The purpose was to strengthen the liquidity position and control of banks, promoting also information disclosure to ensure market participants' ability to develop a correct understanding of banks' soundness. Therefore, the liquidity principles and following rules represent an important improvement of liquidity risk management practices within this country.

The LCR addresses liquidity risk and imposes banks to hold a minimum amount of "*unencumbered, high-quality liquid assets that can be converted to cash to meet needs for a 30 calendar day time horizon under severe liquidity stress conditions specified by supervisors*" (BCBS, 2010, p. 3). The LCR was introduced in January 2015 with a minimum amount of 60% that will progressively increase until reaching the final level of 100% in January 2019. To construct the LCR, we use a simplified version of the index. This decision relies on the lack of publicly available information on banks' financial statements to reasonably compute the ratio without making strong, potentially debatable assumptions. In the same spirit of prior research

[44] Quarterly accounting data for unlisted banks are not available.

(Chiaramonte & Casu, 2017), we thus compute a proxy for the LCR defined as liquid assets[45] to deposits and short-term funding.

The NSFR addresses funding risk and is designed to mitigate asset liability mismatch "*by establishing a minimum acceptable amount of stable funding based on the liquidity of an institution's assets and activities over a one-year horizon*" (BCBS, 2010, p. 22). The NSFR will be introduced in January 2018 for a minimum level of 100%. At the operational level, this index is the ratio of the available amount of stable funding to the required amount of stable funding:

$$NSFR = \frac{Available\ Stable\ Funding\ (ASF)}{Required\ Stable\ Funding\ (RSF)} = \frac{\sum(Sources * weighting\ factor)}{\sum(Uses * weighting\ factor)}$$

The ASF reflects the fraction of equity and liability financing that is expected to be a stable source of funding. More specifically, it is computed as a weighted average of bank sources on the associated weighting factor measuring the degree of solidity. The RSF instead is related to the liquidity position of a bank's activities and is obtained as a weighting average of assets on the corresponding weighting factor measuring the degree of liquidity (BCBS, 2014).

The NSFR has been object to revisions and amendments since its initial proposal. To estimate it, we thus rely on the final guidelines issued by the BCBS on October 31, 2014. Despite the high level of granularity of our dataset, which allows to differentiate assets and liabilities by term maturity, estimating this ratio according to the BCBS publication requires facing some issues. These challenges derive from the fact that there are no historical public data perfectly matching the required information set by the regulator. Therefore, coherently with Hong et al. (2004), we carefully interpret the BCBS document and select the accounting items best reflecting the Basel III requirements. Following this procedure, we have to make some required but reasonable assumptions and calculate two versions of the index. More specifically, since we

[45] Liquid assets include: trading securities, loans and advances to banks, reserve repo and cash collateral, cash and due from banks. Mandatory reserves are excluded.

cannot divide deposits between "stable" and "less stable" according to the regulator definition[46], we treat the weight associated to deposits more (*NSFR2014_90*) and less prudentially (*NSFR2014_95*). Specific weights, accounting items and assumptions used in the ratio measurement are reported in Table 1A.

As for asset risk, we use an extensive set of backward- and forward-looking measures. Since losses have already been reported on balance sheet, the former variables reflect the backward-looking information of loan quality. Based on prior research (Sironi, 2003), we include: gross non-performing loans to total gross loans (*BLR*), impairment loss on non-performing loans to total non-performing loans (I*NPL*). We further introduce the ratio of impairment loss on performing loans to total performing loans (*IPL*), which measures the amount of allowances set aside for losses on performing loans.

To provide a complete assessment on bank asset risk, the latter measure includes forward-looking information, which so far was never available in academic research in this field. This new information reflects the current risk of both non-performing and performing loans, as expressed by credit ratings given to borrowers by External Credit Assessment Institutions (ECAIs). It is possible to retrieve such information because, unlike other countries, Italian banks are required by financial reporting regulation to disclose in a table, available in the notes to the accounts, their exposures to credit risk divided by external ratings. The weighted average rating that can be computed from this table is a reasonable estimate of loan quality affecting bank performance and soundness in the future. More specifically, this novel variable measures the average loan portfolio risk over a one-year horizon (*LPR*) as follows:

[46] Stable deposits are "*the amount of the deposits that are fully insured by an effective deposit insurance scheme or by a public guarantee that provides equivalent protection and where the depositors have other established relationships with the bank that make deposit withdrawal highly unlikely; or the deposits are in transactional accounts*" (BCBS, 2013, p. 27).

$$LPR = \frac{\sum_{i=1}^{6}(Numeric\ class_i * Exposure_i)}{\sum_{i=1}^{6}(Exposure_i)}$$

where $Numeric\ class_i$ is the numeric rating for credit class i and $Exposure_i$ is the credit risk exposure associated to credit class i. The above-mentioned table provides the ratings assigned by external rating agencies[47] to bank loans, which split them according to 6 credit quality classes, where class 1 has the highest and class 6 the lowest credit quality assessment. We then convert each rating class to a number according to the mapping of ECAIs, which assigns the corresponding credit ratings to credit classes. As a last step, we compute the weighted average of the numeric classes (*Numeric class*) on the corresponding on-balance sheet exposure (*Exposure*). Additional information on the construction of the variable is reported in Table 2.

It is important to note that external rating agencies adopt standard procedures for credit quality assessment, providing an accurate and homogeneous comparison across banks. Furthermore, contrary to internal ratings that are developed by banks, external ratings, being implemented by external agencies, are free of accounting manipulation. On the downside however, these external ratings cover a portion of the whole loan portfolio. For this reason, we also construct the rating coverage ratio (*LRC*) as the amount of loans with an assigned rating over total gross loans.

[Insert Table 1A here]

[Insert Table 2 here]

3.3. Bank- and bond-level controls

Based on Flannery and Sorescu (1996), Sironi (2003) and Acharya et al. (2016), we construct the following bank-level accounting controls: leverage, return on assets, and total assets.

[47] I.e., Standard & Poor's Ratings Services, Moody's Investors Service, Fitch Ratings, and DBRS Ratings.

Leverage (*LEV*) is the ratio of total liabilities to total equity. Return on assets (*ROA*) is the ratio of year-end net income to total assets. Assets (*ASSETS*) is the logarithmic transformation of total year-end assets. At the bond level, we use the logarithmic transformation of total issued amounts (*AMOUNT*) and the time-to-maturity in years (*MATU*). We further include a set of dummy variables for indicating whether the bond is senior (*SENIORITY*), is listed (*LISTED*), is issued by the parent bank (*PARENT*), is offered to institutional investors (*INSTITUTIONAL*) according to the 50,000 minimum denomination threshold, and is privately placed (*PRIVATE*). Due to data limitations, bond ratings are not included.

3.4. Methodology

To test bond spread sensitivity to bank liquidity, funding, and asset risk, we estimate the following panel regression:

$$Spread_{i,b,t} = \alpha + \beta Liquidity_{i,t-\gamma} + \gamma Funding_{i,t-\gamma} + \rho Asset\ Quality_{i,t-\gamma} + \delta Bank\ Controls_{i,t-\gamma} + Bond\ Controls_{i,b,t} + \mu_t + \varepsilon_{i,a,b,t} \quad (1)$$

Where the dependent variable (*Spread*) is the spread level of bond *i*, issued by bank *b* at time *t*. Liquidity (*LCR*) and funding (*NSFR2014_90* and *NSFR2014_95*) are proxies of the LCR and NSFR, respectively. Asset quality is a vector of both backward- and forward-looking measures of loan risk. Among the former variables, we have: bad loans ratio (*BLR*), impairment loss on non-performing loans to total non-performing loans (*INPL*) and impairment loss on performing loans to total performing loans (*IPL*). Among the latter, we include the average loan portfolio risk over a one-year horizon (*LPR*). Bank-level controls are the rating coverage ratio (*LRC*), leverage (*LEV*), return on average assets (*ROA*), and the logarithmic transformation of total assets (*ASSETS*). Bond-level controls are bond issued amounts, logarithmically transformed,

(*AMOUNT*) and maturity expressed in years (*MATU*). We also include a series of dummy variables to account for listed (*LISTED*), senior (*SENIORITY*), parent issued (*PARENT*), institutional (*INSTITUTIONAL*), and privately placed (*PRIVATE*) bonds. μ_t denotes year fixed effects to account for common variation across bonds issued in the same year. To gauge the impact of each bank risk dimension on the dependent variable, we include in some specifications one risk category at a time.

Accounting variables are matched to the dependent variable according to a specific time-criterion. Prior research generally assigns to bonds issued in year *t* accounting measures obtained from the financial statement for the year *t-1*. However, although this standard procedure is extensively adopted, it fails to correctly account for the actual information flow disclosed to investors. Indeed, in the early months of year *t* the financial statement (for the year *t-1*) has not yet been approved and thus it is not accessible to the public. Therefore, we can hardly assume that investors base their investment decisions on undisclosed information. According to the Italian regulation, bank financial statements must indeed be approved by 30 April of each year. Bearing this in mind, we construct a new criterion that matches bonds issued before 30 April to accounting measures obtained from the financial statement for the year *t-2*, while bonds issued after 30 April to accounting measures obtained from the financial statement for the year *t-1*.

We estimate Equation (1) using fixed effects panel data models with heteroscedasticity-robust standard errors clustered at the issuer level. Table 3 shows correlation matrix among independent variables. We observe both low cross-sectional correlation among coefficients and Variance Inflation Factors (VIFs). We therefore conclude that there is no direct evidence of multicollinearity problems in Equation (1).

[Insert Table 3 here]

3.5. Descriptive statistics

In Table 4, we provide descriptive statistics for bond spreads and issued amounts. Until the outbreak of the crisis, bond spreads maintain on average relatively low levels. However, in the post-2007 period, they progressively increase, reaching a peak of 2.7% in 2012, year in which Italy was heavily affected by the negative repercussions of the sovereign debt crisis. Over the same period, we also observe a raise in the number and amount of bonds issued. To mitigate funding concerns emerged during the turmoil, Italian banks indeed strongly relied on bonds as a source of funding. In 2011, the total issued amount was around €41 billion, which is more than twice the reported quantity in 2006.

Table 5 reports detailed information on regressors, while Figures 1-5 display the trend of our key indicators for bank liquidity, funding, and asset risk. Exposure to liquidity risk increased over the 2006-2012 period, as expressed by the monotonic reduction in the LCR (Figure 1). With respect to funding risk instead, the NSFR shows a volatile path with important downward movements corresponding to the onset of the subprime crisis, triggered by subprime mortgages in 2007, and sovereign debt crisis, started with the bailout plan to rescue Greece in 2010 (Figure 2). As an interesting aspect, the average NSFR is greater than the 100% requirement set by the BCBS.

Regarding asset quality, the ratio of bad loans (Figure 3) rises from 3% in 2006 to more than 9% in 2012. Despite deteriorating asset quality, coverage was extremely inadequate. Impairment loss on both non-performing and performing loans exhibits a downward trend (Figure 4). More specifically, from 2007 to 2009, *INPL* sharply decreases, while subsequently it fluctuates around 34%. Following a short increment during the first years, *IPL* instead diminishes from 2008

onward. Because of the worsening in bank asset quality, one-year expectations of loan portfolio risk progressively increase starting from 2007 with an average *LPR* of about 5, referring to a A+ loan rating, and reaching almost the value of 9 in 2012, referring to a BBB loan rating (Figure 5).

Overall, there is clear evidence that Italian banks were in an increasingly state of weak liquidity and asset quality, while funding risk appears to be more variable, worsening in correspondence to the stages of the financial crisis.

[Insert Table 4 here]

[Insert Table 5 here]

[Insert Figures 1-5 here]

4. Results

4.1. Regression analysis

Table 6 reports results from the regression analysis explaining the determinants of bank bond spreads. Four alternative specifications of Equation (1) are reported (columns 1-4), each using one risk category of interest, together with a set of control variables. More in detail, the first one includes the liquidity risk variable. Consistently with our expectations, we observe that higher LCR, i.e. lower liquidity risk exposure, is associated with lower credit spreads.

With regards to bank control variables, results show that, although marginally significant, higher leverage (*LEV*) increases bond spreads, while profitability (*ROA*) and total assets (*ASSETS*) do not affect bank cost of funding. With regards to bond control variables, privately placed bonds (*PRIVATE*) exhibit larger spreads on average. Since private placements are targeted at a restricted number of sophisticated and accredited investors, which are generally institutional investors in our context, individuals operating in this market have higher bargaining

power and hence can obtain, *ceteris paribus*, higher yields. Subordinated bonds are, by definition, risker than senior bonds. Therefore, the seniority variable (*SENIORITY*) has a positive and statistically significant sign. We also document that listed bonds (*LISTED*), generally characterized by a higher information disclosure to investors, have a positive impact. *MATU* negatively influences the dependent variable. This result is probably driven by term structure of IRS, which is our benchmark risk-free rate. Prior research indeed finds either a positive and negative relation between swap spreads and maturity (Trück, et al., 2004). Finally, *PARENT* and *INSTITUTIONAL* are not statistically significant.

The following specification (column 2) includes our funding risk measure[48]. We can see that *NSFR2014_90* does not explain bond spreads. One possible explanation to this result relates to the fact that, due to the evolving nature of this index, the market may have failed to discriminate banks according to their ratio level. To address this issue, we compute the NSFR based on the 2010 version issued by the BCBS on December 16 (BCBS, 2010), which has proceeded the final one. Table 1B reports accounting items, weighting factors and assumptions adopted based on the 2010 document. Analogously to the 2014 version of the ratio, we provide two interpretations of the 2010 guidelines, treating the weighting coefficient assigned to deposits less (*NSFR2010_80*) and more (*NSFR2010_90*) optimistically. We then replace the 2014 NSFR with these alternative specifications. Table 7 displays the results of the regressions estimates: columns 1 and 2 respectively include the *NSFR2010_80* and the *NSFR2010_90* variables, while columns 3 and 4 show the full model (Equation (1)) with these alternative regressors. It appears evident that the NSFR maintains not significant in all regressions (columns 1-4 of Table 7), which seems to rule out the previous explanation.

[48] We use *NSFR2014_90*. However, using *NSFR2014_95* results do not change.

An alternative interpretation of the lack of significance could be driven by the specific and detailed structure of the NSFR. Hence, we include an alternative, more general funding risk variable, computed as the ratio of total loans in customer deposits and short-term funding (*Loans/Fund*): a higher value indicates a higher funding gap and consequently higher likelihood to experience funding tensions. Results of this specification, which are reported in Table 8[49], confirm prior findings, suggesting that bank funding gap does not influence bond spreads.

Control variables in column 2 of Table 6 do not show significant differences with respect to column 1 with two minor exceptions. *LEV* is not significant and maintains no effect in subsequent regressions. *ASSETS* is marginally significant with a positive coefficient, which is in contrast to prior research documenting a TBTF discount on yield spreads for large financial institutions. However, this variable is seldom significant. Moreover, our dataset includes relatively large banks and not small financial institutions: we thus have limited variation in asset size that can explain this outcome.

Thereafter, column 3 of Table 6 includes backward-looking measures of loan risk. *BLR* and *INPL* have positive and statistically significant coefficients. As expected, greater exposure to non-performing loans (higher *BLR*) leads to higher credit spreads. Furthermore, higher allowances for non-performing loans (higher *INPL*) are not perceived by investors as a higher coverage against losses, which would result in a positive market signal, but as an indication of higher expected losses, which indeed result in higher bond spreads. Penalizing banks with higher *INPL*, as compared to those with lower level of it, may have diminished banks' incentives to manage non-performing loans, resulting in higher exposure to asset risk (Figures 3-5). In contrast, *IPL* reduces banks' cost of funding. We interpret this result as evidence that the market

[49] Column 1 of Table 8 includes the alternative specification, i.e. *Loans/Fund*, together with our control variables. Column 2 of Table 8 reports the full model, with all variables of interest and including our alternative funding risk specification.

perceives banks that set aside higher allowances for loans characterized by low insolvency risk as more prudent than banks with lower *IPL* levels.

In the last alternative specification (column 4 of Table 6), we include our forward-looking measure of loan risk. As a remarkable result, the coefficient of *LPR* is positive and significant, indicating that investors look beyond standard, *ex post* measures of asset risk and price the forward-looking information implicit in bank loan portfolios. Controlling for a comprehensive set of bank risk measures, the higher the fraction of loans covered by external ratings, a proxy for the level of transparency to investors, the lower credit spreads are. Indeed, *LRC* reports a negative and statistically significant coefficient.

The final equation (column 5 of Table 6) includes all risk category of interest, along with control variables. Regression estimates confirm previous findings, further strengthening our interpretation and highlighting three main results. First, bank liquidity and asset risk are key predictors of credit spreads during the recent financial crisis. Second, funding risk seems to perform as a non-binding factor for banks[50]. The interpretation is simple: if the market does not discriminate among banks based on their funding risk exposure, banks are less committed to mitigate and manage it. Third, investors price forward-looking information inherent in loan portfolio risk, which provides an interesting and promising outcome on the strength of market discipline (Morgan & Stiroh, 2001).

[Insert Table 6 here]

[Insert Table 1B here]

[Insert Table 7 here]

[Insert Table 8 here]

[50] We thank Prof. Barbara Casu for this insightful comment.

4.2. Pre- and post-Basel III

Since the BCBS formally issued the liquidity framework on 16 December 2010[51], one possible concern regards investors' ability to correctly understand banks' liquidity and funding conditions, as defined by Basel III, in the pre-issue period. We partially address this aspect when we replace in Table 8 the NSFR with a more general, although less representative, definition of funding risk. However, this further analysis fails to shed light on whether investors' attention on banks' risk profile has evolved over the pre- and post-publication period. Before the onset of the financial crisis, liquidity and funding risks have received little attention by practitioners and policymakers. Therefore, it is reasonable to expect that market discipline was also affected by the delayed recognition of such risks. With this purpose, we re-estimate Equation (1) in the years preceding and following the official document release, which occurred in the same year the sovereign debt crisis erupted.

From Table 9, which displays the results, three main findings emerge. First, the *NSFR* maintains no significance both before (column 1) and after (column 2) the Basel III issuance in 2010. Second, the *LCR* and *LPR* affect bank cost of funding only following 2010. Third, asset quality deterioration, expressed by *BLR*, is statistically significant, and with the expected sign, in both subsets.

Overall, there is evidence that liquidity risk was not a major concern by investors before Basel III. In the following years, however, investors have begun pricing banks' liquidity positions. This is not the case for the *NSFR* that does not seem to bind banks. These results are

[51] The liquidity ratios were first proposed on December 17, 2009 when the BCBS issued "*International Framework for Liquidity Risk Management Standards and Monitoring"* (Consultative Document).

consistent with the idea that liquidity risk, contrary to funding risk, has received much more attention during the financial crisis and, as a result, is perceived as more relevant by investors.

Results further suggest that investors adopt a backward-looking view on loan quality before Basel III, whereas thereafter they reasonably recognize the need to evaluate it using a more accurate, long-term perspective. This interpretation is coherent with the common idea that the banks' risks were not timely assessed before the financial crisis.

We also perform the analysis in the years before and after the sovereign debt crisis that, according to Ricci (2015), we set from 2 May 2010 onward. Results remain qualitatively unchanged[52], extending previous interpretations to the pre- and post-sovereign debt crisis period. Finally, investors' evolving perspective on banks' risk dimensions proves the importance to examine market discipline during banking crises.

[Insert Table 9 here]

5. Robustness check

5.1. Explicit and implicit supports

During the financial crisis, the adoption of policy intervention measures to support financially distressed banking firms and the existence of implicit government guarantees might have affected investors' incentives to discipline banks. We explicitly account for any explicit or implicit government support perceived by investors and check the robustness of our results.

With regards to explicit support, we use a dummy variable to account for banks that were bailed out by the Italian government during the examined period and assign them the value 1 after they receive funding (*Intervened*). Following Acharya and Steffen (2015), we obtain bailed

[52] To save space, outcomes are not reported but are available upon request.

out information from the official state-aid website of the European Commission (EU)[53]. Detailed list of intervened banks, date and type of intervention received are reported in Table 10.

To account for implicit support instead, we use two measures of bank credit risk (Acharya, et al., 2016). First, we collect Standard & Poor's credit ratings. Issuer ratings are a traditional measure of credit risk that assess bank financial commitment after considering all possible external supports that the bank might receive. Second, we gather Moody's Bank Financial Strength (MBFS) ratings as an alternative measure of credit risk. These ratings are "free-standing" ratings that measure the intrinsic bank financial strength without accounting for potential outside interventions.

Discrepancies on bank credit risk between these two ratings provide insight on these agencies' assessment about potential government funding to banks in case of financial distress (Acharya, et al., 2016). Therefore, by comparing the effect of these ratings, we attempt to examine, to some extent, expectations of government guarantees. From an operational perspective, we transform both Standard & Poor's (*Issuer rating*) and MBFS (*Free-standing rating*) ratings into numbers according to an increasing scale giving higher value to riskier financial institutions[54]. Note that, while issuer ratings are available for most of the banks in our dataset, stand-alone ratings are available for a smaller subset of banks.

Overall, when banks receive support measures, market participants may reduce their incentives to monitor banks because of explicit or implicit protection from losses.

Column 1 of Table 11 adds to Equation (1) the *Intervened* and *Issuer rating* variables, while in column 2 of Table 11 the *Issuer rating* is replaced with the *Free-standing rating* variable[55].

[53] Information on bailout funding is available here: http://ec.europa.eu/competition/elojade/isef/index.cfm?clear=1&policy_area_id=3.
[54] We convert S&P issuer ratings according to Table 2, while we transform MBFS ratings using the following scale: A (bank documents superior financial strength)=1,...E (bank documents very poor financial strength)=13.
[55] We avoid including *Issuer rating* and *Free-standing rating* together due to collinearity issues.

We find that *Issuer rating* has a positive sign. This coefficient captures the effect of bank rating on credit spreads net of the effect captured by our bank-specific risk variables and controls, which include measures of liquidity, funding, asset quality, leverage, and profitability. In other words, it is the impact on bond spreads of the remaining aspects that are assessed by external agencies when developing the rating: implicit government guarantees and bank's risk management strategies. Given the statistical significance of the variable, it seems to suggest that investors price implicit government guarantees. In line with this argument, *Free-standing rating* does not have a significant effect on bond spreads, probably because most of the impact is absorbed by our bank specific factors.

The *Intervened* variable does not explain bank cost of funding, surprisingly indicating that investors do not discriminate between banks that received and did not receive bail out funding. As an important result, our variables of interest retain importance in both regressions, except for *LCR* that loses explanatory power in the second specification.

In sum, we find qualitative similar results for our variables of interest. We further provide some evidence that investors price implicit government guarantees, while explicit government support does not seem to influence bank cost of funding.

[Insert Table 10 here]

[Insert Table 11 here]

6. Conclusions

This research tests whether investors in adverse market conditions can differentiate among the risk dimensions that have emerged during the financial turmoil as primary determinants to promote bank stability and mitigate excessive risk-taking. This is done by examining from 2007

to mid-2014 the sensitivity of bond spreads of the 15 largest Italian banks to standard and newly proposed measures of liquidity, funding, and asset risk that take both a backward and forward-looking focus.

Our empirical estimates show that credit spreads reflect the level of bank liquidity risk. This effect is driven by the increased relevance that liquidity risk has taken following the official release of Basel III in 2010, introducing new international liquidity requirements for banks. On the other hand, our funding risk variable, as defined by Basel III, is not significant. This result is also confirmed when using alternative specifications and dividing the analysis in two subgroups to capture the years before and after the Basel III official announcement; this means that liquidity, and not funding risk, matters for investors, confirming the claim that liquidity risk is a more stringent requirement for banks than funding risk. To some extent, we can infer that liquidity risk absorbs and incorporates, from a market perspective, the role and effect of funding risk.

Consistently with Morgan and Stiroh (2001), asset risk measures are important drivers of bond spreads. The most interesting result, however, is that among asset risk variables, our forward-looking measure on loan portfolio risk has a positive impact that, similarly to liquidity risk, is due to the increased importance asset risk received after 2010. In the spirit of Morgan and Stiroh (2001) yet using a novel asset risk indicator instead, we interpret this finding as evidence that investors correctly price expectations concerning bank loan portfolio risk.

We further conduct a robustness analysis to check whether our results are influenced by explicit or implicit government supports. In line with prior research (Sironi, 2003; Acharya, et al., 2016), regression estimates document that unsecured bondholders price implicit subsidy. Considering that during the financial crisis several banks have received bailout funding, it is

reasonable to observe that perceptions of implicit guarantees have, as a result, increased. In contrast, explicit support does not influence bank cost of debt. Despite accounting for government support, the effect of our variables of interest remain broadly unchanged.

The results provide relevant implications both for scholars and practitioners as they contribute with a novel insight to the ongoing debate about the role of the market in disciplining banks during a financial crisis.

This study focuses only on Italian banks, since only for them it was possible to construct detailed and forward-looking measures of risk. With the current level of disclosure on balance sheets, a cross-country comparison would not be applicable. In view of the introduction of IFRS 9 from 2018, which will replace the incurred loss with the expected loss model (IFRS, 2014), future research could extend the analysis to multiple countries and examine potential country-of-origin heterogeneous reactions.

References

Acharya, V., Anginer, D. & Warburton, A. J., 2016. The End of Market Discipline? Investor Expectations of Implicit Government Guarantees. SSRN Working Paper Series.

Acharya, V. & Steffen, S., 2015. The "greatest" carry trade ever? Understanding eurozone bank risks. *Journal of Financial Economics,* Volume 115, pp. 215–236.

Allen, B., Chan, K. K., Milne, A. & Thomas, S., 2012. Basel III: Is the cure worse than the disease?. *International Review of Financial Analysis,* Volume 25, pp. 159–166.

Avery, R. B., Belton, T. M. & Goldberg, M. A., 1988. Market Discipline in Regulating Bank Risk: New Evidence from the Capital Markets. *Journal of Money, Credit and Banking,* Volume 20, pp. 597–610.

Balasubramnian, B. & Cyree, K. B., 2014. Has market discipline on banks improved after the Dodd–Frank Act?. *Journal of Banking & Finance,* Volume 41, pp. 155–166.

BCBS (Basel Committee on Banking Supervision), 2009. International framework for liquidity risk measurement, standards and monitoring. Bank for International Settlements, December.

BCBS (Basel Committee on Banking Supervision), 2010. Basel III: international framework for liquidity risk measurement, standards and monitoring, Bank for International Settlements, December.

BCBS (Basel Committee on Banking Supervision), 2013. Basel III: the liquidity coverage ratio and liquidity risk monitoring tools, Bank for International Settlements, January.

BCBS (Basel Committee on Banking Supervision), 2014. Basel III: the net stable funding ratio, Bank for International Settlements, October.

Berger, A., Davies, S. & Flannery, M., 2000. Comparing market and supervisory assessments of bank performance: who knows what when?. *Journal of Money, Credit, and Banking,* Volume 32, pp. 641–667.

Blanco, R., Brennan, S. & Marsh, I. W., 2005. An empirical analysis of the dynamic relation between investment-grade bonds and credit default swaps. *Journal of Finance,* Volume 55, pp. 2255–2281.

Chiaramonte, L. & Casu, B., 2017. Capital and liquidity ratios and financial distress. Evidence from the European banking industry. *The British Accounting Review,* Volume 49, pp. 138–161.

Cubillas, E., Fonseca, A. R. & González, F., 2012. Banking crises and market discipline: International evidence. *Journal of Banking & Finance,* Volume 36, pp. 2285–2298.

DeYoung, R., Flannery, M., Lang, W. & Sorescu, S., 2001. The information content of bank exam ratings and subordinated debt prices. *Journal of Money, Credit, and Banking,* Volume 33, pp. 900–925.

Dietrich, A., Hess, K. & Wanzenried, G., 2014. The good and bad news about the new liquidity rules of Basel III in Western European countries. *Journal of Banking & Finance,* Volume 44, pp. 13–25.

Flannery, M. J. & Sorescu, S. M., 1996. Evidence of Bank Market Discipline in Subordinated Debenture Yields: 1983-1991. *The Journal of Finance,* Volume 51, pp. 1347–1377.

Gorton, G. & Santomero, A. M., 1990. Market Discipline and Bank Subordinated Debt. *Journal of Money, Credit and Banking*, Volume 22, pp. 119–128.

Grasso, R., Linciano, N., Pierantoni, L. & Siciliano, G., 2010. Bond issued by Italian banks: risk and return characteristics, Quaderno di Finanza Consob n. 67.

Gropp, R., Gruendl, C. & Guettler, A., 2014. The Impact of Public Guarantees on Bank Risk-Taking: Evidence from a Natural Experiment. *Review of Finance,* Volume 18, pp. 457–488.

Hadad, M. D. et al., 2011. Market discipline, financial crisis and regulatory changes: Evidence from Indonesian banks. *Journal of Banking & Finance,* Volume 35, pp. 1552–1562.

Hong, H., Huang, J.-Z. & Wu, D., 2014. The information content of Basel III liquidity risk measures. *Journal of Financial Stability,* Volume 15, pp. 91–111.

Hull, J., Predescu, M. & White, A., 2004. The relationship between credit default swap spreads, bond yields, and credit rating announcements. *Journal of Banking and Finance,* Volume 28, pp. 2789–2811.

IFRS, 2014. *IASB completes reform of financial instruments accounting.* [Online] Available at: http://www.ifrs.org/news-and-events/2014/07/iasb-completes-reform-of-financial-instruments-accounting/.

IMF (International Monetary Fund), 2011. *Global Financial Stability Report, Durable Financial Stability: Getting There from Here,* International Monetary Fund, Washington DC.

Jagtiani, J., Kaufman, G. & Lemieux, C., 2002. The effect of credit risk on bank and bank holding company bond yields: evidence from the post-FDICIA period. *The Journal of Financial Research,* Volume 25, pp. 559–575.

King, M. R., 2013. The Basel III Net Stable Funding Ratio and bank net interest margins. *Journal of Banking and Finance*. Volume 37, pp. 4144–4156.

Martinez Peria, M. S. & Schmukler, S. L., 2001. Do Depositors Punish Banks for Bad Behavior? Market Discipline, Deposit Insurance, and Banking Crises. *Journal of Finance,* Volume 56, pp. 1029–1051.

Morgan, D. P. & Stiroh, K. J., 2000. Bond Market Discipline of Banks: Is the Market Tough Enough?. Federal Reserve Bank of New York Staff Report*,* Issue 95.

Morgan, D. P. & Stiroh, K. J., 2001. Market Discipline of Banks: The Asset Test. *Journal of Financial Services Research,* Volume 20, pp. 195–208.

Sironi, A., 2003. Testing for Market Discipline in the European Banking Industry: Evidence from Subordinated Debt Issues. *Journal of Money, Credit, and Banking,* Volume 35, pp. 443–472.

Ricci, O., 2015. The impact of monetary policy announcements on the stock price of large European banks during the financial crisis. *Journal of Banking & Finance,* Volume 52, pp. 245–255.

Trück, S., Laub, M. & Rachev, S., 2004. The Term Structure of Credit Spreads and Credit Default Swaps - An Empirical Investigation. SSRN Working Paper Series.

Vazquez, F. & Federico, P., 2015. Bank funding structures and risk: Evidence from the global financial crisis. *Journal of Banking & Finance,* Volume 61, pp. 1–14.

Appendix

Table 1A. Computation of the NSFR (2014)

The Net Stable Funding Ratio (NSFR) is the ratio of Available Stable Funding (ASF) to Required Stable Funding (RSF). The minimum requirement set by the BCBS is 100%. With respect to two alternative specifications, this table reports accounting items, calibrating factors and assumptions based on the 2014 version of the index (BCBS, 2014).

	NSFR2014_90	*NSFR2014_95*	*Assumptions*
Available Stable Funding (Sources)			
Tier 1	100	100	
Tier 2	100	100	
Debt securities with residual maturity of more than 1 year	100	100	
Other liabilities with residual maturity of more than 1 year	100	100	
Deposits and current accounts- clientele with residual maturity more than 1 year	100	100	
Deposits and current accounts- clientele with residual maturity less than 1 year	90	95	#1
Sight deposits and current accounts- clientele	90	95	
Deposits and current accounts- clientele of indefinite duration	90	95	
Debt securities with residual maturity of less than 1 year	50	50	
Required Stable Funding (Uses)			
Loans with clientele with residual maturity more than 1 year	100	100	
Loans with banks with residual maturity more than 1 year	100	100	
Loans with clientele with residual maturity less than 1 year	50	50	
Loans with clientele of indefinite duration	50	50	#3
Loans with banks with residual maturity less than 6 months	15	15	
Loans with banks with residual maturity between 6 months and 1 year	50	50	
O.I.C.R shares with residual maturity more than one year	100	100	#2
Other debt securities with residual maturity more than one year	50	50	
Loans with banks of indefinite duration	15	15	#3
Treasury bonds with residual maturity more than one year	5	5	
Main Assumptions			
#1: Clientele are classified as retail and small business customers			
#2: O.I.C.R shares are classified as unencumbered assets			
#3: Loans of indefinite duration are classified as unencumbered loans with less than six-month term			

Table 1B. Computation of the NSFR (2010)

The Net Stable Funding Ratio (NSFR) is the ratio of Available Stable Funding (ASF) to Required Stable Funding (RSF). The minimum requirement set by the BCBS is 100%. With respect to two alternative specifications, this table reports accounting items, calibrating factors and assumptions based on the 2010 version of the index (BCBS, 2010).

	NSFR2010_80	*NSFR2010_90*	*Assumptions*
Available Stable Funding (Sources)			
Tier1	100	100	
Tier 2	100	100	
Debt securities with residual maturity of more than 1 year	100	100	
Other liabilities with residual maturity of more than 1 year	100	100	
Deposits and current accounts- clientele with residual maturity more than 1 year	100	100	
Deposits and current accounts- clientele with residual maturity less than 1 year	80	90	#1
Sight deposits and current accounts- clientele	80	90	
Deposits and current accounts- clientele of indefinite duration	80	90	
Debt securities with residual maturity of less than 1 year	50	50	
Required Stable Funding (Uses)			
Loans with clientele with residual maturity more than 1 year	100	100	
Loans with banks with residual maturity more than 1 year	100	100	
Loans with clientele with residual maturity less than 1 year	85	85	
Loans with clientele of indefinite duration	50	50	#3
Loans with banks with residual maturity less than 6 months	0	0	
Loans with banks with residual maturity between 6 months and 1 year	0	0	
O.I.C.R shares with residual maturity more than one year	100	100	#2
Other debt securities with residual maturity more than one year	50	50	
Loans with banks of indefinite duration	0	0	
Treasury bonds with residual maturity more than one year	5	5	
Main Assumptions			
#1: Clientele is classified as retail and small business customers			
#2: O.I.C.R shares are classified as unencumbered assets			
#3: Loans of indefinite duration are classified as unencumbered loans with less than six-month term			

Table 2. Computation of the LPR

The average loan portfolio risk (*LPR*) is computed as the weighted average of the numeric classes on the associated on-balance sheet exposures. To obtain the numeric classes, we use the mapping of ECAI credit ratings to credit classes. We then extend the mapping assigning to each credit rating a numeric value (i.e., numeric rating), starting from 1 for the AAA class and ending with 21 for the D class. Finally, for each credit class, we compute the arithmetic average of the numeric ratings associated to that specific class. We then repeat this procedure for all credit classes and compute numeric classes.

	ECAI / Standard & Poor's Ratings	Numeric Rating	Credit Class	Numeric Class
Investment grade	AAA	1	Class 1	2.5
	AA+	2		
	AA	3		
	AA-	4		
	A+	5	Class 2	6
	A	6		
	A-	7		
	BBB+	8	Class 3	9
	BBB	9		
	BBB-	10		
Speculative grade	BB+	11	Class 4	12
	BB	12		
	BB-	13		
	B+	14	Class 5	15
	B	15		
	B-	16		
	CCC+	17	Class 6	19
	CCC	18		
	CC	19		
	C	20		
	D	21		

Table 3. Correlation analysis

	LCR	*NSFR2014_90*	*BLR*	INPL	*IPL*	*LPR*	*LRC*	*LEV*	*ROA*	*ASSETS*	*AMOUNT*	*MATU*	*LISTED*	*SENIORITY*	*PARENT*	*INSTITUTIONAL*
LCR	1	0.22	0.08	0.5	0.26	-0.29	-0.13	0.5	0.38	0.21	0.27	0	0.15	0.01	0.24	0.11
NSFR2014_90	0.22	1	0.05	-0.06	0.09	0.03	-0.05	0.19	0.11	-0.26	0.13	0.03	-0.05	0.01	0.23	0
BLR	0.08	0.05	1	-0.22	0.3	0.5	0.33	0.38	-0.54	0.03	0.29	-0.02	0.31	0.04	0.39	0.15
INPL	0.5	-0.06	-0.22	1	0.22	-0.43	-0.08	0.25	0.43	0.3	0.04	-0.03	0.04	0.01	0.03	-0.02
IPL	0.26	0.09	0.3	0.22	1	0.14	0.42	0.08	-0.24	0.15	0.12	0.03	-0.03	0.02	0.32	0.07
LPR	-0.29	0.03	0.5	-0.43	0.14	1	0.18	0	-0.52	0.12	0.13	-0.02	0.09	0.02	0.04	0.02
LRC	-0.13	-0.05	0.33	-0.08	0.42	0.18	1	-0.07	-0.29	-0.29	0.01	0.01	0.08	0.03	0.36	0.04
LEV	0.5	0.19	0.38	0.25	0.08	0	-0.07	1	0.01	0.09	0.22	0	0.25	0.04	0.19	0.03
ROA	0.38	0.11	-0.54	0.43	-0.24	-0.52	-0.29	0.01	1	-0.13	-0.05	-0.04	-0.19	-0.03	-0.02	-0.04
ASSETS	0.21	-0.26	0.03	0.3	0.15	0.12	-0.29	0.09	-0.13	1	0.14	-0.03	0	-0.01	-0.31	0.04
AMOUNT	0.27	0.13	0.29	0.04	0.12	0.13	0.01	0.22	-0.05	0.14	1	-0.08	0.18	0.1	0.32	0.03
MATU	0	0.03	-0.02	-0.03	0.03	-0.02	0.01	0	-0.04	-0.03	-0.08	1	0.06	0.1	0.14	0.02
LISTED	0.15	-0.05	0.31	0.04	-0.03	0.09	0.08	0.25	-0.19	0	0.18	0.06	1	0.19	0.11	-0.02
SENIORITY	0.01	0.01	0.04	0.01	0.02	0.02	0.03	0.04	-0.03	-0.01	0.1	0.1	0.19	1	0.05	0.01
PARENT	0.24	0.23	0.39	0.03	0.32	0.04	0.36	0.19	-0.02	-0.31	0.32	0.14	0.11	0.05	1	0.11
INSTITUTIONAL	0.11	0	0.15	-0.02	0.07	0.02	0.04	0.03	-0.04	0.04	0.03	0.02	-0.02	0.01	0.11	1
PRIVATE	-0.07	-0.04	-0.1	-0.01	0.07	-0.03	0.07	-0.13	-0.15	0.07	-0.2	0.14	-0.06	-0.01	-0.05	0.06
VIF	2.86	1.91	4.79	2.24	2.44	2.06	1.86	2.47	3.89	1.94	1.50	1.15	1.43	1.07	2.20	1.08

This table reports correlation coefficients and VIFs of the explanatory variables of Equation (1). Accounting variables are all winsorized at the 10% level.

Table 4. Descriptive statistics – part A

Year	N. of Issues	Spread		Amount (Euro)		
		Mean	Std. Dev	Mean	Std. Dev	Total
2006	762	-0.2419	0.647396	23,680,000	50,157,714	18,046,880,352
2007	763	-0.2613	0.612770	26,550,000	70,937,487	20,258,320,393
2008	744	0.07560	0.851137	35,630,000	124,533,967	26,507,558,994
2009	786	0.6264	0.894504	48,780,000	183,550,747	38,341,451,472
2010	728	0.5715	0.790576	30,430,000	82,004,532	22,150,569,848
2011	971	1.2740	1.070688	42,580,000	113,989,884	41,340,703,000
2012	548	2.743	1.063535	63,300,000	161,870,452	34,690,474,000
2013	351	2.000	0.745844	71,930,000	175809,355	25,249,078,000
2014	344	1.642	0.739818	45,530,000	88,352,478	15,663,813,312
Total	5,997	0.9354	1.268181	61,940,000	122,647,476	242,248,849,371

This table shows descriptive statistics for bank bonds by issuing year. Spread is computed as the difference between the yield to maturity and the corresponding maturity-match Interest Rate Swap (IRS). Amount is the amount of bonds issued (in Euro).

Table 5. Descriptive statistics – part B

Variables	Mean	Percentiles		Standard Deviation
		25th	75th	
LCR (%)	19.40	10.26	26.92	10.42
NSFR2014_90 (%)	120.0	113.10	125.30	7.92
NSFR2014_95 (%)	123.2	116.00	128.30	8.24
BLR (%)	5.87	3.45	7.37	2.57
INPL (%)	35.20	29.28	38.60	5.95
IPL (%)	0.44	0.38	0.51	0.10
LPR	6.88	5.75	8.07	1.88
LRC (%)	29.11	20.26	37.96	17.26
LEV	10.88	8.94	12.63	1.93
ROA (%)	0.44	0.15	0.76	0.29
ASSETS	18.12	17.39	18.67	0.80
AMOUNT	15.72	14.22	17.19	2.05
MATU	3.38	2.00	3.00	2.24
LISTED	0.07			0.59
SENIORITY	0.004			0.06
PARENT	0.52			0.50
INSTITUTIONAL	0.11			0.32
PRIVATE	0.05			0.21

This table reports descriptive statistics of the explanatory variables of Equation (1). Bank-specific accounting variables are all winsorized at the 10% level.

Table 6. Regressions of spread on bank liquidity, funding, and asset risk variables

Variables	(1)	(2)	(3)	(4)	(5)
LCR	-0.0218410*** [0.0081823]				-2.6661e-02*** [9.8798e-03]
NSFR2014_90		-0.0038763 [0.0047640]			8.4328e-05 [7.3898e-03]
BLR			0.1028167*** [0.0279929]		1.1416e-01*** [4.0592e-02]
INPL			0.0113854* [0.0068796]		1.8408e-02** [7.9773e-03]
IPL			-1.5739106*** [0.4393037]		-1.2502e+00** [5.6761e-01]
LPR				0.0760362*** [0.0274911]	6.6761e-02** [3.0046e-02]
LRC				-0.0111288*** [0.0023394]	-6.2569e-03** [3.0776e-03]
LEV	0.0633307* [0.0344653]	0.0520196 [0.0330188]	0.0224661 [0.0294848]	0.0232884 [0.0316583]	2.8984e-02 [3.3539e-02]
ROA	0.2263154 [0.1581668]	0.1140763 [0.1591606]	-0.0231793 [0.1711266]	0.1758511 [0.1786135]	2.6780e-01 [1.7092e-01]
ASSETS	0.3124923 [0.2094139]	0.3547911* [0.2051163]	0.1528262 [0.2036551]	0.5159055** [0.2213749]	2.5108e-01 [2.4698e-01]
AMOUNT	-0.1100161 [0.0904677]	-0.1128736 [0.0897371]	-0.1183506 [0.0895885]	-0.1327729 [0.0929872]	-1.3435e-01 [9.2023e-02]
MATU	-0.0303580* [0.0164046]	-0.0312800* [0.0164981]	-0.0344023* [0.0179296]	-0.0406273** [0.0165037]	-4.3214e-02** [1.7109e-02]
LISTED	0.4273726** [0.2009827]	0.4418856** [0.2106334]	0.3894944** [0.1931613]	0.4926631** [0.2162471]	4.4312e-01** [2.0272e-01]
SENIORITY	1.3012406*** [0.3349689]	1.3498377*** [0.3414305]	1.3528921*** [0.3566614]	1.3524529*** [0.3402724]	1.2456e+00*** [3.3382e-01]
PARENT	0.2829722 [0.1839791]	0.2762152 [0.1785408]	0.2696468 [0.1659943]	0.3813014** [0.1809645]	3.9623e-01** [1.8694e-01]
INSTITUTIONAL	0.1982110 [0.1352441]	0.1803733 [0.1334122]	0.1848885 [0.1237158]	0.1768898 [0.1387733]	1.9697e-01 [1.2930e-01]
PRIVATE	0.4632901*** [0.1336862]	0.4536221*** [0.1367825]	0.4288570*** [0.1338192]	0.4604701*** [0.4604701]	4.5500e-01*** [1.0867e-01]
# of banks	15	15	15	14	14
# of observations	4,682	4,682	4,604	3,966	3,888
Adjusted R-squared	0.55094	0.54782	0.55063	0.52894	0.5367483
Year FE	(Yes)	(Yes)	(Yes)	(Yes)	(Yes)

This table reports the results from the regression analysis examining the spread-to-risk relationship of bond spreads over the 2007 to mid-2014 period. The estimation is an OLS regression with clustered standard errors at the issuer level. *Spread* is computed as the difference between the yield to maturity and the corresponding maturity-match interest rate swap. *LCR* and *NSFR2014_90* are proxies for the *LCR* and *NSFR*, respectively. *BLR* is the ratio of bad loans to total gross loans. *INPL* is the ratio of impairment loss on non-performing loans to total non-performing loans. *IPL* is the ratio of impairment loss on performing loans to total performing loans. *LPR* is the average loan portfolio risk over a one-year horizon. *LRC* is the amount of loans with an assigned rating over total gross loans. *LEV* is the ratio of total liabilities to total equity. *ROA* is the ratio of year-end net income to total assets. *ASSETS* is the logarithmic transformation of total assets. *AMOUNT* is the bond issued amount, logarithmically transformed. *MATU* is bond maturity expressed in years. *LISTED* is a dummy variable for listed bonds. *SENIORITY* is a dummy variable for senior bonds. *PARENT* is a dummy variable for parent issued bonds. *INSTITUTIONAL* is a dummy variable for bond issues targeted at institutional investors. *PRIVATE* is a dummy variable for privately placed bonds. Standard errors clustered at the issuer level are reported in parenthesis. ***, **, and * indicate statistical significance at 1%, 5%, and 10%.

Table 7. Alternative NSFR based on the 2010 version

Variables	(1)	(2)	(3)	(4)
LCR			-0.0273008***	-0.02679656***
			[0.0090349]	[0.00926263]
NSFR2010_80	-0.0014857		0.0016753	
	[0.0041649]		[0.0051299]	
NSFR2010_90		-0.0011785		0.00041062
		[0.0022022]		[0.00537172]
BLR			0.1126879***	
			[0.0361122]	
INPL			0.0187625**	0.01849283**
			[0.0086462]	[0.00882397]
IPL			-1.2879062**	-1.25893149**
			[0.5869468]	[0.58573838]
LPR			0.0661081**	0.06658298**
			[0.0278111]	[0.02766970]
LRC			-0.0062650**	-0.00624375**
			[0.0029531]	[0.00299857]
LEV	0.0492379	0.0494776	0.0299366	0.02922870
	[0.0309318]	[0.0312356]	[0.0303767]	[0.03041719]
ROA	0.1217558	0.1230589	0.2693244	0.26792380*
	[0.1584258]	[0.1598425]	[0.1565383]	[0.15914850]
ASSETS	0.3951677**	0.3976874**	0.2684131	0.25474313
	[0.1901904]	[0.1869379]	[0.2249341]	[0.22013220]
AMOUNT	-0.1132466	-0.1133137	-0.1345142	-0.13439048
	[0.0895556]	[0.0897168]	[0.0920141]	[0.09206712]
MATU	-0.0312286*	-0.0312533**	-0.0432101**	-0.04320634**
	[0.0164663]	[0.0164960]	[0.0169563]	[0.01697309]
LISTED	0.4380767**	0.4383682**	0.4429591**	0.44316374**
	[0.2071949]	[0.2079662]	[0.1983995]	[0.19828734]
SENIORITY	1.3557523***	1.3558044***	1.2452488***	1.24539266***
	[0.3386235]	[0.3385255]	[0.3331439]	[0.33344849]
PARENT	0.2737529	0.2737600	0.3955046**	0.39602903**
	[0.1759708]	[0.1760074]	[0.1851806]	[0.18548873]
INSTITUTIONAL	0.1810563	0.1809213	0.1962111	0.19681145
	[0.1325463]	[0.1327982]	[0.1289450]	[0.12907624]
PRIVATE	0.4512165 ***	0.4511953***	0.3955046**	0.45501147***
	[0.1366208]	[0.1366941]	[0.1851806]	[0.10819813]
# of banks	15	15	14	14
# of observations	4,682	4,682	3,888	3,888
Adjusted R-squared	0.54759	0.54758	0.53233	0.5323
Year FE	(Yes)	(Yes)	(Yes)	(Yes)

This table reports the results from the regression analysis examining the spread-to-risk relationship of bond spreads over the 2007 to mid-2014 period. The estimation is an OLS regression with clustered standard errors at the issuer level. *Spread* is computed as the difference between the yield to maturity and the corresponding maturity-match interest rate swap. *LCR* is proxy for the LCR. The *NSFR2010_80* and *NSFR2010_90* variables are proxies for the NSFR based on the 2010 version of the index. *BLR* is the ratio of bad loans to total gross loans. *INPL* is the ratio of impairment loss on non-performing loans to total non-performing loans. *IPL* is the ratio of impairment loss on performing loans to total performing loans. *LPR* is the average loan portfolio risk over a one-year horizon. *LRC* is the amount of loans with an assigned rating over total gross loans. *LEV* is the ratio of total liabilities to total equity. *ROA* is the ratio of year-end net income to total assets. *ASSETS* is the logarithmic transformation of total assets. *AMOU*NT is the bond issued amount, logarithmically transformed. *MATU* is bond maturity expressed in years. *LISTED* is a dummy variable for listed bonds. *SENIORITY* is a dummy variable for senior bonds. *PARENT* is a dummy variable for parent issued bonds. *INSTITUTIONAL* is a dummy variable for bond issues targeted at institutional investors. *PRIVATE* is a dummy variable for privately placed bonds. Standard errors clustered at the issuer level are reported in parenthesis. ***, **, and * indicate statistical significance at 1%, 5%, and 10%.

Table 8. Alternative funding risk variable

Variables	(1)	(2)
LCR		-0.0264382***
		[0.0080921]
Loans/Fund	0.0038277	0.0043938
	[0.0046260]	[0.0048879]
BLR		0.1154512***
		[0.0336021]
INPL		0.0186304**
		[0.0080302]
IPL		-1.3607320***
		[0.5217903]
LPR		0.0693042**
		[0.0286067]
LRC		-0.0060191**
		[0.0030205]
LEV	0.0614090	0.0402589
	[0.0381924]	[0.0356541]
ROA	0.1554571	0.2768360*
	[0.1500380]	[0.1489949]
ASSETS	0.4575151	0.2728125
	[0.1607749]	[0.2257176]
AMOUNT	-0.1144573	-0.1352971
	[0.0900218]	[0.0918756]
MATU	-0.0316171*	-0.0436996**
	[0.0165407]	[0.0170432]
LISTED	0.4513793**	0.4504963**
	[0.2114623]	[0.1956214]
SENIORITY	1.3520787***	1.2435992***
	[0.3333593]	[0.3298103]
PARENT	0.2715108	0.3947680**
	[0.1733629]	[0.1873612]
INSTITUTIONAL	0.1814731	0.1964026
	[0.1330467]	[0.1285759]
PRIVATE	0.4551342***	0.4584817***
	[0.1364803]	[0.1077299]
# of banks	15	14
# of observations	4,682	3,888
Adjusted R-squared	0.54789	0.53268
Year FE	(Yes)	(Yes)

This table reports the results from the regression analysis examining the spread-to-risk relationship of bond spreads over the 2007 to mid-2014 period. The estimation is an OLS regression with clustered standard errors at the issuer level. *Spread* is computed as the difference between the yield to maturity and the corresponding maturity-match interest rate swap. *LCR* is the proxy for the LCR. *Loans/Fund* is the ratio of total loans in customer deposits and short-term funding. *BLR* is the ratio of bad loans to total gross loans. *INPL* is the ratio of impairment loss on non-performing loans to total non-performing loans. *IPL* is the ratio of impairment loss on performing loans to total performing loans. *LPR* is the average loan portfolio risk over a one-year horizon. *LRC* is the amount of loans with an assigned rating over total gross loans. *LEV* is the ratio of total liabilities to total equity. *ROA* is the ratio of year-end net income to total assets. *ASSETS* is the logarithmic transformation of total assets. *LRC* is the amount of loans with an assigned rating over total gross loans. *AMOU*NT is the bond issued amount, logarithmically transformed. *MATU* is bond maturity expressed in years. *LISTED* is a dummy variable for listed bonds. *SENIORITY* is a dummy variable for senior bonds. *PARENT* is a dummy variable for parent issued bonds. *INSTITUTIONAL* is a dummy variable for bond issues targeted at institutional investors. *PRIVATE* is a dummy variable for privately placed bonds. Standard errors clustered at the issuer level are reported in parenthesis. ***, **, and * indicate statistical significance at 1%, 5%, and 10%.

Table 9. Pre- and post-Basel III

Variables	(1) *Pre-Basel III*	(2) *Post-Basel III*
LCR	0.0085 [0.0137]	-0.0542*** [0.0207]
NSFR2014_90	0.0073 [0.0108]	-0.0091 [0.0099]
BLR	0.1108*** [0.0371]	0.082* [0.0493]
INPL	0.0064 [0.0107]	0.0194 [0.0368]
IPL	-1.0526 [1.1031]	1.3503 [0.8815]
LPR	0.0022 [0.0225]	0.0731** [0.0342]
LRC	-0.0007 [0.004]	-0.0124** [0.0052]
LEV	-0.0002 [0.0275]	0.074 [0.0517]
ROA	-0.0154 [0.1557]	1.1726*** [0.4213]
ASSETS	0.1636 [0.229]	1.3346*** [0.462]
AMOUNT	-0.1678** [0.0821]	-0.1004 [0.095]
MATU	-0.0546*** [0.0137]	-0.0147 [0.0575]
LISTED	1.2334*** [0.3256]	0.2861* [0.1466]
SENIORITY	0.2224 [0.2002]	1.6108*** [0.3313]
PARENT	0.2431** [0.1097]	0.5103** [0.2483]
INSTITUTIONAL	0.0085 [0.1419]	0.2579** [0.128]
PRIVATE	0.0073 [0.0912]	0.0606 [0.3084]
# of banks	14	14
# of observations	2069	1819
Adjusted R-squared	0.312	0.385
Year FE	(Yes)	(Yes)

This table reports the results from the regression analysis examining the spread-to-risk relationship of bond spreads over two periods: before (column 1) and after (column 2) the official release of the Basel III framework, which occurred on December 16, 2010. The estimation is an OLS regression with clustered standard errors at the issuer level. *Spread* is computed as the difference between the yield to maturity and the corresponding maturity-match interest rate swap. *LCR* and funding *NSFR2014_90* are proxies for the LCR and NSFR, respectively. *BLR* is the ratio of bad loans to total gross loans. *INPL* is the ratio of impairment loss on non-performing loans to total non-performing loans. *IPL* is the ratio of impairment loss on performing loans to total performing loans. *LPR* is the average loan portfolio risk over a one-year horizon. *LRC* is the amount of loans with an assigned rating over total gross loans. *LEV* is the ratio of total liabilities to total equity. *ROA* is the ratio of year-end net income to total assets. *ASSETS* is the logarithmic transformation of total assets. *AMOUNT* is the bond issued amount, logarithmically transformed. *MATU* is bond maturity expressed in years. *LISTED* is a dummy variable for listed bonds. *SENIORITY* is a dummy variable for senior bonds. *PARENT* is a dummy variable for parent issued bonds. *INSTITUTIONAL* is a dummy variable for bond issues targeted at institutional investors. *PRIVATE* is a dummy variable for privately placed bonds. Standard errors clustered at the issuer level are reported in parenthesis. ***, **, and * indicate statistical significance at 1%, 5%, and 10%.

Table 10. List of intervened banks

Bank	Intervened	Date of first intervention	Type of Intervention
Banca Carige SpA	No		
Banca Monte dei Paschi di Siena Spa	Yes	27 March, 2009	Recapitalization
Banca Popolare dell'Emilia Romagna Società Cooperativa	No		
Banca Popolare di Milano SpA	Yes	21 September, 2009	Recapitalization
Banca Popolare di Sondrio Società Cooperativa	No		
Banca Popolare di Vicenza SpA	No		
Banco Popolare Società Cooperativa	Yes	10 March, 2009	Recapitalization

Credito Emiliano Holding	No		
Credito Valtellinese SpA	Yes	9 June, 2009	Recapitalization
Iccrea Holding SpA	No		
Intesa SanPaolo SpA	No		
Mediobanca SpA	No		
UniCredit Spa	No		
Unione di Banche Italiane SpA	No		
Veneto Banca SpA	No		

Table 10 displays the list of 15 banks analysed in this research. For each bank, the second column shows whether it received state aid or not. For banks that received state aid, the third column documents the date and the fourth column shows the type of intervention received.

Table 11. Explicit and implicit supports

Variables	(1)	(2)
LCR	-0.01845187*	0.00605324
	[0.01083247]	[0.01201388]
NSFR2014_90	0.00023435	-0.01565832*
	[0.00970404]	[0.00939009]
BLR	0.10765355***	0.17788702***
	[0.03434091]	[0.04109769]
INPL	0.02281474***	0.01459263
	[0.00533141]	[0.01024945]
IPL	-1.25532528**	-2.40797313***
	[0.54781565]	[0.90267664]
LPR	0.09610353**	0.08408931***
	[0.04114128]	[0.03183648]
LRC	-0.00352708	-0.00150128
	[0.00431129]	[0.00358955]
LEV	-0.01132324	0.06162033**
	[0.03570863]	[0.02812161]
ROA	0.53647193***	0.14875262
	[0.16880161]	[0.13995455]
ASSETS	0.06809164	0.55347286**
	[0.25786158]	[0.22816802]
AMOUNT	-0.15310349*	-0.17460619**
	[0.08777454]	[0.08594382]
MATU	-0.03005427	-0.04788407***
	[0.01985862]	[0.01023481]
LISTED	0.46512371**	0.71486276***
	[0.18326581]	[0.25326937]
SENIORITY	1.25482667***	0.87376474***
	[0.38029463]	[0.26581361]

PARENT	0.43726788**	0.41539515**
	[0.17905018]	[0.16602970]
INSTITUTIONAL	0.13622217	0.07539340
	[0.11335929]	[0.10871324]
PRIVATE	0.55467913***	0.46499574***
	[0.08561356]	[0.07149156]
Intervened	0.07219245	-0.00019808
	[0.23326042]	[0.14805768]
Issuer rating	0.17220888***	
	[0.02991761]	
Free-standing rating		-0.01633713
		[0.02706156]
# banks	12	9
# observations	3,387	3,180
Adjusted R-squared	0.5539278	0.55883
Year FE	(Yes)	(Yes)

This table reports the results from the regression analysis examining the spread-to-risk relationship of bond spreads over the 2007 to mid-2014 period. The estimation is an OLS regression with clustered standard errors at the issuer level. *Spread* is computed as the difference between the yield to maturity and the corresponding maturity-match interest rate swap. *LCR* and funding *NSFR2014_90* are proxies for the LCR and NSFR, respectively. *BLR* is the ratio of bad loans to total gross loans. *INPL* is the ratio of impairment loss on non-performing loans to total non-performing loans. *IPL* is the ratio of impairment loss on performing loans to total performing loans. *LPR* is the average loan portfolio risk over a one-year horizon. *LRC* is the amount of loans with an assigned rating over total gross loans. *LEV* is the ratio of total liabilities to total equity. *ROA* is the ratio of year-end net income to total assets. *ASSETS* is the logarithmic transformation of total assets. *AMOUNT* is the bond issued amount, logarithmically transformed. *MATU* is bond maturity expressed in years. *LISTED* is a dummy variable for listed bonds. *SENIORITY* is a dummy variable for senior bonds. *PARENT* is a dummy variable for parent issued bonds. *INSTITUTIONAL* is a dummy variable for bond issues targeted at institutional investors. *PRIVATE* is a dummy variable for privately placed bonds. *Intervened* is a dummy variable for banks that received bailout funding. *Issuer rating* is the numeric transformation of S&P issuer rating. *Free-standing rating* is the numeric transformation of MBFS ratings. Standard errors clustered at the issuer level are reported in parenthesis. ***, **, and * indicate statistical significance at 1%, 5%, and 10%.

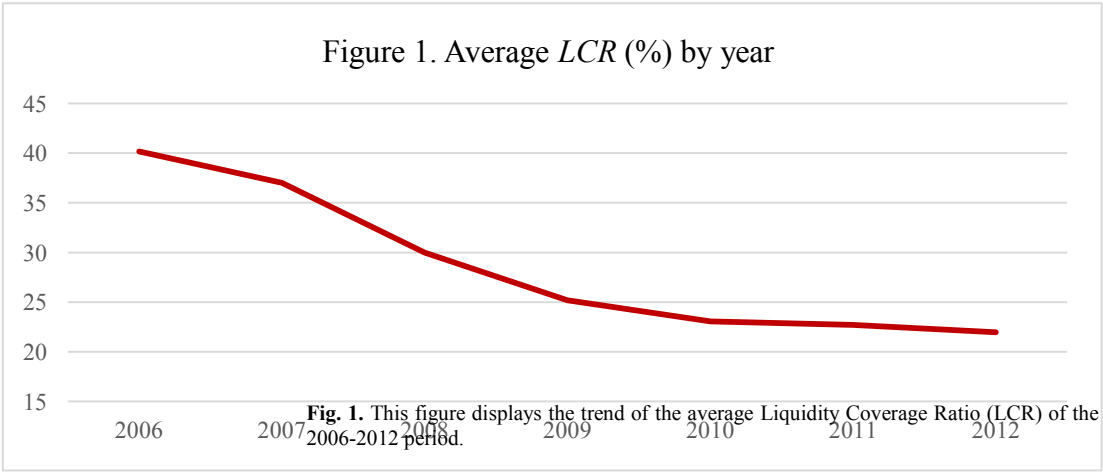

Fig. 1. This figure displays the trend of the average Liquidity Coverage Ratio (LCR) of the largest Italian banks over the 2006-2012 period.

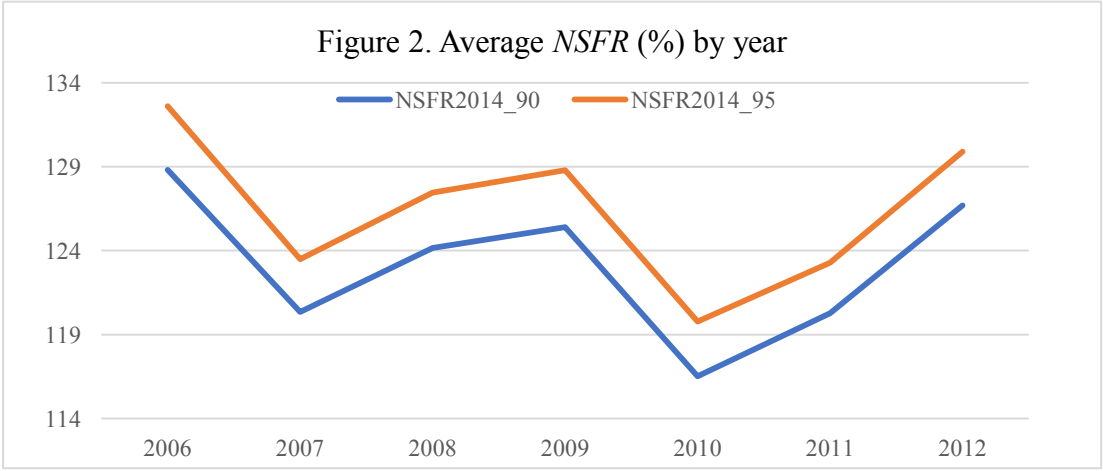

Fig. 2. This figure displays the trend of the average Net Stable Funding Ratio (NSFR) of the largest Italian banks over the 2006-2012 period. *NSFR2014_90* and *NSFR 2014_95* are computed using the 2014 version of the index, respectively assigning weight 90 and 95 to deposits to clientele with residual maturity less than one year.

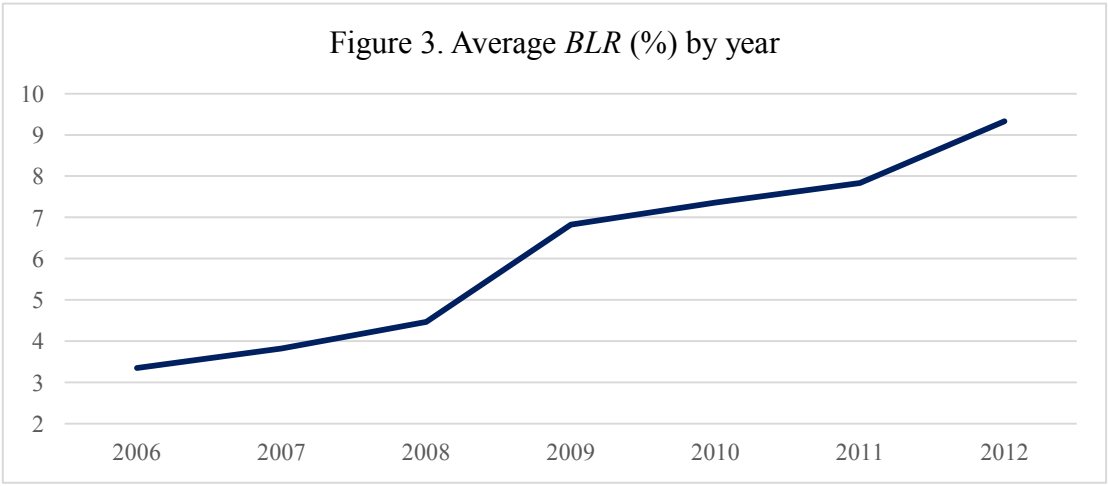

Fig. 3. This figure displays the trend of the average Bad Loans Ratio (BLR) of the largest Italian banks over the 2006-2012 period.

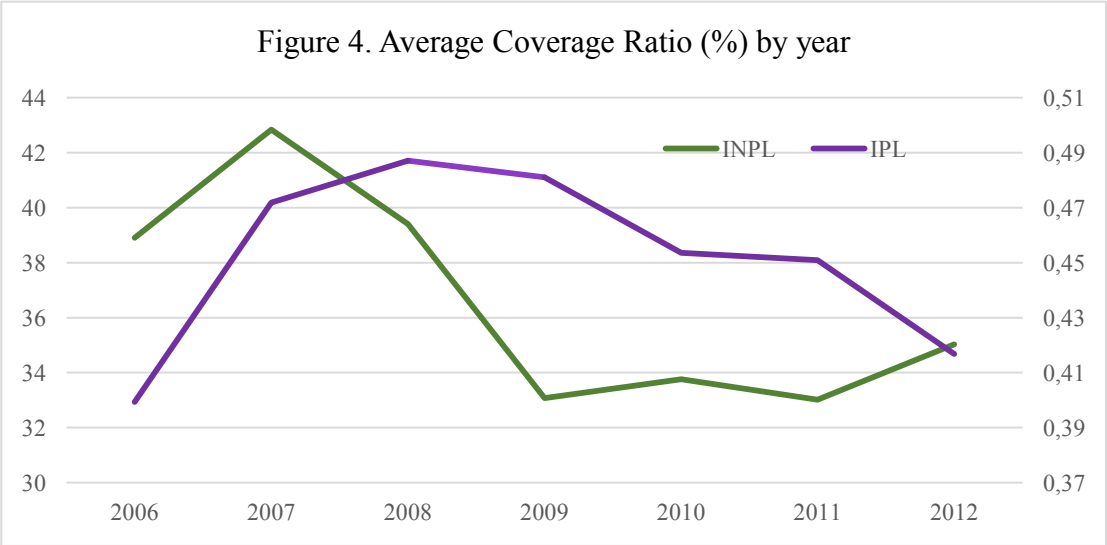

Fig. 4. This figure displays the trend of Impairment Loss on Non-Performing Loans (INPL) and Impairment Loss on Performing Loans (IPL) of the largest Italian banks over the 2006-2012 period.

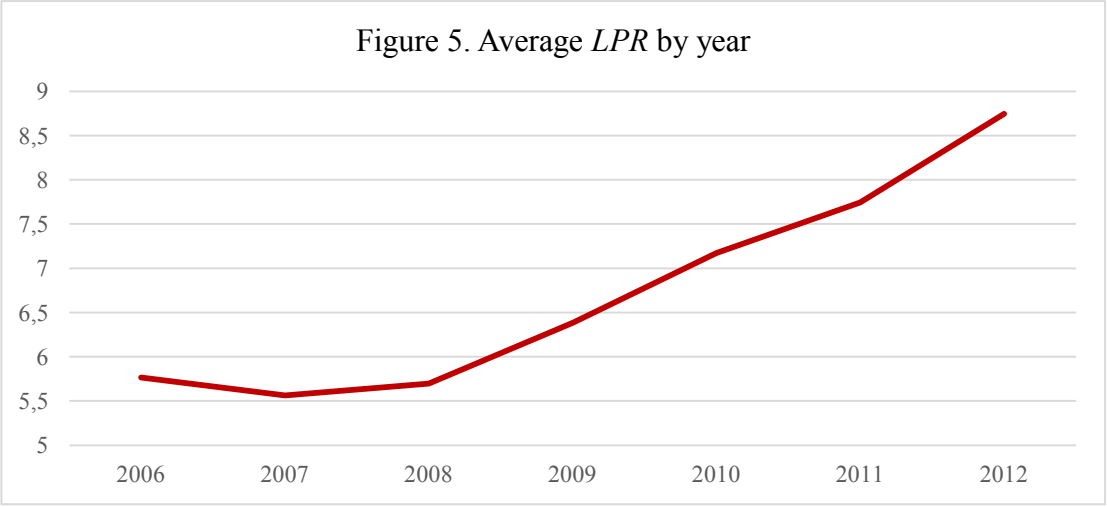

Fig. 5. This figure displays the trend of the average Loan Portfolio Risk (LPR) of the largest Italian banks over the 2006-2012 period.

Paper III

What Drives the Concentration of Households' Investments in Bank Bonds?

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Abstract

Using unique panel data on Italian households, the article examines the drivers of bank bond concentration for retail investors receiving tailor-made recommendations from bank financial advisors. The regression analysis documents three key results. First, investor attributes such as education, experience, occupation, and investment horizon explain a small variation in bank bond concentration. Second, the length of the bank-client relationship tends to substantially increase investors' bond portfolio exposure towards bank bonds. Third, weaker banks, in terms of funding structure and profitability, whose advisors exert high fundraising skills in bank bonds, seem to strongly and positively predict clients' bond concentration. This effect retains importance even when controlling for unobserved heterogeneity through bank and branch fixed effects. Furthermore, results do not change when including bank bond average risk premium, bank credit risk, sovereign debt downgrades in the model, and when splitting the analysis between portfolios with high and low exposure to concentration risk. This research contributes to the understanding of the reasons why households disproportionally concentrate investments in bank bonds, casting doubt on the effectiveness of current investor protection policies.

Keywords: Portfolio Concentration, Bank Bonds, Household Portfolios

1. Introduction

This paper investigates the concentration of households' investments in bank bonds when bank financial advisors provide them with tailor-made recommendations. A significant portion of households report receiving bank financial advice when choosing how to invest their savings[56]. However, while there is widespread evidence of the influence of financial advisors on their

[56] E.g., in the USA, 19% of individual investors claim to talk with their bank financial advisors when deciding how to allocate their money. Likewise, in the UK, around 21% of individual investors report to speak with their bank financial advisors (BlackRock, 2013). In Italy, which is the setting object of this research, a similar share of individual investors, namely 28%, report receiving investment recommendations from bank financial advisors (Linciano, et al., 2016).

clients' equity portfolio concentration (Hackethal, et al., 2012; Foerster, et al., 2017; Hoechle, et al., 2017), little evidence exists regarding bond concentration. This is despite the high concentration in bank bond holdings in the Euro area market (Boermans, 2015), bonds represent an important source of financing for many banks[57] and the relatively high participation rate of households from different countries in this market[58] (Badarinza, et al., 2016).

The lack of research is partially due to the fact that bank bonds have long been considered to have little impact on portfolio risk. However, after the outbreak of the recent financial crisis, several countries (e.g., USA, Denmark, Portugal, Cyprus, Greece, Italy) attributed losses on the retail bondholders of their failed banks[59], questioning the riskiness of such instruments excluded from Deposit Insurance Schemes in Europe. Furthermore, under the new bail-in framework, bondholders' exposure to losses has been raised in case of bank failure, thereby strengthening concerns in this regard.

Understanding the drivers of bank bond concentration, and the role played by bank financial advisors in shaping it, thus constitutes an important but still unexplored area of study.

Over the years, financial institutions have widely issued bonds targeted at retail investors[60]. Although apparently safe, concentrating portfolio holdings in one-issuer bonds can significantly

[57] The Euro area bank bond market stood around 4,000,000 million Euro at the beginning of 2015. This amount is obtained using data from the Securities Holdings Statistics (SHS) from the European Central Bank (ECB). The SHS are available here: https://www.ecb.europa.eu/stats/financial_markets_and_interest_rates/securities_holdings/html/index.en.html.

[58] E.g., participation rate of households in the bond market is 14.6% in Italy, 28.2% in the UK, and 13.2% in the USA (Badarinza, et al., 2016).

[59] E.g., USA: Lehman Brothers. Denmark: Amagerbanken A/S and Fjordbank Mors A/S. Portugal: Banco Espirito Santo. Cyprus: Bank of Cyprus. Greece: Bank of Greece. Italy: Banca Marche, Banca Popolare dell' Etruria e del Lazio, Cassa di Risparmio di Ferrara, Cassa di Risparmio di Chieti.

[60] In December 2015, about 13% of bonds issued by German banks are held by Euro area households, corresponding to an outstanding amount of 80,000 million Euro of German bank bonds in households' portfolios. In Italy, roughly 38% of bank bond issues are held by Euro area households, which is the highest among Euro area countries. This percentage refers to an outstanding amount of 223,000 million Euro of Italian bank bonds in households' portfolios. In the UK and France, around 4% (outstanding amount of 22,970 million Euro in households' portfolios) and 5% (outstanding amount of 43,000 million Euro in households' portfolios) of bank bonds are held by Euro area households, respectively. These figures are computed using data from the

increase portfolio volatility and reduce its risk-adjusted performance as compared to a well-diversified bond portfolio, leading to inefficient asset allocation. Retail bank bonds are particularly interesting in the study of portfolio concentration because of their illiquid market (Grasso, et al., 2010) and negatively skewed returns[61]. Moreover, as demonstrated by McEnally and Boardman (1979), benefits of bond portfolio diversification (especially for low rated bonds) are of approximately the same magnitude as those of common stocks.

What drives cross-sectional variation in bank bond holdings? Drawing from prior research, I develop three main hypotheses explaining why households receiving advisors' recommendations might hold extremely poorly diversified bond portfolios. First, an extensive body of literature claims that investors' characteristics should have first-order relevance in explaining investors' choices. It is well documented that investors' preferences depend, for instance, on age, wealth, education, experience, and risk-aversion (Campbell, 2006). Second, ties with the issuer could influence the propensity to invest in such securities. The longer a client has been undertaking any banking relationship with the issuer, the more likely she/he perceives it as trustworthy and safe, eliciting loyalty feelings. Third, investors might hold concentrated portfolios due to external pressures. Banks act as both issuers and advisors for investors. This phenomenon may lead to principal-agent issues in the provision of financial information (Bolton, et al., 2007; Inderst & Ottaviani, 2009): banks (principal) need to raise funds and investors (agents) want to minimize portfolio risk exposure (conflict of interests) but it is difficult for them to assess ex-ante the quality of the recommendations provided by bank advisors (information asymmetries). Although

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Securities Holdings Statistics (SHS) from the European Central Bank (ECB). The SHS are available here: https://www.ecb.europa.eu/stats/financial_markets_and_interest_rates/securities_holdings/html/index.en.html.

[61] Note that, over the past years, the market has been characterized by low interest rates. Furthermore, bank bonds are typically bought by investors at the time of issuance (i.e., at par value), have medium term maturity and are relatively illiquid. Under such circumstances, I can reasonable talk about negatively skewed returns.

possible, such behaviour is in contrast to the Markets in Financial Instruments Directive 2004/39/EC (MiFID)[62].

This paper aims to examine households' bond portfolio concentration towards bonds of a nearby bank, where diversification failure occurs both across firms and geographic location. Specifically, I claim that bank bond concentration is driven by individual attributes (related-attributes hypothesis), the length of the relationship between client and issuer (bank-client loyalty hypothesis), and external pressures (conflict-of-interest hypothesis).

To that end, I use unique Italian data over the 2011-2015 period. Italy offers an interesting setting for evaluating households' bond portfolio concentration. Researchers have largely documented that bonds constitute, on average, the primary asset choice of individual investors within this country. Among bonds, according to a survey on Italian households by Linciano et al. (2016), bank bonds are the most widely detained financial products as of 2015. Furthermore, nearly 40% of total outstanding Italian bank bonds are held by Euro area households[63], which is by far the highest among European countries.

The dataset, obtained by eight *Banche di Credito Cooperativo* (Cooperative Credit Banks, or CCBs), includes investment choices of roughly 25,000 households, along with sociodemographic information. Moreover, it contains accounting data on banks, the number of advisors operating in branches and the amount of funds raised by the latter.

[62] Since 2007, year in which the regulation came into force in Europe, this directive *"governs the provision of investment services in financial instruments by banks and investment firms and the operation of traditional stock exchanges and alternative trading venues*" (European Commission, n.d.).

[63] This percentage is measured as of December 2015, using data from the Securities Holdings Statistics (SHS) from the European Central Bank (ECB). The SHS are available here: https://www.ecb.europa.eu/stats/financial_markets_and_interest_rates/securities_holdings/html/index.en.html.

Italy's CCBs are characterised for "*being local, mutual, not-for-profit cooperatives*" (Credito Cooperativo , n.d.). While U.S. credit cooperatives are generally government-funded (Angelini, et al., 1998), Italian CCBs are private enterprises whose stated goals are the "*wellbeing of their stakeholders and the development of the local economy"* (Credito Cooperativo , n.d.). With a widespread distribution all over the country, they represent 55.9%[64] of the total number of banks operating in Italy and therefore constitute a large portion of the Italian banking system. The cooperative nature of CCBs makes them particularly suitable to establish trust-based investor-advisor relationships, highlighting the important role played by bank advisors in these institutions (Monti, et al., 2014).

The main findings of this article are the following. First, bank bond concentration is lower for investors with a longer investment horizon, while it is greater among less educated and less experienced investors. Clients' occupation also increases bank bond holdings. Differences in individual observable information thus contribute to explain bank bond concentration, which is coherent with the related-attributes hypothesis. Nevertheless, investors' characteristics surprisingly jointly determine only 6% of the variation in bank bond holdings. Second, I show that investors with a longer banking relationship hold a considerably greater portion of their bond portfolio in bank bonds, which is in line with the bank-client loyalty hypothesis. Third, I document that the explanatory power of the model almost doubles when bank and branch characteristics are added. More specifically, bank bond concentration raises when the issuer experiences funding needs, i.e. the bank is less profitable and characterised by a weaker funding structure. However, the most interesting result is that advisors with high capabilities to promote

[64] This percentage is obtained as of December 2015.

bank bonds among their clients, but low capabilities to raise other funding sources, significantly increase the cross-sectional variation in bank bond concentration. Overall, these outcomes provide support that, under some circumstances, banks exert influence through bank advisors on their clients' bond portfolio, confirming the conflict-of-interest hypothesis. Results retain strong importance even when including bank and branch-level fixed effects. A series of robustness checks further investigate the latter hypothesis. More specifically, I construct a representative bond spread for each bank and year that proxies the yield paid by banks on bonds. I account for bank credit risk using internal credit ratings assigned by the holding bank to major CCBs. Furthermore, considering that the period under investigation covers the sovereign debt crisis and that Italian banks were highly exposed to sovereign debt risk, I add Fitch's long-term issuer default ratings, assigned to the Italian government debt, to the model. To provide insight into the relevance of bank bond holdings in the total portfolio, I split portfolios in subgroups to examine if the effect of the variables of interest changes according to different risk exposures. Finally, I divide banks in two classes based on their level of reliance on bank bond funding. Controlling for all the above factors, results remain broadly unchanged and provide support of the agency argument in explaining households' bank bond concentration.

The contributions of the paper to prior literature are manifold. First, this research is important for retail investors. Bondholders should be fully aware of the risk they take in disproportionally investing in bank bonds. Since they might either enjoy small gains (with high probability) or suffer big losses (with low probability), they should pay attention to the risks borne. Second, the analysis carried out in this study has implications for bank advisory services to retail clientele. Due to the reliance of investors on advisor recommendations, it is crucial for banks to provide

customized and impartial investment advice by professional and highly qualified individuals to ensure that clients' specific needs are addressed. Finally, the research provides meaningful implications for the ongoing discussion about splitting up the dual role of financial intermediaries and separating their retail and banking activity with their advisory service. Although this paper does not aim at estimating agency costs, it suggests that agency issues drive bank bond concentration. If this is the case, there are two main solutions to the problem: either disentangle the dual role of banks or introduce tougher enforcement rules to ensure that unsophisticated and vulnerable households do not excessively concentrate their savings. While progress to protect investors has been made by the introduction of the new MiFID II, which will be adopted by January 2018, the new legislation mainly focuses on investment products and does not provide the same legislative relevance to service provision. Whether such guidelines are sufficient to ensure investor protection, limiting banks' incentives to invent tricks to circumvent the regulation, it is an empirical question for further research.

The article is organized as follows. Section 2 reviews major studies on this topic and develops testable hypotheses. Thereafter, Section 3 describes the data and methodology used for the empirical analyses. Section 4 presents the findings. Section 5 displays robustness checks. Finally, Section 6 provides the conclusions.

2. Related literature

The issue of diversification has received extensive consideration in the finance literature and has prompted several studies focusing on equity. Among researchers, it is commonly agreed that household portfolios are poorly diversified (Blume & Friend, 1975; Kelly, 1995;

Polkovnichenko, 2005). Though such behaviour appears inefficient from a modern portfolio theory standpoint and financial advisors could in principle ensure greater diversification, academics have provided different explanations, including: individual attributes, issuer-investor relationship and principal-agent conflicts.

Studies on household finance point out that economic and sociodemographic variables should be key factors for determining individuals' propensity to invest in specific securities. Among investor characteristics, according to Campbell (2006), age and wealth have a first-order importance since they explain several household financial decisions. Furthermore, investment choices should match investment objectives, typically expressed through household risk tolerance and investment horizon. It is also generally accepted among researchers that experience, financial knowledge, income, and profession – proxy for investor sophistication – should limit investment mistakes and diversification issues (Dhar & Zhu, 2006; Guiso & Jappelli, 2008; Lusardi & Mitchell, 2014).

Cognitive psychology researchers claim that individuals have restrained ability to manage information and to carry out multiple activities at once, which hamper their problem-solving skills (Miller, 1956; Kahneman, 1973). Considering that relevant information on financial markets is hard to obtain, and that investors have limited abilities and financial literacy (Lusardi & Mitchell, 2014), households may decide to seek investment advice. The length of the relationship with the advisor, along with that of the issuing firm, is an additional factor that can affect investment choices. Previous research examines the impact of the length of bank-client relationship on the propensity to trade on advice (Hoechle, et al., 2017; Stolper & Walter, 2017) and delegate (Calcagno & Monticone, 2015). Intuitively, longer banking relations tend to be

stronger and more stable than shorter banking relations. Consequently, investors with a long-standing relationship might enjoy higher levels of loyalty with the issuer, leading to higher investment concentration toward firm-issued securities.

The advisory service has also been the subject of several discussions due to the potential agency costs resulting from the conflict of interest between investors and investment advisors (Golec, 1992). When financial advisors suggest the stocks, bonds, or funds managed by their companies, principal-agent problems may arise, undermining the quality of recommendations. Under such circumstances, households may end up with suboptimally diversified portfolios. Due to their double role, both as an intermediary and issuer, banks are particularly exposed to conflict of interest (Bolton, et al., 2007). On one side, they provide investment advice to their clients and, on the other side, they sell and issue investment products. From this perspective, it is reasonable to infer that a conflict of interest is more likely to arise when the issuer exhibits high fundraising needs. Banks could indeed rely on their consulting service to raise funds and increase profits (Hoechle, et al., 2016), incentivizing their advisors (both formally, e.g., through contract incentives, and informally, through a kind of moral suasion) to allocate bank bonds to their clients and generating a potential misalignment of interest between advisors and investors.

Despite the fact that existing literature provides widespread evidence on shareholders, relatively little is known about how bondholders' shape their portfolios and the role played by bank financial advisors. McEnally and Boardman (1979) examine the benefits of bond diversification and document that the variance reduction gained by increasing portfolio size is substantially high, especially for low rated bonds. Furthermore, considering that the bank bond market is becoming increasingly illiquid following the recent financial crisis and is typically

characterized by negatively skewed returns, concentrating investments in one-issuer bonds could be inefficient. Yet, surprisingly, empirical evidence shows that households tend to disproportionally invest in few securities.

Existing literature on bond holdings has focused on country- (Schoenmaker & Bosch, 2008; De Moor & Vanpée, 2013) and firm-level analyses (Francis, et al., 2007), whereas, to the best of my knowledge, no research has examined retail investors and used individual-level data. The present study fills this gap, investigating the determinants of bank bond concentration when investors receive recommendations from bank advisors. Consistently with the above-mentioned literature, I posit that such behaviour is driven by individual attributes (related-attributes hypothesis), issuer-investor relationship (bank-client loyalty hypothesis) and external pressures (conflict-of-interest hypothesis).

3. Data and Methodology

3.1. Data collection and source

The data used in this research are supplied by 8 Italian CCBs issuing relatively illiquid bonds[65]. These banks provide a diversified spectrum of services – such as bank accounts, investment accounts, loans, mortgages – that resemble those offered by standard brokerage firms in the USA (Hoechle et al., 2017). CCBs operates through a network of bank branches spread across the local community. In the province where they operate, their market share by deposits, compared to all cooperative banks in the province, ranges between 7% and 25%.

[65] Most of bonds issued are unlisted.

Advisors working in these branches are bank employees authorized to make financial recommendations under the MiFID regulation. The advisory service is free of charge and is provided to all investors through personal meetings between the client and the advisor[66]. The remuneration of bank employees is based on a fixed wage plus a bonus depending on the bank and branch achievements[67]. The cooperative structure of these banks provides a favourable environment to develop strong and trust-based connections with bank advisors. Therefore, customers at CCBs are prone to trust their advisors and adopt advice-following behaviours, perceiving their interests aligned with those of bank employees (Monti, et al., 2014). This aspect provides an interesting setting for the research as it might set a lower bound on the influence of agency issues on bank bond concentration.

Each bank has supplied year-end observations on households' asset allocation choices and responses to the MiFID questionnaire[68] over the 2011-2015 period. The data include portfolio composition of all households receiving tailor-made recommendations. More specifically, portfolios include the following data concerning investments: account's cash balance, CCB-issued bonds, other bonds, government bonds, stocks, depository certificates, repos, insurance policies, and derivatives. With regards to investors' characteristics, data include the length of the bank-customer relationship, sociodemographic information and investors' responses to questions addressing mainly experience, financial knowledge, and risk aversion.

[66] Advisory contacts through phone calls is very limited (around 1%), while consulting via emails or letters is not provided.
[67] I do not have specific information on compensation contracts of bank advisors. However, examining a typical incentive program at one of the banks in the dataset, I can reasonably infer that the bonus is below 10% of the overall compensation. Despite its relatively moderate level, it is important to point out that conflict of interest is not merely limited to explicit, monetary incentives (Fecht, et al., 2017) but it is also related to implicit incentives, such as career progress and reputational concerns of bank employees.
[68] Investors fill out a questionnaire addressing investment experience, financial knowledge, risk profile, wealth, and investment goals. The information provided by the questionnaire is then reviewed by bank advisors to verify the suitability and appropriateness of investment products. Most CCBs require their clients to update their questionnaire every three years. Failure to fill out the questionnaire would prohibit investors from executing any transaction.

I adopt several data-cleaning procedures to the raw data. First, I consider only individual investment accounts, excluding jointly held accounts because investment choices could be related to characteristics of many investors (Foerster, et al., 2017). For the same reason, I drop investors younger than 20 and older than 90 years old. Second, I set the value of each household's portfolio greater than the bond minimum denomination, which corresponds to €1,000. Third, I eliminate individuals with incomplete questionnaire data. The final dataset consists of almost 25,000 households who have an active investment account at some point during the examined period.

In addition to the information on individuals, I obtain bank and branch- level data for the same period. At the bank level, I collect data on profitability and liquidity. As an important aspect, although heterogeneous in terms of operating policies, these banks are characterised by a similar business structure, thereby providing a homogeneous dataset of financial institutions. At the branch level, I gather data on the total numbers of investment advisors, year-end bank bond funding and year-end total funding. To be included in the final database, total clients per branch must be greater than 5[69].

3.2. Methodology

To investigate the drivers of bank bond concentration, I first estimate a panel regression model of the following form:

$$y_{i,a,b,t} = \alpha + \beta INVESTOR_{i,t} + Controls + \varepsilon_{i,a,b,t} \quad (1)$$

[69] By setting the threshold to 10 clients, the results are qualitatively similar.

in which the dependent variable is the bond portfolio share invested in bonds issued by the bank *a* of the investor *i* at time *t*, who relies on recommendations of advisors operating in the branch *b* of bank *a*[70]. To test the related-attributes hypothesis, I introduce the $INVESTOR_{i,t}$ vector, which includes the following variables for households: gender, age, occupation, education, risk tolerance, financial knowledge, experience, investment horizon, income, total debt, and assets held. As for control variables, I include account balance (*Account balance*), total portfolio value (*Total portfolio value*)[71], and a dummy variable that indicates whether portfolios have value over €100,000, since these investment accounts are generally managed by senior financial advisors and receive advanced investment advice (*Advanced*).

The second model is designed to test the bank-client loyalty hypothesis:

$$y_{i,a,b,t} = \alpha + \beta INVESTOR_{i,t} + \gamma LENGTH_{i,t} + Controls + \varepsilon_{i,a,b,t} \quad (2)$$

The variable of interest, $LENGTH_{i,t}$, is constructed as the number of years a household has been registered by the bank[72]. I expect the length of the bank-client relationship to have a positive effect on the dependent variable: strong and long-lasting relationships with the bank may generate positive feelings in investors that in turn may perceive bank-issued securities as trustworthy investments. To gauge the impact of investors' characteristics alone, Equation (1) and (2) exclude any bank and branch information.

Finally, to explore the conflict-of-interest hypothesis, the third model includes bank- and branch-level data:

[70] In other words, for each portfolio four dimensions are considered: investor (*i*), time (*t*), reference bank (*a*) and branch (*b*). Unfortunately, the dataset does not include information about which branch advisor each client speaks to. Therefore, inference is provided at the branch-level.

[71] Total portfolio includes: CCB-issued bonds, other bonds (CCB-issued bonds are excluded), government bonds, stocks, depository certificates, repos, insurance policies, and derivatives.

[72] It refers to the number of years a household has started any relationship with the bank. Hence, it may or may not correspond to the number of years the household has opened its investment account.

$$y_{i,a,b,t} = \alpha + \beta INVESTOR_{i,t} + \gamma LENGTH_{i,t} + \rho BANK_{a,t} + \delta ADVISOR_{a,b,t} + Controls + \mu a + \mu b + \varepsilon i,a,b,t \quad (3)$$

With reference to the former, (i.e., the $BANK_{a,t}$, vector), I consider two major variables on bank operating policies: return on average assets (*ROA*), which is a standard measure of profitability, and total loans over direct funding from customers (*Loans/Fund*), which captures the asset-liability mismatch. Financial institutions with a weaker funding structure and lower profitability are more likely to push their advisors into raising funds than banks with a stronger balance sheet. With reference to the latter (i.e., $ADVISOR_{b,t}$), I include the following ratio:

$$Bondfund\_Advisor = \frac{Bank\ bond\ funding_{a,b,t}}{n°\ advisors_b} \Big/ \frac{Bank\ bond\ funding_{a,t}}{n°\ advisors_a}$$

where the numerator is computed as bank issued bonds held by retail investors of branch *b* of bank *a*, at time *t*, divided by the total number of advisors operating at branch *b*, and the denominator is computed as bank issued bonds held by retail investors of bank *a*, at time *t*, divided by the total number of advisors operating at bank *a* (*Bondfund_Advisor*). This variable measures branch advisors' skill in bank bond fundraising with respect to advisors operating in other branches of the bank. Hence, higher values indicate relatively higher fundraising capability of branch advisors.

To disentangle advisor fundraising capabilities in bank bonds with their fundraising skills in other instruments, I compute the same previous ratio replacing bank issued bonds with all other sources of bank direct and indirect funding (*Otherfund_Advisor*) [73]:

[73] All other sources of direct and indirect funding include: account cash balance, other bonds (CCB-issued bonds are excluded), government bonds, stocks, depository certificates, repos, insurance policies, and derivatives. As a robustness check, I also

$$Otherfund\_Advisor = \frac{Other\ funding_{a,b,t}}{n°\ advisors_b} \Big/ \frac{Other\ funding_{a,t}}{n°\ advisors_a}$$

Finally, μ_a and μ_b are respectively bank and branch fixed effects. These latter are added to capture unobserved common variation in portfolios among investors of the same bank and branch[74].

All regressions are estimated using panel data random effects with Mundlak (1978) corrections and standard errors clustered at the individual level. These models allow to consistently estimate both time invariant (i.e., gender) and time variant regressors, controlling for possible correlation between the unobserved individual effects and time varying variables. Mundlak (1978) has indeed demonstrated that fixed effect estimates equal random effect estimates when including time averages for the time variant regressors.

To detect potential multicollinearity concerns, I further report in Table 3 the Variance Inflation Factors (VIFs) and Generalized Variance Inflation Factors (GVIFs) for independent variables. All VIFs and GVIFs are below the 5 threshold, suggesting that our model is not affected by collinearity issues.

3.3. Descriptive statistics

Table 1 shows summary statistics for households and their portfolios. More specifically, panel A provides sociodemographic information on 24,838 individuals and the length of the bank-client relationship. Of all investors, 48% are female and are, on average, 52 years old as of December 2015. Customers are characterised by long banking relations, with an average duration

construct an alternative measure of *Otherfund_Advisor* without including account cash balance and results do not change. Regression estimates including this alternative specification are available upon request.

[74] Due to collinearity issues, bank and branch fixed effects are included separately in Equation (3).

of around 16 years, and report to have a long investment horizon (58%). The education variable is divided in three levels based on the training received by clients. 51% of them report to have a high school diploma, 36% completed elementary or middle school, and the remaining hold a university degree. As far as job is concerned, 49% of the individuals are employed, 24% are self-employed, 18% are retired, while the other 9% belong to the unemployed category, which includes also housewives and students.

Risk tolerance, financial knowledge, and experience are scores obtained by branch advisors through the MiFID questionnaire at the beginning of the advisory service. The vast majority of investors (82%) report "moderate" risk tolerance, while only 6% and 12% report respectively "low" and "high" risk tolerance. Similarly, 70% report "moderate" experience in financial markets, while the rest of clients is almost equally split between the "low" and "high" category. Most individuals consider having a relatively high knowledge in investment products: 57% are indeed assigned to a "moderate to high" financial knowledge category. Of the remaining 43%, 23% report "moderate" financial knowledge, 10% are classified as either "low" or "low to moderate", while only 10% are labelled having "high" financial knowledge. The average earnings capacity is €28,930 per year, which is comparable to that of the Italian population of €29,479[75]. Of the clients in the dataset, the majority (i.e., 59%) has total assets (i.e., financial products, real estate, and cash) less than €200,000 and (i.e., 90%) holds less than €30,000 of medium to long-term debt.

Panel B shows portfolio characteristics. The average investor in the dataset holds about 70% share of bond portfolio and 42% share of total portfolio in bank-issued bonds. The remaining

[75] The data are computed as of 2014 and are gathered from the National Institute for Statistics (Istat), available here: http://dati.istat.it/.

fraction of the total portfolio is mainly invested in funds (34%) and other instruments (15%), which include depository certificates, repos, insurance policies, and derivatives. Portfolio values are right-skewed, with the mean value of €67,900 above the median of €30,848. Roughly one-fifth of individuals receives advanced advisory service and thus has portfolio value over €100,000.

Table 2 displays summary statistics for the 8 banks (Panel C) and their branches (Panel D) as of December 2015. The average bank reports a ROA of 0.14% and total loans over direct funding of 98%. The number of bank branches ranges between a minimum of 10 to a maximum of 36. On average, there are four financial advisors per branch, raising € 7,621,000 of bank bond funds and € 16,190,000 of other funding sources.

[insert Table 1 here]

[insert Table 2 here]

[insert Table 3 here]

4. Results

4.1. Analysis of bank bond concentration

Table 4 reports the results from regressions using random effects with Mundlak (1978) correction to explain households' bank bond concentration. Equation (1) includes only investor characteristics as independent variables. Education plays an important role: investors who report to have an education level above high school (relatively to investors with high school education level) concentrate less of their bond portfolio in bank bonds, whereas investors who report to have an education level below high school (relatively to investors with high school education

level) concentrate more of their bond portfolio in these securities. This result supports the literature stating that education matters in making better investment decisions (Karlsson & Nordén, 2007).

Occupation is also a relevant predictor of bank bond concentration. I find that self-employed, employed, and unemployed investors, relatively to retired investors, are more exposed to concentration risk. Moreover, all categories have comparable economic effects.

Client's risk tolerance surprisingly does not explain the dependent variable, while all financial knowledge categories report positive and statistically significant coefficients, contradicting prior research showing a positive relation between financial literacy and portfolio diversification (Guiso & Jappelli, 2008). However, considering the relatively low fraction of households in the lowest (omitted) category for risk tolerance and financial knowledge, which may affect this outcome, I also estimate Equation (1), replacing each dummy variable with an ordinal variable[76]. With reference to risk tolerance, Table A1 in the supplementary appendix documents a negative and statistically significant coefficient. I interpret this outcome as evidence that these households, being more prone to losses, prefer to invest in asset categories that are risker in terms of market volatility (e.g., equity). With reference to financial knowledge, the result confirms the positive impact on bank bond concentration. This finding, which runs counter to the standard view on the benefits of financial knowledge, could be driven by the self-evaluative nature of this variable, constructed according to what investors report to know about financial products and not what they actually know. In this regard, the financial knowledge score might be influenced by the level of investor overconfidence.

[76] Starting from the lowest category, I assign values from 1 to 3 for risk tolerance, and from 1 to 5 for financial knowledge.

In Table 4, experience reduces bank bond holdings, which is concurrent with the concept of learning through experience and with a lower likelihood among experienced households to exhibit higher bank bond concentration.

Investors with longer investment horizons concentrate less than those with shorter investment horizons, which is probably explained by the fact these securities are short to medium term investments[77].

Income, proxy for investor sophistication, has a positive and statistically significant coefficient, indicating that households with higher level of this variable allocate higher bond portfolio share in bank bonds than investors with lower levels of it. Despite this unexpected outcome, this regressor loses some of its explanatory power in the following regressions. A similar effect is also reported for *Total portfolio value*. After controlling for all observable attributes, account balance, total assets and total debt either do not or marginally explain the dependent variable. Finally, age shows a negative coefficient that, however, becomes statistically not significant when bank and branch characteristics are added in the following equations.

To a different extent, estimates from Equation (1) report substantial variation in bank bond holdings across investor characteristics, confirming the related-attribute hypothesis. However, despite using a comprehensive set of observable information on households, the model surprisingly explains less than 6% of the cross-sectional variation in bank bond concentration, leaving a remarkable amount of variation unexplained.

Results from Equation (2), adding the length of the bank-client relationship, document that households with longer banking relationships concentrate more than households with shorter

[77] The average maturity of CCB-issued bonds is around 3 years.

banking relationships. Longer bank-customer relations are typically stronger and more prone to elicit feelings of fidelity in investors, which in turn may perceive bank-issued instruments as trustworthily and safe, resulting in higher bank bond concentration. This finding provides support for the bank-client loyalty hypothesis.

Columns 3- 6 report four alternative specifications of Equation (3). The first one (column 3 of Table 4) includes bank-specific characteristics that act as indicators of bank operating policies, while the second one (column 4 of Table 4) controls for unobserved bank heterogeneity through bank fixed effects. I expect financial institutions with weaker funding structure and lower profitability to be more exposed to principal-agent issues and, therefore, to promote a greater amount of bank-issued bonds to their own clientele. Consistently with my expectations, when issuer banks are less profitable (lower *ROA*) and experience a higher funding gap (higher *Loans/Fund*), investors hold on average a relatively higher share of bank bonds in their bond portfolio. As a striking result, the adjusted R-squared substantially increases from 6% in column 1 to almost 11% in column 3[78].

To capture more directly fundraising pressures by means of financial advisors, I include in the third specification the *Bondfund_Advisor* and *Otherfund_Advisor* variables (column 5 of Table 4), and in the fourth specification branch fix-effects[79] (column 6 of Table 4) to control for unobserved branch heterogeneity. Results document that investors from branches with relatively more productive financial advisors, in terms of fundraising ability in bank bonds, take higher concentration risk as compared to investors from branches with relatively less productive

[78] Since I add a restricted number of variables, the increase in the adjusted R-squared should not be mechanically associated to the higher number of regressors.
[79] I do not include bank fix effects due to collinearity issues with branch fixed effects.

financial advisors[80]. On the other hand, if advisors exhibit fundraising capabilities in other channels, a completely opposing finding emerges, as reported by a negative and statistically significant coefficient for the *Otherfund_Advisor* variable [81] [82].

Overall, the substantially higher explanatory power of Equation (3), as compared to Equations (1)- (2), shows that variation in bank bond concentration is substantially determined by bank and branch-level advisor characteristics. Furthermore, the estimated coefficients of the variables of interest, which is coherent with my expectations, provide evidence of the conflict-of-interest argument in explaining bank bond concentration and bank-advisor role in shaping households' bond portfolio.

[insert Table 4 here]

5. Robustness checks

5.1. Alternative specification

As a robustness check, I construct an alternative fundraising skill measure to account for the fact that advisors' ability to raise funds also depends on the number of clients to which they provide tailor-made recommendations. Bearing this in mind, I compute the following variable as a difference of two ratios:

$$Client\_Bondfund\_Advisor = \frac{Bank\ bond\ funding_{a,b,t}}{n°\ advisors_b * n°\ clients_b} - \overline{\left(\frac{Bank\ bond\ funding_{a,b,t}}{n°\ advisors_b * n°\ clients_b}\right)}$$

[80] To partially address potential endogeneity issues, I compute the covariance between *Bondfund_Advisor* and regression residuals, which I find approximately equal to zero.
[81] The *Bondfund_Advisor* and *Otherfund_Advisor* variables exhibit low VIF (3.01 and 3.02, respectively) but relatively high positive correlation. For this reason, I also estimate the regression model including one variable at a time and results are qualitatively similar.
[82] Results do not change when including the alternative *Otherfund_Advisor* variable constructed without including account cash balance.

where the first ratio is computed as bank issued bonds held by retail investors of branch *b* divided by the product between the total number of clients and advisors operating at branch *b*. I then subtract the mean value of the ratio across all branches (i.e., the second ratio) to get the *Client_Bondfund_Advisor* variable. Assuming equal amount of raised funds and number of advisors, the variable assigns higher values to branches with less clients compared to those with more clients, as average raised funds per client are higher for the former. Analogously, I then compute the *Client_Otherfund_Advisor* variable replacing bank bonds with all other sources of direct and indirect funding for banks. Table 5 contains results from Equation (3) substituting the branch variables for their alternative specifications. I observe that the variables of interest in supporting the conflict-of-interest argument, namely the bank and branch variables, still retain significant importance both in column 1 without branch fixed effects and in column 2 with them, thereby confirming previous findings from Table 4.

[insert Table 5 here]

5.2. Do average risk premium, bank, and sovereign credit risk crowd out the effect of branch advisors?

To provide further insight into the impact of advisors' fundraising skills on their clients' bank bond holdings, I run the following regression, controlling for the average risk premium on bank bonds, bank, and sovereign credit risk.

$$y_{i,a,b,t} = \alpha + \beta INVESTOR_{i,t} + \gamma FIDELITY_{i,t} + \rho BANK_{a,t} + \delta ADVISOR_{a,b,t} +$$
$$+ \theta RISK\ PREMIUM_{a,t} + \sigma BANK\ CREDIT\ RISK_{a,t} +$$

$$+ \varphi SOVEREIGN\ CREDIT\ RISK_{a,t} + Controls + \mu_b + \varepsilon_{i,a,b,t}$$

(4)

To compute the yield, I collect data from Bloomberg on all CCB-issued bonds targeted at retail investors[83] that are outstanding during the period under examination to construct a representative bond spread per each bank and year. I exclude bonds with mixed coupon type[84] or complex floating rates due to data limitations. Overall, I obtain 549 bond issues by 8 CCBs over the 2004-2015 period: of which 203 are fixed-rate, 202 are variable-rate (i.e., step up and step down bonds) and the remaining floating-rate coupons (i.e., bonds with coupon expressed as fixed margin over index) [85]. For each fixed and variable rate issue, I then compute the spread at issuance defined as the difference between the yield to maturity and that of the corresponding maturity-match Interest Rate Swap (IRS). For each floating rate issue instead, I measure the spread at issuance using the fixed spread over the reference index. To get the average risk premium (*Risk Premium*), I calculate for each bank at year-end the weighted average of bond spreads on the amount issued.

To compute bank credit risk, I use internal credit ratings assigned by the holding bank on a yearly basis to most CCBs, since external credit ratings are not available. Internal ratings divide bank credit risk in 7 classes, where class 1 has the lowest and class 7 has the highest credit risk assessment. I then convert each credit class to a number, assigning higher values to riskier banks (*Bank credit risk*).

[83] To account only for bond issues targeted at retail investors, I exclude from the computation bond issues with minimum denomination above €20,000.
[84] I.e., bonds with the following coupon type: fix then floating and vice versa.
[85] CCBs do not issue callable, puttable, and convertible bonds.

To account for Italy's credit risk, I further include default ratings on sovereign debt set by Fitch. During the years under investigation, which cover most of the sovereign debt crisis period, credit rating for Italy's government debt has been downgraded twice. Starting from an A+ value in the end of 2011, the rating downgraded to A– in January 2012 and to BBB+ in March 2013. As for bank credit risk, I then transform each rating class in a number according to an increasing scale (*Sovereign credit risk*)[86].

Table 6 reports regression estimates of Equation (4). Controlling for the risk-return trade-off and sovereign credit risk, findings show that branch variables, which measure fundraising skills and to some extent capture advisor ability to push their clients to increment bank bond holdings, still retain strong importance. Similarly, the effect of bank variables remains unchanged. This robustness check is coherent with the conflict-of-interest hypothesis.

[insert Table 6 here]

5.3. Relevance for the total portfolio

The research focuses on investor bond portfolios. However, to examine whether the effect of investor attributes, bank and branch advisor variables changes according to the bank bond exposure to the total portfolio[87], I estimate Equation (3) for two sub-datasets using as a cut-off

[86] I use the following scale: AAA=1, …D=21.

[87] The total portfolio is composed of either bonds and other financial instruments. More specifically, it includes: CCB-issued bonds, other bonds (CCB-issued bonds are excluded), government bonds, stocks, depository certificates, repos, insurance policies, and derivatives.

the mean of the distribution of the share of bank bonds in the total portfolio[88]. Regression estimates are reported in Table 7. The first and second column respectively include investors with a relatively low and high share of bank bonds in the total portfolio.

Despite a drop in the explanatory power of some regressors, investor attributes predict the variation in bank bond holdings in the same direction as in Table 4 but with some minor exceptions. Longer investment horizons have a positive effect only for portfolios with relatively low exposure, while a negative effect for portfolios with relatively high bank bond share. Portfolio size exhibits a similar effect. In case of low bank bond exposure, investors reporting higher debts concentrate less as compared to investors reporting less debts, while, counterintuitively, in case of high bank bond exposure, an opposite result emerges, since individuals with higher *Total debt* take an additional risk by concentrating more of their bond portfolio than individuals with lower *Total debt*. Interestingly, investors receiving advanced advisory (*Advanced*) assume higher concentration risk in the case of low exposure, while they assume lower concentration risk in the case of high exposure. This finding seems to suggest that the advanced advisory service prompts a corrective action for large portfolios with relative high bank bond concentration.

The remaining coefficients from Table 7 show consistent results with Table 4. Among the most important variables, years of bank-customer relationship maintain a positive and statistically significant coefficient independently of bank bond exposure. Bank characteristics, expressed by *ROA* and *Loans/Fund*, contribute to explain bank bond concentration with the

[88] With regards to experience, risk tolerance, and knowledge, I include numeric variables instead of dummy variables. This is explained by the fact that the fraction in the lowest category of these variables substantially diminishes when dividing the dataset into two subgroups.

expected sign, even though *Loans/Fund* displays a negative yet marginally significant coefficient in column 2. Remarkably, *Bondfund_ Advisor* is significant only for portfolios having high bank bond share. In other words, the branch advisor variable exhibits influence only when clients have relatively high exposure to bank bonds, which seems to provide an implicit evidence of the misaligned incentives between clients and branch advisors. Overall, estimates from this robustness check provide qualitative similar outcomes from prior regressions, further confirming previous findings.

[insert Table 7 here]

5.4. Relevance of bank bonds for total bank funding

To provide further insight on the role of bank bonds as a source of funding, I estimate Equation (3) dividing the dataset between banks that rely relatively more and less on bank bond funding. Similarly to Table 7, I use as threshold the mean value of the ratio of bank bond funding to total bank funding. Table 8 documents regression coefficients for the two subsets (column 1 and 2). Among the main variables of interest, relationship length and branch characteristics maintain highly significant with the expected sign in both regressions. With respect to bank variables, there is evidence that profitability reduces bank bond concentration regardless of the share of bank bond funding. In contrast, asset liability mismatch, expressed by *Loans/Fund*, increases bank bond concentration only for banks using relatively less bank bond funding, whereas it decreases it for banks relying relatively more on this funding channel. A possible explanation is that banks with a higher funding gap do not attempt, *ceteris paribus*, to mitigate

this mismatch allocating further bonds to their clientele. However, this apparent promising result on the banks' side, clearly requires further investigations for future research.

6. Conclusions

Although concentration of bond portfolios is a risky investment activity, relatively little is known about why households concentrate their bond portfolio and the role played by bank advisors in shaping it.

Using Italian data on 8 banks, their branches, and their clients, I examine the main determinants of bank bond concentration for retail investors receiving tailor-made recommendations from bank financial advisors. Accounting for unobserved investor, bank, and branch information, regression estimates show three main findings. First, investor attributes, that theoretically should be key predictors in explaining investment choices, exhibit extremely low explanatory power. Only 6% of the cross-sectional variation in bank bond concentration is indeed determined by investor observable characteristics. This result is consistent with Foerster et al. (2017) who find marginal effect of a comprehensive set of investor characteristics on the risky share and home bias of Canadian households following financial advice. Second, the length of the bank relationship has a positive effect, indicating that investors with longer and thus stronger ties with the issuer are prone to increase their bond portfolio share in bank-issued securities, probably perceiving such instruments as safe investments. Third, bank and branch characteristics are the strongest predictors. This result provides evidence of the influence of the issuer in shaping their clients' bond portfolio. More specifically, the average investor concentrates more when banks experience higher funding needs than when they are more solid.

In line with this evidence, higher branch advisors' fundraising skill in bank bonds, and lower capability in other bank funding sources, positively influence bank bond holdings. Overall, these findings support the conflict-of-interest argument in explaining bank bond concentration and the literature highlighting that, under some circumstances, financial advisors exploit their naïve clients (Inderst & Ottaviani, 2012).

To confirm these results, I perform a series of robustness checks. First, using an alternative specification of advisors' fundraising ability. Second, adding the average risk premium paid by banks on bonds, the level of bank, and sovereign credit risk to the model. Finally, running the analysis for portfolios with relatively high and low bank bond exposure, and for banks with relatively high and low reliance on bank bond funding.

This study provides relevant implications for both scholars and practitioners. It contributes to the discussion about the determinants of investors' lack of diversification in a context characterised by potential conflict of interest between clients and bank financial advisors. Furthermore, it sheds light on a timely policy issue on investor protection. Given that empirical evidence shows that investors have poor financial literacy (Lusardi & Mitchell, 2014) and report to rely on advisors' recommendations, the research findings question the effectiveness of current policies to safeguard investors. Theoretically, advisors could act as an important complement in the provision of financial information, informing households of the risk they take when deciding how to invest their savings. However, this might not always be the case. Therefore, greater attention by policymakers is necessary to limit conflict of interest when banks supply investment advice.

References

Angelini, P., Di Salvo, R. & Ferri, G., 1998. Availability and cost of credit for small businesses: Customer relationships and credit cooperatives. *Journal of Banking & Finance,* Volume 22, pp. 925–954.

Badarinza, C., Campbell, J. Y. & Ramadorai, T., 2016. International Comparative Household Finance. *Annual Review of Economics ,* Volume 8, pp. 111–144.

BlackRock, 2013. *Investor Pulse Survey (2013).* [Online] Available at: http://www.blackrock.ch/individual/en-ch/get ting-started/investor-pulse

Blume, M. E. & Friend, I., 1975. The asset structure of individual portfolios and some implications for utility functions. *Journal of Finance*, Volume 30, pp. 585–603.

Boermans, M. A., 2015. Market concentration in the euro area bond markets - an application with granular sectoral securities holdings statistics, Bank for International Settlements.

Bolton, P., Freixas, X. & Shapiro, J., 2007. Conflicts of interest, information provision, and competition in the financial services industry. *Journal of Financial Economics*, Volume 85, pp. 297–330.

Calcagno, R. & Monticone, C., 2015. Financial literacy and the demand for financial advice. *Journal of Banking & Finance,* Volume 50, pp. 363–380.

Campbell, J. Y., 2006. Household Finance. *Journal of Finance,* Volume 61, pp. 1553–1604.

Credito Cooperativo , n.d. *Sito Ufficiale del Credito Cooperativo — The Credito Cooperativo.* [Online] Available at: http://www.creditocooperativo.com/template/default.asp?i_menuID=42125

De Moor, L. & Vanpée, R., 2013. What drives international equity and bond holdings? An empirical study. *Applied Financial Economics*, Volume 23, pp. 1067–1082.

Dhar, R. & Zhu, N., 2006. Up Close and Personal: Investor Sophistication and the Disposition Effect. *Management Science*. Volume 52, pp. 726–740.

European Commission, n.d. *Investment services and regulated markets - Markets in financial instruments directive (MiFID).* [Online] Available at: https://ec.europa.eu/info/business-economy-euro/banking-and-finance/financial-markets/securities-markets/investment-services-and-regulated-markets-markets-financial-instruments-directive-mifid_en

Fecht, F., Hacketal, A. & Karabulut, Y., 2017. Is Proprietary Trading Detrimental to Retail Investors?. *Journal of Finance*, forthcoming.

Foerster, S., Linnainmaa, J. T., Melzer, B. T. & Previtero, A., 2017. Retail financial advice: does one size fit all?. *Journal of Finance*, forthcoming.

Francis, B., Hasan, I. & Waisman, M., 2007. Does geography matter to bondholders?. FRB of Atlanta Working Paper No. 2007-2.

Golec, J. H., 1992. Empirical tests of a principal-agent model of the investor-investment advisor relationship. *Journal of Financial and Quantitative Analysis*, Volume 27, pp. 81–89.

Grasso, R., Linciano, N., Pierantoni, L. & Siciliano, G., 2010. Bond issued by Italian banks: risk and return characteristics, Quaderno di Finanza Consob n. 67.

Guiso, L. & Jappelli, T., 2008. Financial literacy and portfolio diversification. EUI Working Papers, pp. 1–36.

Hackethal, A., Haliassos, M. & Jappelli, T., 2012. Financial advisors: A case of babysitters?. *Journal of Banking & Finance,* Volume 36, pp. 509–524.

Hoechle, D., Ruenzi, S., Schaub, N. & Schmid, M., 2016. Financial Advice and Bank Profits. Swiss Institute of Banking and Finance Working paper.

Hoechle, D., Ruenzi, S., Schaub, N. & Schmid, M., 2017. The Impact of Financial Advice on Trade Performance and Behavioral Biases. *Review of Finance*, Volume 21, pp. 871–910.

Inderst, R. & Ottaviani, M., 2009. Misselling through agents. *The American Economic Review,* Volume 99, pp. 883– 908.

Inderst, R. & Ottaviani, M., 2012. How (not) to pay for advice: A framework for consumer financial protection. *Journal of Financial Economics,* Volume 105, pp. 393–411.

Kahneman, D., 1973. *Attention and effort.* Prentice Hall, Englewood Cliffs, New Jersey.

Karlsson, A. & Nordén, L., 2007. Home sweet home: home bias and international diversification among individual investors. *Journal of Banking & Finance,* Volume 31, pp. 317–333.

Kelly, M., 1995. All their eggs in one basket: portfolio diversification of US households. *Journal of Economic Behavior and Organization,* Volume 27, pp. 87–96.

Linciano, N., Gentile, M. & Soccorso, P., 2016. Report on Financial Investments of Italian Households. Behavioural Attitudes and Approaches-2016 Survey, Consob Statistics and analyses, Rome.

Lusardi, A. & Mitchell, O. S., 2014. The Economic Importance of Financial Literacy: Theory and Evidence. *Journal of Economic Literature,* Volume 52, pp. 5–44.

McEnally, R. W. & Boardman, C. M., 1979. Aspects of corporate bond portfolio diversification. *The Journal of Finacial Research,* Volume 2, pp. 27–36.

Miller, G. A., 1956. The magical number seven, plus or minus two: some limits on our capacity for processing information. *Psychological Review,* Volume 63, pp. 81–89.

Monti, M., Pelligra, V. & Berg, N., 2014. Retail investors and financial advisors: New evidence on trust and advice taking heuristics. *Journal of Business Research,* Volume 67, pp. 1749–1757.

Mundlak, Y., 1978. On the pooling of time series and cross section data. *Econometrica,* Volume 46, pp. 69–85.

Polkovnichenko, V., 2005. Household Portfolio Diversification: A Case for Rank-Dependent Preferences. *The Review of Financial Studies,* Volume 18, pp. 1467–1502.

Schoenmaker, D. & Bosch, T., 2008. Is the home bias in equity and bonds declining in Europe?. *Investment Management and Financial Innovations,* Volume 5, pp. 90–102.

Stolper, O. & Walter, A., 2017. Birds of a feather: The impact of social proximity on the propensity to follow financial advice. SSRN Working Paper Series.

Appendix

Table 1. Descriptive statistics for investor characteristics and their portfolio

Variable	*Mean*	*Percentiles*		*Standard Deviation*
		25th	*75th*	
Panel A: Investors (N=24,838)				
Female	0.4762			0.499
Age	52.2	42.0	62.0	15.047
Length of relationship (years)	16.13	9.00	23.00	8.144
Income	28,930	10,000	30,000	2,0031.57
Account balance	19.600	2.027	19.310	60.06213
Education				
Below high school	0.363			0.4854996
High school	0.5102			0.4999928
Above high school	0.1253			0.3258715
Occupation				
Self-employed	0.238			0.4284675
Employed	0.4907			0.4998134
Unemployed	0.0931			0.2851904
Retired	0.1781			0.3860072
Risk tolerance				
Low	0.0647			0.2805259
Moderate	0.8189			0.3864553
High	0.1163			0.2954183
Financial knowledge				
Low	0.00560			0.1030392
Low to Moderate	0.08405			0.3199911
Moderate	0.2335			0.4192561
Moderate to High	0.5732			0.4973815
High	0.1036			0.2928635
Experience				
Low	0.1786			0.3934632
Moderate	0.7092			0.4587392

High	0.1122			0.3123912
Time horizon				
1 year	0.00565			0.09973245
1- 3 years	0.08827			0.3235973
3- 5 years	0.3209			0.4758991
5+ years	0.5852			0.4994034
Total assets				
< €200,000	0.5935			0.4932092
€200,000- €500,000	0.3100			0.4669867
€500,000- €1,000,000	0.0690			0.2535103
€1,000,000- €3,000,000	0.0223			0.1486579
> €3,000,000	0.0051			0.0697644
Total debt (medium and long-term)				
< €30,000	0.8967			0.3045663
€30,000- €50,000	0.0372			0.1889084
€50,000- €80,000	0.0232			0.1514562
> €80,000	0.0428			0.2026656
Panel B: Portfolio characteristics				
Portfolio allocation				
CCB-issued Bonds (% of total portfolio)	0.347	0.0000	0.7039	0.4092
CCB-issued Bond (% of bond portfolio)	0.713	0.429	1.000	0.3998
Other bonds (% of total portfolio)	0.036	0.0000	0.0000	0.138875
Government bonds (% of total portfolio)	0.048	0.0000	0.0000	0.173802
Equity (% of total portfolio)	0.0579	0.0000	0.0000	0.417405
Funds (% of total portfolio)	0.337	0.0000	1.000	0.4135961
Others (% of total portfolio)	0.153	0.0000	0.099	0.3063196
Total portfolio value	67.90	11.03	74.19	126.39
Advanced	0.233			0.42271

This table reports summary statistics for investors (Panel A) and portfolio characteristics (Panel B). All variables are computed as of December 2015. Total portfolio value and account balance are scaled dividing by 1,000 and winsorized at the 10% level.

Table 2. Descriptive statistics for banks and their branches

Variable	*Mean*	*Percentiles*		*Standard Deviation*
		25th	*75th*	
Panel C: Bank characteristics (N=8)				
ROA	0.001	0.100	0.270	0.264
Loans/Fund	0.980	0.9291	1.020	0.1084
Panel D: Branch characteristics (N= [min 10, max 36])				
Financial advisors	3.74	3.74	5.0	1.551
CCB-issued bond funds	7,621,000	2,107,000	8,928,000	11,929,066
Other funds	16,190,000	6,801,000	18,950,000	15,965,145
Bondfund_ advisor	1.4760	0.7605	1.8410	1.1451
Otherfund_ advisor	1.4420	0.7618	1.8360	0.9257

This table reports summary statistics for bank (Panel C) and branch characteristics (Panel D). All variables are measured as of December 2015.

Table 3. Multicollinearity analysis

Variables	VIF	Df	GVIF^(1/(2*Df))
Age	2.51	1	1.58
Female	1.14	1	1.07
Length of relationship	1.31	1	1.15
Account balance	1.12	1	1.06
Total portfolio value	1.96	1	1.4
Income	1.32	1	1.15
Education	1.51	3	1.07
Occupation	3.02	3	1.20
Risk tolerance	1.68	2	1.14
Financial knowledge	2.49	4	1.12
Experience	2.47	2	1.25
Time horizon	1.32	1	1.15
Total assets	1.66	1	1.29
Total debt (> 3 years)	1.08	1	1.04
Advanced	1.64	1	1.28
Loans/Fund	1.04	1	1.02
ROA	1.04	1	1.02
Bondfund_ Advisor	3.01	1	1.74
Otherfund_ Advisor	3.02	1	1.74

This table displays VIFs, degrees of freedom and Generalized VIFs for independent variables of Equation (3).

Table 4. Regressions of bank bond concentration on investor attributes, bank characteristics, and branch-level advisor information

Variables	(1)	(2)	(3)	(4)	(5)	(6)
Constant	2.6479e-01*** [3.2878e-02]	2.6154e-01*** [3.2812e-02]	-6.4924e-01*** [4.4471e-02]	8.6271e-01*** [1.3240e-01]	-5.2283e-01*** [4.6183e-02]	8.6452e-01*** [1.3994e-01]
Age	-3.2361e-03*** [1.1017e-03]	-4.5688e-03*** [1.1517e-03]	-4.8358e-04 [2.9538e-04]	-9.3637e-05 [2.7876e-04]	-3.6079e-04 [2.9112e-04]	1.2867e-04 [2.7138e-04]
Female	1.0177e-02* [5.2561e-0]	1.0948e-02** [5.2557e-03]	8.6885e-03 [5.4322e-03]	5.5347e-03 [5.1066e-03]	9.8829e-03* [5.3521e-03]	7.7320e-03 [4.9086e-03]
Length of relationship		1.3392e-03*** [3.4311e-04]	5.4612e-03*** [1.1746e-03]	5.6601e-03*** [1.1700e-03]	5.3109e-03*** [1.2038e-03]	6.0439e-03*** [1.2004e-03]
Account balance	-2.0431e-05 [4.0504e-05]	-2.0492e-05 [4.0507e-05]	-3.3117e-05 [4.1744e-05]	-3.0836e-05 [4.1627e-05]	-1.7624e-05 [4.1402e-05]	-1.0399e-05 [4.1702e-05]
Total portfolio value	8.8957e-05** [3.8146e-05]	8.9645e-05** [3.8139e-05]	6.0188e-05 [3.9269e-05]	6.5525e-05* [3.9195e-05]	6.5474e-05* [3.9494e-05]	7.6644e-05* [3.9771e-05]
Income	5.2763e-07*** [1.4869e-07]	5.3616e-07*** [1.4874e-07]	4.8101e-07*** [1.4835e-07]	-2.9617e-08 [1.4696e-07]	5.1065e-07*** [1.4727e-07]	-1.6642e-07 [1.4675e-07]
Education						
Below high school	1.8820e-02*** [6.4989e-03]	1.7679e-02** [6.5112e-03]	2.0883e-02*** [6.6404e-03]	1.7424e-02*** [6.3191e-03]	1.6771e-02** [6.5489e-03]	1.5492e-02*** [6.2017e-03]
Above high school	-5.4587e-02*** [8.9418e-03]	-5.2568e-02*** [8.9488e-03]	-4.4026e-02*** [9.1964e-03]	-3.3717e-02*** [8.6882e-03]	-3.6705e-02*** [9.0413e-03]	-2.9749e-02** [8.4245e-03]
Occupation						
Self-employed	6.2903e-02*** [1.0639e-02]	6.0672e-02*** [1.0147e-02]	5.8343e-02*** [1.0511e-02]	2.8094e-02*** [1.0201e-02]	5.0799e-02*** [1.0379e-02]	2.3445e-02** [9.8844e-03]
Employed	6.6587e-02*** [9.2796e-03]	6.3881e-02*** [1.0304e-02]	5.9821e-02*** [1.0695e-02]	1.8523e-02* [1.0452e-02]	5.6915e-02*** [1.0539e-02]	1.7613e-02* [1.0094e-02]
Unemployed	5.6824e-02*** [1.1716e-02]	5.5034e-02*** [1.1736e-02]	4.8528e-02*** [1.2224e-02]	1.4353e-02 [1.1846e-02]	4.8174e-02*** [1.2066e-02]	1.1556e-02 [1.1443e-02]
Risk tolerance						
Moderate	1.5685e-02 [1.2773e-02]	1.5714e-02 [1.2765e-02]	2.1226e-02 [1.4352e-02]	3.1524e-03 [1.3776e-02]	2.9190e-02** [1.4030e-02]	1.9235e-02 [1.3356e-02]
High	-2.3406e-02 [1.5162e-02]	-2.3561e-02 [1.5155e-02]	-1.9942e-02 [1.6617e-02]	-4.0412e-02** [1.6037e-02]	-1.0071e-02 [1.6339e-02]	-2.5503e-02 [1.5681e-02]
Financial knowledge						
Low to Moderate	4.0834e-01*** [2.6676e-02]	4.0642e-01*** [2.6662e-02]	4.0044e-01*** [2.7122e-02]	3.8830e-01*** [2.6057e-02]	3.7068e-01*** [2.6626e-02]	3.0948e-01*** [2.5428e-02]
Moderate	4.5048e-01*** [2.6535e-02]	4.4899e-01*** [2.6511e-02]	4.4017e-01*** [2.6947e-02]	4.1015e-01*** [2.5975e-02]	4.0619e-01*** [2.6384e-02]	3.1877e-01*** [2.5496e-02]

Moderate to High	4.5336e-01*** [2.6649e-02]	4.5259e-01*** [2.6621e-02]	4.3592e-01*** [2.7036e-02]	3.9083e-01*** [2.6102e-02]	4.0501e-01*** [2.6485e-02]	2.9360e-01*** [2.5723e-02]
High	4.8456e-01*** [2.8242e-02]	4.8406e-01*** [2.8212e-02]	4.6207e-01*** [2.8767e-02]	4.1223e-01*** [2.7804e-02]	4.2689e-01*** [2.8248e-02]	3.0684e-01*** [2.7461e-02]
Experience						
Moderate	-5.1627e-02*** [8.0734e-03]	-5.2136e-02*** [8.0754e-03]	-5.1607e-02*** [8.1394e-03]	-3.1160e-02*** [8.0481e-03]	-4.9761e-02*** [7.9868e-03]	-2.7275e-02*** [7.9622e-03]
High	-6.5061e-02*** [1.2231e-02]	-6.5520e-02*** [1.2233e-02]	-7.0517e-02*** [1.2669e-02]	-5.4742e-02*** [1.2418e-02]	-6.7374e-02*** [1.2514e-02]	-5.0614e-02*** [1.2462e-02]
Time horizon	-4.7780e-03*** [1.1165e-03]	-4.9060e-03*** [1.1175e-03]	-5.4666e-03*** [1.1628e-03]	-5.3619e-03*** [1.1578e-03]	-6.0475e-03*** [1.1443e-03]	-6.5144e-03*** [1.1784e-03]
Total assets	-1.3708e-05* [7.6317e-06]	-1.3239e-05* [7.6391e-06]	-9.9619e-06 [7.8233e-06]	-8.1416e-06 [7.5165e-06]	-1.0632e-05 [7.8609e-06]	-1.0642e-05 [7.4773e-06]
Total debt (> 3 years)	-6.4715e-05 [2.3478e-04]	-3.6979e-05 [2.3499e-04]	-6.8261e-05 [2.4547e-04]	3.2264e-06 [2.3021e-04]	-8.1561e-05 [2.3975e-04]	-1.6079e-05 [2.2056e-04]
Advanced	-1.8775e-03 [5.9133e-03]	-2.2331e-03 [5.9171e-03]	-5.0173e-03 [6.2046e-03]	-5.8080e-03 [6.0722e-03]	-6.1937e-03 [6.1371e-03]	-5.7733e-03 [5.9566e-03]
Loans/Fund			4.1397e-01*** [3.6296e-02]	4.2444e-01*** [4.1731e-02]	3.9176e-01*** [4.1775e-02]	4.0573e-01*** [4.1748e-02]
ROA			-1.2767e-01*** [3.7802e-03]	-1.2810e-01*** [4.5227e-03]	-1.3008e-01*** [4.4693e-03]	-1.3043e-01*** [4.4668e-03]
Bondfund_ Advisor					4.5519e-02*** [4.0019e-03]	4.6074e-02*** [4.0178e-03]
Otherfund_ Advisor					-3.6725e-02*** [4.9955e-03]	-3.6941e-02*** [5.0295e-03]
Bank FEs	(No)	(No)	(No)	(Yes)	(No)	(No)
Branch FEs	(No)	(No)	(No)	(No)	(No)	(Yes)
Mundlak's correction	(Yes)	(Yes)	(Yes)	(Yes)	(Yes)	(Yes)
F-test of Mundlak corrected coefficients (p-value)	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
# of investors	23,501	23,501	20,709	20,709	20,709	20,709
# of banks	8	8	8	8	8	8
# of observations	64,666	64,666	56,729	56,729	56,729	56,729
Adjusted R-squared	0.056	0.057	0.109	0.154	0.125	0.190

This table reports the results from Mundlak (1978) corrected random effects estimators to explain households' bank bond concentration. The dependent variable is constructed as the ratio between BCC-issued bonds and the sum of: BCC-issued bonds, other bonds, government bonds, and deposit certificates. Independent variables include investor, bank, and branch characteristics. The total assets and total debt variables are obtained by taking the mean of each category except for the "> €3,000,000" and "> €80,000" category, for which I assume a value of €4,000,000 and €10,000 respectively. These variables are then scaled dividing by 1,000. Total portfolio value and account balance are scaled dividing by 1,000 and winsorized at the 10% level. Standard errors are clustered at the investor level and are reported in parenthesis. ***,**,* denote that estimates are statistically significant at the 1, 5 and 10% level.

Table 5. Robustness check of branch-level advisor information

Variables	(1)	(2)
Constant	-6.2678e-01*** [4.4978e-02]	8.5547e-01*** [1.3906e-01]
Age	-1.9076e-04 [2.9031e-04]	1.4592e-04 [2.7113e-04]
Female	1.0242e-02* [5.3463e-03]	7.6365e-03 [4.9039e-03]
Length of relationship	5.9647e-03*** [1.1793e-03]	6.7863e-03*** [1.1749e-03]
Account balance	-3.6296e-05 [4.1989e-05]	-2.9136e-05 [4.2318e-05]
Total portfolio value	5.7213e-05 [3.8588e-05]	6.8113e-05* [3.8824e-05]
Income	4.6196e-07*** [1.4584e-07]	-1.9584e-07 [1.4514e-07]
Education		
Below high school	1.9409e-02*** [6.4917e-03]	1.7106e-02*** [6.1553e-03]
Above high school	-3.8559e-02*** [9.0207e-03]	-2.9586e-02*** [8.4065e-03]
Occupation		
Self-employed	5.3323e-02*** [1.0312e-02]	1.9235e-02* [9.9044e-03]
Employed	5.8440e-02*** [1.0489e-02]	1.4697e-02 [1.0076e-02]
Unemployed	4.9742e-02*** [1.1898e-02]	8.6978e-03 [1.1305e-02]
Risk tolerance		
Moderate	2.7671e-02* [1.4178e-02]	1.7139e-02 [1.3478e-02]
High	-1.2914e-02 [1.6436e-02]	-2.7203e-02* [1.5758e-02]
Financial knowledge		
Low to Moderate	3.6736e-01*** [2.6642e-02]	3.1143e-0*** [2.5411e-02]
Moderate	4.0686e-01*** [2.6453e-02]	3.2472e-01*** [2.5502e-02]

Moderate to High	4.0278e-01*** [2.6550e-02]	2.9912e-01*** [2.5707e-02]
High	4.2769e-01*** [2.8288e-02]	3.1458e-01*** [2.7445e-02]
Experience		
Moderate	-4.6767e-02*** [7.9628e-03]	-2.3256e-02*** [7.9477e-03]
High	-6.5296e-02*** [1.2502e-02]	-4.6588e-02*** [1.2452e-02]
Time horizon	-5.2678e-03*** [1.1456e-03]	-6.5426e-03*** [1.1822e-03]
Total assets	-9.8439e-06 7.6687e-06]	-1.0064e-05 [7.2906e-06]
Total debt (> 3 years)	-4.3384e-05 [2.3882e-04]	-1.4285e-05 [2.1991e-04]
Advanced	-6.0575e-03 [6.1651e-03]	-5.3605e-03 [5.9502e-03]
Loans/Fund	4.3352e-01*** [4.1873e-02]	4.4667e-01*** [4.1773e-02]
ROA	-1.2484e-01*** [4.5010e-03]	-1.2483e-01*** [4.4975e-03]
Client_Bondfund_ Advisor	3.7717e-06*** [5.1092e-07]	3.9409e-06*** [5.3841e-07]
Client_Otherfund_ Advisor	-1.0632e-06*** [4.0729e-07]	-9.0856e-07** [4.3606e-07]
Bank FEs	(No)	(No)
Branch FEs	(No)	(Yes)
Mundlak's correction	(Yes)	(Yes)
F-test of Mundlak corrected coefficients (p-value)	0.000***	0.000***
# of investors	20,709	20,709
# of banks	8	8
# of observations	56,729	56,729
Adjusted R-squared	0.123	0.187

This table reports the results from Mundlak (1978) corrected random effects estimators to explain households' bank bond concentration. The dependent variable is constructed as the ratio between BCC-issued bonds and the sum of: BCC-issued bonds, other bonds, government bonds, and deposit certificates. Independent variables include investor, bank, and branch characteristics. The total assets and total debt variables are obtained by taking the mean of each category except for the "> €3,000,000" and "> €80,000" category, for which I assume a value of €4,000,000 and €10,000 respectively. These variables are then scaled dividing by 1,000. Total portfolio value and account balance are scaled dividing by 1,000 and winsorized at the 10% level. Standard errors are clustered at the investor level and are reported in parenthesis. ***,**,* denote that estimates are statistically significant at the 1, 5 and 10% level.

Table 6. Regressions of bank bond concentration including average bond risk premium, bank and sovereign credit risk

Variables	(1)	(2)
Constant	-6.5241e-01*** [5.1716e-02]	-3.3199e-01 [2.3687e-01]
Age	7.9353e-03*** [1.5261e-03]	5.4692e-03*** [1.5405e-03]
Female	9.0025e-03* [5.3537e-03]	6.1781e-03 [5.1396e-03]
Length of relationship	6.4445e-04* [3.8064e-04]	2.1744e-03*** [3.6685e-04]
Account balance	-1.4563e-05 [4.2670e-05]	-1.1204e-05 [4.2452e-05]
Total portfolio value	7.6585e-05* [4.0745e-05]	8.2747e-05** [4.0653e-05]
Income	4.9775e-07*** [1.4889e-07]	-6.5239e-08 [1.4770e-07]
Education		
Below high school	1.6408e-02** [6.5111e-03]	1.3465e-02*** [6.2990e-03]
Above high school	-3.7297e-02*** [9.0272e-03]	-2.8858e-02*** [8.6949e-03]
Occupation		
Self-employed	5.1129e-02*** [1.0614e-02]	1.9436e-02* [9.9044e-03]
Employed	5.4811e-02*** [1.0794e-02]	1.4200e-02 [1.0076e-02]
Unemployed	4.6510e-02*** [1.2248e-02]	1.6494e-02 [1.1305e-02]
Risk tolerance		
Moderate	2.9674e-02** [1.3889e-02]	1.8151e-02 [1.3478e-02]
High	-4.6269e-03 [1.6122e-02]	-1.4519e-02 [1.5758e-02]
Financial knowledge		
Low to Moderate	3.4618e-01*** [2.5794e-02]	3.1143e-0*** [2.5411e-02]
Moderate	3.6308e-01*** [2.5723e-02]	3.2472e-01*** [2.5502e-02]
Moderate to High	3.7086e-01*** [2.5782e-02]	2.9912e-01*** [2.5707e-02]
High	3.9024e-01*** [2.7625e-02]	3.1458e-01*** [2.7445e-02]
Experience		

Moderate	-4.4356e-02*** [8.0693e-03]	-2.9516e-02*** [8.0224e-03]
High	-5.4201e-02*** [1.2827e-02]	-4.6588e-02*** [1.2452e-02]
Time horizon	-5.0405e-03*** [1.1608e-03]	-5.1068e-03*** [1.2579e-02]
Total assets	-8.7135e-06 [7.9901e-06]	-8.0257e-06 [7.7377e-06]
Total debt (> 3 years)	-8.9017e-05 [2.4221e-04]	-2.2692e-05 [2.3146e-04]
Advanced	-7.8218e-03 [6.2053e-03]	-8.1309e-03 [6.1208e-03]
Loans/Fund	5.8941e-01*** [4.3366e-02]	6.0230e-01*** [4.3289e-02]
ROA	-1.2330e-01*** [5.2917e-03]	-1.2842e-01*** [5.3157e-03]
Bondfund_ Advisor	4.5204e-02*** [4.0709e-03]	4.5553e-02*** [5.3841e-07]
Otherfund_ Advisor	-3.2769e-02*** [5.0698e-03]	-3.3711e-02** [4.3606e-07]
Av. Risk Premium	3.1121e-02*** [8.4462e-03]	1.4649e-02* [8.7049e-03]
Bank credit risk	1.8397e-03* [1.1158e-03]	2.8099e-03** [1.1278e-03]
Sovereign credit risk	-6.2936e-03** [2.4618e-03]	8.3411e-04 [2.6027e-03]
Bank FEs	(No)	(Yes)
Branch FEs	(No)	(No)
Mundlak's correction	(Yes)	(Yes)
F-test of Mundlak corrected coefficients (p-value)	0.000***	0.000***
# of investors	19,899	19,899
# of banks	7	7
# of observations	54,018	54,018
Adjusted R-squared	0.14814	0.17604

This table reports the results from Mundlak (1978) corrected random effects estimators to explain households' bank bond concentration. The dependent variable is constructed as the ratio between BCC-issued bonds and the sum of: BCC-issued bonds, other bonds, government bonds and deposit certificates. Independent variables include investor, bank, and branch characteristics. The model further includes a representative bank bond average risk premium, bank, and sovereign credit risk. The total assets and total debt variables are obtained by taking the mean of each category except for the "> €3,000,000" and "> €80,000" category, for which I assume a value of €4,000,000 and €10,000 respectively. Total portfolio value and account balance are scaled dividing by 1,000 and winsorized at the 10% level. These variables are then scaled dividing by 1,000. Standard errors are clustered at the investor level and are reported in parenthesis. ***,**,* denote that estimates are statistically significant at the 1, 5 and 10% level.

Table 7. Relevance for the total portfolio

Variables	(1) *< 50th percentile*	(2) *> 50th percentile*
Constant	-8.3325e-01*** [4.4569e-02]	8.2757e-01*** [1.6613e-02]
Age	-2.9230e-04 [3.9161e-04]	-3.2295e-04*** [1.1369e-04]
Female	-1.6877e-02** [7.7050e-03]	-2.0529e-03 [2.2185e-03]
Length of relationship	1.5686e-02*** [1.8951e-03]	4.8380e-03*** [6.9519e-04]
Account balance	-3.8867e-05 [3.8994e-05]	1.3431e-05 [3.2844e-05]
Total portfolio value	1.4514e-04*** [4.8371e-05]	-1.3234e-04*** [3.2922e-05]
Income	2.5041e-07 [1.9566e-07]	2.6754e-07*** [5.7559e-08]
Education		
Below high school	6.7218e-03 [8.8057e-03]	6.7925e-03*** [2.5452e-03]
Above high school	-4.0977e-02*** [1.1547e-02]	-3.9778e-03 [3.8811e-03]
Occupation		
Self-employed	3.6328e-02** [1.2645e-02]	1.8509e-02*** [4.4571e-03]
Employed	5.8258e-02*** [1.2580e-02]	1.0024e-02** [4.3758e-03]
Unemployed	4.5776e-02*** [1.5307e-02]	-1.7569e-03 [5.5122e-03]
Risk tolerance	8.5951e-03 [8.1853e-03]	-1.1625e-02*** [3.2608e-03]
Financial knowledge	5.1317e-02*** [4.2205e-03]	3.6285e-03** [1.7475e-03]
Experience	-2.3679e-03 [7.9732e-03]	-1.7084e-02*** [2.5437e-03]
Time horizon	7.7575e-03*** [1.3233e-03]	-1.5132e-03*** [4.4914e-04]
Total assets	-4.3021e-05*** [1.0219e-05]	5.3058e-06 [3.4185e-06]
Total debt (> 3 years)	-5.6029e-04** [2.7822e-04]	1.6698e-04** [7.7090e-05]

Advanced	4.4647e-02*** [8.5647e-03]	-2.7566e-02*** [3.6767e-03]
Loans/Fund	2.9975e-01*** [4.9474e-02]	-4.0604e-02* [2.4683e-02]
ROA	-5.6236e-02*** [5.0843e-03]	-1.8575e-02*** [2.4163e-03]
Bondfund_ Advisor	2.8277e-03 [2.2249e-03]	1.4482e-02*** [3.2167e-03]
Otherfund_ Advisor	-2.4478e-03 [4.9485e-03]	-8.9458e-03*** [3.4022e-03]
Mundlak's correction	(Yes)	(Yes)
F-test of Mundlak corrected coefficients (p-value)	0.000***	0.000***
# of investors	9,793	14,195
# of banks	8	8
# of observations	20,744	35,985
Adjusted R-squared	0.13489	0.45994

This table reports the results from Mundlak (1978) corrected random effects estimators to explain households' bank bonds concentration. The dependent variable is constructed as the ratio between BCC-issued bonds and the sum of: BCC-issued bonds, other bonds, government bonds, and deposit certificates. Independent variables include investor, bank, and branch characteristics. The first subset (column 1) includes portfolios with bank bond exposure to the total portfolio below the mean value, while the second subset (column 2) includes portfolios with bank bond exposure to the total portfolio above the mean value. The total assets and total debt variables are obtained by taking the mean of each category except for the "> €3,000,000" and "> €80,000" category, for which I assume a value of €4,000,000 and €10,000 respectively. These variables are then scaled dividing by 1,000. Total portfolio value and account balance are scaled dividing by 1,000 and winsorized at the 10% level. Standard errors are clustered at the investor level and are reported in parenthesis. ***,**,* denote that estimates are statistically significant at the 1, 5 and 10% level.

Table 8. Relevance of bank bonds for total bank funding

Variables	(1) *< 50th percentile*	(2) *> 50th percentile*
Constant	-9.2323e-02** [4.3839e-02]	4.4942e-01*** [5.8859e-02]
Age	-1.5635e-04 [3.0699e-04]	-4.9471e-04*** [3.3679e-04]
Female	8.3415e-03 [5.9125e-03]	2.1612e-02*** [6.2281e-03]
Length of relationship	2.6844e-02*** [1.9834e-03]	1.9369e-03*** [4.5285e-04]
Account balance	5.7626e-05** [6.8788e-05]	-1.4946e-04** [6.7108e-05]
Total portfolio value	1.2404e-04 [5.8153e-05]	-7.6324e-05 [5.1088e-05]
Income	5.4010e-07*** [1.5358e-07]	1.7277e-07 [1.5851e-07]
Education		
Below high school	1.8585e-02*** [6.6937e-03]	3.3370e-02*** [7.2107e-03]
Above high school	-4.0270e-02*** [9.6853e-03]	-5.0328e-02*** [1.1006e-02]
Occupation		
Self-employed	5.4947e-02*** [1.0766e-02]	3.5480e-02*** [1.1401e-02]
Employed	6.5684e-02*** [1.0704e-02]	3.2966e-02*** [1.1652e-02]
Unemployed	5.1555e-02*** [1.2611e-02]	1.4292e-02 [1.3135e-02]
Risk tolerance	-8.5163e-03 [7.9095e-03]	5.4758e-03 [8.8426e-03]
Financial knowledge	4.3878e-02*** [4.4182e-03]	2.6770e-02*** [4.6819e-03]
Experience	-6.3791e-02*** [6.7807e-03]	-4.4888e-02*** [6.9332e-03]
Time horizon	-5.0436e-03*** [1.2197e-03]	2.7968e-03** [1.3214e-03]
Total assets	-1.5403e-05* [8.6246e-06]	-2.2436e-05** [9.4402e-06]
Total debt (> 3 years)	-3.2538e-04 [2.4823e-04]	-2.1054e-04 [2.4916e-04]

Advanced	-2.0282e-02*** [7.4898e-03]	-1.9511e-02** [7.6536e-03]
Loans/Fund	8.9128e-01*** [5.9915e-02]	-8.0232e-01*** [6.0644e-02]
ROA	-3.7354e-01*** [1.9253e-02]	-6.7381e-02*** [6.1358e-03]
Bondfund_ Advisor	3.9043e-02*** [4.5186e-03]	6.3072e-02*** [7.6467e-03]
Otherfund_ Advisor	-3.7342e-02*** [8.6380e-03]	-3.3157e-02*** [6.2974e-03]
Mundlak's correction	(Yes)	(Yes)
F-test of Mundlak corrected coefficients (p-value)	0.000***	0.000***
# of investors	17,856	13,931
# of banks	8	8
# of observations	29,832	26,897
Adjusted R-squared	0.22438	0.45994

This table reports the results from Mundlak (1978) corrected random effects estimators to explain households' bank bond concentration. The dependent variable is constructed as the ratio between BCC-issued bonds and the sum of: BCC-issued bonds, other bonds, government bonds, and deposit certificates. Independent variables include investor, bank, and branch characteristics. The first subset (column 1) includes banks with bank bond funding over total funding below the mean value, while the second subset (column 2) includes banks with bank bond funding over total funding above the mean value. The total assets and total debt variables are obtained by taking the mean of each category except for the "> €3,000,000" and "> €80,000" category, for which I assume a value of €4,000,000 and €10,000 respectively. These variables are then scaled dividing by 1,000. Total portfolio value and account balance are scaled dividing by 1,000 and winsorized at the 10% level. Standard errors are clustered at the investor level and are reported in parenthesis. ***,**,* denote that estimates are statistically significant at the 1, 5 and 10% level.

Supplementary appendix

Table A1. Regression of bank bond concentration using ordinal values for risk tolerance and financial knowledge

Variables	(1)
Constant	5.9304e-01*** [2.6638e-02]
Age	-3.2170e-03 *** [1.1036e-03]
Female	1.1778e-02** [5.3251e-03]
Account balance	-1.8291e-05 [4.0690e-05]
Total portfolio value	9.1869e-05** [3.8190e-05]
Income	6.2943e-07 *** [1.5180e-07]
Education	
Below high school	2.1415e-02*** [6.6112e-03]
Above high school	-5.6201e-02*** [9.0937e-03]
Occupation	
Self-employed	6.5165e-02*** [1.0224e-02]
Employed	6.9849e-02*** [1.0325e-02]
Unemployed	5.4259e-02*** [1.1781e-02]
Risk tolerance	-1.4242e-02** [7.1838e-03]
Financial knowledge	3.9891e-02*** [3.9780e-03]
Experience	
Moderate	-5.0002e-02*** [8.1094e-03]
High	-8.0357e-02*** [1.2043e-02]

Time horizon	-4.5808e-03*** [1.1278e-03]
Total assets	6.2943e-07*** [1.5180e-07]
Total debt (> 3 years)	-1.2230e-04 [2.3556e-04]
Advanced	-2.4463e-03 [5.9434e-03]
Bank FEs	(No)
Branch FEs	(No)
Mundlak's correction	(Yes)
F-test of Mundlak corrected coefficients (p-value)	0.000***
# of investors	23,501
# of banks	8
# of observations	64,666
Adjusted R-squared	0.04673

This table reports the results from Mundlak (1978) corrected random effects estimators to explain households' bank bond concentration. The dependent variable is constructed as the ratio between BCC-issued bonds and the sum of: BCC-issued bonds, other bonds, government bonds and deposit certificates. Independent variables include investor, bank, and branch characteristics. Experience and risk aversion are ordinal variables. The total assets and total debt variables are obtained by taking the mean of each category except for the "> €3,000,000" and "> €80,000" category, for which I assume a value of €4,000,000 and €10,000 respectively. These variables are then scaled dividing by 1,000. Total portfolio value and account balance are scaled dividing by 1,000 and winsorized at the 10% level. Standard errors are clustered at the investor level and are reported in parenthesis. ***,**,* denote that estimates are statistically significant at the 1, 5 and 10% level.

Conclusions

This dissertation aims to shed light on the reaction, and the behaviour, of bank credit investors. With this purpose, I have developed three papers that use multiple levels of analysis and explore some of the major, recent debates about the banking industry.

The first study addresses the open question of whether the liquidity requirements, introduced by the new Basel III regulatory framework, are pursuing their targeted goal of limiting bank fragility and reducing credit risk. Focusing on an event study methodology on CDS data (proxy for creditors' perceived credit risk) that uses a robust five-factor model, the research documents a significant rise in the perceived credit risk of European banks. This result shows, at the aggregate level, the limited efficacy, at least on a short-term market perspective, of the regulation, as expressed by negative debtholder wealth effects. This is an interesting finding as it runs counter to the regulatory objective, thereby increasing knowledge on the potential unforeseen impacts of tighter liquidity requirements (Allen, et al., 2012)[89]. Testing for any heterogeneous market reaction, the study further highlights that the negative CDS market response depends on bank-specific factors: financial institutions with stronger balance sheets (in terms of liquidity and capital indicators) are less sensitive to tighter liquidity events, whereas financial institutions with weaker balance sheets (in terms of poor asset quality) are more sensitive to regulatory events. This finding is consistent with the fact that the liquidity standards have been conceived to support solid banks to face exogenous market shocks (Hong, et al., 2014)[90]. If instead banks are

[89] Allen, B., Chan, K.K., Milne, A. & Thomas, S., 2012. Basel III: Is the cure worse than the disease?. *International Review of Financial Analysis*, Volume 25, pp. 159–166.

[90] King, M. R., 2013. The Basel III Net Stable Funding Ratio and bank net interest margins. *Journal of Banking & Finance*, Volume 37, pp. 4144–4156.

Hong, H., Huang, J.-Z. & Wu, D., 2014. The information content of Basel III liquidity risk measures. *Journal of Financial Stability*, Volume 15, pp. 91–111.

weak, the adoption could worsen the already weaker condition of these financial institutions. Bearing in mind that Basel III is the first attempt by regulators to design harmonized international liquidity standards, the research increases knowledge in this context. This is particularly meaningful to create regulations that are better adjusted to their purpose and mitigate potential rise in divergence between more and less solvent banks that the adoption may cause.

From a theoretical view, this paper points out the lack of banking models on liquidity regulation. Despite some recent improvements in this direction have been undertaken (Calomiris, et al., 2015)[91], most of the theoretical models provide relevant implications for liquidity risk but do not incorporate liquidity risk management as an input factor.

The second study deals with the ongoing debate about the existence and strength of market discipline (Flannery & Sorescu, 1996; Jagtiani, et al., 2002; Sironi, 2003)[92], which is an important complementary regulatory channel to the policy measures set by regulators. As the recent financial crisis clearly highlighted the delayed recognition by regulators of liquidity, funding, and asset risk exposure, this paper sheds light on the role of the bond market in this regard. The empirical evidence shows that bondholders price the liquidity and asset risk taken by banks, while funding risk is not significant. Focusing on asset quality, the analysis further documents that the bond market assesses both past information and future expectations of loan losses. This result has a twofold implication. First, it is an encouraging finding in the literature

[91] Calomiris, C. W., Heider, F. & Hoerova, M., 2015. A Theory of Bank Liquidity Requirements. Columbia Business School Research Paper No. 14/39.

[92] Flannery, M. J. & Sorescu, S. M., 1996. Evidence of Bank Market Discipline in Subordinated Debenture Yields: 1983-1991. *Journal of Finance*, Volume 51, pp. 1347–1377.
Jagtiani, J., Kaufman, G. & Lemieux, C., 2002. The effect of credit risk on bank and bank holding company bond yields: evidence from the post-FDICIA period. *The Journal of Financial Research*, Volume 25, pp. 559–575.
Sironi, A., 2003. Testing for Market Discipline in the European Banking Industry: Evidence from Subordinated Debt Issues. *Journal of Money, Credit, and Banking*, Volume 35, pp. 443–472.

examining the strength of market discipline (Morgan & Stiroh, 2001)[93]. Second, it points out the need to increase transparency and improve quality in bank annual reports by introducing forward-looking information. The relevance of this aspect has been fully incorporated into the new IFRS 9, which will be adopted from January 2018.

In sum, the second study shows, to some extent, the presence of market discipline during turbulent market conditions, which however seems to be more pronounced for some bank risk classes and particularly relevant following Basel III. Given the complementary role of the market, more research is needed to advance knowledge on this topic and improve regulatory responses to financial crises.

The third study contributes to the discussion concerning investor protection (Inderst & Ottaviani, 2012)[94]. As unsecured bondholders' potential losses have recently increased, this issue has become particularly relevant for retail investors. By examining the drivers of households' bank bond concentration and using a rigorous methodological framework (the model controls for unobserved heterogeneity at the individual, bank, and branch level), the research documents that bank and branch characteristics are the main factors influencing bank bond holdings. When banks are weaker, and advisors exhibit higher fundraising skill, investors tend to concentrate more than when banks are stronger, and advisors show lower fundraising capability. Investor observable characteristics instead exhibit an effect that is lower than what theory on household finance would predict.

[93] Morgan, D. P. & Stiroh, K. J., 2001. Market Discipline of Banks: The Asset Test. *Journal of Financial Services Research*, Volume 20, pp. 195–208.
[94] Inderst, R. & Ottaviani, M., 2012. How (not) to pay for advice: A framework for consumer financial protection. *Journal of Financial Economics*, Volume 105, pp. 393–411.

Overall, findings support the conflict-of-interest argument in explaining why households, taking investment recommendations from bank advisors, concentrate their bond portfolio holdings in these securities. Although the research does not estimate agency costs and provides indirect evidence of agency problems, it sheds light on a timely policy issue, which has implications for bondholders' risk exposure, bank advisory service, and current investment policy. Given that banks can profit from retail investors (Hoechle, et al., 2016)[95], it is clearly meaningful to examine potentially investor-damaging activities by banks. Acquiring a good understanding of the sources of likely risky decisions indeed constitutes the first step to then develop ideas to limit them (Campbell, 2006)[96]. With limited financial literacy (Lusardi & Mitchell, 2014)[97] and conflict of interest in the bank-client relationship (Bolton, et al., 2007)[98], households are particularly exposed to unfavorable behaviours. Using unique data on individual investors, this research thus contributes to the very limited studies examining bondholder concentration. It further suggests a need to increase supervision of bank activities to ensure that bond portfolio holdings match the risk preferences of retail investors. This will avoid the extreme, although possible, case in which unsophisticated bondholders are forced to rescue their distressed banks, losing their life savings (e.g., Banca Popolare dell' Etruria).

[95] Hoechle, D., Ruenzi, S., Schaub, N. & Schmid, M., 2016. Financial Advice and Bank Profits. Swiss Institute of Banking and Finance Working paper.
[96] Campbell, J. Y., 2006. Household Finance. *Journal of Finance*, Volume 61, pp. 1553–1604.
[97] Lusardi, A. & Mitchell, O. S., 2014. The Economic Importance of Financial Literacy: Theory and Evidence. *Journal of Economic Literature*, Volume 52, pp. 5–44.
[98] Bolton, P., Freixas, X. & Shapiro, J., 2007. Conflicts of interest, information provision, and competition in the financial services industry. *Journal of Financial Economics,* Volume 85, pp. 297–330.