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Completing a Banking Union in Europe
Evolution, challenges and market impact

Pancotto, Livia

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Completing a Banking Union in Europe: Evolution, challenges and market impact

Livia Pancotto

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UNIVERSITY

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Abstract

This thesis investigates the establishment of Banking Union (BU) in Europe. A thorough analysis of the evolution of the new regulatory framework is presented, while offering insights on the impact of BU on financial markets. A central theme is the tight interconnection among sovereign and banking risk and the impact of BU implementation on this sovereign-bank nexus. A particular focus is placed on Italian banking due to its dominant role in the EU-wide Non-Performing Loan (NPL) crisis. The adoption of multiple methodologies strengthens the findings: (i) event study methodology; (ii) Difference-in-Differences; and (iii) Difference and System Generalized Methods of Moments.

The first empirical chapter provides evidence of different financial market reactions to the implementation of BU. Bank stock and Credit Default Swap (CDS) markets show divergent responses to the announcements associated with BU, with the CDS market reacting more strongly to the information content arising from BU news. Moreover, bank-specific features influence the market responses for bank sub-groups. The analysis conducted in the second empirical chapter suggests that market participants did not assess the implementation of the new EU bank resolution regime as being fully effective in weakening the sovereign-bank nexus in the short-term. Drawing evidence from the CDS market, a lack of immediate credibility in the Bank Resolution and Recovery Directive (BRRD) is revealed. The third empirical chapter provides an exhaustive analysis of the NPL burden in both the European and Italian contexts. In shedding light on the factors explaining the ex-post credit risk, the countercyclical nature of the NPL volumes is confirmed. Among bank-specific variables, profitability and credit growth are inversely associated with NPL volumes.

The thesis identifies several strengths and shortcomings of the BU project, by framing them under different perspectives. In identifying several policy implications, insights are revealed on the necessity of future improvements to BU. Overall, the findings of this thesis make a significant contribution to academic literature and to the ongoing policy debate, while also being of interest to market participants.

Ai miei genitori.

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Chapter 1: Introduction

"The task of setting the sovereignty of Europe's nation-states within a common, legally constituted order […] would not be possible without institutions empowered to address and solve common problems […] in the economic field, a single market would require monetary union and both would require firm institutional foundations" (Padoa-Schioppa, 2000, p.2).

The research presented in this thesis is motivated by the changing landscape of European banking following the financial and sovereign debt crises of 2007-12. Starting in Greece in late 2009, the European sovereign debt crisis mostly involved peripheral euro area Member States, i.e. Greece, Ireland, Italy, Portugal and Spain (GIIPS countries). Over a prolonged period of extreme economic and financial instability, multiple large-scale assistance programmes were necessary for governments otherwise unable to repay their unsustainably large debts.[1] A double-dip recession that started in the third quarter of 2011 and ended in the first quarter of 2013 resulted in a cumulative decline in the euro area GDP of about 1.5 per cent (CEPR, 2015). The European sovereign debt crisis highlighted weaknesses and inherent contradictions in the institutional architecture of the euro area. The mismatch between centralised monetary policy and domestic bank responsibilities was exacerbated by unsustainable national policies. This combination of destabilising elements hampered the ability to provide an effective response to the crisis.

Financial stability was also drastically undermined by negative feedback loops between domestic banks and national governments. Through different transmission channels, working *via* both the asset and liability sides of banks' balance sheets, a very close interconnection between sovereign and bank risk became a striking feature of the euro area banking landscape (BIS, 2011). Deterioration in a sovereign's creditworthiness can directly cause mark-to-market losses on banks' portfolios of government debt securities (Angeloni and Wolff, 2012). The adverse impact becomes

[1] In May 2010, Greece received the first of three bailout packages for €110bn (the last one was agreed in 2015). In November 2010, the European Union (EU) and International Monetary Fund (IMF) agreed on a bailout rescue plan to the Irish government (€85bn). In May 2011, it was the turn of Portugal to receive external assistance of €78bn.

increasingly significant when there exists a strong "home bias" in banks' sovereign portfolios, as revealed for euro area banks (Battistini et al., 2013; Floreani and Habib, 2015; Véron, 2017).[2]

Beyond the impact on bank funding conditions in terms of credit risk, sovereign tensions also affect the banking sector in terms of liquidity and funding risks. The possibility of employing government paper as collateral in the interbank lending market and central bank refinancing operations implies that an increase in sovereign risk reduces the value of this collateral, thereby weakening banks' funding capacity. In this context, a crucial role is also played by the current capital and liquidity regulation, i.e. Basel III agreement, Capital Requirements Regulation (CRR) and Capital Requirement Directive (CRD) IV. The preferential treatment of sovereign exposures in terms of zero risk-weights and their exclusion from existing limits within the large exposures framework has represented an incentive for banks to hold large amounts of domestic sovereign debt (ESRB, 2015; Enria et al., 2016).

Another possible transmission channel able to affect banks' funding conditions is represented by the actions of Credit Rating Agencies (CRAs). Sovereign rating downgrades normally impact the rating of domestic banks negatively, leading to an increase in their wholesale funding costs and potentially impairing their market access (Arezki et al., 2011; De Santis, 2012; Alsakka et al., 2014). Finally, BIS (2011) identifies a transmission channel *via* the implicit and explicit government guarantees to banks, especially to those deemed systemically important. When a deterioration of the fiscal position of sovereigns occurs, both implicit and explicit government guarantees could lose value, reducing the funding benefits that banks draw from them (Schich and Lindh, 2012; Allen et al., 2015; Cordella et al., 2017).

The direction of the contagion can also be considered in the reverse way, from the banking system to the sovereign level. A banking crisis induces an upsurge in sovereign risk, as observed in Ireland (2008), in Iceland (2008) and in Cyprus (2013), and negative effects of government support to banks can run from banks to sovereign debt quality. A fragile banking system can negatively affect the soundness of the

[2] "Home bias" refers to the tendency of many euro area banks to hold excessive amounts of debt securities of their home country, as a proportion of total assets (Véron, 2017).

government through two principal channels: draining public finances (*via* bank rescue packages) and reducing economic growth, with adverse consequences in terms of capacity to absorb new shocks (BIS, 2011). Further, bank support measures might necessitate additional fiscal disbursements and guarantees for bank liabilities (explicit and implicit), leading to an increase in the actual or potential amount of sovereign debt. Moreover, a highly burdened banking sector undertaking significant deleveraging is harmful to real economic growth and tax revenue, hampering the sovereign' capability to service its own debt (OECD, 2012).

The situation whereby ailing banks weaken the sovereign's financial position, and *vice versa*, has been commonly referred to in the literature as the sovereign-bank nexus (Nikolov and Popov, 2014; Schoenmaker and Véron, 2016; Breckenfelder and Schwaab, 2017). The potential mutual reinforcing effect between sovereign and bank risk had detrimental effects in terms of euro area financial stability (Constâncio, 2011; Angelini et al., 2014; Black et al., 2016). Steps to weaken or break this nexus represented a major driving force in the establishment of a European Banking Union (BU) in mid-2012.[3]

This thesis aims to contribute to the existing literature on the sovereign-bank nexus, in the euro area, with a specific focus on the impact associated with the new European banking regulation framework. Significant related contributions in the prior academic literature have considered the tight interconnection among sovereign and bank risks, but have primarily focused on the European crisis period. The following are the most influential works on this topic: Alter and Schuler (2012), De Bruyckere et al. (2013), Acharya et al. (2014), Alter and Beyer (2014) and Farhi and Tirole (2017). All of these studies contributed by providing evidence of a negative feedback loop between banks and sovereigns in the euro area in 2007-2012, while identifying the main transmission channels. This thesis builds upon this literature while investigating original research questions more closely tied to the post-crisis development and implications of BU.

[3] Such risks were starkly evident in Greece in late 2011, when the 50 per cent haircut on national debt implied large losses on banks' balance sheets (Andritzky et al., 2016).

Launched in June 2012, the BU represented an essential institutional response to the financial and sovereign debt crises, which were severely affecting the region (Constâncio, 2014).[4] Breaking the sovereign-bank nexus and reducing financial fragmentation among euro area countries were the initial triggers for establishing the ambitious project. The direct recapitalization of weak European banks, to alleviate pressures on sovereigns, was the original motivation driving the BU establishment. Furthermore, restoring banks' balance sheets and the lending channel, in order to reinstate the effectiveness of monetary policy transmission, were fundamental goals of the BU. Finally, the focus on preventing expensive public bailouts and thereby avoiding recourse to taxpayers' money, was central in building the new financial and institutional framework.

Coinciding with the outset of my research for this thesis, European banking supervision became operational on 4 November 2014, when the European Central Bank (ECB) assumed its role as a single supervisor.[5] The creation of a level playing field, as the natural consequence of the convergence of rules and practices, was the rationale underlying the establishment of a Single Supervisory Mechanism (SSM).[6] Additionally, the cooperation between the SSM and the National Competent Authorities (NCAs), under a single supervisory regime, ensured the implementation of a fully integrated approach for the supervision of cross-border institutions. The shift to the European level of banking oversight was intended to reduce national idiosyncrasies, which for a long time prevented the harmonisation of the system (Gehrig et al., 2016).

The setting-up of an integrated European system of banking supervision was a logical precondition for the creation of the other pillars of the BU (ECB, 2016).[7] The second component of the project, the Single Resolution Mechanism (SRM) is considered to be a necessary complement to the SSM in order to achieve an effective

[4] See https://www.ecb.europa.eu/press/key/date/2014/html/sp140424_1.en.html.

[5] The shift from national to European supervision was preceded by a 12-months Comprehensive Assessment (CA), jointly conducted by the ECB and European Banking Authority (EBA), on 130 euro area banks (representing about the 82% of total banking assets in the euro area).

[6] The application of a harmonised methodology for the Supervisory Review and Evaluation Process (SREP), in 2015, as well as the 2016 ECB guidelines for addressing the issue of Non-performing loans (NPLs), represented major steps towards the harmonisation of European banking supervision.

[7] The BU project is based upon a Single Rulebook, which consists of a set of common prudential rules applied to financial institutions across Europe (i.e. operating in the Single Market).

operation of the framework. The SRM introduced a single authority responsible for the orderly resolution of insolvent financial institutions in the BU area.[8] Based on the Bank Resolution and Recovery Directive (BRRD) and supported by a Single Resolution Fund (SRF), the SRM represented a second key step towards strengthening financial integration and de-linking banks from sovereigns (Constâncio, 2014). The SRM, backed by a Single Resolution Board (SRB), became fully operational on 1 January 2016, with the purpose of ensuring the successful and timely resolution of any failing banks within the euro area in the future. Limiting the adverse impact of bank failures on the real economy and government finances of euro area countries is the aim of the new resolution regime, which also retains a role for National Resolution Authorities (NRAs).

The BRRD, as the legal basis of the new European crisis management framework, outlines the rules for preventing and addressing crisis events. In a case of bank failure, multiple resolution tools are available, including the bail-in mechanism. Under this perspective, the BRRD is recognized as one of the most crucial regulatory changes in Europe in recent years (Constâncio, 2014). The Directive marked the end of the bail-out culture and the beginning of the bail-in era. External money from the resolution fund can only be employed after the bail-in of shareholders and (unsecured) creditors for at least 8% of a bank's total liabilities, including own funds.[9] Finally, the use of public resources, either from national governments or from the European Stability Mechanism (ESM) as direct recapitalisation, can only occur in extreme circumstances to preserve overall financial stability.

A European Deposit Insurance Scheme (EDIS) is the third pillar of the BU. Proposed in late 2015 by the European Commission (EC), the EDIS would rely on the system of national deposit guarantee schemes (DGSs) regulated by the Directive 2014/49/EU. The scheme would apply to deposits below €100,000 with all banks within the BU area. Harmonising the degree of retail depositors' protection across euro area countries would increase their confidence in the system, independently from their geographical location, while further weakening the link between credit

[8] All 19 euro area countries are automatically part of the BU area, while the other EU Member States can voluntarily join it. At the time of writing this chapter (February 2018), Bulgaria, Denmark, Sweden and Romania are non-euro area EU members which expressed their interest in joining the BU (Hüttl and Schoenmaker, 2016; EC, 2017).

[9] In the case of the BU, the SRF can only contribute in covering up to the 5% of a bank's liabilities.

institutions and their national governments. The scheme will develop gradually and with different stages, foreseeing national contributions increasing over time until 2024, when the EDIS should be fully operational. Nevertheless, negotiations about the implementation of the EDIS faced much opposition, especially from Germany, thus making the EDIS one of the missing elements of the BU (at the time of writing this thesis). Different positions within the European Parliament and the Council exist regarding (i) the final settings of the scheme (in terms of re-insurance, co-insurance or full-insurance); (ii) the timeline for building up the system; and (iii) the heterogeneity of legacy issues and potential moral hazard risks across different national banking sectors (EC, 2017).[10]

Risk reduction, especially in more vulnerable euro area banking sectors, is a necessary precondition for the full implementation of a single EDIS and thereby the completion of the BU project. Resolving financial distress arising from the Non-Performing Loans (NPLs) situation, in countries such as Italy, is vital in order to achieve a common safety net for euro area depositors. As stated by the ECB President Mario Draghi in November 2017, "risk reduction and risk sharing should go in parallel ... and NPLs are part of this" (Financial Times, 2017).[11] Moreover, limiting banks' exposures to sovereign debt remains a key element in the debate on the EDIS implementation. Nevertheless, difficulties remain in reaching agreement regarding constraints on banks in terms of their sovereign debt holdings, which is delaying progress towards the achievement of a complete BU (Financial Times, 2017).[12] Furthermore, a common fiscal backstop, able to strengthen the overall confidence in the new bank resolution framework, is still lacking (EC, 2017).[13] Beyond the application of the resolution tools (e.g. bail-in mechanism), the access to a common last-resort backstop is essential to maintain financial stability and to reduce the costs potentially borne by taxpayers.[14]

[10] Refer to the EC Communication 2017/592 for a detailed overview of the potential stages towards a EDIS (http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2017%3A592%3AFIN).
[11] See https://www.ft.com/content/c548abde-ce14-11e7-9dbb-291a884dd8c6.
[12] See https://www.ft.com/content/611b7212-b263-11e7-aa26-bb002965bce8.
[13] See http://ec.europa.eu/finance/docs/law/171011-communication-banking-union_en.pdf.
[14] A recent proposal by the EC regarded the conversion of the ESM into a European Monetary Fund (EMF) with extended new powers. The proposal encountered the opposition of those EU Member States which contribute the most to the ESM capital, such as Germany and France (Financial Times, 2017). See https://www.ft.com/content/c34d6ff6-d6af-11e7-a303-9060cb1e5f44.

Addressing the misalignment of unified bank supervision and resolution, on the one hand, and national deposit guarantee, on the other hand, is fundamental to further reinforcement of the euro area institutional and financial architecture. At the same time, unwinding the risks which accumulated in banks' balances sheets before the establishment of the BU is imperative in order to restore the credibility in the European banking sector, while making it more resilient to future shocks (EC, 2017).

The above developments provide the motivation and context for this thesis. Its broad objectives involve the investigation of several aspects of the authorities' progress with the BU. On this basis, the thesis provides timely insights on the initial success and credibility of the project. The realisation of the vision of European BU mostly depends on the ability of the newly established mechanisms to instil credibility and trust (Gehrig et al., 2016). At the time of writing this chapter, four years from the start of the BU project, the specific academic literature on the topic remains very limited. Despite notable academic contributions by Gros and Schoenmaker (2014), Conlon and Cotter (2015), Hadjiemmanuil (2015), Neuberg et al. (2016) and Schoenmaker (2017), many gaps in the evidence remain at this time.[15] These authors advance different proposals on how to effectively complete the BU, in an integrated framework, focusing on the steps to be implemented (e.g. creation of a common insurance deposit scheme and convincing risk-sharing mechanisms). Moreover, specific contributions present empirical analyses on the implications of the new bank resolution regime and bail-in provision on European banks. This research aims at filling some remaining gaps in evidence by providing insights on the market perception of the implementation of the new institutional framework in Europe. This objective assumes great relevance when framed in the context of very recent events, which in mid-2017 put the single supervisory authority and the crisis management procedures under serious scrutiny for the first time with the cases of the Spanish Banco Popular and the two Veneto banks in Italy (Angeloni, 2017).

[15] A developing strand of academic literature discusses the legal framework of the BU project (Moloney, 2014; Binder, 2015; Busch and Ferrarini, 2015, among others). Several policy contributions also significantly contributed to the related literature (Acharya et al., 2012; Elliott, 2012; Pisani-Ferry et al., 2012; Véron and Wolff, 2013; Véron, 2015; Shäfer et al., 2016).

Furthermore, a recurring question in the policy debate regards the effectiveness of European banking supervision in addressing the NPL problem in a timely manner. It remains uncertain whether the adopted strategy and initiatives were entirely appropriate (Gehrig et al., 2016). Reducing the burden of NPLs on banks' balance sheets represented one of the key priorities of the SSM since its inception.[16] Benefits in terms of improved bank profitability and potential stimulus to economic growth were also complementary targets (Angeloni, 2017). The research developed in this thesis aims at comprehensively analysing the drivers of the NPLs in the Italian banking sector, thereby contributing new insights beyond the closely related academic literature (Quagliarello, 2007; Bofondi and Ropele, 2011; Garrido et al., 2016).

Quagliarello (2007), for the period 1985-2002, investigates the potential cyclical nature of loan loss provisions and new bad debts for a sample of Italian banks. Bofondi and Ropele (2011) explore the effect of macroeconomic conditions on banks' loan quality in the Italian context during 1990-2010. For 2005-2014, Garrido et al. (2016) examine the bank-specific and macroeconomic determinants of NPLs in the Italian banking system. These authors also provide a review of the policy actions undertaken, until 2015, by the Italian government to solve the NPL issue. Nevertheless, compared to these previous academic studies, this thesis includes the most recent data sample which crucially captures periods when the Italian banking system has witnessed several high-profile events, such as the precautionary recapitalization of Monte dei Paschi di Siena (MPS) SpA and the wind up of two Veneto banks in 2017. The thesis is also able to reflect other policy and practical developments in this area, which were very frequent in 2016-18.

The thesis is structured around three empirical chapters, which reflect the three main research questions under investigation:

- *How did announcements about the implementation of BU in Europe impact on financial markets?*

[16] As of January 2018, the EC stated that the volumes of NPLs within the EU, although declining, are still above the pre-crisis levels (http://europa.eu/rapid/press-release_MEMO-18-310_en.htm).

- *Did financial market participants evaluate the new resolution rules as effective in weakening the link between sovereign and bank risks in Europe?*
- *What factors are most influential in determining the high levels of NPLs in the Italian banking sector?*

Evaluating the financial market responses to the implementation of the BU project is one essential element to gain an appreciation of the level of credibility of the new regulatory framework. To achieve an effective European banking supervision, as well as for any successful bank resolution, market confidence is a necessary precondition. The path towards a more integrated and genuine European Monetary Union (EMU), as discussed by Van Rompuy in mid-2012, ultimately requires positive approval by market participants.[17] If general confidence in the new rules and changes is lacking, the possibility of disentangling sovereign and bank risks is compromised, leaving the original and most prominent goal of BU unmet. Under this perspective, it is essential to evaluate the effectiveness of the new European bank resolution regime in weakening the sovereign-bank nexus and also to consider the implementation of potential policy actions and corrective measures.[18]

At the same time, exploring one of the major issues in the European banking sector, i.e. the NPL problem, is of great importance in order to provide a comprehensive representation of the context on which BU is built on. Moreover, the analysis is instrumental to assess the effectiveness of the new European framework in dealing with the undesirable legacy of the financial crisis, including the sovereign debt tensions. The focus on the Italian banking sector and its recent developments appears as a logical consequence because Italy is the euro area country with the highest volumes of NPLs (€326bn as of October 2017 – Financial Times, 2017).[19] Finally, the investigation also offers some insights on the important practical deviations from the application of the common rules, depending on individual countries' specific features.

[17] See https://www.consilium.europa.eu/media/21570/131201.pdf.
[18] The resolution of the two Veneto banks in Italy, in June 2017, raised concerns about the loopholes in the new rules, which *de facto* allowed the Italian government to bypass the EU principles (Financial Times, 2017). See https://www.ft.com/content/71ece778-5a53-11e7-9bc8-8055f264aa8b.
[19] See https://www.ft.com/content/d9177a14-acfe-11e7-aab9-abaa44b1e130.

The remainder of the thesis is organised as follows. Chapter 2 provides an exhaustive analysis of the BU, which develops an underpinning and framework as the starting point of the entire research developed in this thesis. Chapter 2 addresses the following main issues: (i) the rationale behind the BU project; (ii) its implications; and (iii) its multiple-pillar structure. The study also reviews the 2014 ECB Comprehensive Assessment (CA) of the euro area banking sector. This chapter primarily focuses on the *status quo* in 2015, at the earlier stage of my research. The subsequent chapters provide more specific attention to the relevant developments during 2016-17.

The thesis then proceeds with three empirical investigations corresponding to the main research questions mentioned above. Chapter 3 investigates the financial market reactions to the implementation of the BU project. With evidence from the stock and credit default swap (CDS) markets, an event study methodology is employed to assess the effect of the overall regulatory reform, as well as each single associated announcement. Further insights are conveyed in identifying the potential heterogeneity in the market reactions across different banks' sub-samples (e.g. Globally Systemically Important Banks, G-SIBs). Moreover, in a multivariate framework, the chapter explores which bank-specific factors contribute in amplify or mitigate the market reactions.

Chapter 4 employs a Difference-in-Differences (DiD) framework to explore the short-run impact of the new European bank resolution rules on the sovereign-bank nexus. The implementation of the BRRD is considered as an exogenous shock which provides the setting for a natural experiment. Built upon evidence from the CDS market for banks and non-financial companies, the aim of the analysis is to test the credibility of the new resolution regime in relation to the sovereign to non-sovereign link in the case of banks.

Chapter 5 provides a deep insight on the problems and challenges within the Italian banking sector and its recent developments. It includes a comprehensive overview, especially in terms of NPLs in both the European and Italian contexts. The analysis proceeds to illustrate the impediments, the implications and the potential strategies to address the NPL problem. Later in the chapter, the investigation addresses the primary research question relating to the identification of the micro- and macro-economic determinants of the high NPL levels in Italian banks' balance

sheets. To this end, in a dynamic panel context, Difference and System Generalized Method of Moments (GMM) estimations are employed. Chapter 6 presents the overall conclusions of the thesis.

It is evident that the thesis has adopted a range of approaches and methodologies. Employing the event study, DiD and Difference/System GMM methodologies to conduct the empirical analyses in Chapters 3, 4 and 5 reflects my professional development as a researcher. This was not without challenges. The application of various methods implied both an accurate reading of the related literature and a deep understanding of their assumptions and limitations. Nevertheless, the entire research developed in the thesis has benefited from this exercise, strengthening the reliability of the findings and overall inferences.

A similar consideration also holds for the construction of the datasets employed in the empirical chapters. Especially with regard to the CDS data, some challenges were encountered in constructing the samples. This was unexpected, in the sense that almost all of the related academic literature ignores the variations in CDS data quality across different sources. While representing a constraint, this also enabled a comprehensive investigation and understanding of the market structures and incidentally the data construction in widely used commercial databases. CDS data availability, as well its reliability, represent a major consideration in the empirical design. As highlighted by Mayordomo et al. (2014), there exist non-random deviations from the common trend across different datasets for CDS prices. This creates issues both in terms of data consistency and the opportunities to create a wider sample, resulting from the merging of data from different sources.

Additionally, only large companies, financial and non-financial, have traded CDS contracts. The latter represents a further potential limitation to the purpose of selecting and analysing a deeper and more representative sample of European banks. This issue is likely to gain more emphasis in the near future because the European banking system consists of more than 3,100 less significant institutions (LSIs), which are often considerably smaller than the 119 banks deemed as significant entities (as

of October 2017).[20] The overall effort in retrieving reliable data for satisfactory samples, as well as the implementation of various methodologies, with different degrees of complexity, has contributed in enriching the thesis by providing a wider spectrum of empirical perspectives.

Chapter 6 provides an overview of the results and findings of the thesis, offers a thorough illustration of its contributions to knowledge and policy implications, addresses the limitations of the work and discusses potential future research avenues. To briefly summarise the thesis' main contributions, in terms of regulation and policy, the following aspects are emphasised. First, the implementation of the new European banking supervision framework was broadly perceived by the markets as effective. The evidence of a detrimental impact on banks' share prices and a general increase in banks' CDS prices might be motivated by higher compliance costs, as well as a tougher supervision regime. The impact was larger for G-SIBs, which were expected to be subject to more intrusive supervision, compared to the previous regime, with supplementary investigations and on-site visits. These findings are in line with a small number of academic and policy contributions, such as Angeloni (2015), Gehrig et al. (2016) and Carboni et al. (2017). Market participants also evaluate as effective the implementation of the new bank resolution rules. This evidence is reflected in rising CDS prices, which potentially indicate a perceived increase in the riskiness of banks' debt, as a consequence of the new bail-in philosophy.

Despite a preliminary positive assessment by the market in terms of effectiveness of the new European banking framework and its remarkable initial achievements, the central target of breaking the sovereign-bank nexus in the euro area has not yet been accomplished. Building evidence from the CDS market for banks and non-financial corporates over the period 2011-2016, the main findings do not indicate a significant decoupling of bank CDS spreads from sovereign CDS spreads, compared to the corresponding evidence for the European non-financial sector. An overall narrowing of the gap between bank and sovereign risk occurs, which implies a lack of immediate credibility of the BRRD in financial markets.

[17] For the list of ECB supervised entities, see www.bankingsupervision.europa.eu/banking/list/who/html/index.en.html.

The creation of a completely level playing field, which enables fair competition among euro area banks, is also far from being a reality. The harmonisation of practices and rules (e.g. national insolvency laws) is crucial to strengthen the credibility and effectiveness of the new European bank regulatory regime. Although some significant steps have been undertaken in this direction, such as the attempt to achieve a uniform classification and treatment of NPLs, further improvements are required in order to achieve a complete and effective BU in Europe.[21] Furthermore, decisive structural reforms, supported by a higher degree of political stability, are fundamental in the Italian context to boost the slow economic recovery. Overcoming the protracted recession period which affected the country following the global financial crisis is a necessary precondition to reduce the NPL burden.

To summarise, the structure of the thesis is as follows. Chapter 2 provides the background and analyses the BU and its main pillars. Chapter 3 reports the first empirical work about the impact on financial markets of the BU implementation. Chapter 4 presents the second empirical analysis, focusing on the short-run impact of the BRRD on the sovereign-bank nexus in the euro area. Chapter 5 empirically investigates the determinants of the (high) NPL volumes in the Italian banking sector. Beyond the focus on Italy, Chapter 5 also offers a comprehensive analysis on the *status quo* in terms of NPL volumes at the European level. Finally, Chapter 6 concludes the thesis and presents some limitations, policy contributions and potential avenues for future research.

[21] The January 2018 introduction of the International Financial Reporting Standard (IFRS) 9 should also contribute to the harmonisation of the European banking system.

Chapter 2: The development of the European Banking Union project

2.1 Introduction

"The ambitious project of Banking Union in Europe is perhaps the most transformative institutional response to the crisis experienced by the euro area in the last few years" (Véron, 2015, p.5).

The Banking Union (BU) project, launched in mid-2012, implies a significant transfer of key banking responsibilities, such as supervision and resolution, from national regimes to the European level. It represents a remarkable step in progressing with the objective of fostering European financial integration and weakening the vicious feedback loop between euro area banks and sovereigns. The first building block, a common supervisory framework for the banking system, became effective on 4 November 2014, with the European Central Bank (ECB) at the head of the Single Supervisory Mechanism (SSM). The Single Resolution Mechanism (SRM), the second cornerstone, has also been established and together with a Single Resolution Fund (SRF) perform the key task of bank resolution and recovery starting from 1 January 2016. At the time of writing (February 2018), the implementation of the third pillar of BU, a common European Deposit Insurance Scheme (EDIS), remains controversial. Proposed by the European Commission (EC) in late 2015 and expected to be fully operational from 2024, agreements about the adoption and functioning of the EDIS are currently central to the policy debate.[22] From a practical perspective, the transition towards BU, started with the 12-month Comprehensive Assessment (CA) of the euro area banking system. This preliminary financial health check, conducted by the ECB in cooperation with the National Competent Authorities (NCAs) and the European Banking Authority (EBA), consisted of an Asset Quality Review (AQR) and stress tests. The exercise, carried out on the 130 largest euro area credit institutions, started in late 2013 and its results were published on 26 October 2014.

[22] Due to the current incompleteness of EDIS, the empirical work in the thesis does not address any developments regarding this pillar of BU.

The aim of this chapter is to introduce and analyse the BU, its rationale and main components. The remainder of the chapter is organized as follows. Section 2.2 presents the European BU concept and the progress so far. Section 2.3 discusses the underlying rationale of BU. Section 2.4 critically analyses the SSM. Section 2.5 presents the 2014 ECB CA. Section 2.6 offers insights on the SRM and Section 2.7 concludes the chapter.

2.2 European Banking Union: Concept and progress so far

In 1999, few weeks after the launch of the single currency, Tommaso Padoa-Schioppa, a great supporter of the European project, wrote: "I am convinced, however, that in the future the needs will change and the multilateral mode will have to deepen substantially. Over time such a mode will have to be structured to the point of providing the banking industry with a true and effective collective euro area supervisor. It will have to be enhanced to the full extent required for banking supervision in the euro area to be as prompt and effective as it is within a single nation" (Padoa-Schioppa, 1999).[23]

In September 2007, Padoa-Schioppa was among the few to understand the potential implications of the global financial crisis, although at its early stage (Angeloni, 2012). The then Italian Finance minister saw in the crisis both an opportunity and a need to implement a new European financial architecture. In his view, a centralized regulatory and supervisory framework was a necessary response to such a critical situation. In particular, a BU was needed to support a still fragile and incomplete monetary union.

With the emergence of the European sovereign debt crisis, which started in Greece at the end of 2009, the theme related to BU attracted a renewed attention.[24] The then president of the European Council, Herman Van Rompuy, in a 2012 report titled "Towards a Genuine Economic and Monetary Union", proposed the required

[23] "Lecture by Tommaso Padoa-Schioppa Member of the Executive Board of the ECB at the London School of Economics" Financial Markets Group on 24 February 1999. See http://www.ecb.europa.eu /press/key/date/1999/html/sp990224.en.html.

[24] The starting date for the Greek sovereign debt crisis is commonly considered to be 16 October 2009, when the Greek Prime Minister George Papandreou in his first parliamentary speech disclosed the country's true fiscal conditions. On 5 November 2009, the Greek authorities revealed that the fiscal deficit was twice as much as had been previously reported (12.7 per cent of GDP rather than 5 per cent).

policy actions, as part of a comprehensive package, to ensure the stability and integrity of the European Monetary Union (EMU).[25] The stage-based process for the achievement of a deeper economic and monetary integration is based on four key building blocks: (i) an integrated financial framework; (ii) an integrated budgetary framework; (iii) an integrated economic policy framework; and (iv) a democratic legitimacy and accountability at the decision-making level in the EMU. These key elements, in public debate, are commonly referred to as BU, Fiscal Union, Competitiveness Union and Political Union (Véron, 2012). The final version of that roadmap, delivered in December 2012 and endorsed by the "Four Presidents" (European Council, 2012), suggested the establishment of a BU in three stages.[26] The first stage would involve (i) the transfer of bank oversight from the NCAs to the ECB through a SSM; (ii) the harmonisation of national resolution and deposit guarantee frameworks; and (iii) the set-up of an operational framework for direct bank recapitalization by the European Stability Mechanism (ESM). The second stage would regard the establishment of a common resolution authority together with an adequate backstop in order to ensure impartial, timely and effective bank resolution decisions. The last phase would consist of the creation of a centralised shock-absorption function to improve the resilience of the euro area.

The prospect of the creation of BU at the European level concretely materialised in spring 2012. In order to restore confidence into the banking sector and single currency, in May 2012 the then President of the EC (José Barroso) proposed the idea of a BU characterised by a SSM able to (i) oversee banks; (ii) apply prudential rules uniformly and impartially; and (iii) supervise cross-border banking markets. On 29 June 2012, at the end of the Euro Area Summit, the heads of states and governments of the member countries stated: "We affirm that it is imperative to break the vicious circle between banks and sovereigns" and formally asked the EC to set up a proposal

[25] The final version of the report, dated 5 December 2012, is available at http://www.consiliu m.europa.eu /uedocs/cms_Data/docs/pressdata/en/ec/134069.pdf.

[26] At the time of the report, the President of the European Council (Herman Van Rompuy), the President of the EC (José Manuel Barroso), the President of the Eurogroup (Jean-Claude Juncker) and the President of the ECB (Mario Draghi).

for creating the SSM, involving the ECB.[27] The possibility to directly recapitalize weak euro area banks, *via* the ESM, was made contingent on the creation of the SSM.

On 12 September 2012, the EC published a set of proposals: (i) a Communication titled "Roadmap towards a Banking Union"; (ii) a legislative proposal for the establishment of the SSM, including a proposed ECB regulation; and (iii) a proposed EBA amending regulation.[28] On the basis of the Article 127(6) of the Treaty on the Functioning of the European Union (TFEU), the ECB was established as the licensing authority for the supervision of all banks in the euro area, thus implementing the first big step of BU. The original ambitious timetable, designed in a situation of urgency, envisaged the starting date of the project would be 1 January 2014, but that timescale soon slipped. On 15 October 2013, the European Council approved the SSM regulation, setting on 4 November 2014 the starting date of the SSM as banking supervisor.[29]

BU, a crucial step forward on the path of European financial integration, refers to a system based on four key cornerstones:

- Single Rulebook for the European financial market;
- Single Supervisory Mechanism (SSM);
- Single Regulation Mechanism (SRM), supported by both a Single Resolution Fund (SRF) and a potential fiscal backstop;[30]
- European Deposit Insurance Schemes (EDIS).

The achievements of BU are the SSM regulation of 15 October 2013 and the SRM Regulation of 15 July 2014.[31] The first one entrusts the ECB with a list of specific tasks

[27] The Euro Area Summit Statement is available at http://www.consilium.europa.eu/media/21400/20120629-euro-area-summit-statement-en.pdf.

[28] The European Banking Authority (EBA), based in London and established on 1 January 2011 as part of the European System of Financial Supervision (ESFS), is an independent body, which works to ensure effective and consistent prudential regulation and supervision throughout the European banking system (pan-EU supervisory authority). One of the main tasks of the EBA is the contribution to the creation of the European Single Rulebook in order to achieve a level playing field in the European banking system. Changes in the EBA voting procedures, notably required by the UK, were made in order to prevent the Member States participating in the SSM from having a dominant role in decisions involving the EU-wide Single Market.

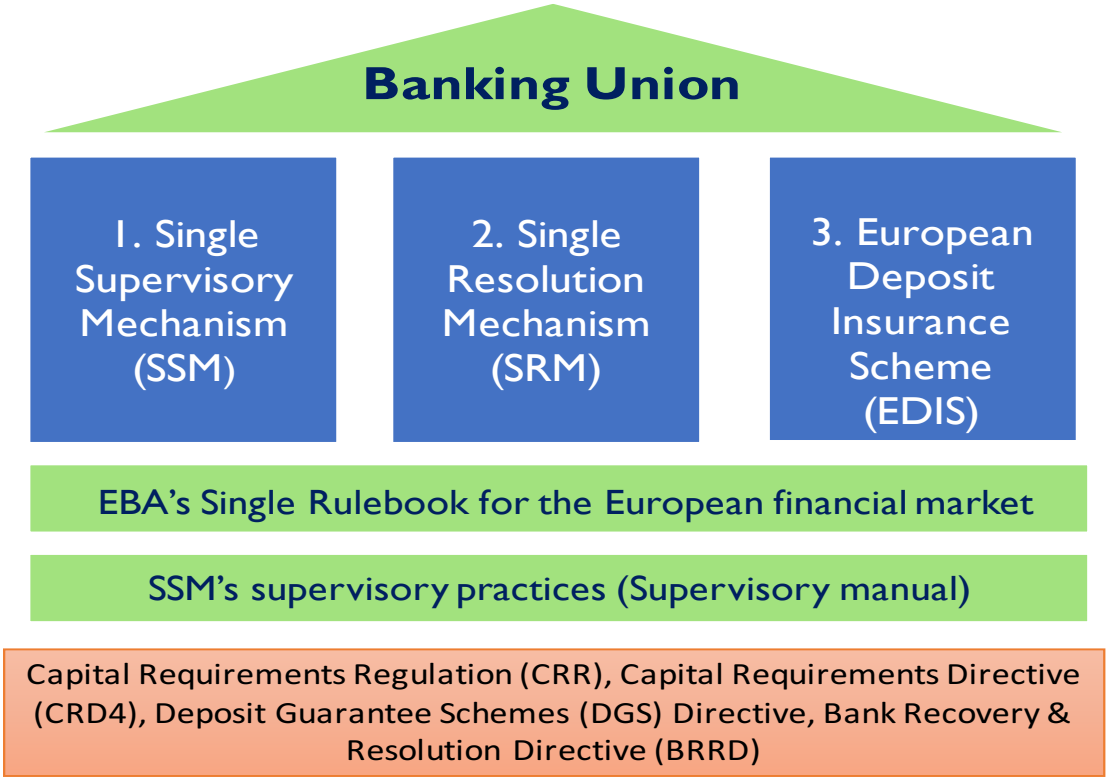
[29] The Council Regulation (EU) No 1024/2013 of 15 October 2013 is available at http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:287:0063:0089:EN:PDF.

[30] As of February 2018, a common fiscal backstop at the European level is still lacking.

[31] Respectively, Council Regulation (EU) No 1024/2013 of 15 October 2013 and Regulation (EU) No 806/2014 of 15 July 2014.

about the supervision of banks in the euro area. The second one establishes the creation of a Single Resolution Board (SRB) from 1 January 2015 and gives it a key role in the management of future situations of crisis, regarding banks covered by the SSM. A SRF, financed by the banking system and established to resolve failing banks, is also introduced. The fund's operating modalities are specified in a distinct intergovernmental agreement signed on 14 May 2014 by all the EU Member States, except Sweden and the UK. Additional relevant pieces of legislation, which predate the launch of the European BU in fall 2012, and involve all 28 EU Member States, are: (i) the Capital Requirements Regulation (CRR) and Fourth Capital Requirements Directive (CRD4) of 26 June 2013; (ii) the Deposit Guarantee Schemes (DGS) Directive of 16 April 2014; and (iii) the Bank Recovery and Resolution Directive (BRRD) of 15 May 2014.

Figure 2.1 - European Banking Union: Key elements



Source: Angeloni (2012), own elaboration.

2.3 Rationale for the Banking Union

The project of BU implies a shift to the European level of the institutional and regulatory framework to ensure the stability and soundness of the European banking system (Constâncio, 2012). It represents the biggest surrender of sovereignty since the introduction of the single currency. The stated rationale behind the initiative to build a European BU is to achieve two worthy aims: on the one hand, to preserve and advance the singleness of the European financial market and on the other hand, to break the so-called "diabolic loop" between banks and sovereigns, highlighted during the 2009-12 crisis in the euro area (Herring, 2013).

The need for strengthening bank supervisory and regulatory integration in Europe represented the inevitable outcome of recognising an inner contradiction existing in its financial structure: the singleness of the financial markets on one side, and the fragmentation, along domestic lines, of banking oversight and banking safety nets (Angeloni, 2012). Foster financial stability and integration in Europe was thus the aim of BU. The euro crisis has revealed that financial stability cannot be handled effectively at the national level, due to the presence of the vicious loop between sovereigns and banks (Schoenmaker and Siegmann, 2013). Indeed, in a monetary union characterized by domestic supervision, resolution, and safety nets, fragility and stress in national banking systems can determine spillovers to the domestic fiscal sector, triggering a negative fiscal/financial loop that weakens both. The BU topic has arisen as one of the possible ways to address the incompleteness of EMU.

Originally, the structure of the monetary union in Europe was built on two pillars: a monetary pillar based on the ECB's policies, characterized by independency and price-stability orientation, and a slightly coordinated fiscal pillar addressing fiscal discipline. The EMU structure involved a minimal financial policy component, except for the general ban on capital controls and the promotion of the Internal Market for financial services (both related to the whole EU). A similar condition also regarded the banking component, which stemmed only from the monetary policy function and the common rules and standards related to the banking sector and the deposit insurance (Pisani-Ferry et al., 2012). The ECB itself had a limited set of financial competences, mostly associated with financial stability. According to Sarcinelli (2013), it took about

20 years and a severe crisis to recognise that the EMU structure designed by the Maastricht Treaty was an initial framework requiring advances to be completed, a "bare-bones union" as argued by Pisani-Ferry et al. (2012). The evident mismatch between centralised monetary policy decisions and domestic banking responsibilities represented a destabilising element for long time, also undermining the capability to effectively address both the financial and sovereign debt crisis.

Based on the 2012 EC memo, the main goals of the BU were:

- Breaking the link between Member States and their banks;
- Restoring the credibility of the financial sector;
- Preserving taxpayers' money;
- Making sure that banks serve society and real economy.[32]

The above list reports objectives that belong to two different dimensions: a short-term dimension related to crisis management and economic growth recovery; and a medium/long term dimension related to the prevention of future banking crises (Dullien, 2014). In a short-term perspective, the key challenges are represented by both the necessity to weaken the vicious link between banks and national finances and to restore the credibility of the financial sector (fostering, in this way, the economic recovery in Eurozone peripheral countries). In a long-term perspective, the main objective is minimising losses to taxpayers, protecting them against the costs of future bank bailouts.[33]

The 2009-12 European sovereign debt crisis has shown the weakness of the governance structure in the euro area, highlighting particularly the issues related to bank regulation, supervision and regulatory forbearance. These factors, together with the fragmentation of the euro area financial space, mostly during periods of instability, represented the triggers for BU in Europe.

[32] The EC MEMO "Towards a Banking Union" is available at http://europa.eu/rapid/ press-release_MEMO-12-656_en.htm.

[33] Since October 2008, and over the following three years, the use of taxpayers' money to rescue failing banks, including guarantees, amounted to €4.5tn, equivalent to around more than a third of the euro area's GDP (EC, 2013). See the "Opening keynote speech at the Conference on the Blueprint for a deep and genuine EMU" available at http://europa.eu/rapid/press-release_SPEECH-13-387_en.htm.

With the eruption of the debt crisis, the highly interconnected and integrated euro area financial system, with the eruption of the debt crisis, started to experience a process of fragmentation along national borders. The flows of capital considerably reduced, especially from North to South, leading to balance-of-payment crises within the monetary union (Pisani-Ferry et al., 2012). Compared to pre-crisis levels, there was a significant reduction in gross capital flows, with the largest contraction related to banking flows (Allen et al., 2011). Cross-border banks, which were European in tranquil times, became national in times of crisis since they were strongly relying on domestic resources (e.g. Fortis and Dexia cases). Moreover, national banking authorities encouraged the cut of cross-border lending, with regards to both the interbank lending and the bank lending to the real economy (re-nationalisation of credit supply). Banking flows from the core euro area countries (i.e. France and Germany) to the distressed peripheral economies not only decreased, but also reversed radically (Herring, 2013). This phenomenon reflected both the concerns of creditor banks about the deteriorated creditworthiness of peripheral areas and the domestic regulators' pressures, in creditor countries, aimed at protecting their economies from problems arising from peripheral countries. This aspect was particularly harmful for the euro area financial market. Increasing pressures in funding and lending markets led to a disintegration of financial markets in the euro area.

The nexus between banks and their home-country sovereigns became tighter and the correlation between the financing cost of euro area banks and those of the relative governments increased, mostly in the peripheral countries (the so-called GIIPS countries, i.e. Greece, Ireland, Italy, Portugal and Spain). This was evident looking at the high degree of correlation both between sovereign and bank bond yields as well as Credit Default Swap (CDS) spreads. Those distressed countries, which gradually lost market confidence and consequently the access to the wholesale funding, started to become (i) dependent on national finances; (ii) more affected by capital outflows; and (iii) less reactive to the ECB monetary policy.

Growing divergences in bank funding conditions along national borders led, in turn, to cross-country differences in lending conditions, especially to Small and Medium-sized Enterprises (SMEs) in euro area peripheral countries. This category of firms represents the "back-bone" of the European business context, counting for

around 68% of the EU employment and about 60% of the EU's GDP (Giuli, 2014).[34] Also, SMEs strongly rely on banking credit and therefore increasing differentials in lending rates between core and periphery areas contributed to further hinder the prospect of recovery in distressed economies. As Paul Taylor (2012), journalist of Reuters, stated "the best managed Spanish or Italian banks or companies have to pay far more for loans, if they can get them, than their worst managed German or Dutch peers".[35] Such situation gave rise to a distort competition in the single market and to a sub-optimal allocation of the financial resources across the EMU.

Furthermore, contractions in credit supply within domestic lines, together with higher funding costs (on both banks and governments in some countries), led to an impairment of the monetary policy transmission mechanism, amplifying fragmentation and volatility of financial markets (Angeloni, 2012). Despite the ECB accommodative monetary policy, lending conditions for non-financial corporations and households became tighter than expected, particularly in peripheral regions. The need to solve such critical situation justified extraordinary policy measures undertaken by the ECB with the aim to restore both the transmission of monetary policy and the credit channel, including the Securities Markets Programme (SMP) and the Outright Monetary Transactions (OMTs).[36]

The vicious loop between banking and sovereign risk, observed during the debt crisis, also weakened national efforts to restore fiscal sustainability. Troubled countries facing fiscal adjustments were penalized by financial markets due to the further burden arising from the support to their national banking sectors. Consequently, their banks started to face growing refinancing pressures and the degree of integration of the euro area banking system decreased further. In this situation, the attempt to re-establish both banking stability and fiscal sustainability became potentially self-defeating (Angeloni, 2012).

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[34] See http://bruegel.org/wpcontent/uploads/imported/publications/BTTD2014_Working_Paper_Session2_final.pdf.

[35] "Euro zone fragmenting faster than EU can act", Reuters, 9 July 2012, available at http://www.reuters.com/article/2012/07/09/us-eurozone-banking-policyidUSBRE86805N201 20709.

[36] In May 2010, the ECB decided to intervene in some dysfunctional securities debt markets to guarantee depth and liquidity (i.e. implementing the SMP). In August 2012, the ECB announced the possibility of OTMs in secondary sovereign bond markets. The aim of both the operations was to restore and preserve the right functioning of the monetary policy transmission mechanism, avoiding at the same time a potential break-up of the single currency.

In recognising the crucial role played by banks in the European financial system and their influence on the functioning of the wider European economy, Elliott (2012) highlighted five key reasons to explain the adoption of BU:

- Dealing with bank weaknesses that contributed to the euro sovereign debt crisis;
- Reducing the risk of a further banks' contribution in worsening the euro crisis;
- Restoring the effectiveness of the monetary policy of the ECB;
- Reintegrating the European banking system;
- Solving long-standing consistency issues with the unified European banking market.

The 2009-12 European sovereign debt crisis was exacerbated by situation of distress in domestic banking sectors. Troubles in the banking system were, indeed, a central dimension of the crisis (Véron, 2012). In Ireland and Spain, for instance, the extent of the banking sector issues, in turn associated with a sharp drop in real estate prices, was so extended to threaten government stability (Angelini et al., 2014). In countries as Greece, instead, the sovereign situation was recognized as the main fragility factor. Difficulties linked to public finances affected the banking sector through different transmission channels; a remarkable aspect was the issue related to large banks' holdings of domestic government bonds ("home-bias" issue). This condition tied together the fates of sovereigns and banks, leading to a self-reinforcing negative feedback loop, which brought the Eurozone close to collapse.

The inter-linkage between troubled banks and debt-burdened governments showed that the euro area would be significantly more stable if financial institutions were fastened in Europe and not so closely tied to their home country governments. Weakening the link between banks and their own sovereigns therefore represented a key target for policy-makers in order to make the financial system more stable and resilient (Gros, 2013). Elliott (2012) argued that the risk of domestic bank runs, a dimension of financial contagion, particularly triggered the move towards a BU in Europe. Many citizens of distressed countries, driven by concerns regarding the sustainability of national debts, started to move their funds outside national borders. The withdrawal of money seriously affected banks' solvency, forcing many institutions

to rely on the ECB support. In the light of this evidence, the adoption of a BU, and especially the prospect of a cross-border mutualisation of the potential costs would lower the risk of the downward spiral characterizing weak countries.

The need to avoid the worst of potential future troubles, restoring confidence in the whole European banking system, represented a further rationale behind the BU project. This attempt was also aimed at re-establishing the effectiveness of the monetary policy transmission mechanism, partially impaired by the serious problems affecting the banking sector, including the fragmentation process. Furthermore, the necessity of solving long-standing consistency issues between national authorities and a unified European banking market represented another reason underlying the move towards a BU. The transfer of sovereignty to supranational-level institutions, although delicate, was considered a critical step in order to ensure the stability and soundness of the European banking system.

2.4 Single Supervisory Mechanism

The SSM, a common supervisory framework for the banking system, represented the first building block of the wider project of European BU. The SSM regulation of 15 October 2013 put the ECB in charge of banking supervision for all banks across the euro area. On 4 November 2014, the ECB assumed its tasks as single banking supervisor, marking the beginning of a new EU financial supervision regime. The establishment of the SSM represents a cornerstone in the strengthening of the institutional framework of the euro area, which was deeply supported by the Larosière report of 2009.[37]

The implementation of a single set of supervisory standards and practices is aimed at reducing the likely of future banking crises and the associated cost for taxpayers (avoiding the repetition of the mistakes occurred in the recent past). In addition, these significant changes in the Eurozone supervisory architecture should contribute in reducing fragmentation by both ensuring high standards of supervision and establishing a level playing field for financial institutions (Angeloni, 2014).

[37] The High-Level Group on Supervision, chaired by Jacques de Larosière, published a report in 2009 on how to strengthen the future architecture of the European financial supervision. Available at http://ec.europa.eu/internal_market/finances/docs/de_larosiere_report_en.pdf.

The SSM involves a supervisory system composed of NCAs and the ECB, which combines at the same time all expertise of national supervisors and a strong decision-making centre. This enables both the exchange of cross-border information, improving the supervision of cross-border entities, and the performance of cross evaluations to recognize any risk that potentially threatens the whole banking system. Moreover, an even-handed supervisory mechanism across the euro area should contribute in reducing the incentive of national banking authorities to protect their national champions, only taking national interests into account (Schoenmaker, 2013). Events as the already mentioned collapses of European cross-border banks (i.e. Dexia and Fortis) proved that in times of distress domestic authorities have focused on preserving national institutions, ignoring the connected negative cross-border externalities (Gros and Schoenmaker, 2014). European, as well as euro area level authorities should include the systemic impacts of banks failures (network or systemic externalities) within the wider geographical space.

Starting from November 2014, the ECB is the single supervisor of the euro area banking sector assuming exclusive responsibility for those "specific supervisory tasks which are crucial to ensure a coherent and effective implementation of the Union's policy relating to the prudential supervision of credit institutions" (Council Regulation No 1024/2013). The ECB directly supervises all significant credit institutions in the euro area. More specifically, the direct oversight of significant financial institutions under the SSM is assumed by Joint Supervisory Teams (JSTs), which include experts from both ECB/SSM and NCAs, enabling thus to adopt a fully integrated approach in supervising of cross-border entities (Constâncio, 2013). A bank is classified as significant if (i) the total value of its assets is more than €30bn; (ii) it has an economic importance for specific Member States or whole EU economy; (iii) the total value of its assets is more than €5bn and the ratio of its cross-border assets/liabilities in more than one other Member State to its total assets/liabilities is over 20%; and (iv) it has requested or obtained funds from the European Financial Stability Facility (EFSF) or the ESM.[38] The three largest banks in each Member State are directly supervised in any case. As of October 2017, 119 are the euro area entities, accounting for about the

[38] See https://www.bankingsupervision.europa.eu/banking/list/criteria/html/index.en.html.

82 per cent of the euro area total banking assets, which are directly supervised by the ECB/SSM.

The remaining banks, around 3,100 less significant institutions (LSIs), are supervised indirectly *via* the NCAs.[39] Nonetheless, the ECB may at any time inspect and assume the responsibility even on the LSIs that it does not oversee directly (in this sense, the ECB always maintains a final supervisory authority).[40] All euro area countries are automatically covered by the SSM. The other EU Member States, outside the EMU, through the establishment of a "close cooperation" with the ECB can voluntarily join the SSM and thereby the BU.

2.4.1 The SSM micro and macro supervisory tasks: Complexities and benefits

The Council Regulation of 15 October 2013 conferred specific tasks on the ECB concerning policies relating to the prudential supervision of credit institutions in the euro area. The legal basis for the ECB Regulation is provided by the TFEU, article 127(6).[41] The wide-range of specific supervisory tasks delegated to the ECB notably include:

- Authorizing financial institutions and withdrawing banking licences;
- Ensuring compliance with the EU prudential rules in terms of liquidity, securitization, large exposure limits, own funds requirements, leverage, reporting and public disclosure commitments;
- Ensuring compliance with governance rules, risk management procedures, internal controls, remuneration policies and capital adequacy;
- Preparing for situation of crisis. This involves stress tests, recovery plans and early intervention actions. Regarding the early intervention powers and the related ECB entrusting, the legislator widely interpreted the TFEU rules. The legal basis of the SSM Regulation permits the conferring to the ECB of only prudential supervisory tasks, and not also crisis management powers. Early

[39] For the list of entities directly and indirectly supervised by the SSM, see https://www.bankingsupervision.europa.eu/ banking/list/who/html/index.en.html.

[40] This legal competence represents an important persuasive tool to guarantee the adoption of harmonised supervisory practices across the entire euro area banking system.

[41] "The Council, acting by means of regulations in accordance with a special legislative procedure, may unanimously, and after consulting the European Parliament and the ECB, confer specific tasks upon the ECB concerning policies relating to the prudential supervision of credit institutions and other financial institutions with the exception of insurance undertakings".

intervention function is in a borderline position between supervision and crisis management. Therefore, these powers are associated with what is commonly called "prompt corrective action", which regards distressed financial institutions and can be applied before the intervention of the Resolution Authority;

- Assessing the adequacy of Mergers and Acquisitions (M&As) among banks (national supervisors have the task to prepare the initial evaluation, the ECB has the final responsibility).

A broad set of powers is also matched with the above-listed tasks. The ECB can conduct on-site inspections and the necessary investigations to collect information beneficial in effectively performing its role. Moreover, the ECB also avails of sanctioning powers.

This extensive array of micro-prudential tasks is complemented with a "potentially synergic direct role in macro-prudential supervision" (Merler, 2014, p. 4).[42] The 2009-12 euro area crisis suggested, in this perspective, that supervising the micro-prudential risks at individual level is potentially insufficient to preserve the stability of the overall system. Additionally, policies designed to foster the micro-level safety may also contribute to undermine financial stability. Risks at macro and micro levels can on occasion be mutually reinforcing. The financial sector can negatively impact the real economy in ways that jeopardize the overall economy. The SSM regulation entrusts the ECB with macro-prudential policy powers with the aim of contributing to the "stability of the financial system within the Union and each Member State" (SSM regulation, Article n.1).[43] This extends the scope of the Union policy framework and represent a relevant improvement since, for the first time, "Europe has the direct authority and instruments to control systemic risk in the financial sector" (Angeloni, 2014, p. 72).[44]

[42] See http://bruegel.org/wpcontent/uploads/imported/publications/BTTD2014_Working_Paper_Session2_final.pdf.

[43] For the list of macro-prudential tasks and tools, see SSM Regulation, Article n.5.

[44] The first step in setting-up a macro-prudential framework in Europe was the establishment of the European Systemic Risk Board (ESRB) in 2010. The latter is responsible for the macro-prudential oversight of the financial system within the European Union (EU).

Nonetheless, there are several complexities regarding the actual implementation of European macro-prudential policy. These mainly arise from (i) the foreseen interplay between the ECB and the national authorities responsible for the macro-prudential policy in the participating countries; and (ii) the interaction between central banks and supervisory authorities, which play complementary roles within the Member States and in the SSM central structures. Essentially, the macro-prudential approach at the European level represents a new and unexplored policy field, both in terms of doctrinal and practical aspects (Angeloni, 2014).

Another crucial aspect in the functioning of the SSM is the simultaneous presence, in the same body, of monetary policy and supervisory tasks. This, for many observers, may lead to "overburdening, role confusion or distorted incentives" (Angeloni, 2012). In order to avoid the risk of "contamination" between monetary function and prudential supervision, which in turn could lead to potential conflict of interests and loss of reputation, certain principles must be respected. More specifically, these are: (i) a clear separation has to be ensured between supervisory decision-making and monetary policy; (ii) the SSM should have a complete and clearly defined set of supervisory tools; and (iii) the supervisory agency must be independent, transparent and accountable. The establishment of a separate Supervisory Board within the ECB addresses the point related to the decision-making structure within the ECB.[45] The Supervisory Board, which performs most of the regular supervisory functions, proposes draft decisions to the Governing Council, which, in turn, can adopt or object the proposed draft, but cannot change it ("non-objection" procedure). In case of conflicts between the two bodies, there is the intervention of the Mediation Panel to resolve differences of views. Lastly, the Administrative Board of Review carries out internal administrative reviews regarding the ECB's supervisory decisions, in order to ensure the compliance of these decisions with rules and procedures.

Nevertheless, there are good reasons explored in the academic literature supporting the idea that the banking supervision task should be conferred to either

[45] As of February 2018, the Supervisory Board is composed by: Chair (Danièle Nouy), Vice-Chair (Sabine Lautenschläger), four ECB representatives and representatives of national supervisors. See https://www.bankingsupervision.europa.eu/organisation/whoiswho/supervisoryboard/html/index.en.html.

the central bank or to a distinct supervision agency (Constâncio, 2012). Some of these considerations were highlighted in a 2011 ECB's paper, which considering the euro area, concluded that the attribution of prudential supervisory responsibilities to national central banks could have positive effects. Benefits associated with the allocation of supervisory tasks to the central bank are: (i) the implicit interest of the central bank, which also carries out the monetary policy, in the stability of the financial system, (ii) the close relation between micro and macro prudential approaches, (iii) the potential information synergies between the oversight of payment systems and banks' supervision (iv) the expertise about the financial sector of central banks and (v) the operational independence of the supervisory authority from political interference.

2.4.2 Limits to the scope of the SSM powers

The scope of the SSM supervisory powers is constrained when considering three main dimensions: (i) geographical (covered countries), (ii) functional (covered competences) and (iii) institutional (covered banks).

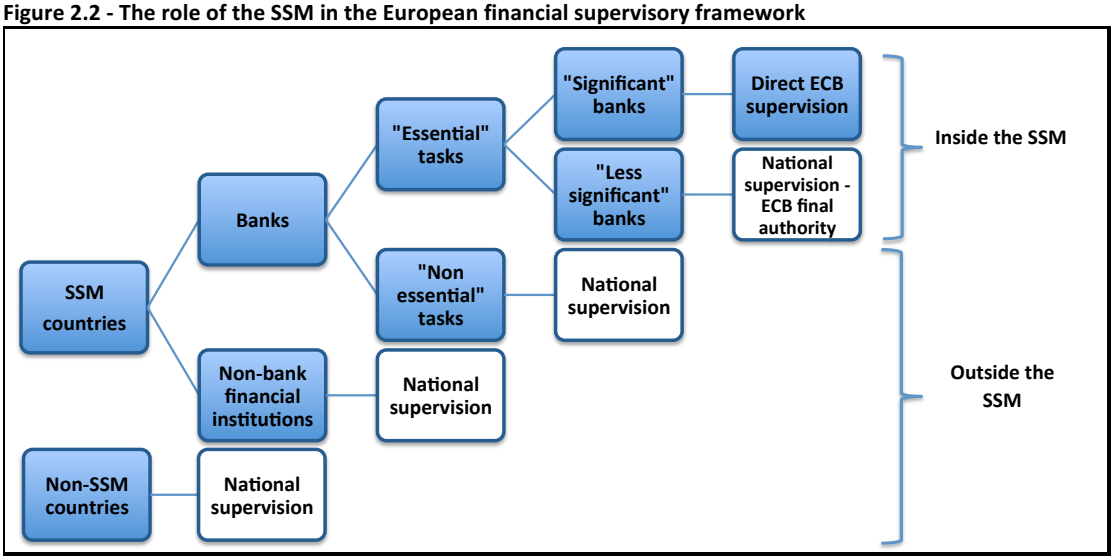
First, the SSM and the BU area do not cover all the EU Member States. This was made inevitable by the strong position adopted in 2011 by the UK and summarised by George Osborne (the Chancellor of the Exchequer) as the "remorseless logic" of the Eurozone policy integration. A process that would receive the British support, without an actual British participation (Véron, 2014). The BU area is likely to some Member States outside the EMU, but most probably not all of them. This geographical aspect gives a hybrid nature to the BU, since it is positioned somewhere between the EMU and the Single Market.

Second, the SSM only deals with part of the broader financial sector (i.e. banks). In addition, not all banks within the BU area are directly covered by the Mechanism. Many LSIs, mostly concentrated in Germany, Austria and Italy, are not directly supervised by the ECB and they also escape the authority of the SRM in the event of crisis (Véron, 2014). Although LSIs do not represent a potential threat for the financial stability of the system, the regulatory asymmetry might lead to a risk of concentration, with adverse effects for the whole system (e.g. case of Spanish *cajas de ahorros* in the 2000s). Moreover, the establishment of the €30bn threshold as one

of the criteria to be deemed as significant entity might disincentive domestic consolidation processes, with the purpose of escaping the ECB direct control.

Third, some prudential supervisory tasks, considered as “non- essential” in preserving the stability and soundness of the whole financial system, remain of national competence. Among these functions there are: (i) consumer financial protection; (ii) anti-money laundering, (iii) anti-fraud; and (iv) other components of banking regulation.

Figure 2.2 - The role of the SSM in the European financial supervisory framework



Source: Verhelst (2013), own elaboration.

2.5 A preliminary financial health check: The ECB Comprehensive Assessment

Prior to the SSM assuming its supervisory responsibilities on 4 November 2014, a CA of the euro area banking system was undertaken ("a key step to draw a line under the crisis", Reuters, 2014).[46] The ECB assessment, provided under Article 33(4) of the SSM regulation and considered as a crucial element towards the operational start of the new supervisory regime, started in November 2013 and lasted 12 months. It was a financial health check, conducted by the ECB together with the NCAs and the EBA, of 130 euro area credit institutions (participating banks, accounting for about the 82 per cent of the euro area banking assets).[47]

The stated aims of the exercise were:

- Strengthening banks' balance sheets by fixing the identified issues through the necessary corrective actions (in order to safeguard bank solvency in the short term)
- Enhancing transparency by improving the quality of the available information on banks' financial conditions (to enable a more accurate evaluation of their solvency)
- Restoring trust by ensuring all stakeholders on the effectiveness of the outlined corrective actions

The exercise consisted of two components: (i) the AQR to enhance the transparency of banks' exposures by assessing their asset quality (as of 31 December 2013), including the adequacy of asset and collateral valuation and associated provisions; and (ii) the EBA stress test to evaluate the resilience of banks' balance sheets under two different scenarios (i.e. a baseline and an adverse scenario).[48,49]

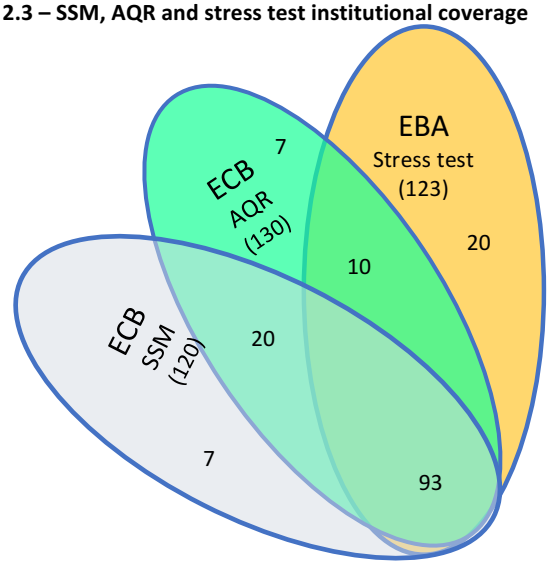
[46] See https://www.reuters.com/article/us-ecb-supervision-nouy-shadowbanks/nouy-says-european-banking-union-far-from-complete-idUSKBN0IN1H120141103?feedType=RSS&feedName=GCA-Economy2010.

[47] Not all the banks included in the exercise are subsequently directly supervised by the ECB. For further details and for the list of the participating banks, see the Appendix 9.1 of the ECB "Aggregate Report on the Comprehensive Assessment", October 2014.

[48] In the initial draft of the CA, as outset in October 2013, there was a third pillar, i.e. the "Supervisory Risk Assessment", which was later downgraded in importance and visibility (Véron, 2014). This was the result of the delay (from 2014 to 2015) in the finalization of the centralised Risk Assessment System to score all supervised entities across different risk categories.

[49] The banks were required to maintain a minimum Common Equity Tier 1 (CET1) ratio of 8%, under the baseline scenario and of 5.5% under the adverse scenario.

Figure 2.3 – SSM, AQR and stress test institutional coverage



Description: Initially the SSM directly covered 120 significant Eurozone banks; the AQR covered 130 Eurozone banks; the EBA stress test covered 123 banks across the 22 EEA countries (21 EU member states plus Norway).
Source: de Groen and Lannoo (2014).

The CA ended with an aggregate disclosure of the findings, both at country and bank level, coupled with recommendations for supervisory measures. Banks found as having capital shortcomings were required to undertake corrective actions and to provide capital plans within two weeks of the results' public disclosure. Within six months, for gaps identified in the AQR or under the baseline scenario, and within nine months, for gaps identified under the adverse scenario, banks had to provide detailed explanations about their way to address these shortfalls.

The CA identified an overall capital shortage of €24.6bn across 25 credit institutions.[50] Considering the amount of net capital raised by the participating banks, since 31 December 2013, which was already employed to cover the shortfalls of twelve out of these 25 institutions, the remaining capital gap to be filled was of €9.5bn.[51] Moreover, in accordance with the restructuring plans agreed with the EC, five of these identified institutions were able to restore their conditions (almost) completely. Only eight banks had to raise capital for €6bn within the following six to nine months. This evidence suggested that most euro area banks adequately

[50] The 25 banks with a shortfall were: nine Italian, three Greek, three Cypriot, two Slovenian, two Belgian, and one each from Austria, Ireland, Spain, Portugal, France and Germany respectively.
[51] Among these 13 banks, four are Italian: Monte dei Paschi di Siena (the worst with a capital shortfall of €2.1bn), Banca Carige, Banca Popolare di Milano and Banca Popolare di Vicenza.

improved their financial *status*, reducing therefore their constraints in financing the real economy (De Groen, 2014). Restoring confidence in the resilience of the banking sector, thereby improving its lending capability was among the main purposes of the ECB assessment.

On 26 October 2014, the EC welcomed the publication of the results of the EU-wide stress test and AQR declaring that they were "robust exercises, unprecedented in scale and among the most stringent worldwide" (EC, 2014).[52] Danièle Nouy, Chair of the SSM Supervisory Board, also affirmed: "transparency is an important element in enhancing the confidence of investors in the European banking system" (Reuters, 2014).[53]

The 2010 and 2011 EBA stress tests gave clean bills of health to institutions such as Allied Irish Banks, Bankia and Dexia which failed shortly afterwards. In contrast, the 2014 assessment exercise was widely considered as more robust and credible. Major improvements compared to the past exercises are in regard to: (i) the inclusion of the AQR; (ii) the harmonization of the definition of non-performing loans (NPLs); (iii) the uncovering of hidden losses; and (iv) the guarantee of adequate alignment between the work of the domestic supervisors and the EBA.[54] This latter aspect reduced the incentives for weaker banks and their domestic supervisors to hide relevant information from the EBA.

Moreover, the new role assumed by the ECB as single banking supervisor, gave it the access to a wider set of information, enabling for a timely discover of potential issues. However, there were many concerns regarding the EU-wide exercise and its effectiveness, especially in terms of rigorousness and impartiality. According to Wolff (2013), the ECB was forced to choose between a "rock and a hard place", being an excessively strict assessment a potential threat for financial stability. On the contrary, an overly lenient "touch" could have undermined the credibility of the ECB itself. A different view considered the reassurance of the markets the only aim of the CA (EU

[52] See http://europa.eu/rapid/press-release_STATEMENT-14-336_en.htm.

[53] See https://www.reuters.com/article/us-ecb-supervision-nouy-shadowbanks/nouy-says-european-banking-union-far-from-complete-idUSKBN0IN1H120141103?feedType=RSS&feedName=GCA-Economy2010.

[54] Before the establishment of the EBA, on 1 January 2011, there existed the Committee of European Banking Supervisors (CEBS).

Committee, 2013). De Groen (2014), while providing policy recommendations, highlights technical weaknesses associated with the standards adopted by the ECB in conducting the CA. Lastly, the lack of a common bailout fund represented a major concern at the time of the assessment on the European banking sector. Resorting to taxpayers' money, at least in the short-term, was a real, undesirable option (Merler, 2014).

2.6 Single Resolution Mechanism

The second pillar of European BU is the SRM. On 14 May 2014, the European Council and the European Parliament adopted the Directive 59/2014, known as the BRRD, "establishing a framework for the recovery and resolution of credit institutions and investment firms". On 15 July 2014, a regulation was adopted to develop these mechanisms as a part of the project of BU (fully operational from 1 January 2016). The establishment of the SRM represents the second key step towards reducing financial fragmentation and weakening the negative feedback loop between sovereigns and banks in the euro area. In this perspective, the orderly resolution of insolvent financial institutions across countries enables to avoid costly government bailouts, with potential beneficial effects in de-linking bank and sovereign risk.

The SRM Regulation establishes a centralized authority competent for the resolution of financial institutions both in the monetary union and in participating Member States (from 1 January 2015 onwards). This permits to undertake effective, timely and impartial resolution actions, particularly relevant when dealing with failures of cross-border entities. The SRM represents, therefore, a natural and logical complement to the SSM. In a framework where banks are regulated and overseen at European level, the presence of a common resolution mechanism is essential to avoid mismatches of responsibilities, which might weaken the credibility of the SSM and delay banks' resolutions.

The SRM Regulation also introduces a SRF, financed by the banking system and established to resolve distressed banks in the BU participating countries. From 2016 and within a period of eight years (2016-2023), the SFR is expected to reach a target level of at least 1% of all covered deposits in the BU area, corresponding to around

€55bn.[55,56] Initially divided in national compartments, the fund is gradually mutualised. The construction of the fund entails the 40 per cent mutualisation in the first year, additional 20 per cent in the second year (for a total 60 per cent) and a progressive increase by 8 percentage points on annual basis over the remaining years. During the transitional period, forms of bridge financing in favour to individual national compartments from other compartments or external sources are possible, conditional on the reimbursement by the involved country. Therefore, if during the eight-year transition period, failing institutions in one participating member still need public funds after the bail-in mechanism, a significant part of the costs is initially covered by the country itself to be then retrieved from its own banking sector (*via* levies).

The described mechanism, in the short-term, is not expected to be very dissimilar from the *status quo*. This meaning that the negative feedback loop between banks and sovereigns in the euro area would not be weakened and different positions among participating countries might still lead heterogeneity in the adopted approaches to deal with distressed financial sectors (Merler, 2014). In addition, the final overall capacity of the resolution fund is likely to be insufficient to represent an adequate common resource in case of systemic banking crises at the European level (Véron, 2014). The initial plan to allow the ESM to directly recapitalise banks (as stated on 29 June 2012), was then discarded and only re-considered during the summer of 2014, after about two years of intensive negotiations. Finally, in late 2014 the euro area Member States agreed on the ESM operational framework for the direct recapitalisation of systemic and viable euro area banks. Under specific circumstances, the ESM was therefore entitled to act as a lender of last resort in the BU area.[57]

The annual fee to the common resolution fund, which includes a basic contribution with a risk factor adjustment, was expected to mainly impact on European largest and riskiest banks. While potentially favouring many small and

[55] Initially the transitional period was supposed to be of ten years, then the timetable for the mutualisation process has been shortened (IMF, 2014).

[56] As of June 2017, the SRF amounts to €17.4bn (SRB, 2017). For further details, see https://srb.europa.eu/en/content/single-resolution-fund.

[57] See https://www.esm.europa.eu/ press-releases /esm-direct-bank-recapitalisation-instrument-adopted.

medium sized banks (e.g. Spanish and German institutions), only contributing with a flat fee, the burden was anticipated to be heavier on large entities, e.g. French banks (Financial Times, 2014).[58]

The BRRD, basis of the SRM and which applies to all 28 EU Member States, represents one of the most important regulatory change in Europe during the last years (Constâncio, 2014). The application of the Directive and related tools marked the end of the culture of bail-out and the beginning of the culture of bail-in.[59] More specifically, the BRRD includes a minimum set of common rules and procedures for the recovery and resolution of European credit institutions and investment firms. From January 2016, under the BRRD and in all resolution cases, there will be a bail-in of shareholders and debtholders equal at least to the 8 per cent of the bank total liabilities, including its own funds. Only after this threshold is reached, money from the resolution fund (or the ESM direct recapitalisation instrument) can be used for another 5 per cent of bank total liabilities (including own funds).

In this way, the use of public funds to cover bank losses represents the last step of the resolution process. However, there is some flexibility in the adoption of the rules, since the BRRD also introduces the possibility for national governments to intervene in case of severe systemic crisis. In any case, this option remains a last resort measure. The bail in procedure follows a sequential order (pecking-order), based on which the recourse to private resources appears as the first option. More specifically, equity holders are the first to contribute in absorbing the losses and financing the resolution, followed by the holders of hybrid capital instruments and subordinated debt (junior debt-holders). In the third position, there are senior debt holders and deposits above €100,000. Then, insured deposits from individuals and small companies will be included if necessary to reach the 8 per cent threshold. Only the category of insured deposits is completely excluded from the bail-in mechanism. A bail-in applies to all liabilities of the institution not backed by assets or collateral, but not to covered deposits, short-term (interbank) lending or customer assets (Conlon and Cotter, 2015).

[58] See https://www.ft.com/content/abc93c04-591f-11e4-a722-00144feab7de.
[59] The BBRD will be implemented from 1 January 2015, except for the provisions related to the bail-in tool that will be effective from 1 January 2016.

Although the second pillar of BU, the SRM, is recognized as a valuable effort to solve the "too big and too interconnected to fail" problem in the euro area, it presents some critical aspects. These are mostly related to its constitutional and institutional complexities. The first type of complexity regards the different jurisdictional areas of the EU and the BU area, whilst the second is associated with the intricate SRM decision-making process (ESFRC, 2014).[60] In this perspective, a resolution process involves the intervention of too many actors, expected to take politically highly sensitive decisions. This might be to the detriment of the rapidity of the decision process itself, which is a crucial factor in bank resolution.

[60] See http://www.esfrc.eu/sitebuildercontent/sitebuilderfiles/statement39.pdf.

2.7 Conclusions

The European BU project is a substantial development towards fostering financial integration and weakening the destructive feedback loop between banks and sovereigns in the euro area. The first pillar, i.e. the single supervision framework, became effective on 4 November 2014, while the second pillar (i.e. the SRM) is fully operational from January 2016. At the time of completing this thesis (February 2018), the final pillar, the EDIS, is still lacking. Although the new institutional framework is a remarkable and unprecedented effort in restoring the foundations of the euro area banking sector, while potentially addressing its shortcomings, further harmonisation and additional cooperation are still necessary. The establishment of a common fiscal backstop remains essential to support the single resolution facility and to complete the BU project. The EC proposal in late 2017 to convert the ESM into a European Monetary Fund (EMF) with extended new powers can be framed within this latter context.

The BU represents a significant pooling of sovereignty at the European level and was rapidly instigated in a situation of crisis and urgency, after other possible alternatives failed (e.g. "Eurobonds" issued by euro area sovereign countries).[61] This scenario made it more challenging to bind all countries to a common perspective. As an unavoidable consequence, the implementation of BU since mid-2012 has been incomplete and partially unbalanced along different dimensions (Véron, 2014). The achievement of a fully effective BU is hindered by some countries, such as Germany and Finland, who firstly require further risk reduction actions to strengthen the euro area banking sector (Financial Times, 2018).[62] The southern euro area countries, on the other hand, are understandably more oriented towards an increased degree of risk-sharing across countries, while also re-launching the proposal of common safe assets. The apparent distance between the two positions, i.e. risk-reduction and risk-sharing, might be encompassed by the creation of a credible EDIS, which would enhance market discipline, while reducing the room for political crises (Financial

[61] For a critical review on this topic, see https://www.ft.com/content/0e8d3194-3c8d-11e7-821a-6027b8a20f23.
[62] See https://www.ft.com/content/6dd7703a-0044-11e8-9650-9c0ad2d7c5b5.

Times, 2018).[63] In this perspective, substantial reforms in more distressed countries, such as Italy, are fundamental to achieve a shared view. Consequently, the genuine completion of a BU remains a somewhat distant prospect.

[63] See https://www.ft.com/content/d223fa7c-011b-11e8-9650-9c0ad2d7c5b5.

Chapter 3: Market reactions to the implementation of Banking Union in Europe

3.1 Introduction

The Banking Union (BU) project implies a significant shift of responsibilities from the national to the European level and represents a substantial step forward in the process of fostering European financial integration and weakening the vicious feedback loop between banks and sovereigns (Acharya et al., 2014). The first building block, a common supervisory framework for the euro area banking system, became effective on 4 November 2014, with the European Central Bank (ECB) at the head of the Single Supervisory Mechanism (SSM). The Single Resolution Mechanism (SRM), the second cornerstone, which aims to ensure timely and effective resolution of euro area failing banks, was launched in 2015 and became fully operational on 1 January 2016. The SRM includes a Single Resolution Board (SRB) and a Single Resolution Fund (SRF) and implements the EU-wide Bank Recovery and Resolution Directive (BRRD) in the euro area. The third pillar of the BU, a pan-European deposit insurance scheme (EDIS), remains under debate and has not been established as of February 2018.[64]

The transition towards European banking supervision was preceded by a Comprehensive Assessment (CA) of the euro area banking system, jointly conducted by the ECB, the European Banking Authority (EBA) and the National Competent Authorities (NCAs). The exercise, which consisted of an Asset Quality Review (AQR) and a stress test on the 130 largest credit institutions across the European Union (EU), started in late 2013 and its results were published on 26 October 2014. The CA identified an overall capital shortfall of €24.6bn across 25 European credit institutions.

Although the CA was widely considered to be a more robust and credible exercise than the previous EU-wide assessments, a key weakness was recognised in the focus on a single capital ratio, the Common Equity Tier 1 (CET1). Steffen (2014) points out that the adoption of regulatory capital ratios relies on the crucial

[64] In November 2015, the European Commission (EC) made a proposal for a EDIS. The gradual creation of such a scheme, similarly to that of the Single Resolution Fund (SRF), might imply a temporary "mutualisation" period, through a top-up or reinsurance mechanism, to end in 2024 with a fully-fledged and common EDIS.

assumption that the weights correctly reflect the risk of the underlying asset.[65] Sovereign debt represents a particular example that demonstrates this potential issue: although the European sovereign crisis made evident that government debt can no longer be regarded as risk-free (e.g. the Greek case), regulators did not change the relative risk weights, which are still kept at zero (Basel accords – first pillar). Moreover, Steffen (2014) highlights that the ECB's CA, and specifically the stress component, did not account for the systemic risk (contagion risk) arising from linkages and feedback effects between banks, as well as the exposures to similar assets and similar comparable macroeconomic shocks.

Several studies (Steffen, 2014; De Groen, 2014; Acharya and Steffen, 2014; Acharya et al., 2014) present results from alternative macro-prudential stress tests, which prove to be useful as benchmarks for the regulatory tests. De Groen (2014), using the data disclosed by the CA, estimates the cumulative impact of the AQR and stress test on a range of different regulatory ratios. The various studies involving Acharya and Steffen provided a number of benchmark stress tests to estimate capital shortfalls of European banks during a systemic crisis. They based their alternatives on publicly available market data and found possible capital shortfalls much larger than the figures disclosed by the ECB. In their view, the regulatory stress test results were potentially strongly influenced by the flexibility of national regulators in defining and measuring bank capital and by the adoption of risk-weighted assets in computing the prudential capital requirements.[66] Furthermore, the differences between the capital shortfalls estimated in Acharya and Steffen (2014) and those estimated by the ECB appeared to be driven by large banks in core European countries, mainly France and Germany. The CA did not highlight capital gaps for these banks. This evidence is likely to be explained by the fact that systemic risk and feedback effects from the banking

[65] The current approach followed in assessing capital requirements is heavily dependent on the regulatory capital ratios established under Basel accords (Acharya et al., 2014).

[66] A truly consistent definition of capital applied to all the banks supervised by the ECB has been employed since November 2014 when the Supervisory Review and Evaluation Process (SREP) was adopted (Véron, 2015). The SREP essentially consists of four components: (i) evaluation of the bank's business models; (ii) assessment of the internal governance and risk management; (iii) analysis of risks to the bank's capital; (iv) analysis of risks to the bank's liquidity and funding. Each analysis is based on both quantitative and qualitative tools (Angeloni, 2016).

system to the real economy, which are incorporated in market data, were not accounted in the regulatory exercise (Steffen, 2014).

Ferri and Pesic (2015) assess the market reaction to the process towards BU in Europe (especially referring to its first pillar, the SSM). They focused on four events associated with the ECB's CA. Considering banks' share prices as the response variable, their results suggested that market participants have only gradually appreciated the establishment of the central supervisor, showing an initial negative sentiment.

Sahin and de Haan (2016) explore the reaction of financial markets to the announcement of the exercise and the publication of its outcomes.[67] These authors found that share prices and Credit Default Swap (CDS) spreads of banks generally did not react to these events. Only when grouping banks per country was there some limited evidence of markets' responses. Covi and Ambrosini (2016), in examining the impact of the ECB's 2014 CA on the correlation between stock returns and CDS spreads, find evidence about the credibility, accuracy and effectiveness of the exercise.

Lazzari et al. (2016), in investigating the stock price reaction to the ECB's 2014 CA, conclude that the exercise conveyed limited valuable information to the market about banks' financial condition.[68] Moreover, they found evidence of negative abnormal returns in response to the announcement of the exercise results for almost all banks, independently from the benchmark employed to compute the abnormal returns. Market participants reacted to news of systematic nature, rather than idiosyncratic ones, becoming aware of a tougher and more costly banking supervisory approach (in turn reflected into higher regulatory cost/risk for banks' shareholders). Carboni et al. (2017) investigate the stock market reaction to the announcement and results' disclosure of the CA and find that the exercise achieved the purpose of increasing transparency. Also, they reported a negative and more pronounced market response of banks likely to be subject to the ECB, compared to that of smaller entities.

[67] The focus of the analysis is on two key dates: 23 October 2013 (announcement of the ECB's CA) and 26 October 2014 (publication of the results).

[68] The authors investigate the market reaction to the announcement related to the release of the CA results (26 October 2014).

The BRRD, which is the basis of the SRM and applies to all 28 EU Member States, represents one of the most important regulatory changes in Europe during the recent years (Constâncio, 2014). It marked the end of the culture of bail-out and the beginning of the culture of bail-in. The BRRD includes a minimum set of common rules and procedures for the recovery and resolution of European credit institutions and investment firms. In all resolution cases, as of 2016, the BRRD requires a bail-in of shareholders and bondholders equal to at least 8% of total liabilities of a given bank, including own funds.[69] Therefore, a bank's investors, instead of taxpayers, are supposed to bear the costs of bank failures.

Schäfer et al. (2016b) analyse the reactions of banks' CDS and stock prices to the announcement of a bail-in. More specifically, the authors consider five country cases plus the implementation of the SRM, as the bail-in relevant aspect of the BU in Europe.[70] They demonstrate that creditor bail-in events led to a rise in CDS spreads and to a consequent reduction in bail-out expectations across European banks. They document decreasing stock returns, although not as marked as for CDS premia, and also find evidence that the increase in CDS quotes is more pronounced for Global Systemically Important Banks (G-SIBs) and for institutions located in peripheral euro area countries (Greece, Ireland, Italy, Portugal and Spain - the so-called GIIPS countries). The market response to the implementation of the SRM is limited, although according to the authors the new regime reduces bail-out expectations substantially.

In a retrospective fashion, Conlon and Cotter (2015) investigate the implications of the single resolution framework for the euro area banks during the recent global financial crisis. Their findings indicate that large systemically important euro area credit institutions (those directly supervised by the ECB under the SSM)

[69] The debate on the bail-in of bank liabilities is based around two distinct concepts: (i) the Total Loss Absorbing Capacity (TLAC), issued by the Financial Stability Board (FSB); (ii) and the Minimum Requirement for Own Funds and Eligible Liabilities (MREL), set in conformity with the BRRD. Albeit both requirements are determined for pursuing the same overall objective, they present differences in terms of scope and features (Deutsche Bundesbank, 2016). For further details on the topic, see https://www.bundesbank.de/Redaktion/EN/Downloads/Publications/Monthly_Report_Articles/2016/2016_07_minimum_requirements_tlac_mrel.pdf?__blob=publicationFile.

[70] The five bail-in cases are related to (i) the Danish Amagerbanken; (ii) the Spanish Bankia; (iii) the Dutch SNS Reaal; (iv) the Cyprus case; and (v) the Portuguese Banco Espirito Santo. All the cases occurred before the new European bail-in rules came into force in January 2016.

would have solely required equity write-downs in order to cover impairment losses (with no impact on deposits or long term debt). Nevertheless, to guarantee an adequate level of capitalization after the bail-in procedure, the majority of (large) listed banks would have required the conversion to equity for senior and subordinated debt. Depositors would not be affected in any of the considered cases. Furthermore, in analysing the resolution triggers, the authors document the implied difficulties in the identification of objective triggers.

This chapter presents an event study of the impact on financial markets of the implementation of the BU project. More specifically, the analysis examines the effect of the overall regulatory reform, as well as the associated individual announcements, on banks' share prices and CDS spreads. A further interest is also on the potential heterogeneity of the reactions across different types of banks. The time period spans from mid-2012 (corresponding to the peak of the euro area debt crisis) to November 2014, when the SSM becomes effective. The sample consists of European banks subjected to the ECB's 2014 CA for which both stock and CDS prices are available. In order to correctly interpret the effect of the main event of interest, i.e. the regulatory reform discussed over a period of around three years, it is fundamental to evaluate the informational content of each related sub-event. 17 key event dates, corresponding to the ECB's press releases on the project, are identified and among these, eight are associated with the CA, seven to the banking supervision and two to the new resolution regime.

The adoption of an event study framework, and more specifically of a regulatory event study, is not without challenges (Binder, 1985). First, the prolonged negotiating process between the involved parties can lead the outcome to be known before the assumed event date. Regulatory events typically involve multiple announcements rather than a single well-defined one and, compared to other types of announcements, are more likely to be anticipated. In order to deal with these potential issues and to correctly identify the relevant (information) events, the followed approach is of considering only official announcements (i.e. ECB press releases). Additionally, to better investigate the extent to which these events convey significant information to the financial markets, detailed research on the associated media coverage is performed.

Potential biases could arise from using the same set of event dates for all the firms, in turn belonging to the same industry. For this reason, to account for both cross-sectional correlation in the residuals and event clustering, the adjusted version of the Boehmer, Musumeci and Poulsen (BMP) test (1991), developed by Kolari and Pynnönen (2010), is employed. To test whether the Cumulative Average Abnormal Returns (CAARs) are statistically different from zero, a non-parametric t-statistic (i.e. the generalized sign test by Cowan, 1992) is also used in conjunction with the standard parametric one.

Beyond the analysis of how financial markets react to the establishment of the new European regulatory framework, this chapter's research questions also focus on understanding whether bank-specific factors can potentially amplify or mitigate these responses. A multivariate analysis, which employs various bank-level explanatory variables, is therefore conducted with the aim of explaining the cross-sectional variation in the Abnormal Returns (ARs), for both the stock and CDS markets.

From a theoretical point of view, this research can be positioned within the strand of academic and policy contributions which explore the establishment and implementation of the BU in Europe (among others, Elliot, 2012; Pisani-Ferry, 2012; Véron, 2012; Goyal, 2013; Herring, 2013; Dullien, 2014; Gros and Schoenmaker, 2014; Merler, 2014; Xafa, 2015).

Differently from recent empirical works, which exclusively focus either on the ECB's CA (Ferri and Pesic, 2015; Sahin and de Haan, 2016; Covi and Ambrosini, 2016; Carboni et al., 2017) or on the bail-in tool under the BRRD (Conlon and Cotter, 2014, 2015; Schäfer et al., 2016b), the empirical analysis performed in this work considers the entire journey towards BU and all its components. To some extent, it represents an extension of the work in Schäfer et al. (2016a) where the authors analyse the reactions of bank stock and CDS markets, in Europe and the US, following the main international regulatory changes during the period 2009-2011.

The univariate analysis demonstrates that the stock market did not anticipate the new regulatory reform. Banks located in Eurozone countries, both in core and peripheral economies, show a positive significant stock price reaction to the implementation of the new project at European level. Banks reported to have capital shortfalls under the ECB's 2014 CA ("GAP" banks) reveal the strongest reaction, albeit

not statistically significant. Share prices of credit institutions situated outside the Eurozone, alongside those of G-SIBs, negatively react to the regulatory changes. Nevertheless, these responses are relatively weak and statistically not significant.

When considering the reaction to the sub-events, the implementation of the supervisory element of the new institutional framework have a detrimental effect on banks' share prices. This may be motivated by the higher compliance costs associated with the tougher supervision. The market response to the sub-events related to the ECB's 2014 CA is positive and pronounced for all the sub-group of banks (especially for GAP banks), whereas close to zero for the credit institutions located outside the euro area. The increased level of transparency, following the euro area financial health check, as well as the fact the several banks improved their capital position with consequent beneficial effects for the stability of the entire system, might explain this positive market response. The impact of the announcements about the new European resolution rules is negative on all banks' shares, with the GAP banks showing the strongest reaction.

While the sub-group of GAP banks is the most affected by the regulatory reform, the share prices of banks located in European but non-Eurozone countries reveal the most limited reaction. Contrary to the initial expectations of a more pronounced market reaction, share prices of G-SIBs do not show any significant reaction.

With regard to the bank CDS market, the evidence suggests that overall (i) market participants have anticipated the information content related to the news releases on the implementation of the BU project; and (ii) the new regulatory framework has been perceived as beneficial in lowering the level of bank riskiness, especially with regard to the most distressed groups of institutions.

The announcements associated with the new supervisory framework led to a general increase in banks' CDS prices, except for the sub-group of GAP institutions. The positive reactions, particularly pronounced for the sub-groups of banks located in core euro area economies and the G-SIBs, might depend on their impending

subjection to enhanced supervision.[71] Compared to the evidence found for the stock market, the market responses to the sub-events relating to the ECB's CA are of opposite direction, thus having a similar underlying implication. The impact of the announcements about the new resolution regime is overall of positive sign thereby reflecting rising CDS spreads. This indicates, from the investors' perspective, a potential increase in the perceived level of banks' debt riskiness as a consequence of the bail-in philosophy implied in the new European procedures for the resolution of struggling institutions. When considering the CDS market, the category of G-SIBs, which have been widely perceived to benefit from implicit government guarantees, demonstrates to significantly react to the implementation of the ambitious project of BU.

The results for the cross-sectional analysis of the cumulative abnormal returns (CARs) for the stock market reveal positive associations with capital levels and with the business model orientation. A higher level of capitalization, especially when captured by a non-risk based leverage measure, is associated with positive abnormal stock market reactions. The same consideration holds for the share prices of credit institutions with a business model more oriented to traditional lending activities. Bank specific factors characterizing the sub-sample of institutions reported to have capital shortfalls under the ECB's 2014 CA, are shown to influence the shareholders' reaction the most.

From the multivariate analysis related to the CDS market, it emerges that the degree of capitalization is positively associated with the level of G-SIBs' CDS spreads, but more generally has a negative association with the level of CDS spreads for the other bank groups. This evidence might support the idea that market investors perceive a higher riskiness linked to increasing levels of capital. For banks located in non-EMU countries and the G-SIBs, weak credit quality appears to be a relevant factor in explaining abnormal increases in CDS quoted spreads. Bank-level features associated with the sub-sample of systemically important banks demonstrate to play a significant role in determining the investors' reaction in the CDS market.

[71] For a detailed description of the additional capital and supervisory requirements applied to the G-SIBs, refer to https://www.bis.org/publ/bcbs255.pdf.

The remainder of the chapter is organized as follows. Section 3.2 briefly reviews the relevant literature on the event study methodology. Section 3.3 outlines the structure of an event study. Section 3.4 discusses the application of the event study methodology for cases of regulatory reforms. Section 3.5 outlines the hypotheses and Section 3.6 discusses the data and methodology. Section 3.7 presents the explanatory variables employed in the multivariate analysis. Section 3.8 reports the empirical results and Section 3.9 concludes the chapter.

3.2 The event study methodology: A brief literature review

The event study methodology (Campbell et al., 1997; MacKinlay, 1997) is a powerful research tool used to assess the financial impact of a specific event on the value of an asset. The utility of this type of method arises from the fact that, given rationality of the market agents, the effects of an event will be incorporated immediately in asset prices (MacKinlay, 1997). The event's economic effect can therefore be measured considering asset prices observed over a relatively short time horizon. These approaches provide a direct test of market efficiency. Systematically and persistent non-zero ARs are inconsistent with the hypothesis that asset prices adjust quickly to fully incorporate new information. Furthermore, the extent of "abnormal" performance at the time of an event offers a measure of the unanticipated impact of some event on the wealth of the firms' security holders.[72]

The use of event study methodology has become widespread over time mainly because of its general applicability and its relative ease of implementation (McWilliams and Siegel, 1997). In the field of accounting and finance, this method has been applied to a broad range of events both at firm-specific and market-wide levels. Examples include earnings announcements, mergers and acquisitions (M&As), issuance of new capital (debt or equity), and macroeconomic news releases. In other areas, such as law and economics, event studies are also employed to examine, for instance, the impact on the corporate's value of a change in the regulatory

[72] The event study methodology is used to gauge the impact of an event on various assets (e.g. equity, bonds, foreign exchange rates, implied volatility, etc.). When referring to wealth effects, the term "security" is commonly used.

environment. In the majority of the cases, the attention is on the event's impact on the price of a specific class of corporate securities, usually common equity.

Kothari and Warner (2009) seek to quantify the number of published event studies and found over 500 works in five major finance journals, over the period 1974-2000. Ball and Brown (1968) and Fama et al. (1969) are the pioneering works in the field, which introduced the methodology that is essentially still in use today. Ball and Brown (1968) produce evidence of a significant relationship between stock price movements and the information contained in accounting reports. Fama et al. (1969) analyse the effects of stock splits on stock prices after controlling for the effects of simultaneous dividend increases. By testing over 900 stock splits occurring during the period from 1956 to 1960, they obtain results supporting the informational efficiency of the stock market.[73] In the years following these pioneering studies, several adjustments of the basic methodology have been proposed, particularly with the aim of dealing with issues arising from the violations of the statistical assumptions adopted in the early works. It is, indeed, well established that the utility of this approach heavily depends on the validity of a number of rather restrictive assumptions (Brown and Warner, 1980, 1985).

3.3 Structure of an event study

Campbell et al. (1997) and MacKinlay (1997) provide a brief outline of the structure of an event study. It is possible to identify seven main steps related to: (i) event definition; (ii) selection criteria; (iii) normal and abnormal returns, (iv) the estimation procedure; (v) testing procedure; (vi) empirical results; and (vii) interpretation and conclusions.

[73] The concept of informational efficiency is pivotal in finance as it enables explanation of the reasons and modalities behind asset price changes in financial markets. The Efficient Market Hypothesis (EMH), associated with the idea of a "random walk", refers to the proposition that current stock prices fully reflect all available information about the value of the considered firm at any point in time. Therefore, there is no way for the investors to systematically outperform the market by using this set of information. Roberts (1967) distinguished among three specifications of market efficiency, on the basis of the underlying information set available to market agents: (i) weak form; (ii) semi strong form; and (iii) strong form. Markets are said to be weak form efficient if current stock prices reflect all historical information. The semi-strong form claims that current stock prices also incorporate all publicly available information. Lastly, a market is strong form efficient if current stock prices fully reflect all existing information, both public and private. The event study approach relies on the concept of semi strong market efficiency, in testing the speed of adjustment of prices to new information.

The initial step in conducting an event study is to define the event of interest, which likely should have a financial unanticipated impact providing new information to the market, and to determine the period over which the corporate's asset prices will be analysed (i.e. the event window). The event window consists of the day of the event, but in practice is often extended to multiple days, comprising at least the day of the event and the day after the event. This has the aim of accounting for slow market responses or in some cases (e.g. earnings announcement) for effects occurring after the stock market closes on the announcement day. It is common to set the event window to be longer than the period of interest, since this allows the consideration of periods (days) surrounding the central event. The pre-event and post-event days may also be of interest in the analysis. Lead effects in periods prior to the event day occur when market agents predict the event on the basis of assumptions or due to leakage of information. Lag effects occur when the market reaction is instead distributed over several days after the event day.

McWilliams and Siegel (1997) state that the choice of an event window exceeding the standard 2-day length should be justified in terms of uncertainty about the effect of the event and its occurrence. Moreover, due to the greater difficulty in controlling for confounding effects when longer windows are adopted, an event window should be as short as possible. In particular, "it should be long enough to capture the significant effect of the event, but short enough to exclude confounding effects" (McWilliams and Siegel, 1997, p. 636).[74] While considering pre-event days seems reasonable, testing for lag effects seems inconsistent with the EMH, which provides the basis for the use of the event study methodology.[75] DeBondt and Thaler (1985), however, demonstrate that market agents tend to "overreact" to unexpected and extreme events, thus producing effects on days after the event day.

The second step in an event study is to define the selection criteria for the inclusion of a given asset in the considered sample. Restrictions may arise from the data availability or the membership of a specific sector/industry. At this stage, prior

[74] In applying the event study methodology, it is critical to isolate the effect of the event under consideration from the effect of other events occurring during the event window (i.e. confounding effects).

[75] The EMH implies almost instantaneous adjustments in asset prices to the arrival of new information.

research tends to provide an overview of the features of the main sample (e.g. average market capitalization, industry affiliation), while also reporting any potential biases that could have been introduced through the sample selection. Sample size represents a potential issue since the test statistics adopted in the event study approach rely on normality assumptions associated with large samples. In cases of small samples, usually researchers use bootstrap techniques, which do not imply the normality assumptions that are required with large samples (McWilliams and Siegel, 1997). Furthermore, test statistics used in the event study framework tend to be quite sensitive to outliers and a small sample amplifies the effect of any security's return on the sample statistic. Therefore, the interpretation of significance can be problematic when dealing with small samples.

The assessment of the event's impact on the firm's value requires a measure of the AR ("central to any event study is the measurement of the abnormal return", Campbell et al., 1997, p. 150). For each firm (security) *i* in the sample, the return for time period *t* relative to the event is defined as:

Equation 3.1

$$R_{it} = K_{i,t} + e_{i,t}$$

where K_{it} is the normal return (i.e. expected return given a specific model of expected returns) and e_{it} is the abnormal or unexpected component of returns.[76] According to this return decomposition, the abnormal return (AR) is the difference between the actual *ex post* return and the predicted (normal) return, both of them measured over the event window, as illustrated in the Equation 3.2:

Equation 3.2

$$e_{i,t} = R_{i,t} - K_{i,t}$$

In an equivalent way, it is possible to define the AR (e_{it}) as the difference between the return conditional on the event and the predicted return unconditional on the event (Kothari and Warner, 2009). Therefore, the AR, over the relevant event

[76] Expected returns may be either logarithmic or arithmetic. Nevertheless, the logarithmic returns are commonly preferred (see Strong, 1992 and Corrado and Truong, 2008).

window, represents a direct measure of the unanticipated variation in security holder wealth due to the occurrence of the event.

In order to define the AR it is necessary to specify a model of normal returns. A security's price performance, indeed, can be labelled as "abnormal" only if compared to a certain benchmark (Brown and Warner, 1980). The most adopted approaches for modelling the normal returns are (i) the constant mean return model; and (ii) the market model. The first one implies that the mean return of a given asset is constant over time. The second one, an example of a one-factor model, assumes a linear relation between the market return and the asset return. Both are statistical approaches since they are based solely on statistical assumptions regarding the behaviour of security returns and do not rely on any economic restriction.[77]

The market model represents an improvement compared to the constant mean return model. This is because, by removing the component of return related to variation in the market's performance, the variance of the abnormal return is consequently reduced (allowing for a more accurate detection of the event's effects).[78] Compared to economic models, which rely on economic theory to specify causal relationships between the variables (in addition to statistical assumptions), a market model presents the desirable characteristic of simplicity. Economic models, conversely, tend to increase complexity without improving the predictive power. In the light of this, according to Campbell et al. (1997, p. 157), "there seems to be no good reason to use an economic model rather than a statistical model in an event study".

For statistical models, it is commonly assumed that asset returns are jointly multivariate normal and independently and identically distributed (i.i.d.) over time. A wide variety of normal performance return models has been adopted in event studies. Both the bias and accuracy of the normal return measure can vary across alternative

[77] The alternative main category of models for measuring normal returns is the one that groups the economic approaches. These approaches rely on theoretical assumptions related to the investors' behaviour and not only on statistical assumptions. Two common examples of economic models are the Capital Asset Pricing Model (CAPM) and the Arbitrage Pricing Theory (APT). For an exhaustive description of both statistical and economic models see MacKinlay (1997), Campbell et al. (1997), Brown and Warner (1985).

[78] The parameters of the market model, α and β, under general condition can be estimated through an Ordinary Least Squares (OLS) procedure (see MacKinlay, 1997).

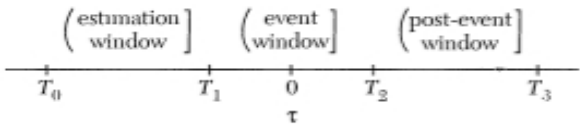
approaches, affecting the properties of the abnormal/unexpected return measures. Each model presents some drawbacks in dealing with the characteristics of the return data (e.g. non-normality, cross-correlation, heteroskedasticity), but besides these model-specific issues, as Fama (1991) states, all tests are joint tests. This poses an important challenge since all tests would be jointly a test of both the ARs and the selected model. Therefore, any AR tests could lead to misleading conclusions if the wrong model for generating the expected returns is specified.

A correct selection of the model helps in reducing the noise term and increasing the power of tests. Binder (1998) highlights different model mis-specification errors arising from the selection of a wrong model, such as omitted variable problem or inclusion of irrelevant variables. The choice of the most appropriate model is a crucial step in conducting an event study. Brown and Warner (1980) examine various methodologies used in event studies to measure security price performance and find that mean adjusted returns model, market adjusted returns model and market and risk adjusted returns model perform similarly. Nevertheless, in case of clustering, the mean adjusted returns model performs poorly compared to the other two methods. “Beyond a simple, one factor market model there is no evidence that more complicated methodologies convey any benefit” (Brown and Warner, 1980, p. 249). Other studies (Dyckman et al., 1984; Armitage, 1995; MacKinlay, 1997) report the superior performance of the market model over the other alternatives in most circumstances. Recently, Campbell et al. (2010), in considering event study articles on multi-country samples, highlight that relatively simple models are used for modelling normal returns (e.g. market adjusted returns model and the simple market model).

Once a normal return model is selected, it is necessary to define the estimation window. The estimation window is a time period, prior to the event window, over which the normal returns for each security are estimated. Usually the two windows (event and estimation) must not overlap in order to possibly ensure that the normal return model parameter estimates are not influenced by the returns around the event date. The length of the estimation window, as for the event window, can vary. According to Kothari and Warner (2009) long-horizon tests are more problematic than short-horizon tests, which instead are “relatively straightforward and trouble-free” (p. 9).

The time line of a typical event study is:

Figure 3.1 - Time line for an event study



Source: Campbell et al. (1997).

Supposing that the event occurs at $t = 0$, $t = T_1 + 1$ to $t = T_2$ represents the event window and $t = T_0 + 1$ to $t = T_1$ is the estimation window. The length of the estimation window is $L_1 = T_1 - T_0$, while $L_2 = T_2 - T_1$ is the length of the event window.

Once the ARs are measured, the next step in an event study framework is the testing procedure. In order to draw overall inferences about the considered event, it is firstly necessary to aggregate abnormal return observations. The aggregation is along two dimensions: (i) through time; and (ii) across securities.

In estimating the performance measure, for each security (firm), over any multi-period event window, it is necessary to define the concept of a Cumulative Abnormal Return (CAR). Given an event window spanning from t_1 to t_2, where $T_1 < t_1 \leq t_2 \leq T_2$ (see Figure 3.1) the CAR for a security *i* over the event window is:

Equation 3.3

$$CAR_i\,(t_1\,, t_2) = \sum_{t=t_1}^{t_2} AR_{i,t}$$

A standard assumption is that AR_i values are i.i.d. and therefore the CAR_i is a sum of *m* normally distributed variables. The distribution of the CAR under the null hypothesis $(H_0 : CAR = 0)$ that abnormal performance is equal to zero (thus that event has no influence on the returns' behaviour), is:

Equation 3.4

$$CAR_i\,(t_1\,, t_2) \sim N[0, \sigma_i^2\,(t_1, t_2)]$$

For *N* securities (firms), the cross-sectional mean (average) AR for any event day *t* is defined as:

Equation 3.5

$$AAR_t = \frac{1}{N}\sum_{i=1}^{N} AR_{i,t}$$

The sum of the average abnormal returns (AARs) over the event window from t_1 to t_2 gives the Cumulative Average Abnormal Return (CAAR), as defined in the following equation:

Equation 3.6

$$CAAR\ (t_1, t_2) = \sum_{t=t1}^{t2} AAR_t$$

That can be equivalently obtained by forming the CAR for each security and aggregating them through time, as follows:

Equation 3.7

$$CAAR\ (t_1, t_2) = \frac{1}{N}\sum_{i=1}^{N} CAR_i(t_1, t_2)$$

The related distribution under the null hypothesis of no abnormal performance is:

Equation 3.8

$$CAAR(t_1, t_2) \sim N\left[0, \sigma^2\left(CAAR(t_1, t_2)\right)\right]$$

The aim of testing the abnormal performance occurring over the event window is the detection of the event's significant impact on the value of the security. Based on the assumptions concerning the distribution of ARs, it is possible to use both parametric and non-parametric tests. Common parametric tests are the Patell (1976) test and the Boehmer et al. (1991) standardized cross-sectional test (BMP test), which accounts for potential event induced volatility. Commonly adopted non-parametric tests are the sign test and the rank test.

Following Kothari and Warner (2009), a standard test statistic is represented by the CAR divided by an estimate of its standard deviation.[79] The test statistic is defined as:

Equation 3.9

$$\theta = \frac{CAR(t_1, t_2)}{\sqrt{\sigma^2}(t_1, t_2)}$$

where $\sigma^2(t_1, t_2) = L\sigma^2(AR_t)$ represents the variance of the one-period mean AR. Under the null hypothesis of no abnormal performance, the test statistic (θ) is usually assumed unit normal.

After determining the significance of the ARs, the last step in conducting an event study is the analysis and interpretation of the results, with relative conclusions.

3.3.1 Parametric significance tests

Patell (1976) suggested a test statistic where the event window ARs (residuals) are standardized by the standard deviation of the estimation period's ARs. This approach reduces the impact on the test of securities with large return standard deviations. The test is based on the assumption of cross-sectional independence of the returns across security-events and on their normality. ARs are standardized as follows:

Equation 3.10

$$SAR_{i,t} = \frac{AR_{i,t}}{S_{ARi,t}}$$

for market-model ARs, $S_{ARi,t} = S_{ARi}\left[1 + \frac{1}{M_i} + \frac{(R_{m,t} - \bar{R}_m)^2}{\sum_{t=T_0}^{T_1}(R_{m,t} - \bar{R}_m)^2}\right]^{1/2}$

where $S_{ARi} = \sqrt{\frac{1}{M_1 - 1}\sum_{t=T_0}^{T_1}\left(AR_{i,t} - \overline{AR}_{i,t}\right)^2}$, M_i refers to the number of non-missing returns in the estimation period and $\bar{R}_m$is the mean of the market returns in the estimation period. In this way, the standard error is corrected by the forecast (prediction) error.

[79] Different approaches to estimate the standard deviation have been investigated in the literature (Campbell et al., 1997).

Patell's test statistic, for day *t*, is of the following form:

Equation 3.11

$$Z_t = \frac{1}{\sqrt{N}} \sum_{i=1}^{N} \sqrt{\frac{M_i - 4}{M_i - 2}} \frac{AR_{i,t}}{s_{i,t}}$$

Under the null hypothesis, if the standardized ARs are independent across security-events, the statistic converges to unit normal. Campbell and Wesley (1993) find that in the case of Nasdaq samples, due to the frequency of zero returns and the non-normality of the data, the Patell approach rejects too often a true null hypothesis. Maynes and Rumsey (1993), considering the less liquid portion of the Toronto Stock Exchange (TSE), highlight a similar misspecification of the test statistic. Cowan and Sergeant (1996) also demonstrate an over-rejection in Nasdaq samples in upper-tailed but not lower-tailed tests. Kolari and Pynnönen (2010) find evidence of Patell's test sensitivity to event-induced volatility and a tendency in over-rejecting the null hypothesis.

Boehmer et al. (1991) propose a standardized cross-sectional approach robust to event-induced volatility. The test statistic for day *t* is defined as:

Equation 3.12

$$Z_t = \frac{\left(\frac{N(T-2)}{T-4}\right)^{-1/2} \sum_{i=1}^{N} \frac{AR_{i,t}}{s_i}}{s_t}$$

where $s_t = \sqrt{[1/(N-1)] \sum_{i=1}^{N} \left(AR_{i,t} - \overline{AR}_t\right)^2}$ is the cross-sectional standard deviation of ARs on day *t* and $\overline{AR}_t$ is the mean portfolio AR on *t*.

Although standardized approaches by Patell (1976) and Boehmer et al. (1991) have been shown to outperform popular non-standardized tests in event studies, they rely on the assumption of cross-sectional independence of the residuals. This assumption is valid when the event date is not common to the companies and the companies do not belong to the same industry. The adoption of test statistics relying on independence between the returns undervalues the standard errors and leads to over-rejection of the null hypothesis of no event impact when true. Kolari and Pynnönen (2010) propose corrections to standard test statistics, the original Patell *t*-

statistic and the original BMP *t*-statistic, to account for potential cross-sectional correlation.

A correlation-adjusted Patell *t*-test is of the following form:

Equation 3.13

$$t_{AP} = \frac{t_p}{\sqrt{1 + (n-1)\bar{r}}}$$

where $\bar{r}$ is the average of the sample correlations of estimation period ARs and t_p is the original Patell *t*-statistic.

A correlation-adjusted BMP *t*-statistic is of the following form:

Equation 3.14

$$t_{AB} = t_B \sqrt{\frac{1 - \bar{r}}{1 + (n-1)\bar{r}}}$$

where t_B is the original BMP *t*-statistic. If the return correlations are zero, the adjusted *t*-statistic reduces to the original one.

3.3.2 Non-parametric significance tests

Examples of non-parametric tests for event studies, which do not imply any restrictive assumptions about the distribution of returns, are the sign test (Cowan, 1992) and the rank test (Corrado, 1989). Usually, non-parametric tests are adopted in conjunction with parametric tests in order to provide a check of the robustness of conclusions based on the standard significance tests.

The generalized sign test developed by Cowan (1992), which does not require symmetry of the AR distribution, compares the proportion of positive ARs in the event window to the proportion from a period unaffected by the event. The number expected is based on the fraction of positive ARs in the estimation period, defined as:

Equation 3.15

$$\hat{p} = \frac{1}{N} \sum_{i=1}^{N} \frac{1}{M_i} \sum_{t=T_0}^{T_1} s_{i,t}$$

where:

$$s_{i,t} = \begin{cases} 1 \; if \; AR_{i,t} > 0 \\ 0 \; otherwise \end{cases}$$

The test statistic uses the normal approximation to the binomial distribution with parameter $\hat{p}$. The generalized sign statistic is defined as:

Equation 3.16

$$Z_{GS} = \frac{w - n\hat{p}}{\sqrt{n\hat{p}(1-\hat{p})}}$$

where w is the number of stocks in the event window for which the CAR is positive.

The rank test developed by Corrado (1989) is based on the initial transformation of each security's ARs in ranks over the period including both the estimation window and the event window. As defined in Equation 3.17:

Equation 3.17

$$K_{i,t} = rank\left(AR_{i,t}\right)$$

The test compares the ranks in the event period for each security with the expected average rank under the null hypothesis of no abnormal performance. The test statistic for event day *t* is:

Equation 3.18

$$t_{Rank} = \left[\left(\frac{1}{N_t}\sum_{i=1}^{N_t} K_{i,t}\right) - \overline{K}\right] \Big/ s_k$$

where $\overline{K} = \frac{1}{N_t}\sum_{i=1}^{N_t} K_{i,t}$ is the expected rank and the standard deviation $s_k = \left\{\frac{1}{T}\sum_{t=1}^{T}\left[\frac{1}{N_t}\sum_{i=1}^{N_t}\left(K_{i,t} - \overline{K}\right)\right]^2\right\}^{1/2}$

3.4 Application of the event study methodology for cases of regulatory reform

The event study approach is well-suited to investigate the valuation effects of regulatory reforms. Event studies are suitable techniques for assessing the effects of regulations on the market (Sorokina et al., 2013). The analysis of the impact of changes in regulation, through event study methodology, has attracted extensive attention in economics and banking literature.

Dann and James (1982) explore the impact of changes in deposit rate regulation on the common stock values of US savings and loan institutions (S&Ls). Binder (1985) examines the ability of stock returns in grasping the impact of regulation when the timing of new information is uncertain. The author identifies three characteristics that make regulatory event studies more problematic than ordinary event studies. First, in many cases, the date on which expectations change is not exactly known. Differently from simple events (e.g. stock splits), regulatory events typically involve multiple announcements rather than a single well-defined announcement. Moreover, regulatory announcements, compared to corporate announcements, are more likely to be anticipated. Due to the extent of potential wealth transfers, the negotiation process between the involved parties (i.e. interest groups and politicians) is prolonged, thus, the outcome is potentially known before the time. Second, it is not clear *a priori* the sign of the impact of changes in the regulation: in the same industry some enterprises may gain value while others lose value. Lastly, differently from other events, regulatory changes often affect firms belonging to the same industry over the same temporal frame. Thus, in the presence of significant ARs, it is not easy to distinguish whether these are due to regulation or to some other industry-specific shock.[80]

Allen and Wilhelm (1988) analyse the capital market's reaction to the introduction of the 1980 Depository Institutions Deregulation and Monetary Control Act (DIDMCA) in the US banking sector. Slovin et al. (1990) evaluate the financial

[80] Stigler (1974), in considering collective actions in the US context, states that the interests of large companies differ sharply from those of small companies. Posner (1974) observes the presence of a potential asymmetry among the positions of an industry's participants. James (1983) finds that, as a consequence of deregulation in the US banking sector (i.e. removal of deposit rate ceilings), retail commercial banks lost value while wholesale banks gained value.

market's reaction to changes in reserve regulation for US banks. Eyssell and Arshadi (1990) investigate the impact of the 1988 Basel accord on a sample of large and publicly traded US banks. O'Hara and Shaw (1990) explore the effect on bank equity values of the US Comptroller of the Currency's decision of a "too big to fail" (TBTF) policy in 1984. Sundaram et al. (1992) assess the impact on the stock market of the Financial Institutions Reform, Recovery and Enforcement Act (FIRREA) of 1989. Wagster (1996) explores the impact of the first Basel accord (i.e. 1988 agreement) on the international banking system.

Fratianni and Marchionne (2009), for the US, Western Europe and Pacific region, examine the impact of government rescue interventions on banks' equity valuation during the global financial crisis. Veronesi and Zingales (2010) investigate the effect of the Paulson Plan on the value of US banks relative to the non-financial sector. Ueda and Weder di Mauro (2010) analyse the changes in the implicit government subsidy to large financial institutions in the US and in Europe considering both bail out (e.g. Bear Stearns case) and non-bail-out events (e.g. Lehman Brothers case). Bayazitova and Shivdasani (2012) examine the effects on US financial institutions of the government capital injections under the Troubled Asset Relief Program (TARP). Norden et al. (2013) investigate the impact on stock market performance of corporate borrowers arising from government interventions in the US banking industry. Horváth and Huizinga (2015) analyse the reaction in euro area financial markets to the announcement of the creation of the European Financial Stability Facility (EFSF) in 2010. Moenninghoff et al. (2015) explore the stock price reactions of large banks to the regulation on G-SIBs. Schäfer et al. (2016a) investigate the reactions of European and US financial markets to major regulatory reforms during the period from 2009 to 2011. Bruno et al. (2018) evaluate the stock market reactions of European banks to announcements regarding liquidity regulation under the Basel III framework.

3.5 Hypotheses

This section outlines the hypotheses on the potential impact of announcements related to the implementation of BU on both the bank stock and CDS markets.

3.5.1 Stock market reaction

A generally held view in economics, proposed by Stigler (1971), suggests that regulatory reforms provide opportunities to expropriate wealth from competitor groups (so-called "capture theory"). Peltzman (1976), in extending and formalizing Stigler's theory, states that the fundamental product, which is traded in the political market, is a transfer of wealth. Another prominent but opposing view, the "public-interest" hypothesis, is that regulation serves the public interest to enhance social welfare at the expense of the regulated industry (Needham, 1983).[81] It is plausible to conceive how this chapter's analysis would fit under this viewpoint, i.e. increasing the stability and the solvency of the European banking system would serve the public interest.

Influential work by Schwert (1981) argues that investors seek to identify regulation that may lead to increased asset prices while discouraging regulation that decreases asset prices. Therefore, they tend to sell the shares of firms for which regulatory changes are detrimental and buy the shares of firms that might benefit from these changes. In this sense, expectations are fundamental and play a crucial role in influencing investors' decisions. Changes in regulation might lead investors to modify their beliefs about expected returns, affecting their propensity in holding shares, e.g. bank equity in the context of this chapter. In the worst scenario, this could result into a general investors' aversion toward funding banks and this may have consequent systemic repercussions (Bruno et al., 2018).

The overall impact of the implementation of BU in Europe on bank shareholders is not clear *a priori*. An appreciation in stock prices may be expected if the new regulatory framework is perceived as influential in improving banks' stability without having negative impacts on their profitability. By lowering potential systemic

[81] When unanticipated changes in regulation occur, the capture theory would generally predict positive ARs, while the public interest theory would predict the opposite.

risk and contagion (which were notable features of the European sovereign debt crisis), the new regulation may entail positive shareholder wealth effects. Moreover, stock prices may also react positively due to perceived benefits of a convergence towards a common set of rules applied at the European level.

When considering the ECB's CA, which represented the entry point to the first pillar of BU (i.e. the SSM), a potential adverse market reaction may be expected due to the impact of the exercise on the banking sector's profitability. In this regard, additional capital associated with extra provisioning, as a consequence of the new asset valuation, may be expected to adversely impact banks' Return on Equity (ROE) and their stock prices (Schäfer et al., 2016a).[82] The underlying assumption would be that equity capital for banks would be perceived to be more expensive than debt, due to the tax deductibility of interest and the presence of implicit subsidies (Moenninghoff et al., 2015).[83] In this perspective, due to the potential increase in funding costs, the impact would be expected to be stronger for both the group of G-SIBs and that of credit institutions located in euro area troubled countries (GIIPS countries). The magnitude of the effect on stocks for banks found with capital gap during the ECB's assessment exercise (GAP banks) would be expected to depend both on the size of the capital shortfall and their capability in covering it.

Additionally, tougher but still not completely transparent new rules regarding the treatment of failing banks, could lead to a potential negative reaction in the stock market.[84]

Finally, the market response of institutions belonging to countries outside the euro area would be expected to be less pronounced than that of banks situated in Eurozone countries. Nevertheless, due to a potential competitive advantage, a neutral or positive market reaction would be expected.

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[82] A common definition of Non-Performing Exposure (NPE) was adopted by the ECB in conducting the AQR in 2014. The standard definition, provided by the EBA, includes "any obligations that are 90 days overdue, or that are impaired or in default" (ECB, 2014). For further details see https://www.bankingsupervision.europa.eu/banking/comprehensive/ html/ind ex.en.html.

[83] The topic related to public implicit guarantees was particularly significant before the BRRD came into force (1 January 2015) and the SRM was established at the European level.

[84] Differences in the implementation at national level of the BBRD, with respect to bail-in hierarchies, may increase uncertainty in the stock market (Mikosek, 2016). In this regard see, for instance, the late 2015 cases of the Portuguese Banco Novo and the four Italian regional banks (Banca Etruria, Banca Marche, CariFerrara and CariChieti). See Appendices 3.A and 3.B for further details.

3.5.2 CDS market reaction

Establishing a prior hypothesis for the anticipated direction of the CDS market reaction to the new regulatory regime appears more straightforward compared to that of the stock market. The general aim of the BU project of strengthening the euro-area banking sector may be perceived to reduce bank riskiness. The redistribution of the risk between taxpayers, depositors and debt-holders, as a result of the new bail-in rules, together with an enhanced market discipline may also contribute to a reduction of the overall risk in the system (Cœuré, 2013).[85] Thanks to the bail-in powers and to an increased transparency, funding costs would better reflect the banking risk enhancing the overall financial stability (IMF, 2014). Therefore, a decrease in banks' CDS spreads would be expected, given their inherent nature as risk indicators.

The bail-in mechanism for dealing with distressed banks, which refers to the re-capitalization of the institutions through the compulsory write-down of liabilities or the conversion of debt into equity, is an underlying feature of both the BRRD and the SRM (Conlon and Cotter, 2015). The bail-in basis spans from junior to senior unsecured debt and includes also uninsured customer deposits which exceed €100,000.[86] When considering the new bail-in philosophy, a reduction in bail-out expectations across banks would be expected with a consequent increase in credit risk premia. This would be in turn reflected in a rise in CDS spreads, due to an increased perception of banking default risk (Schäfer et al., 2016b).[87] This evidence contrasts with the *pre* bail-in period

[85] The removal of implicit guarantees should increase the effort of debt-holders in monitoring banks, therefore mitigating moral hazard issues. This, in turn, should reduce the CDS quotes (IMF, 2014).

[86] In case of bank resolution, the BRRD requires a bail-in of shareholders and bondholders equivalent to at least 8% of total liabilities, including own funds (Constâncio, 2014). "A bail-in applies to all liabilities not backed by assets or collateral, but not to deposits protected by a deposit guarantee scheme, short-term (inter-bank) lending or client assets" (Conlon and Cotter, 2014, p. 257). The bail-in sequence under the BRRD (Article 48) is the following:

- CET 1
- Additional Tier 1
- Tier 2
- Subordinated liabilities
- Other eligible instruments including senior unsecured debt or deposits not covered by a Deposit Guarantee Scheme (DGS).

[87] As a consequence of the increased level of risk, holders of bail-in liabilities may be expected to require, everything else being equal, a higher return.

(before January 2016), when bank bailouts were associated with decreasing bank CDS quoted spreads (King, 2009; BIS, 2009; Ejsing and Lemke, 2011).

Furthermore, different types of banks, as well as banks located in different countries, may be expected to demonstrate different price reactions to the selected events. G-SIBs, for instance, would be expected to experience a larger reduction in bailout expectations and, thus, a more pronounced CDS market reaction than smaller banks for events associated with the new resolution mechanism (Schäfer et al., 2016b). The new bail-in rules should in principle affect more those institutions that in the past would have most benefited from an implicit public subsidy. Also, within this category, it should impact the riskiest banks the most (Cœuré, 2013). A similar consideration would hold for banks located in peripheral countries, particularly affected by the sovereign debt crisis and characterized by high levels of public debt (GIIPS countries). CDS prices of institutions found with capital shortfalls (GAP banks) may be expected to react differently from those of non-GAP banks, particularly to announcements related to the new single supervision framework and ECB assessment exercise. Overall, similarly to the share prices, market reactions of banks located outside the euro area would be expected to be less strong than those of banks situated in Eurozone countries.

Table 3.1 summarizes the stated hypotheses regarding the expected financial market reactions to the selected events.

Table 3.1 - Expected impact on financial markets of the implementation of BU

Event	Expected impact on bank stock market		Expected impact on bank CDS market	
Implementation of BU	↑	Improvement of banking system stability	↑	Application of new bail-in rules
		Presence of convergence benefits		
	↓	Adverse impact on profitability	↓	Reduction of banking system riskiness
		Uncertainty about new rules		

3.6 Data and methodology

The following section provides a description of the sample, the selected event dates and the adopted methodology.

3.6.1 Sample selection

The sample comprises the European banks subjected to the ECB's 2014 CA. The original sample, consisting of 130 institutions, was reduced due to constraints on data availability. More specifically, the sample for the stock market analysis is of 50 banks from 19 countries, corresponding to those that were publicly listed and with liquid traded shares, while the credit market analysis is conducted on a sample of 33 credit institutions.[88] Table 3.2 provides an overview of the banks in the sample, also reporting the country of origin, market capitalization and total assets. Moreover, the table indicates whether the financial institution (i) participated in both the AQR and stress test; (ii) is falling under the direct supervision of the SSM; (iii) has CDS data available; (iv) is found with capital shortfalls during the ECB's CA; and (v) is classified as G-SIB.

For the stock market, unadjusted daily closing prices are considered. The reference currency is the Euro for all the stock prices, except for those related to institutions located in Denmark, Hungary, Norway, Poland, Sweden and UK. For these banks, price data are converted to Euros using relevant exchange rates. The data for banks located in the UK are further converted to Euro units as Datastream provides quotes in GBP pence.

For the credit market, daily CDS quotes on senior 5-year debt contracts are used, since these are (i) widely considered the most liquid ones; (ii) constitute the majority of the CDS market; and (iii) the most adopted in the standard practice in the academic literature (Jorion and Zhang, 2007; Eichengreen et al., 2012; Alter and Shuler, 2012; Aizenman et al., 2013; De Bruyckere et al., 2013; Horváth and Huizinga, 2015; Schäfer et al., 2016a). More specifically, the selected type is "CDS premium mid"

[88] The applied liquidity criterion, also valid for the CDS market, was to retain only the entities whose stock returns/spread changes were non-zero in over 50% of the observations. This led to the exclusion of two Cypriot banks and one bank from Malta. Another four banks (one each from Austria, Germany, Poland and Slovakia, respectively) were also excluded from the analysis, in a previous step, due to data inconsistency.

and with a modified-modified restructuring (MM) clause. The reference currency is the Euro for the entire sample of bank CDS contracts.

Data are obtained from Thomson Reuters Datastream for the period from 1 June 2011 to 30 November 2014. The data span a longer timeframe than the time around the considered announcements in order to estimate the expected returns to employ in the abnormal performance evaluation.

Table 3.2 - Data sample

						Comprehensive Assessment					
#	Bank Name	Country		Market Cap. *(mil €)*	Total Asset *(th €)*	AQR	Stress Test	SSM	CDS	Capital Gap	G-SIBs
1	ERSTE GROUP BANK AG	Austria	AT	10,887	199,157,127	✓	✓	✓	✓		
2	DEXIA SA	Belgium	BE	78	222,894,000	✓	✓	✓		✓	
3	KBC GROUP NV	Belgium	BE	17,200	239,825,000	✓	✓	✓	✓		
4	COMMERZBANK AG	Germany	DE	13,343	546,565,000	✓	✓	✓	✓		
5	DEUTSCHE BANK AG	Germany	DE	35,356	1,604,329,000	✓	✓	✓	✓		✓
6	DANSKE BANK A/S	Denmark	DK	16,818	432,421,212		✓		✓		
7	JYSKE BANK AS	Denmark	DK	2,795	35,118,232		✓				
8	SYDBANK A/S	Denmark	DK	1,433	19,812,412		✓				
9	BANCO BILBAO VIZCAYA ARGENTARIA SA	Spain	ES	51,773	570,993,000	✓	✓	✓	✓		
10	BANCO DE SABADELL SA	Spain	ES	7,606	157,225,009	✓	✓	✓	✓		
11	BANCO POPULAR ESPANOL SA	Spain	ES	8,316	144,708,741	✓	✓	✓	✓		
12	BANCO SANTANDER SA	Spain	ES	73,735	1,094,570,000	✓	✓	✓	✓		✓
13	BANKINTER SA	Spain	ES	4,466	55,003,362	✓	✓	✓	✓		
14	BNP PARIBAS	France	FR	70,499	1,792,578,000	✓	✓	✓	✓		✓
15	CREDIT AGRICOLE SA	France	FR	23,277	1,534,097,000	✓	✓	✓	✓		✓
16	SOCIETE GENERALE	France	FR	33,719	1,229,166,000	✓	✓	✓	✓		✓
17	ALPHA BANK	Greece	GR	6,892	70,908,579	✓	✓	✓	✓		
18	EUROBANK ERGASIAS SA	Greece	GR	3,024	74,523,000	✓	✓	✓		✓	
19	NATIONAL BANK OF GREECE SA	Greece	GR	9,228	108,521,000	✓	✓	✓	✓	✓	
20	OTP BANK	Hungary	HU	3,864	34,942,933		✓				
21	ALLIED IRISH BANK	Ireland	IE	58,381	113,906,000	✓	✓	✓			
22	GOV. COMP. BANK OF IRELAND	Ireland	IE	8,156	130,423,000	✓	✓	✓	✓		
23	BANCA CARIGE	Italy	IT	968	40,371,263	✓	✓	✓		✓	
24	BANCA MONTE DEI PASCHI	Italy	IT	2,049	194,936,183	✓	✓	✓	✓	✓	
25	BANCA PICCOLO CREDITO VALTELLINESE	Italy	IT	643	26,703,614	✓	✓			✓	
26	BANCA POPOLARE DELL'EMILIA ROMAGNA	Italy	IT	2,317	60,719,474	✓	✓	✓		✓	
27	BANCA POPOLARE DI MILANO	Italy	IT	1,453	48,506,477	✓	✓	✓	✓	✓	
28	BANCA POPOLARE DI SONDRIO	Italy	IT	1,291	32,461,096	✓	✓	✓		✓	
29	BANCO POPOLARE	Italy	IT	2,459	123,190,023	✓	✓	✓	✓	✓	
30	CREDITO EMILIANO	Italy	IT	1,933	31,345,948	✓	✓	✓			
31	INTESA SANPAOLO	Italy	IT	27,810	615,304,000	✓	✓	✓	✓		
32	MEDIOBANCA - BANCA DI CREDITO FINANZIARIO	Italy	IT	5,477	72,191,860	✓	✓	✓	✓		
33	UNICREDIT	Italy	IT	31,146	827,217,573	✓	✓	✓	✓		✓
34	UNIONE DI BANCHE ITALIANE	Italy	IT	4,451	121,960,688	✓	✓	✓	✓		
35	BANK OF VALLETTA	Malta	MT	795	7,187,753	✓	✓	✓			
36	ING GROUP	Netherlands	NL	38,787	1,079,244,000	✓	✓	✓	✓		✓
37	DNB NOR ASA	Norway	NO	21,139	285,681,000		✓		✓		
38	BANK BPH SA	Poland	PL	1,005	7,882,071		✓				
39	PKO BANK POLSKI	Poland	PL	11,851	47,779,363		✓				
40	BANCO BPI SA	Portugal	PT	1,690	42,182,295	✓	✓	✓		✓	
41	BANCO COMERCIAL PORTUGUES	Portugal	PT	3,279	79,825,628	✓	✓	✓	✓		
42	NOVA KREDITNA BANKA MARIBOR	Slovenia	SI	31	4,810,800	✓	✓	✓		✓	
43	VSEOBECNA UVEROVA BANKA	Slovakia	SK	296	11,514,528	✓	✓	✓			
44	NORDEA BANK AB	Sweden	SE	39,651	629,994,070		✓		✓		✓
45	SVENSKA HANDELSBANKEN AB	Sweden	SE	22,276	281,293,569		✓		✓		
46	SWEDBANK AB	Sweden	SE	23,151	205,686,439		✓		✓		
47	BARCLAYS	United Kingdom	UK	52,668	1,571,466,426		✓		✓		✓
48	HSBC HOLDINGS PLC	United Kingdom	UK	149,914	1,933,861,454		✓		✓		✓
49	LLOYDS BANKING GROUP	United Kingdom	UK	67,663	1,011,930,340		✓		✓		
50	ROYAL BANK OF SCOTLAND GROUP	United Kingdom	UK	25,207	1,231,250,063		✓		✓		✓

Description: The table shows the list of banks included in the sample and their country of origin. It reports figures on market capitalization and total assets as at 31/12/2013 (in line with the data used in the CA). It also indicates whether the financial institution (i) participated in both the AQR and stress test; (ii) is falling under the direct supervision of the SSM; (iii) has CDS data available; (iv) is found with capital shortfalls during the ECB's CA; and (v) is classified as G-SIB.

Note: Norway is the only non-EU country.

3.6.2 Sub-groups

The analysis is conducted both on the whole samples of share prices and CDS spreads and on bank sub-groups. The decision of considering different sub-samples is taken to capture the potential heterogeneity of reactions across different groups of banks. The first sub-sample consists of those credit institutions located in Eurozone countries ("EU_ERZ"). The second one comprises banks located in Eurozone peripheral countries ("GIIPS" countries). Then, institutions headquartered in core Eurozone countries ("CORE") are considered. The group of banks situated in European but non-Eurozone countries ("EU_NONERZ") represents the fourth sub-group, banks found with capital shortfall under the ECB's 2014 CA ("GAP") the fifth and Global Systemically Important Banks ("G-SIBs") the last one.[89] Table 3.3 illustrates the four sub-samples on the basis of the countries where banks are located.[90]

Table 3.3 - Sample countries: Classification into sub-groups

EU_ERZ	GIIPS	CORE	EU_NONERZ
Austria (AT)	Greece (GR)	Austria (AT)	Denmark (DK)
Belgium (BE)	Ireland (IE)	Belgium (BE)	Hungary (HU)
France (FR)	Italy (IT)	France (FR)	Poland (PL)
Germany (DE)	Portugal (PT)	Germany (DE)	Sweden (SE)
Greece (GR)	Spain (ES)	Netherlands (NL)	United Kingdom (UK)
Ireland (IE)			
Italy (IT)			
Malta (MT)			
Netherlands (NL)			
Portugal (PT)			
Slovakia (SK)			
Slovenia (SI)			
Spain (ES)			

[89] G-SIBs are those institutions considered too-systemically-to-fail (30 banks as of November 2017). They are subjected to a specific regulatory framework, which involves strengthened supervision, additional capital and a specific resolution scheme besides the general Basel III standards, which provide higher capital and liquidity requirements (Moenninghoff et al., 2015).

[90] Banks found with capital shortfalls under the ECB's 2014 CA ("GAP") and G-SIBs are identified in Table 3.1. The entire samples, for the analysis on both the stock and CDS market, will be subsequently labelled as "ALL".

3.6.3 Event dates

The initial set of event dates is defined by all the ECB press releases associated with the project of BU for the period from June 2012 to 4 November 2014 (i.e. the starting date for the SSM). The regulatory reform, which was discussed over a period of about three years and consists of several sub-events, represents the main event of interest. In this perspective, with the aim of correctly interpret the effect of the reform, it was therefore essential to assess the informational content of each intermediate step. The approach of considering only official announcements led to the identification of 25 event dates. On this set of announcements, a further selection was made to obtain a final list of 17 dates. More specifically, eight events are associated with the CA, seven to the banking supervision component and two to the new resolution mechanism. Additionally, to better investigate the extent to which these key-events conveyed relevant information to the financial markets, detailed research on the associated media coverage was performed.[91] The eight announcements that were removed, because of their minor relevance, were mainly related to the nomination of the Supervisory Board's members and its composition. The first selected event-date, i.e. 12 September 2012, corresponds to the first official ECB announcement on the SSM. Although, as for any regulatory change, informal discussion might have preceded the official communications, the approach followed in this chapter was to only consider the dates associated with the ECB's press releases. This *modus operandi* is in line with related works, such as Resti and Petrella (2013) and Carboni et al. (2017). Table 3.4 reports the selected event dates, spanning over three years, and a brief description for each of them.

[91] This search was conducted using the online Financial Times - EU edition and the websites of Reuters and Bloomberg.

Table 3.4 - Event dates

#	Date	Type	Description
1	12/09/12	Supervision	ECB welcomes Commission's proposal for a single supervisory mechanism
2	13/12/12	Supervision	ECB President Mario Draghi welcomes the agreement on the SSM
3	12/09/13	Supervision	ECB welcomes European Parliament vote to create single supervisory mechanism
4	23/10/13	Comprehensive Assessment	ECB starts comprehensive assessment in advance of supervisory role
5	08/11/13	Resolution	ECB publishes its opinion on the Single Resolution Mechanism (SRM)
6	03/02/14	Comprehensive Assessment	ECB makes progress with asset quality review, and confirms stress test parameters for comprehensive assessment
7	07/02/14	Supervision	ECB launches public consultation on draft ECB SSM Framework Regulation
8	11/03/14	Comprehensive Assessment	ECB publishes manual for asset quality review
9	20/03/14	Resolution	Statement of the ECB on SRM agreement
10	25/04/14	Supervision	ECB publishes SSM Framework Regulation
11	29/04/14	Comprehensive Assessment	ECB to give banks six to nine months to cover capital shortfalls following comprehensive assessment
12	17/07/14	Comprehensive Assessment	ECB publishes disclosure process for comprehensive assessment
13	08/08/14	Comprehensive Assessment	ECB publishes Comprehensive Assessment Stress Test Manual
14	04/09/14	Comprehensive Assessment	ECB publishes final list of significant credit institutions
15	27/10/14	Comprehensive Assessment	ECB's in-depth review shows banks need to take further action
16	30/10/14	Supervision	ECB publishes Regulation on supervisory fees
17	04/11/14	Supervision	ECB assumes responsibility for euro area banking supervision

Note: Since 26 October 2014, the date of publication of the CA outcomes, was a Sunday, the day considered as event date was the following trading day (27/10/2014).
Press releases on supervision matters and associated issues are usually published in the morning at 10:00 CET, although there is no stated fixed rule on the timing.
ECB's press releases can be found at https://www.ecb.europa.eu/press/pr/date/2016/html/index.en.html

3.6.4 Methodology

In order to investigate whether the implementation of the project of BU produced abnormal movements in the selected financial markets, a standard event study methodology is adopted as in Campbell et al. (1997). In the first step of the event study, the AR of a security is estimated as the difference between the actual (*ex post*) return and the expected (*ex ante*) return, over the selected event window.[92] Expected or normal return estimations are obtained through the market model specified as follow:

[92] ARs are relative to the stock market, whereas Abnormal Spreads is the terminology for the CDS market. In the remainder of the chapter, with a slight abuse of notation, also the coefficients for the analysis on the CDS market are denoted as CARs or CAARs.

Equation 3.19

$$R_{i,t} = \alpha_i + \beta_i R_{m,t} + \varepsilon_{i,t}$$ [93]

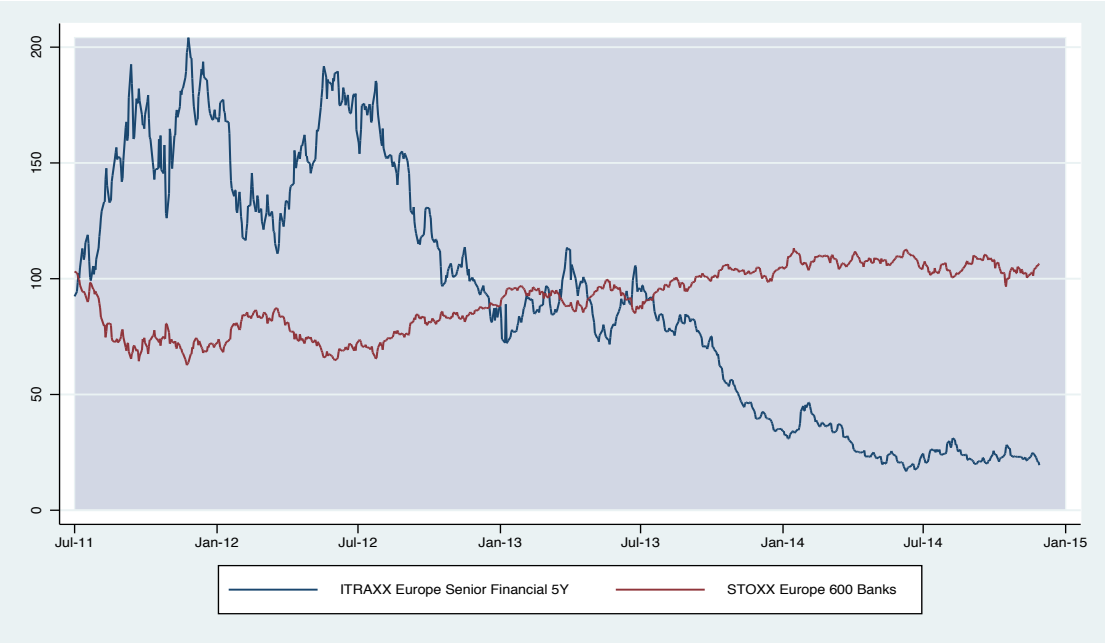
$$\text{with} \quad E\left[\varepsilon_{i,t}\right] = 0 \qquad VAR\left[\varepsilon_{i,t}\right] = \sigma^2$$

$R_{i,t}$ is the daily asset return of bank *i* at time *t*, $R_{m,t}$ is the market return and $\varepsilon_{i,t}$ is the zero mean error term. α_i, β_i and σ^2 are the parameters of the market model, estimated via the OLS method over the estimation window (Campbell et al., 1997). In case of stocks, log returns are computed, while with regards to the CDSs, absolute spread changes as in Hull et al. (2004) and Norden and Weber (2004) are calculated. As the proxy for the stock market portfolio, the *STOXX Europe 600 Banks Index* is employed (sourced from Datastream), whereas the *ITRAXX Europe Senior Financial 5Y Index* is adopted as the benchmark in the CDS analysis (sourced from Bloomberg).[94] Figure 3.2 shows the trends in the European stock and CDS markets for the time period considered in the analysis, from June 2011 to November 2014.

[93] The corresponding formula to measure the abnormal spread changes in the credit market is given by the following formula: $\Delta CDS_{i,t} = \alpha_i + \beta_i \Delta Index_t + \varepsilon_{i,t}$. This approach is consistent with many other researchers, e.g. Norden and Weber (2004), Morgan et al. (2014), Neretina et al. (2014), Sahin and de Haan (2016).

[94] The analysis is also conducted using a non-industry specific index, the *MSCI Europe Index*. Although a larger magnitude of the significant coefficients is found, general findings are not altered. Using a 1-day event window instead of a 3-day event window does not significantly affect the overall outcomes. For the stock market, coefficients are of the same direction, but generally less significant with evidence of reaction also for the category of G-SIBs. In contrast, for the CDS market results are overall more strongly statistically significant, especially when associated to supervision and resolution announcements (these results are not reported in the chapter).

Figure 3.2 - Trends in European financial markets: Stock and CDS indexes



Note: Base value June 2011 = 100
Source: EBA, own elaboration.

In the second step of the event study, the residuals or ARs are computed by subtracting the estimated values obtained in the first step (expected returns) from the actual values

Equation 3.20

$$AR_{i,t} = R_{i,t} - \left(\widehat{\alpha_i} - \hat{\beta}_i R_{m,t}\right)$$

The window for the estimation of the market model parameters, for both the stock prices and the CDS spreads, is of 255 trading days, from t −275 to t −20, where $t = 0$ was the event day (i.e. day of press release). The size of this estimation window is sufficient to perform an event study based on daily data (MacKinlay, 1997; Thompson, 1995). Negative ARs in stock prices indicate that the market value of the bank "abnormally" drops following an event, while positive ARs imply an increase in the market value (Moenninghoff et al., 2015). Negative abnormal changes in CDS spreads reflect a decrease in the market's perception on bank debt riskiness, while positive abnormal CDS spreads imply an increase in such a perception.

The ARs are successively aggregated over the relevant event window in order to obtain the CAR. The focus is on a symmetric three-day event window (-1, +1) to capture effects that can potentially occur after the market closes, as well as leakage

and lag effects. Employing a short event window mitigates the impact of potentially confounding effects, whose influence usually increases if an event window is wider.

Furthermore, cross-sectional measures of the AARs and CAARs, for both the event period and the pre-event period (-11, -2), are computed. To test whether AARs and the CAARs significantly differ from zero, various parametric and non-parametric tests are employed. More specifically, the following parametric tests are considered: (i) the cross-sectional standard *t*-statistic; (ii) the Patell test (1976); (iii) the BMP test (1991); and (iv) the adjusted versions of both the Patell and BMP tests, by Kolari and Pynnönen (2010). Regarding the non-parametric tests, the generalized sign test developed by Cowan (1992) and the Corrado rank test (1989) are employed.[95]

The univariate analysis is conducted with the aim of assessing both the overall impact of the regulatory event (i.e. implementation of BU) on financial markets and the effect of each single announcement associated with the project. A further interest is also on the heterogeneity of reactions across different types of banks.

In addition to the univariate analysis, a cross-sectional regression approach is also applied to investigate the relationship existing between the magnitude of abnormal performance and firm-specific characteristics (MacKinlay, 1997). [96] In the closely related literature, the estimated ARs for the selected sample of securities are usually employed as the dependent variable in a regression with firm-specific factors as regressors (Binder, 1998).

3.7 Explanatory variables in the multivariate analysis

Beyond the analysis of how financial markets reacted to the implementation of the new European regulatory framework, this chapter's research questions also focus on understanding whether bank-specific factors could potentially amplify or mitigate these responses. In the multivariate analysis, conducted with the aim of explaining the cross-sectional variation in the CARs (for both the stock and CDS markets), various bank-level explanatory variables are employed.

[95] In this chapter, for ease and clarity of presentation, only the CAARs were reported. Moreover, among the various significance tests that have been conducted, the presented results include only one parametric test (the adjusted version of the BMP test) and one non-parametric test (the generalized sign test). Again, this is in the interests of clarity and brevity.

[96] Refer to Section 3.7 for further details on the multivariate analysis.

Table 3.5 reports the set of explanatory variables considered in the regression analysis, as well as the dependent variable represented by the observed CARs over a 3-day event window. Except for the bank size indicator, which is measured as the natural logarithm of total assets (in millions of Euros), all the other variables are ratios. The latter are constructed from banks' balance sheet information, on annual basis, obtained from Bureau Van Dijk's BankScope database, for the period from 2012 to 2014. Solely for the CET1 ratio, data is gathered from SNL Financial.[97] The employed bank-level variables are common to both the analysis on the stock market and on the CDS market.

Table 3.5 – Bank-specific variables included in the multivariate analysis

Label	Variable	Indicator
CAR (-1,1)	Cumulative Abnormal Returns (%) (bps)	Dependent Variable
TIER1_RATIO	TIER 1 Capital to Risk-weighted Assets (%)	Capitalization
NPL	NPLs to Gross Loans (%)	Asset Quality
TOT_ASSET	Total Assets (Ln)	Size
ST_FUND	Deposit and Short Term Funding to Total Assets (%)	Funding Structure
CET1	Common Equity Tier 1 Ratio (%)	Capitalization
LOAN_TA	Net Loans to Total Assets (%)	Business Model
LEVERAGE_T	Total Assets to Total Equity - Ordinary measure (%)	Capitalization
LIQUID_ASS	Liquid Assets to Total Assets (%)	Liquidity
INTEREST	Interest Income to Average Earning Assets (%)	Profitability
NON_INTEREST	Non-Interest Income to Gross Revenues (%)	Diversification
RWA_TA	Risk-weighted Assets to Total Assets (%)	*Ex-ante* Risk Taking

Description: The table presents the entire set of bank-level explanatory variables considered in the multivariate analysis, as well as the dependent variable (CARs computed over a 3-day event window around each announcement). It reports the definition and the bank characteristic which is being captured.
Note: a basis point is one hundredth of a percent (0.01%).

[97] The CET1 is defined as the ratio of common equity capital to risk-weighted assets under the fourth Capital Requirements Directive (CRD IV), which came into effect on 1 January 2014. Under Basel III, CET1 capital must be at least 4.5% of risk-weighted assets all times.

Due attention is given to potential multicollinearity among explanatory variables. For this reason, the various capital explanatory variables (TIER1_RATIO, CET1 and LEVERAGE_T) are considered separately as alternatives. The same consideration applies for the business model proxy (LOAN_TA) and the liquidity indicator (LIQUID_ASS).[98]

Table 3.6 presents the pairwise correlation coefficients between the variables employed in the regression analysis.

Table 3.6 - Correlation matrix

Panel A - Stock market												
VARIABLES	CAR	TIER1	NPL	TA	ST_F	CET1	LOAN	LEV_T	LIQ	N_INT	RWA	INT
CAR (-1,1) %	1											
TIER1_RATIO	0.03	1										
NPL	0.02	-0.09 **	1									
TOT_ASSET	-0.01	-0.07 *	-0.38 ***	1								
ST_FUND	-0.01	-0.13 ***	0.45 ***	-0.51 ***	1							
CET1	0.01	0.78 ***	-0.21 ***	-0.02	0.00	1						
LOAN_TA	0.00	-0.13 ***	0.25 ***	-0.54 ***	0.35 ***	0.10 ***	1					
LEVERAGE_T	0.03	0.15 ***	0.28 ***	-0.47 ***	0.30 ***	0.05	0.36 ***	1				
LIQUID_ASS	-0.01	0.20 ***	-0.53 ***	0.45 ***	-0.38 ***	0.12 ***	-0.73 ***	-0.33 ***	1			
NON_INTEREST	-0.05	-0.15 ***	-0.23 ***	0.13 ***	-0.27 ***	0.04	-0.08 **	-0.30 ***	0.09 **	1		
RWA_TA	0.02	-0.35 ***	0.38 ***	-0.52 ***	0.40 ***	-0.33 ***	0.54 ***	0.68 ***	-0.58 ***	-0.22 ***	1	
INTEREST	0.01	-0.01	0.25 ***	-0.41 ***	0.30 ***	-0.01	0.37 ***	0.43 ***	-0.33 ***	-0.13 ***	0.45 ***	1

[98] Multicollinearity issues exist in a multiple regression model when two or more predictors (independent variables) are highly correlated. Pairs of variables showing a correlation coefficient above 0.7 should not normally be included in the same model specification (Farrar and Glauber, 1967; Tabachnick and Fidell, 2013). Although the correlation coefficient between TIER1_RATIO and LEVERAGE_T does not pose concerns in terms of potential multicollinearity, the variables are still considered separately as alternatives.

Panel B - CDS market													
CAR (-1,1)*bps*	1												
TIER1_RATIO	0.09 **	1											
NPL	0.09 **	-0.35 ***	1.00										
TOT_ASSET	0.08 *	0.19 ***	-0.41 ***	1.00									
ST_FUND	0.06	-0.15 ***	0.52 ***	-0.45 ***	1.00								
CET1	0.07 *	0.82 ***	-0.24 ***	-0.01	0.02	1.00							
LOAN_TA	-0.09 **	-0.12 **	0.37 ***	-0.69 ***	0.53 ***	0.15 ***	1.00						
LEVERAGE_T	0.04	-0.19 ***	0.31 ***	-0.25 ***	0.27 ***	-0.03	0.45 ***	1.00					
LIQUID_ASS	0.09 **	0.32 ***	-0.51 ***	0.58 ***	-0.53 ***	0.10 **	-0.83 ***	-0.54 ***	1.00				
NON_INTEREST	-0.17 ***	-0.17 ***	-0.18 ***	0.16 ***	-0.30 ***	-0.15 ***	-0.15 ***	-0.19 ***	0.04	1.00			
RWA_TA	-0.03	-0.47 ***	0.36 ***	-0.40 ***	0.24 ***	-0.41 ***	0.48 ***	0.77 ***	-0.63 ***	-0.07 *	1.00		
INTEREST	0.01	-0.32 ***	0.29 ***	-0.46 ***	0.48 ***	-0.12 ***	0.50 ***	0.44 ***	-0.54 ***	-0.47 ***	0.50 ***	1	

Description: The table shows the simple pairwise correlation coefficients between the variables, for both the stock and CDS markets. Sample period: 2012-2014.
Note: *** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level.

In order to deal with the presence of potential extreme data points (i.e. outliers), all bank-level explanatory variables, as well as the dependent variable, are winsorized at 1 per cent in each tail of the distribution.[99] The winsorization technique allows for setting the values of a certain variable, which are above or below a given cutoff, equal to the selected cutoff (Bali et al., 2016).[100] Extreme data points are, in this way, replaced by more plausible values. Differently from the truncation (elimination) of the extreme observations, the advantage of the winsorization procedure is of mitigating the influence on results of extreme values, while maintaining them in the sample.[101] Regarding the capital indicators, a value of zero is assigned to every negative observation.[102] This approach has permitted retaining the outlying values rather than changing them to acceptable values.

[99] The most commonly adopted methods to address the presence of outliers are winsorization and truncation (Leone et al., 2017). On the possibility of applying the winsorization procedure to the ARs see, among others, Cowan and Sergeant (2001), Mendenhall (2004) and Armour et al. (2010). Cowan and Sergeant (2001) demonstrate that, in the case of long-run ARs, the winsorization technique reduces biases arising from skewness and produces better specified test statistics (especially in small samples).
[100] The winsorization procedure is carried out by setting the values of a variable X that are in the top *h* percent of all values of X to the 100-*h*th percentile of X. In a similar way, values of X in the bottom *l* percent of X values are set to the *l*th percentile of X (Bali et al., 2016).
[101] An outlier can either be an error (e.g. measurement error, sampling error) or a genuine but extreme value (Ghosh and Vogt, 2012).
[102] An alternative approach could have been to omit these observations. See Bruno et al. (2018).

Table 3.7 and 3.8 report the descriptive statistics on the variables before and after the winsorization process, respectively.

Table 3.7 - Descriptive statistics: Before the winsorization

Panel A - Stock market							
VARIABLES	**Obs.**	**Min**	**Max**	**Mean**	**Std.Dev.**	**Kurtosis**	**Skewness**
CAR (-1,1)	850	-46.86	233.38	0.20	9.23	481.49	18.67
TIER1_RATIO	850	0.00	23.30	13.29	3.32	4.84	0.88
NPL	850	0.41	44.89	11.43	10.10	5.03	1.52
TOT_ASSET	850	8.38	14.59	11.98	1.59	2.24	-0.14
ST_FUND	850	35.26	92.49	62.27	13.26	2.04	0.04
CET1	850	0.00	21.20	12.42	2.94	5.30	0.33
LOAN_TA	850	19.35	77.95	54.69	13.93	3.13	-0.85
LEVERAGE_T	850	-3.77	16.03	6.67	2.86	4.88	0.83
LIQUID_ASS	850	3.93	42.95	16.90	9.55	2.43	0.51
NON_INTEREST	850	-328.34	176.15	37.28	30.21	82.79	-5.05
RWA_TA	850	15.49	86.34	45.30	15.68	2.72	0.25
INTEREST	850	1.33	14.15	3.39	1.58	15.00	2.77
Panel B - CDS market							
VARIABLES	**Obs.**	**Min**	**Max**	**Mean**	**Std.Dev.**	**Kurtosis**	**Skewness**
CAR (-1,1)	561	-92.93	199.43	-0.06	12.00	146.53	7.07
TIER1_RATIO	561	0.00	22.43	13.05	3.11	5.62	0.89
NPL	561	0.41	38.59	9.66	8.73	4.59	1.47
TOT_ASSET	561	10.33	14.59	12.74	1.25	1.83	-0.21
ST_FUND	561	37.01	92.49	58.43	11.34	2.88	0.40
CET1	561	7.21	21.01	12.28	2.52	6.30	1.62
LOAN_TA	561	19.35	74.69	51.97	15.05	2.50	-0.69
LEVERAGE_T	561	-3.77	11.31	5.96	2.00	5.11	0.18
LIQUID_ASS	561	3.93	42.95	18.53	9.65	2.32	0.33
NON_INTEREST	561	0.12	62.33	37.35	11.90	2.65	-0.38
RWA_TA	561	16.50	86.34	41.00	14.71	3.71	0.68
INTEREST	561	1.33	6.79	3.00	1.07	3.82	0.97

Description: The table reports the descriptive statistics on both the dependent variable and bank explanatory variables, before the winsorization at the 1st and 99th percentiles (for both the stock and CDS markets). Obs. refers to the number of observations. TOT_ASSET is the natural logarithm of total assets. Zero values are assigned to negative values of capital indicators. Sample period: 2012-2014.

Table 3.8 - Descriptive statistics: After the winsorization

Panel A - Stock market							
VARIABLES	Obs.	Min	Max	Mean	Std.Dev.	Kurtosis	Skewness
CAR (-1,1)	850	-14.58	12.35	0.01	3.60	7.17	-0.41
TIER1_RATIO	850	7.59	23.30	13.32	3.24	4.43	1.12
NPL	850	0.47	44.89	11.43	10.10	5.03	1.52
TOT_ASSET	850	8.38	14.59	11.98	1.59	2.24	-0.14
ST_FUND	850	37.01	88.45	62.25	13.21	2.01	0.03
CET1	850	5.09	21.01	12.46	2.83	4.05	0.75
LOAN_TA	850	19.63	74.69	54.68	13.91	3.13	-0.86
LEVERAGE_T	850	1.27	16.03	6.70	2.79	4.55	1.08
LIQUID_ASS	850	3.93	40.83	16.90	9.53	2.39	0.50
NON_INTEREST	850	0.12	176.15	38.62	20.37	29.87	4.17
RWA_TA	850	17.06	83.37	45.29	15.64	2.69	0.24
INTEREST	850	1.36	10.49	3.38	1.50	11.21	2.33
Panel B - CDS market							
VARIABLES	Obs.	Min	Max	Mean	Std.Dev.	Kurtosis	Skewness
CAR (-1,1)	561	-32.66	16.11	-0.31	6.71	10.11	-1.75
TIER1_RATIO	561	7.38	22.43	13.08	3.00	4.95	1.28
NPL	561	0.47	38.59	9.66	8.73	4.59	1.47
TOT_ASSET	561	10.46	14.59	12.74	1.25	1.82	-0.21
ST_FUND	561	37.01	88.45	58.42	11.30	2.81	0.38
CET1	561	8.38	21.01	12.29	2.51	6.34	1.66
LOAN_TA	561	19.63	74.04	51.96	15.04	2.49	-0.69
LEVERAGE_T	561	2.68	11.27	5.99	1.90	3.39	0.74
LIQUID_ASS	561	3.93	40.83	18.51	9.62	2.28	0.31
NON_INTEREST	561	7.76	60.40	37.37	11.80	2.48	-0.34
RWA_TA	561	17.06	83.37	40.99	14.66	3.64	0.66
INTEREST	561	1.35	5.85	2.99	1.06	3.50	0.89

Description: The table reports the descriptive statistics on both the dependent variable and bank explanatory variables, after the winsorization at the 1st and 99th percentiles. Obs. refers to the number of observations. TOT_ASSET is the natural logarithm of total assets. Sample period: 2012-2014.

3.7.1 The influence of bank-specific features on financial markets' reactions

The reactions of financial markets to the various components and intermediate steps of the BU might be affected by differences in bank-specific characteristics. This sub-section outlines prior views on how such influences might be revealed.

Better-capitalized banks with higher capital ratios, which are perceived as safer and holding sufficient capital, are expected to experience a neutral or positive stock market reaction to the new regulatory framework. Nevertheless, differences in the results may emerge if considering leverage (equity to assets ratio) rather than risk-weighted capital ratios (TIER1 ratio and CET1 ratio). Acharya and Steffen (2014) argue that the amount of bank capital shortfall found under the ECB's 2014 assessment exercise was in reality around twenty times larger than reported. In their view, that underestimation was due to the adoption of inadequate measures of banks' capital

ratios. They pointed out that the standards used by the ECB could have generated misleading results because they were based on regulatory risk-weights. In some cases, low risk-weights were assigned to some asset classes, thus resulting in an insufficient amount of capital held to cover them (sovereign bonds, with zero risk-weights, represent a crucial example in this respect).[103] In analysing the vulnerability of the credit institutions directly supervised by the ECB, Mody and Wolff (2015) also focused on a non-risk based leverage measure since they considered this approach more reliable in gauging banks' financial conditions. They emphasised the existence of wide differences between leverage and risk-weighted bank capital ratios, while identifying that banks (even those able to meet the minimum regulatory requirements) might show vulnerability to changes in the economic environment and sentiment.

With regard to the CDS premiums, the core function of banking capital in absorbing unexpected losses and preventing potential insolvency should be considered. Well-capitalized banks, with their associated lower probability of default, are expected to demonstrate less abnormal CDS performance than those which are less capitalized (Chiaramonte and Casu, 2013).[104]

Alongside capital holdings, bank liquidity represents a crucial and complementary element in promoting the resilience and soundness of the banking sector. "A bank unable to roll over maturing debt can fail despite being solvent" (Ratnovski, 2013, p.2). Neutral or positive stock price reactions, in response to the implementation of the BU, are expected for more liquid banks, since they are perceived safer compared to less liquid institutions. When considering the bank CDS market, more liquid institutions are expected to reveal a smaller reaction than less liquid ones.

Share prices of credit institutions characterized by high levels of Non-Performing Loans (NPLs) are expected to negatively react to the establishment of the new European regulatory framework. The presence of high NPLs on a bank's balance sheet adversely impacts bank profitability because increased provisions are required,

[103] See, among others, Popov and Van Horen (2013) and Bonner (2016).
[104] Among the different types of regulatory capital, the CET1, which is mostly in the form of common equity, represents the highest quality capital with the highest loss-absorbing capacity (IMF, 2013).

which in turn lower bank net income.[105] Moreover, NPLs do not produce income flows comparable to other performing assets. Impaired assets might also constrain significant amounts of capital due to the associated higher risk-weights. Deterioration in asset quality also increases banks' funding costs (due to lower expected revenue flows) thus increasing investors' risk perception. NPLs for European banks were estimated to be about €1tn in June 2015, equivalent to 7.3 per cent of the EU's GDP (EBA, 2015).[106] Large amounts of NPLs on banks' books are the result of the global financial crisis, the following sovereign debt crisis and a prolonged period of recession. Stocks of NPLs differ across countries, with the highest volumes in southern distressed euro area countries (Aiyar et al., 2015). The share of NPLs on banks' balance sheets is expected to have a negative and sizeable influence on the CDS market response to the implementation of BU.

Larger credit institutions pose a greater risk at the systemic level and are a substantial target group for the new regulatory regime. These banks are expected to demonstrate a negative stock market reaction to the implementation of BU, while having an abnormal increase in their quoted CDS premia.

Shares prices of banks characterized by sufficiently stable funding sources (thus having a reduced level of maturity mismatch) are expected to react less than those of institutions with more volatile funding structures. A higher reliance on short-term liabilities is harmful for banks' stability (IMF, 2013).[107]

Similarly, banks more oriented to traditional intermediation, with an adequate level of asset diversification and with less risk appetite, are expected to demonstrate relatively benign stock market reactions compared with riskier institutions. For the latter, a more pronounced abnormal increase in CDS premia is expected.

Lastly, in response to the implementation of the BU project, banks able to generate and/or maintain greater profitability are expected to reveal positive ARs in the stock market and smaller abnormal performance in the CDS market compared to less profitable institutions.

[105] Large stocks of NPLs on banks' books also hamper their capability in providing new lending to the real economy (Angeloni, 2016).
[106] See http://www.eba.europa.eu/risk-analysis-and-data/risk-assessment-reports.
[107] For a detailed overview on different bank's funding sources and the recent developments in funding structures, see https://www.imf.org/External/Pubs/FT/GFSR/2013/02/pdf/c3.pdf.

3.7.2 Regression model

The baseline empirical model, adopted for the analysis on both the stock and CDS market, is represented by the following equation:

Equation 3.21

$$CAR_{i,t} = \alpha_0 + \beta_1(TIER1) + \beta_2(NPL) + \beta_3(TA) + \beta_4(ST\_F) + \beta_5(LOAN\_TA) + \beta_6(INT) + \beta_7(N\_INT) + \beta_8(RWA\_TA) + \gamma(EV) + \varepsilon_{i,t}$$

where $CAR_{i,t}$ is the CAR, calculated over a 3-day event window, of bank *i* in the event time t: (-1,+1). TIER1 is the ratio of tier1 capital to risk-weighted assets (proxy for capitalization). NPL is the ratio of non-performing loans to gross loans (proxy for asset quality). TA is the natural logarithm of total assets (proxy for bank size). ST_F is the ratio of deposits and short term funding to total assets (proxy for funding structure). LOAN_TA is the ratio of net loans to total assets (proxy for business model). INT is the ratio of interest income to average earning assets (proxy for profitability).[108] N_INT is the ratio of non-interest income to gross revenues (proxy for diversification). RWA_TA is the ratio of risk-weighted assets to total assets (proxy for *ex-ante* risk taking). EV is a vector of dummies for the 17 sub-events.

On panel-structured data, regressions with bank-specific fixed effects and cluster-robust standard errors are run for both the whole sample of banks, as well as the sub-groups. Standard errors are clustered at bank-year level. Simultaneously accounting for multiple dimensions in the dependence of the residuals, especially when dealing with panel data sets, seems to provide more robust results. [109]

[108] The Return on Asset (ROA) was originally selected as profitability indicator. In order to avoid potential distortions arising from cross-border differences in tax laws (ROA is a measure of after-tax rate of return), the ratio of interest income to average earning assets is, therefore, employed.

[109] According to different authors (e.g. Petersen, 2009, Cameron et al., 2011, Thompson, 2011) double-clustered standard errors (clustered by both company and time) significantly improve the accuracy of inferences for panel regressions in finance.

3.8 Empirical results

3.8.1 Univariate analysis

This section discusses how the establishment of the new European banking framework impacted on banks' share and CDS prices. It reports the results for both the whole sample and sub-groups. Furthermore, it distinguishes between the impact of the overall reform and that of each sub-event. The investigation includes both a parametric test (the adjusted version of the BMP test, which accounts for event clustering and event induced volatility) and a non-parametric test (the generalized sign test).

3.8.1.1 Stock market: Reaction to the overall reform

Table 3.9 presents the banks' CAARs for the entire set of announcements associated with the implementation of BU. It illustrates the figures for the entire sample of banks and sub-groups, for both the pre-event window (-11,-2) and the 3-day event window (-1,+1).

Table 3.9 - Stock market reaction to BU

Panel A		ALL		EU_ERZ		GIIPS		CORE	
		Pre-event (-11,-2)	*Event (-1,1)*	*Pre-event (-11,-2)*	*Event (-1,1)*	*Pre-event (-11,-2)*	*Event (-1,1)*	*Pre-event (-11,-2)*	*Event (-1,1)*
All events	Coefficient (CAAR)	0.4037 **	0.2022	0.5302 *	0.3089	0.6771	0.4862	-0.0719	0.0663
	p-value (adjBMP)	0.0278	0.4892	0.0738	0.5229	0.1426	0.5985	0.6234	0.3313
	Coefficient (CAAR)	0.4037	0.2022 **	0.5302 *	0.3089 ***	0.6771	0.4862 *	-0.0719	0.0663 **
	p-value (GENSIGN)	0.2863	0.0305	0.0892	0.0036	0.2935	0.0653	0.3613	0.0273

Panel B		EU_NONERZ		GAP		G-SIBS	
		Pre-event (-11,-2)	*Event (-1,1)*	*Pre-event (-11,-2)*	*Event (-1,1)*	*Pre-event (-11,-2)*	*Event (-1,1)*
All events	Coefficient (CAAR)	-0.0630	-0.0827	0.2887	0.9298	0.2937	-0.0046
	p-value (adjBMP)	0.7442	0.8320	0.2109	0.4221	0.3233	0.8728
	Coefficient (CAAR)	-0.0630	-0.0827	0.2887	0.9298	0.2937	-0.0046
	p-value (GENSIGN)	0.2348	0.5157	0.9200	0.2461	0.5850	0.9146

Description: The table reports the CAARs in the stock market (in %) in response to the implementation of BU. It shows CAARs for (i) the entire sample of banks (ALL); (ii) banks located in European Eurozone countries (EU_ERZ); (iii) banks located in Eurozone peripheral countries (GIIPS); (iv) banks located in core Eurozone countries (CORE); (v) European non-Eurozone countries (EU_NONERZ); (vi) banks identified as having capital shortfalls during the ECB's 2014 CA (GAP); and (vii) G-SIBS. Significance is tested according to the adjusted version of the BMP (1991) test by Kolari and Pynnönen (2010) and the generalized sign test developed by Cowan (1992).
Note: *** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level.

For the entire sample of banks, the pre-event CAAR is +0.40% and significant at the 5% level according to the adjusted BMP test, while the event window CAAR is +0.20% and significant at the 5% level when considering the non-parametric significance test.

For the group of banks located in Eurozone countries, the pre-event CAAR is +0.53% and significant at the 10% level according to both the significance tests. The event window CAAR is also positive +0.31% and highly significant only according to the generalized sign test.

Regarding the group of credit institutions located in Eurozone peripheral countries (GIIPS), both the pre-event and event CAAR are positive (+0.68% and +0.49%, respectively), but only the event period coefficient is significant, at the 10% level, if tested with the non-parametric significance test.

Considering the sub-group of banks located in the euro area core economies, the coefficients for both the pre-event and the event window are relatively small (-0.07% and +0.07%, respectively) and only the event CAAR, tested with the generalized sign test, results statistically significant (at the 5% level).

The sub-sample of banks located in European non-Eurozone countries reveals negative and relatively weak coefficients both for the pre-event and event window (-0.06% and -0.08%, respectively).

Banks reported to have capital shortfalls during the ECB's 2014 CA (GAP banks) show positive but insignificant CAAR for both the pre-event and event window (+0.29% and +0.93%, respectively).

Lastly, for the sub-group of G-SIBs the pre-event CAAR is positive (+0.29%), while the coefficient for the event period is nearly zero. None of them is statistically significant.

Taking into consideration the different length of the two windows, the sub-groups of banks located in Eurozone countries and in GIIPS economies, plus the sub-sample of GAP banks, reveal stronger coefficients in the event window than in the pre-event window. Moreover, the coefficients for the pre-event window are overall not statistically significant, which indicates that the market did not anticipate the regulatory reform immediately prior to announcements. Banks located in Eurozone countries, both in core and peripheral economies, demonstrate a positive significant

stock price reaction to the implementation announcements. GAP banks present the largest coefficient, albeit not significantly different from zero. Share prices of credit institutions situated outside the Eurozone, alongside those of systemically important banks, negatively reacted to the regulatory change. Nevertheless, the coefficients are relatively weak and not statistically significant.

3.8.1.2 Stock market: Reaction to the sub-events

Table 3.10 illustrates the banks' stock market reaction to the sub-events related to the BU project. For each of the 17 announcements it is indicated whether associated with (i) banking supervision; (ii) the resolution framework; or (iii) the ECB's CA. CAARs for the entire sample, as well as for the sub-groups, are reported.[110]

[110] Further evidence of the stock (CDS) market reaction to the European regulatory reform might be apparent from an examination of both the individual banks' abnormal returns (ARs), for each day in the event window, and the CARs. In line with previous literature (e.g. Horváth and Huizinga, 2015; Sahin and de Haan, 2016; Schäfer et al., 2016), and in the interests of brevity and clarity, the disaggregated results are not presented in the chapter.

Table 3.10 – Stock market reaction to BU by sub-event

Panel A						
#	Date		ALL	EU_ERZ	GIIPS	CORE
1	12/09/2012	Coefficient (CAAR)	0.3758	0.6212	0.9260	0.5929
	Supervision	p-value (adjBMP)	0.8168	0.9828	0.9731	0.8292
		p-value (GENSIGN)	0.7310	0.5758	0.6401	0.3519
2	13/12/2012	Coefficient (CAAR)	1.1538	1.7293	2.0081	1.3540
	Supervision	p-value (adjBMP)	0.1953	0.1226	0.0635 *	0.7843
		p-value (GENSIGN)	0.0083 ***	0.0022 ***	0.0089 ***	0.0938 *
3	12/09/2013	Coefficient (CAAR)	0.0512	0.3592	0.9097	-1.0826
	Supervision	p-value (adjBMP)	0.9556	0.5641	0.1493	0.1386
		p-value (GENSIGN)	0.8809	0.1438	0.0103 **	0.3439
4	23/10/2013	Coefficient (CAAR)	-0.1164	-0.9708	-1.5919	0.4986
	Comprehensive	p-value (adjBMP)	0.8527	0.4586	0.4290	0.3066
	Assessment	p-value (GENSIGN)	0.0677 *	0.6378	0.4546	0.0933 *
5	08/11/2013	Coefficient (CAAR)	-1.0969	-1.2879	-0.3981	0.8959
	Resolution	p-value (adjBMP)	0.2237	0.4179	0.3282	0.7091
		p-value (GENSIGN)	0.0665 *	0.0637 *	0.0195 **	0.7300
6	03/02/2014	Coefficient (CAAR)	-0.2380	-0.2867	0.5677	-2.9598
	Comprehensive	p-value (adjBMP)	0.8631	0.9862	0.7259	0.3858
	Assessment	p-value (GENSIGN)	0.2802	0.2154	0.3214	0.6059
7	07/02/2014	Coefficient (CAAR)	0.8571	0.9409	1.4381	-0.3570
	Supervision	p-value (adjBMP)	0.1497	0.1349	0.0408 **	0.6848
		p-value (GENSIGN)	0.1024	0.0577 *	0.0255 **	0.8485
8	11/03/2014	Coefficient (CAAR)	6.4376	9.5391	13.2723	2.7819
	Comprehensive	p-value (adjBMP)	0.4049	0.4564	0.5198 -	0.4849
	Assessment	p-value (GENSIGN)	0.0064 ***	0.0000 ***	0.0000 ***	0.2628
9	20/03/2014	Coefficient (CAAR)	-0.9411	-0.9599	-0.6281	-2.6017
	Resolution	p-value (adjBMP)	0.4179	0.6577	0.7220	0.7751
		p-value (GENSIGN)	0.2198	0.2927	0.3385	0.3978
10	25/04/2014	Coefficient (CAAR)	-1.5586	-1.8418	-1.8634	-1.5620
	Supervision	p-value (adjBMP)	0.0315 **	0.1168	0.3512	0.3192
		p-value (GENSIGN)	0.2351	0.3210	0.9936	0.1245
11	29/04/2014	Coefficient (CAAR)	-0.5886	-0.8789	-0.9439	-0.6966
	Comprehensive	p-value (adjBMP)	0.3692	0.3354	0.6005	0.5927
	Assessment	p-value (GENSIGN)	0.5698	0.6866	0.4172	0.9373
12	17/07/2014	Coefficient (CAAR)	-0.1172	0.0383	0.0172	0.0933
	Comprehensive	p-value (adjBMP)	0.8830	0.8770	0.9820	0.4347
	Assessment	p-value (GENSIGN)	0.6524	0.9063	0.8967	0.8875
13	08/08/2014	Coefficient (CAAR)	-0.0185	0.0082	-1.0527	1.4063
	Comprehensive	p-value (adjBMP)	0.9520	0.9653	0.1858	0.3205
	Assessment	p-value (GENSIGN)	0.8915	0.8846	0.1805	0.0685 *
14	04/09/2014	Coefficient (CAAR)	1.4763	2.2559	2.6704	1.0805
	Comprehensive	p-value (adjBMP)	0.1176	0.0098 ***	0.0515 *	0.2568
	Assessment	p-value (GENSIGN)	0.0037 ***	0.0000 ***	0.0001 ***	0.0830 *
15	27/10/2014	Coefficient (CAAR)	0.1297	0.1082	-0.7297	2.1446
	Comprehensive	p-value (adjBMP)	0.1000	0.1170	0.5322	0.0318 **
	Assessment	p-value (GENSIGN)	0.3949	0.0910 *	0.8188	0.0029 ***
16	30/10/2014	Coefficient (CAAR)	-2.6003	-4.4766	-6.3840	-1.1013
	Supervision	p-value (adjBMP)	0.1634	0.0006 ***	0.0016 ***	0.1874
		p-value (GENSIGN)	0.0237 **	0.0000 ***	0.0000 ***	0.1067
17	04/11/2014	Coefficient (CAAR)	0.2314	0.3536	0.0485	0.6397
	Supervision	p-value (adjBMP)	0.9955	0.9917	0.4950	0.0084 ***
		p-value (GENSIGN)	0.4137	0.5134	0.5134	0.0985 *

Panel B								
#	Date		EU_NONERZ		GAP		GSIBS	
1	12/09/2012	Coefficient (CAAR)	-0.2575		0.7496		-0.5933	
	Supervision	p-value (adjBMP)	0.1650		0.7052		0.3866	
		p-value (GENSIGN)	0.1895		0.9549		0.4131	
2	13/12/2012	Coefficient (CAAR)	-0.3531		2.6027		-0.3432	
	Supervision	p-value (adjBMP)	0.5928		0.2116		0.6273	
		p-value (GENSIGN)	0.8464		0.0196	**	0.6788	
3	12/09/2013	Coefficient (CAAR)	-0.6230		0.5868		-0.1845	
	Supervision	p-value (adjBMP)	0.1626		0.2279		0.6671	
		p-value (GENSIGN)	0.0634	*	0.6151		0.4051	
4	23/10/2013	Coefficient (CAAR)	1.7581		0.9711		0.4229	
	Comprehensive	p-value (adjBMP)	0.0049	***	0.6298		0.8311	
	Assessment	p-value (GENSIGN)	0.0116	**	0.4853		0.7388	
5	08/11/2013	Coefficient (CAAR)	-0.4621		-4.9087		0.0743	
	Resolution	p-value (adjBMP)	0.6691		0.2359		0.8101	
		p-value (GENSIGN)	0.8176		0.0625	*	0.7459	
6	03/02/2014	Coefficient (CAAR)	-0.0799		-0.4791		-0.6385	
	Comprehensive	p-value (adjBMP)	0.8440		0.6799		0.1113	
	Assessment	p-value (GENSIGN)	0.7343		0.5335		0.7857	
7	07/02/2014	Coefficient (CAAR)	0.7783		1.8064		-0.1261	
	Supervision	p-value (adjBMP)	0.5413		0.0220	**	0.4204	
		p-value (GENSIGN)	0.7425		0.0204	**	0.3803	
8	11/03/2014	Coefficient (CAAR)	-1.5864		26.1594		0.3080	
	Comprehensive	p-value (adjBMP)	0.0492	**	0.4468		0.9271	
	Assessment	p-value (GENSIGN)	0.0470	**	0.0005	***	0.7549	
9	20/03/2014	Coefficient (CAAR)	-1.0632		-2.6700		-0.1483	
	Resolution	p-value (adjBMP)	0.4800		0.2949		0.8652	
		p-value (GENSIGN)	0.3562		0.0969	*	0.7657	
10	25/04/2014	Coefficient (CAAR)	-0.9070		-1.9937		0.0551	
	Supervision	p-value (adjBMP)	0.3103		0.6735		0.7660	
		p-value (GENSIGN)	0.3427		0.6635		0.7459	
11	29/04/2014	Coefficient (CAAR)	0.0038		-0.2039		-0.2308	
	Comprehensive	p-value (adjBMP)	0.9552		0.9459		0.6365	
	Assessment	p-value (GENSIGN)	0.8601		0.7993		0.7477	
12	17/07/2014	Coefficient (CAAR)	-0.6020		-0.1645		0.2782	
	Comprehensive	p-value (adjBMP)	0.4122		0.6728		0.4147	
	Assessment	p-value (GENSIGN)	0.4259		0.9693		0.3322	
13	08/08/2014	Coefficient (CAAR)	-0.1367		-1.4383		-0.2924	
	Comprehensive	p-value (adjBMP)	0.7576		0.1573		0.3652	
	Assessment	p-value (GENSIGN)	0.8193		0.9675		0.3985	
14	04/09/2014	Coefficient (CAAR)	-0.3514		2.3670		0.3302	
	Comprehensive	p-value (adjBMP)	0.7253		0.0414	**	0.2924	
	Assessment	p-value (GENSIGN)	0.1449		0.0233	**	0.1248	
15	27/10/2014	Coefficient (CAAR)	0.0591		-1.1734		0.2519	
	Comprehensive	p-value (adjBMP)	0.8570		0.5873		0.6119	
	Assessment	p-value (GENSIGN)	0.1555		0.8276		0.7228	
16	30/10/2014	Coefficient (CAAR)	2.5211		-8.7877		0.4629	
	Supervision	p-value (adjBMP)	0.0001	***	0.0002	***	0.9455	
		p-value (GENSIGN)	0.0026	***	0.0022	***	0.1451	
17	04/11/2014	Coefficient (CAAR)	-0.1039		2.3829		0.2954	
	Supervision	p-value (adjBMP)	0.9221		0.4691		0.2982	
		p-value (GENSIGN)	0.8109		0.3592		0.3405	

Description: The table reports the CAARs in the stock market (in %) in response to the sub-events relating to the BU. It indicates if the event is related to supervision, resolution or CA. It shows CAARs for (i) the entire sample of banks (ALL); (ii) banks located in European Eurozone countries (EU_ERZ); (iii) banks located in Eurozone peripheral countries (GIIPS); (iv) banks located in core Eurozone countries (CORE); (v) European non-Eurozone countries (EU_NONERZ); (vi) banks identified as having capital shortfalls during the ECB's 2014 CA (GAP); and (vii) G-SIBS. Significance is tested according to the adjusted version of the BMP (1991) test by Kolari and Pynnönen (2010), and the generalized sign test developed by Cowan (1992).

Note: *** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level.

The entire sample of banks, at the aggregated level, shows negative CAARs across the 7 announcements related to the supervision regime (-1.49%), positive CAARs across the 8 announcements related to the CA (+6.96%) and negative CAARs across the two announcements related to the resolution framework (-2.04%). If one considers only the statistically significant coefficients, the corresponding figures become negative 3.01% (supervision – events 2, 10 and 16), +7.80% (CA – events 4, 8 and 14) and -1.10% (resolution – event 5).

The three sub-groups of banks located in (i) Eurozone countries; (ii) distressed peripheral countries; and (iii) core euro area economies, produce results with similar inferences, but with different coefficient magnitudes, compared to the corresponding findings for the full sample.

The first group (EU_ERZ) presents negative CAARs across the 7 announcements related to the supervision regime (-2.31%), positive CAARs across the 8 announcements related to the CA (+9.81%) and negative CAARs across the two announcements related to the resolution framework (-2.25%). When considering only the statistically significant values, the corresponding figures become -1.81% (supervision – events 2, 7 and 16), +11.90% (CA – events 8, 14 and 15) and -1.29% (resolution – event 5).

The second group (GIIPS) shows negative CAARs across the 7 announcements related to the supervision regime (-2.92%), positive CAARs across the 8 announcements related to the CA (+12.21%) and negative CAAR across the two announcements related to the resolution framework (-1.03%). When considering only the statistically significant values, the corresponding figures become -2.03% (supervision – events 2, 3, 7 and 16), +15.94% (CA – events 8 and 14) and -0.40% (resolution – event 5).

The third group (CORE) shows negative CAARs across the 7 announcements related to the supervision regime (-1.52%), positive CAARs across the 8 announcements related to the CA (+4.35%) and negative CAARs across the two announcements related to the resolution framework (-1.71%). When considering only the statistically significant values, the corresponding figures are +1.99% (supervision – events 2 and 17) and +5.13% (CA – events 4, 13, 14 and 15). The coefficients associated with the two resolution events are both insignificant.

The sub-group which includes banks located in European but non-Eurozone countries demonstrates a different trend compared to the previous cases. It shows positive CAARs (+1.05%) across the 7 announcements related to the supervision regime, small negative CAARs across the 8 announcements related to the CA (-0.94%) and negative CAARs across the two announcements related to the resolution framework (-1.53%). When considering only the statistically significant values, the corresponding figures are +1.90% (supervision – events 3 and 16) and +0.17% (CA – events 4 and 8). Also in this case, the coefficients associated with the two resolution events are both insignificant.

The group of banks reported to have capital shortfalls during the ECB's 2014 CA presents negative CAARs across the 7 announcements related to the supervision regime (-2.65%), high positive CAARs across the 8 announcements related to the CA (+26.04%) and negative CAARs across the two announcements related to the resolution framework (-7.58%). When considering only the statistically significant coefficients, the corresponding figures become -4.38% (supervision – events 2, 7 and 16) and +28.53% (CA – events 8 and 14). The aggregate coefficient for the two events related to the new resolution framework (event 5 and 9) remains the same since both the individual coefficients are statistically significant.

Lastly, G-SIBs demonstrate very small CAARs across all the 17 announcements. Moreover, none of them is statistically significant.

Table 3.11 summarises the above described figures for both the aggregate CAARs (Panel A) and the significant aggregate CAARs (Panel B).[111]

[111] Consistent with Moenninghoff et al. (2015), both the aggregate (Panel A, Table 3.11) and significant aggregate (Panel B, Table 3.11) coefficients are the outcomes of a simple aggregation across events of the same nature (i.e. "supervision", "Comprehensive Assessment", "resolution"). The intention is to provide a view of the overall market reactions associated with announcements on a common topic.

Table 3.11 - Aggregate CAARs

Panel A - Aggregate CAARs							
Type of event	**ALL**	**EU_ERZ**	**GIIPS**	**CORE**	**EU_NONERZ**	**GAP**	**GSIBS**
Supervision	**-1.49**	**-2.31**	**-2.92**	**-1.52**	**1.05**	**-2.65**	**-0.43**
Comprehensive Assessment	**6.96**	**9.81**	**12.21**	**4.35**	**-0.94**	**26.04**	**0.43**
Resolution	**-2.04**	**-2.25**	**-1.03**	**-1.71**	**-1.53**	**-7.58**	**-0.07**
Panel B - Significant aggregate CAARs							
Type of event	**ALL**	**EU_ERZ**	**GIIPS**	**CORE**	**EU_NONERZ**	**GAP**	**GSIBS**
Supervision	**-3.01**	**-1.81**	**-2.03**	**1.99**	**1.90**	**-4.38**	
Comprehensive Assessment	**7.80**	**11.90**	**15.94**	**5.13**	**0.17**	**28.53**	
Resolution	**-1.10**	**-1.29**	**-0.40**			**-7.58**	

Description: The table reports the aggregate CAARs in the stock market (in %) for the entire sample and the bank sub-groups. The event dates are grouped on the basis of their relevance in terms of (i) banking supervision; (ii) ECB's CA; and (iii) resolution framework (Panel A). Significant aggregate CAARs are reported in Panel B. Significance is tested according to the adjusted version of the BMP (1991) test by Kolari and Pynnönen (2010) and the generalized sign test developed by Cowan (1992).

Related to the new supervision framework, the announcements number 2 ("ECB President Mario Draghi welcomes the agreement on the SSM"), 7 ("ECB launches public consultation on draft ECB SSM Framework Regulation") and 16 ("ECB publishes Regulation on supervisory fees") demonstrate a stronger impact on banks' share prices. More specifically, all the banks, except for those located in European non-EMU countries and the G-SIBs, present positive CAARs following the sub-event 2. The strongest impact is on GAP banks' stock prices (+2.60%). The sub-event 7 has a positive effect on the share prices of all bank sub-groups, except for the institutions located in euro area core countries (-0.36%) and for the G-SIBs (-0.13%). Also in this case, the strongest impact is on GAP banks' stock (+1.81%). Lastly, share prices for all banks, except for those located in European non-Eurozone countries and the G-SIBs, strongly negatively react to the sub-event 16. The strongest effect is, again, on share prices of GAP banks (-8.79%).

With regard to the announcements about the ECB's 2014 CA, the sub-events 8 ("ECB publishes manual for asset quality review") and 14 ("ECB publishes final list of significant credit institutions") demonstrate a more pronounced impact on the wealth of banks' shareholders. Except for share prices of both the credit institutions located in European non-Eurozone countries and the G-SIBs, the impact of the sub-event 8 is

strongly positive for all the other banks, with the sub-group of GAP banks showing the strongest reaction (+26.16%). The stock market response to the sub-event 14 is also positive, with the exception of the same sub-groups, but with the stock prices of the banks located in EMU peripheral countries (GIIPS) showing the most pronounced reaction (+2.67%).

For the date associated with the publication of the results of the ECB's CA (sub-event number 15, "ECB's in-depth review shows banks need to take further action"), all the sub-groups demonstrate positive coefficients, except for the GAP banks and the institutions located in GIIPS economies. The abnormal reaction for the bank share prices in core countries (significant according to both the tests) might be motivated by the fact that the exercise did not highlight any capital gap for large banks located in France and Germany (Acharya and Steffen, 2014). The negative coefficients associated with the most troubled banks might instead depend on a strong sell-off experienced after the publication of the results (Covi and Ambrosini, 2016).

Finally, related to the new resolution regime, the sub-event 5 affects banks' share prices the most. The impact is negative for all bank sub-groups, except for the credit institutions located in core Eurozone economies and the G-SIBs, and the GAP banks, again, demonstrate the strongest reaction (-4.91%).

Summarizing the main findings, except for the sub-groups of banks located outside the EMU and in core Eurozone economies, the implementation of the new European regulatory framework, under the supervision angle, has negatively affected banks' share prices. This evidence might probably be due to the compliance costs associated with the tighter and more intrusive supervision. The market response to the sub-events connected to the ECB's assessment exercise was markedly positive for all the sub-groups of banks (+28.53% for GAP banks) and close to zero for the credit institutions located outside the euro area. The increased level of transparency, following the euro area financial health check, as well as the fact that several banks improved their capital position with consequent beneficial effects for the stability of the entire system, might explain the positive market response (Sahin and de Haan, 2016; Carboni et al., 2017). The impact of the two announcements about the new European resolution rules was negative on all banks' shares, with the GAP banks showing the strongest reaction.

While the sub-group of GAP banks was the most affected by the regulatory reform, the share prices of banks located in European but non-Eurozone countries showed the most limited reaction. Contrary to the initial expectations of a more pronounced stock market reaction, G-SIBs did not show any significant reaction.

3.5.1.1 CDS market: Reaction to the overall reform

Table 3.12 presents banks CDSs' CAARs for the whole set of announcements related to the establishment of the European BU. It illustrates the coefficients for both the pre-event window (-11,-2) and the 3-day event window (-1,+1). Furthermore, it reports the figures for the full sample of banks, as well as the sub-groups.

Table 3.12 - CDS market reaction to BU

Panel A

		ALL		EU_ERZ		GIIPS		CORE	
		Pre-event (-11,-2)	*Event (-1,1)*	*Pre-event (-11,-2)*	*Event (-1,1)*	*Pre-event (-11,-2)*	*Event (-1,1)*	*Pre-event (-11,-2)*	*Event (-1,1)*
All events	Coefficient (CAAR)	-2.9702	-0.0624	-3.6839	-0.1878	-5.4106	-0.2884	-0.7103	0.0548
	p-value (adjBMP)	0.5616	0.6707	0.6646	0.5073	0.8782	0.4382	0.4890	0.6593
	Coefficient (CAAR)	-2.9702 ***	-0.0624 *	-3.6839 ***	-0.1878 *	-5.4106 ***	-0.2884 **	-0.7103	0.0548
	p-value (GENSIGN)	0.0014	0.0656	0.0004	0.0612	0.0001	0.0166	0.2696	0.9228

Panel B

		EU_NONERZ		GAP		G-SIBS	
		Pre-event (-11,-2)	*Event (-1,1)*	*Pre-event (-11,-2)*	*Event (-1,1)*	*Pre-event (-11,-2)*	*Event (-1,1)*
All events	Coefficient (CAAR)	-0.7401	0.3293	-7.9874	-0.6185	-1.0598	0.3736
	p-value (adjBMP)	0.2391	0.6001	0.9106	0.2155	0.3601	0.7815
	Coefficient (CAAR)	-0.7401	0.3293	-7.9874 ***	-0.6185 **	-1.0598	0.3736
	p-value (GENSIGN)	0.7913	0.6625	0.0015	0.0122	0.9593	0.5247

Description: The table reports the CAARs in the CDS market (in bps) in response to the implementation of BU in Europe. It shows CAARs for (i) the entire sample of banks (ALL); (ii) banks located in European Eurozone countries (EU_ERZ); (iii) banks located in Eurozone peripheral countries (GIIPS); (iv) banks located in core Eurozone countries (CORE); (v) European non-Eurozone countries; (vi) banks identified as having capital shortfalls during the ECB's 2014 CA (GAP); and (vii) G-SIBSs. Significance is tested according to the adjusted version of the BMP (1991) test by Kolari and Pynnönen (2010) and the generalized sign test developed by Cowan (1992).
Note: *** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level.

Taking into consideration the different length of the two windows, the full sample alongside (i) the sub-group of banks located in Eurozone countries; (ii) those situated in GIIPS economies; and (iii) the sample of banks reported to have capital shortfalls during the ECB's 2014 assessment reveal stronger coefficients in the pre-

event window than in the event period. Moreover, for the same sub-samples, the (always negative) coefficients in the pre-event window are statistically significant, which indicates that market participants have anticipated the regulatory change announcements. The GAP banks, with a coefficient of -7.99 bps, demonstrate the most pronounced price decline (followed by the group of banks situated in GIIPS countries, with a coefficient of -5.41 bps). However, strong statistical significance (at the 1% level) is observed only when considering the generalized sign test (GENSIGN).

With regard to the event period, negative CAARs are documented for the entire sample, the sub-group of banks located in Eurozone countries, the institutions situated in peripheral euro area countries and the GAP banks. For the two last cases, the CAARs are -0.29 and -0.62 bps, respectively, and are significant at the 5% level (again, only when considering the non-parametric significance test).

From the analysis of the overall sample, it seems that (i) the CDS market participants have broadly overall anticipated the information content related to the news releases on the implementation of the BU project; and (ii) the new regulatory framework was perceived as beneficial in reducing the riskiness of bank debt, particularly regarding the most distressed institutions.

3.5.1.2 CDS market: Reaction to the sub-events

Table 3.13 presents the banks' CDS market reaction to the 17 announcements related to the implementation of the BU project. As in the corresponding analysis on the stock market, each sub-event is defined as being associated with (i) banking supervision; (ii) the resolution framework; or (iii) the ECB's CA. CAARs for the whole sample, as well as for the sub-groups, are reported.

Table 3.13 - CDS market reaction to BU by sub-event

Panel A						
#	Date		ALL	EU_ERZ	GIIPS	CORE
1	12/09/2012	Coefficient (CAAR)	1.1218	1.0816	-0.5050	6.6846
	Supervision	p-value (adjBMP)	0.7576	0.7232	0.4996	0.4263
		p-value (GENSIGN)	0.5887	0.8433	0.2878	0.0259 **
2	13/12/2012	Coefficient (CAAR)	-0.9244	-1.3123	-0.8395	-2.6558
	Supervision	p-value (adjBMP)	0.4691	0.3101	0.2877	0.4893
		p-value (GENSIGN)	0.6805	0.4382	0.8737	0.1565
3	12/09/2013	Coefficient (CAAR)	2.4811	2.9303	3.1363	2.2453
	Supervision	p-value (adjBMP)	0.4922	0.3570	0.3829	0.5808
		p-value (GENSIGN)	0.2023	0.0510 *	0.0723 *	0.5253
4	23/10/2013	Coefficient (CAAR)	2.0812	2.3810	2.8689	1.6607
	Comprehensive	p-value (adjBMP)	0.6271	0.6944	0.4213	0.8994
	Assessment	p-value (GENSIGN)	0.0004 ***	0.0126 **	0.1476	0.0391 **
5	08/11/2013	Coefficient (CAAR)	-3.2996	-4.1079	-5.0997	-2.6035
	Resolution	p-value (adjBMP)	0.3440	0.3527	0.4419	0.1095
		p-value (GENSIGN)	0.0000 ***	0.0015 ***	0.1083	0.0035 ***
6	03/02/2014	Coefficient (CAAR)	-0.0603	-0.0510	0.2502	-0.6889
	Comprehensive	p-value (adjBMP)	0.3876	0.3947	0.3168	0.6384
	Assessment	p-value (GENSIGN)	0.4957	0.7165	0.7412	0.1549
7	07/02/2014	Coefficient (CAAR)	-0.1411	-0.7376	-1.6866	0.7840
	Supervision	p-value (adjBMP)	0.7597	0.8986	0.9900	0.5504
		p-value (GENSIGN)	0.3018	0.6917	0.0250 **	0.0358 **
8	11/03/2014	Coefficient (CAAR)	0.0225	-0.1838	-0.3252	0.0274
	Comprehensive	p-value (adjBMP)	0.5965	0.7087	0.6922	0.8530
	Assessment	p-value (GENSIGN)	0.8132	0.9255	0.3861	0.4761
9	20/03/2014	Coefficient (CAAR)	6.2191	6.7649	7.1156	6.6713
	Resolution	p-value (adjBMP)	0.0050 ***	0.0138 **	0.0012 ***	0.0001 ***
		p-value (GENSIGN)	0.0000 ***	0.0000 ***	0.0013 ***	0.0045 ***
10	25/04/2014	Coefficient (CAAR)	-1.0031	-1.2679	-2.7451	1.7212
	Supervision	p-value (adjBMP)	0.9329	0.9249	0.7364	0.5437
		p-value (GENSIGN)	0.2423	0.3530	0.1526	0.4761
11	29/04/2014	Coefficient (CAAR)	-2.4313	-2.3463	-1.2230	-4.8654
	Comprehensive	p-value (adjBMP)	0.1445	0.2110	0.4062	0.0118 **
	Assessment	p-value (GENSIGN)	0.0003 ***	0.0033 ***	0.1583	0.0047 ***
12	17/07/2014	Coefficient (CAAR)	-1.4053	-1.3038	-1.3230	-1.3252
	Comprehensive	p-value (adjBMP)	0.3491	0.4677	0.3926	0.6437
	Assessment	p-value (GENSIGN)	0.0027 ***	0.0385 **	0.0920 *	0.3694
13	08/08/2014	Coefficient (CAAR)	-2.1117	-2.6084	-2.3432	-3.3149
	Comprehensive	p-value (adjBMP)	0.7897	0.6790	0.8483	0.7012
	Assessment	p-value (GENSIGN)	0.0010 ***	0.0012 ***	0.0298 **	0.0233 **
14	04/09/2014	Coefficient (CAAR)	0.6974	0.5283	1.0726	-0.6934
	Comprehensive	p-value (adjBMP)	0.6997	0.8424	0.7492	0.8505
	Assessment	p-value (GENSIGN)	0.8159	0.7265	0.9383	0.4114
15	27/10/2014	Coefficient (CAAR)	-3.2008	-3.8050	-4.8887	-2.0926
	Comprehensive	p-value (adjBMP)	0.3814	0.4077	0.3408	0.6439
	Assessment	p-value (GENSIGN)	0.0000 ***	0.0001 ***	0.0004 ***	0.1214
16	30/10/2014	Coefficient (CAAR)	2.9913	3.8121	4.9821	1.9728
	Supervision	p-value (adjBMP)	0.7029	0.7215	0.7462	0.7379
		p-value (GENSIGN)	0.1773	0.0841 *	0.2982	0.0502 *
17	04/11/2014	Coefficient (CAAR)	-2.0983	-2.9666	-3.3491	-2.5964
	Supervision	p-value (adjBMP)	0.7737	0.6994	0.7511	0.7234
		p-value (GENSIGN)	0.9713	0.7792	0.1279	0.2035

Panel B								
#	Date		EU_NONERZ		GAP		GSIBS	
1	12/09/2012	Coefficient (CAAR)	1.2473		10.2820		4.6398	
	Supervision	p-value (adjBMP)	0.9035		0.6424		0.6577	
		p-value (GENSIGN)	0.4540		0.5863		0.0312	**
2	13/12/2012	Coefficient (CAAR)	0.2878		0.9152		-1.8727	
	Supervision	p-value (adjBMP)	0.5544		0.4153		0.4379	
		p-value (GENSIGN)	0.5956		0.8929		0.1130	
3	12/09/2013	Coefficient (CAAR)	1.0773		4.5983		2.7447	
	Supervision	p-value (adjBMP)	0.8373		0.1974		0.6406	
		p-value (GENSIGN)	0.3971		0.3932		0.7495	
4	23/10/2013	Coefficient (CAAR)	1.1443		0.9089		2.9654	
	Comprehensive	p-value (adjBMP)	0.2278		0.6675		0.2141	
	Assessment	p-value (GENSIGN)	0.0063	***	0.4576		0.0008	***
5	08/11/2013	Coefficient (CAAR)	-0.7737		-8.3808		-1.7100	
	Resolution	p-value (adjBMP)	0.2722		0.2833		0.0849	*
		p-value (GENSIGN)	0.0039	***	0.1082		0.0010	***
6	03/02/2014	Coefficient (CAAR)	-0.0893		-1.0922		-0.3958	
	Comprehensive	p-value (adjBMP)	0.5126		0.8504		0.5167	
	Assessment	p-value (GENSIGN)	0.4590		0.9772		0.3576	
7	07/02/2014	Coefficient (CAAR)	1.7230		-6.7758		0.6986	
	Supervision	p-value (adjBMP)	0.1364		0.4686		0.6248	
		p-value (GENSIGN)	0.0054	***	0.0724	*	0.1363	
8	11/03/2014	Coefficient (CAAR)	0.6673		-0.0303		0.4485	
	Comprehensive	p-value (adjBMP)	0.4531		0.7033		0.8691	
	Assessment	p-value (GENSIGN)	0.5217		0.3099		0.7603	
9	20/03/2014	Coefficient (CAAR)	4.5135		7.5587		7.4345	
	Resolution	p-value (adjBMP)	0.0001	***	0.0125	**	0.0042	***
		p-value (GENSIGN)	0.0053	***	0.0783	*	0.0009	***
10	25/04/2014	Coefficient (CAAR)	-0.1756		-0.5065		0.9870	
	Supervision	p-value (adjBMP)	0.9786		0.8414		0.5423	
		p-value (GENSIGN)	0.4624		0.9280		0.3564	
11	29/04/2014	Coefficient (CAAR)	-2.6970		-0.9611		-4.7610	
	Comprehensive	p-value (adjBMP)	0.0558	*	0.4749		0.0116	**
	Assessment	p-value (GENSIGN)	0.0299	**	0.3156		0.0066	***
12	17/07/2014	Coefficient (CAAR)	-1.7225		-1.9853		-3.2398	
	Comprehensive	p-value (adjBMP)	0.0373	**	0.5601		0.1235	
	Assessment	p-value (GENSIGN)	0.0152	**	0.8580		0.0037	***
13	08/08/2014	Coefficient (CAAR)	-0.5597		-4.0469		-3.4918	
	Comprehensive	p-value (adjBMP)	0.8761		0.8827		0.3026	
	Assessment	p-value (GENSIGN)	0.3198		0.0427	**	0.0037	***
14	04/09/2014	Coefficient (CAAR)	1.2258		1.6133		-0.4369	
	Comprehensive	p-value (adjBMP)	0.4571		0.7921		0.9988	
	Assessment	p-value (GENSIGN)	0.2797		0.8961		0.2696	
15	27/10/2014	Coefficient (CAAR)	-1.3127		-8.3910		-0.7366	
	Comprehensive	p-value (adjBMP)	0.1852		0.2610		0.5488	
	Assessment	p-value (GENSIGN)	0.0150	**	0.0501	*	0.0216	**
16	30/10/2014	Coefficient (CAAR)	0.4265		9.4155		2.5274	
	Supervision	p-value (adjBMP)	0.6755		0.8707		0.3326	
		p-value (GENSIGN)	0.7633		0.9135		0.0119	**
17	04/11/2014	Coefficient (CAAR)	0.6151		-13.6363		0.5505	
	Supervision	p-value (adjBMP)	0.6008		0.4304		0.7388	
		p-value (GENSIGN)	0.6758		0.0538	*	0.1840	

Description: The table reports the CAARs in the CDS market (in bps) in response to the sub-events relating to the BU. It indicates whether the event is related to supervision, resolution or CA. It shows CAARs for (i) the entire sample of banks (ALL); (ii) banks located in European Eurozone countries (EU_ERZ); (iii) banks located in Eurozone peripheral countries (GIIPS); (iv) banks located in core Eurozone countries (CORE); (v) European non-Eurozone countries (EU_NONERZ); (vi) banks identified as having capital shortfalls during the ECB's 2014 CA (GAP); and (vii) G-SIBSs. Significance is tested according to the adjusted version of the BMP (1991) test by Kolari and Pynnönen (2010), and the generalized sign test developed by Cowan (1992).

Note: *** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level.

Considering only the statistically significant aggregate CAARs (Table 3.14, panel B), except for the full sample and the GAP banks, all sub-groups demonstrate positive CAARs across the 7 announcements related to the new supervision framework. The positive aggregate coefficients, which are particularly high for the sub-group of banks located in core euro area countries and for the G-SIBs, might be due to their impending subjection to enhanced supervision.[112] In contrast to the evidence found for the stock market, but potentially having the same underlying implication, negative aggregate CAARs are associated with the 8 sub-events relating to the ECB's CA.

Regarding the resolution sub-events (events 5 and 9), the aggregate significant CAARs are positive for all groups of banks. The negative (significant) CAARs associated with the first event, and offset by the high positive coefficients related to the second event, may be attributable to a still unclear and preliminary framework about the new bank resolution procedures at the European level. Indeed, while bank CDS spreads declined in reaction to the first announcement, sovereign CDS spreads strongly increased (particularly for GIIPS countries – Table 3.D.1 in the Appendix D). The latter evidence could imply that, at that time, the market perception of possible government bail-outs for European banks in distress was still strong.

The coefficients associated with announcement number 9 ("Statement of the ECB on SRM agreement"), considered as a milestone (Schäfer et al., 2016b), are positive and highly significant, according to both the parametric and non-parametric test, for each bank group considered in the analysis (Table 3.13). This evidence might highlight an increase in the perceived riskiness of banks' debt as a consequence of the bail-in philosophy implied in the new European bank resolution rules (i.e. reflected in higher CDS spreads). In line with Sahin and de Haan (2016), in the date relative to the publication of the results of the ECB's CA (sub-event number 15, "ECB's in-depth review shows banks need to take further action") all the sub-groups demonstrate negative CAARs.

[112] Among the 13 G-SIBs located in the EU, eight are in the euro area and six of them in the core euro area economies (BNP Paribas, BPCE, Crédit Agricole and Société Générale in France; Deutsche Bank in Germany; ING in Netherlands). See http://www.europarl.europa.eu/RegData/etudes/BRIE/2016/574406/IPOL_BRI(2016)574406_EN.pdf.

It is noteworthy that when considering the CDS market, the G-SIBs, which have been perceived to benefit from implicit government guarantees, also significantly react to the implementation of the BU project.

Table 3.14 - Aggregate CAARs

Panel A - Aggregate CAARs							
Type of event	**ALL**	**EU_ERZ**	**PIIGS**	**CORE**	**EU_NONERZ**	**GAP**	**GSIBS**
Supervision	**2.43**	**1.54**	**-1.01**	**8.16**	**5.20**	**4.29**	**10.28**
Comprehensive Assessment	**-6.41**	**-7.39**	**-5.91**	**-11.29**	**-3.34**	**-13.98**	**-9.65**
Resolution	**2.92**	**2.66**	**2.02**	**4.07**	**3.74**	**-0.82**	**5.72**
Panel B - Significant aggregate CAARs							
Type of event	**ALL**	**EU_ERZ**	**PIIGS**	**CORE**	**EU_NONERZ**	**GAP**	**GSIBS**
Supervision		**6.74**	**1.45**	**9.44**	**1.72**	**-20.41**	**7.17**
Comprehensive Assessment	**-7.07**	**-7.68**	**-8.55**	**-6.52**	**-4.59**	**-12.44**	**-9.26**
Resolution	**2.92**	**2.66**	**7.12**	**4.07**	**3.74**	**7.56**	**5.72**

Description: The table reports the aggregate CAARs in the CDS market (in bps) for the entire sample and the bank sub-groups. The event dates are grouped on the basis of their relevance in terms of (i) banking supervision; (ii) ECB's CA; and (iii) resolution framework (Panel A). Significant aggregate CAARs are reported in Panel B. Significance is tested according to the adjusted version of the BMP (1991) test by Kolari and Pynnönen (2010) and the generalized sign test developed by Cowan (1992).

3.8.2 Multivariate analysis

This section discusses the results of the baseline regression model (Equation 3.21) presented in Section 3.7.2.[113] Tables 3.15 and 3.16 contain the estimation results for the entire sample of banks, as well as for the sub-groups (for the stock and CDS markets, respectively).[114] The dependent variable is the bank CAR calculated over a 3-day event window. Robust standard errors control for clustering at the bank-year level.

3.8.2.1 Stock market

In the regression for the entire sample of banks, the TIER1_RATIO (a proxy for the level of capitalization) yields a positive coefficient of 0.200 that is statistically

[113] Equation 3.21 is estimated including event dates only and the first event (i.e. 12 September 2012) represents the base level.

[114] Regarding the analysis on the CDS market, due to a limited number of observations (below 120), the sub-groups of GAP banks and credit institutions located in core Eurozone countries were not considered.

significant at the 5% level. Also, in the case of institutions located in Eurozone countries (EU_ERZ), as well as for banks reported to have capital shortfalls (GAP banks), the coefficients are positive and highly significant (at the 1% and 5% levels, respectively). A higher level of capitalization is associated with positive abnormal performance in the stock market. This evidence is especially strong in the case of GAP banks, for which a one percentage point increase in the TIER1 ratio is associated with an (abnormal) increase in the share prices of around 2.5 percent. Similar results, although more statistically significant, are obtained also when considering an ordinary non-risk based leverage measure (i.e. the assets to equity ratio). The stock market reaction of banks located in Eurozone countries, except for those operating in core economies, is positively affected by their level of capitalization (on average significant at the 5% level). The same holds for banks with capital shortfalls. In contrast, the level of capitalization has a negative coefficient for both banks located outside the EMU countries and G-SIBs, which is statistically significant at the 5% level.[115] The outcomes obtained when using the CET1 ratio demonstrate a sign consistent with the other two cases, but overall they are not statistically significant (these results are not reported in the chapter).

The coefficient on the proxy variable for credit quality (NPL) is generally negative and insignificant, except for the GAP and the G-SIBs sub-groups for which it is positive and strongly significant. In the latter case this could be interpreted as a sign of positive sentiment by the market participants toward the credibility of the new regulatory framework.

The level of total assets (a proxy for bank size) appears to have a mixed impact on the stock market responses. The estimated coefficient is negative in the regressions for (i) the full sample; (ii) the sub-group of banks located in distressed peripheral countries; and (iii) the banks situated in non-Eurozone countries. Nevertheless, only in the latter case the coefficient (of -5.595) is significant (at the 5% level). For the remaining sub-groups, the coefficient is positive and, in the case of both GAP institutions and banks located in core euro area countries, marked and highly

[115] The estimated results for the regressions which include the ordinary leverage ratio, as a proxy for the level of capitalization, are reported in Table 3.C.1 in Appendix 3.C.

significant (33.85 and 36.71, respectively). This positive reaction might suggest a market perception of reduced potential systemic risk associated with the larger institutions.

The proxy for the funding structure, defined as the ratio of deposits and short term funding to total assets, is significant only for GAP banks. The positive coefficient of 0.873 is significant at the 1% level. In the other regressions, the relatively small coefficients have mixed signs yet are always statistically insignificant.

The net loans to total assets ratio, the proxy for the business model orientation, appears to be positively associated with banks' stock price reactions, having strongly significant coefficients in four cases out of seven. The largest coefficient (1.782), which is statistically significant at the 1% level, is obtained in the regression for the sub-group of banks located in Eurozone core countries. Share prices of banks with business models more orientated to traditional activities, since potentially less risky, positively react to the implementation of the new regulatory regime.

The profitability indicator, defined as the ratio of interest income to average earning assets, is generally positively related to the bank stock reactions. This confirms the hypothesis that more profitable banks were expected to reveal positive abnormal performance compared to less profitable ones. Nevertheless, the coefficient is only significant, at the 1% level, in the case of GAP banks. Unexpectedly, for institutions located outside the EMU countries, as well as for G-SIBs, the coefficient is negative and significant. For G-SIBs, the magnitude of the coefficient is noteworthy (-3.469).

The degree of diversification in banking activities, measured by the ratio of non-interest income to gross revenues, demonstrates a mixed association with banks' stock price reactions. It yields a positive coefficient for the whole sample and the two sub-groups of banks both located inside and outside the euro area, with statistical significance only in the latter case. For GAP banks and institutions situated in core Eurozone countries the coefficient is negative and significant at the 5% and 10% levels, respectively.

Lastly, the ratio of risk-weighted assets to total assets (the proxy for *ex-ante* risk taking) appears significant only in the regressions for banks located outside the

EMU and GAP banks. Furthermore, in both cases the coefficient has a negative sign (-0.087 and -0.180, respectively).

With regard to the sub event dates, the multivariate analysis reveals results which are in line with the findings of the univariate analysis. More specifically, the announcements numbered 8 ("ECB publishes manual for asset quality review"), 14 ("ECB publishes final list of significant credit institutions") and 16 ("ECB publishes Regulation on supervisory fees") affect bank stock prices the most. The two sub-event dates associated with the ECB's CA (number 8 and 14) obtain positive coefficients in all the regressions, except for those related to the sub-groups EU_NONERZ and G-SIBs. The coefficient for the sub event 16 is negative in all the regressions, except, again, for the sub-groups EU_NONERZ and G-SIBs. It is particularly pronounced for GAP banks (-8.313). This strong negative reaction of the stock market might be attributable to the higher compliance costs associated with a tougher and more intrusive supervisory regime (Nouy, 2014; Angeloni, 2015). At the bank level, fees are calculated based on the relevance and the risk profile of the supervised entity (ECB, 2014).[116] In this regard, it important to consider that markets' response to regulatory events depends on both the costs and benefits associated with the new proposed rules. Therefore, the interpretation of the reactions broadly relies on how markets evaluate these costs and benefits (Gao et al., 2018).

[116] For further details on supervisory fees, see http://eur-lex.europa.eu/legalcontent/EN/TXT/PDF/?uri=CELEX:32014R1163&from=EN.

Table 3.15 - Determinants of CARs (stock market)

VARIABLES	(1) model	(1) model	(1) model	(1) model	(1) model	(1) model	(1) model
	ALL	EU_ERZ	PIIGS	CORE	EU_NONERZ	GAP	GSIBS
TIER1_RATIO	0.200**	0.385***	0.311	-0.158	-0.088	2.517***	-0.034
	(0.098)	(0.146)	(0.257)	(0.405)	(0.073)	(0.670)	(0.150)
NPL	-0.077	-0.015	-0.063	-1.476**	-0.108	0.555***	0.667***
	(0.059)	(0.080)	(0.102)	(0.567)	(0.183)	(0.198)	(0.209)
TOT_ASSET	-2.735	0.502	-1.833	36.715***	-5.595**	33.855**	4.800
	(1.957)	(3.528)	(4.981)	(10.927)	(2.518)	(12.938)	(4.729)
ST_FUND	-0.054	-0.071	-0.087	0.067	0.053	0.873***	-0.075
	(0.036)	(0.046)	(0.063)	(0.158)	(0.055)	(0.294)	(0.067)
LOAN_TA	0.053	0.117	0.032	1.782***	0.209**	1.115***	0.595***
	(0.049)	(0.074)	(0.081)	(0.308)	(0.082)	(0.333)	(0.206)
INTEREST	0.319	0.765	0.496	2.250	-0.979*	3.952***	-3.469**
	(0.579)	(0.593)	(0.779)	(2.190)	(0.502)	(1.137)	(1.453)
NON_INTEREST	0.044*	0.033	-0.022	-0.143***	0.102***	-0.106**	-0.046
	(0.025)	(0.028)	(0.068)	(0.042)	(0.030)	(0.047)	(0.066)
RWA_TA	0.028	0.031	0.047	-0.084	-0.087**	-0.180**	-0.084
	(0.043)	(0.046)	(0.054)	(0.236)	(0.041)	(0.078)	(0.066)
2.event	1.211	1.755*	2.151	0.440	-0.096	4.069	-0.058
	(0.757)	(1.031)	(1.434)	(1.580)	(0.782)	(2.565)	(1.127)
3.event	-0.063	0.393	1.451	0.883	-1.450**	-0.783	-0.749
	(0.694)	(0.954)	(1.324)	(1.748)	(0.711)	(2.242)	(0.995)
4.event	0.121	-0.542	-0.374	2.304	0.931	-2.347	-0.367
	(0.675)	(0.872)	(1.193)	(1.479)	(0.826)	(2.486)	(1.283)
5.event	-0.851	-0.787	-0.468	2.973*	-1.289	-3.681	-0.572
	(0.710)	(0.969)	(1.195)	(1.460)	(0.803)	(2.549)	(0.969)
6.event	-0.257	0.063	0.501	-0.059	-0.440	0.520	-0.950
	(0.619)	(0.846)	(1.230)	(1.229)	(0.694)	(2.847)	(0.867)
7.event	0.730	0.921	1.844	-0.058	1.062	2.126	-0.298
	(0.613)	(0.787)	(1.109)	(1.057)	(0.998)	(2.784)	(0.819)
8.event	1.466*	2.755**	4.694***	0.340	-1.225	6.127*	-0.215
	(0.870)	(1.100)	(1.465)	(1.586)	(0.968)	(3.274)	(1.676)
9.event	-0.690	-0.311	-0.276	0.268	-1.271	-1.398	-0.387
	(0.588)	(0.768)	(1.088)	(1.293)	(1.022)	(2.654)	(0.922)
10.event	-1.170*	-1.438*	-0.822	-1.199	0.132	-1.048	-0.090
	(0.641)	(0.857)	(1.221)	(1.350)	(0.612)	(2.891)	(0.828)
11.event	-0.865	-1.154	-0.827	-0.739	0.323	-1.896	-0.718
	(0.680)	(0.873)	(1.271)	(1.242)	(0.960)	(3.092)	(0.980)
12.event	-0.291	-0.092	-0.004	0.990	-0.254	-0.774	0.049
	(0.550)	(0.744)	(1.071)	(1.168)	(0.659)	(2.722)	(0.827)
13.event	0.061	0.128	-0.558	1.469	0.505	-2.013	-0.766
	(0.734)	(1.036)	(1.330)	(1.449)	(0.680)	(3.355)	(0.802)
14.event	0.695	1.837**	2.275**	1.804	-1.467**	1.963	0.006
	(0.630)	(0.785)	(1.070)	(1.444)	(0.697)	(2.694)	(0.945)
15.event	0.275	0.590	0.187	2.944*	-0.078	-2.356	-0.074
	(0.743)	(1.022)	(1.426)	(1.521)	(0.778)	(3.521)	(0.853)
16.event	-1.960**	-3.637***	-5.094***	-0.367	3.386***	-8.313**	0.339
	(0.930)	(1.054)	(1.430)	(1.152)	(1.035)	(3.109)	(1.609)
17.event	0.028	0.099	0.082	0.722	0.494	2.084	-0.173
	(0.691)	(0.960)	(1.448)	(1.136)	(0.586)	(3.475)	(0.777)
Constant	28.052	-17.631	18.833	-550.533***	61.121*	-535.987***	-72.557
	(25.984)	(45.639)	(60.358)	(159.569)	(32.338)	(188.208)	(66.839)
Observations	703	501	326	124	185	139	170
R-squared	0.142	0.243	0.344	0.381	0.343	0.447	0.118
Adjusted R-squared	0.047	0.148	0.239	0.173	0.183	0.266	-0.096

Description: The table reports the results for the regression model presented in Equation 3.21, for the entire sample and the bank sub-groups, related to the stock market. The dependent variable is the bank CAR calculated over a 3-day event window. Robust standard errors are clustered at bank-year level (in parenthesis).
Note: *** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level.

3.8.2.2 CDS market

The estimated results for the regression analysis are reported in Table 3.16. The findings suggest, as expected, that the level of capitalization (captured by the TIER1_RATIO variable) has an inverse link with the dependent variable (CARs).[117] Nevertheless, the coefficients are not significantly different from zero. Only for the sub-group of systemically important banks the coefficient is positive (1.726) and significant at the 5% level. This evidence might be motivated by the fact that market investors associate a higher riskiness to increasing levels of capital. Moreover, "forcing banks to raise expensive capital because future profitability is unclear increases the probability of future non-viability" (Financial Times, 2016).[118] When considering the top-quality capital, the CET1 ratio, the associated coefficient for the G-SIBs, although still positive, is not significant, while for the sub-group of banks situated in GIIPS countries the ratio obtains a negative and significant coefficient (-1.711 significant at the 5% level)[119].

Contrary to a priori expectations, the coefficient for the proxy of the loan portfolio quality (NPL) is negative (although small) and insignificant for the largest groups of banks (full sample, banks located in Eurozone countries and credit institutions operating in peripheral distressed economies). However, it is positive and significant for the remaining two sub-groups. A coefficient of 1.100, significant at the 5% level, is obtained for banks located in non-EMU countries, while for the G-SIBs a one percentage point increase in the NPL ratio is associated with an (abnormal) increase in the CDS spreads of around 3 bps. For these two sub-groups, weak credit quality seems to be a relevant factor in explaining abnormal movements (increases) in CDS spreads.

Examining the estimated results, it emerges that abnormal changes in CDS premia, in response to the implementation of the new European regulatory framework, do not appear to be sensitive to the bank's size (captured by the level of total assets).

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[117] Although previously mentioned, it is worth re-iterating that for the CDS market the concept is of cumulative abnormal CDS spreads.

[118] See https://www.ft.com/content/058b4ee0-d0c9-11e5-831d-09f7778e7377.

[119] When considering the leverage ratio none of the estimated coefficients is significant. These results are not reported in the chapter.

The proxy for the funding structure, given by the amount of deposits and short term funding over the total assets, yields positive coefficients for four out of five sub-groups of banks, although statistically different from zero only for the full sample (0.272, significant at the 5% level). For the systemically important banks, the coefficient has negative sign (-0.355) and is significant at the 5% level. In this case, a higher reliance on short-term funding and thus a greater level of liquidity, seems to contribute in lowering the probability of potential distress, which is in turn reflected in lower CDS spreads.

The net loans to total asset ratio (the indicator for the business model orientation), has a negative and marginally significant coefficient of 0.272 in the regression for the full sample. The coefficient is also negative, although insignificant, for the sub-sample of banks located in Eurozone countries. In the remaining cases, the sign is positive but insignificant. Abnormal changes in CDS spreads, following the announcements related to the BU project, do not appear to be influenced by the type of bank business model.

Contrary to what was expected, the proxy for bank profitability (defined as the ratio of interest income over average earning assets) reveals positive, although not significant, coefficients for the full sample and the group of banks situated in Eurozone countries (0.597 and 0.366, respectively). The indicator has the predicted negative relationship with CARs in the CDS market for the sub-groups of (i) banks located in GIIPS countries (-3.687); (ii) the G-SIBs (-3.010); and (iii) banks located outside the EMU countries (-3.914). Nevertheless, only for the latter category is the coefficient statistically significant at the 5% level.

The degree of diversification in banking activities, captured by the ratio of non-interest income to gross revenues, has a positive association with CARs in the CDS market for the main bank sub-groups (ALL, EU_ERZ and GIIPS). The estimated coefficient is marginally significant only for the group of banks located in troubled peripheral economies (0.310 and significant at the 10% level). This positive relation suggests that a higher reliance on non-interest income might be perceived as a factor which contributes in increasing banks' riskiness, reflected, in turn, in higher CDS spreads (Stiroh, 2010). For the group of banks located outside the Eurozone (EU_NONERZ) and the systemically important banks (G-SIBs), the relation is instead

negative and highly significant (the coefficients are -0.097 and -0.475, respectively). In line with the previous literature, it is not clear whether a more diversified income structure and, specifically, the reliance on the non-interest component, have a beneficial impact in lowering the risk (e.g. see, among others, Altunbas et al., 2011; Köhler, 2014).

Finally, the ratio of risk-weighted assets over total assets, which represents the proxy for the *ex-ante* risk taking, demonstrates a mixed effect on the level of CDS spreads. It has negative coefficients for the whole sample and the sub-group of banks located outside the Eurozone, although marginally significant only in the latter case (-0.070 significant at the 10% level). Otherwise it yields positive coefficients, significant only for the sub-sample of credit institutions located in peripheral troubled countries (0.239 and significant at the 10% level).

From investigating the sub-event dates, it emerges that, similarly to the findings in the univariate analysis, bank CDS spreads seem to be particularly sensitive to the implementation of the new bank resolution procedures at the European level. The announcement number 5 shows, on average, a negative impact on the level of CDS premia, particularly marked and highly significant in the case of G-SIBs (-6.580 and significant at the 1% level). The announcement number 9, instead, has a positive influence on the level of CDS spreads, with the full sample and the two sub-groups of institutions located in Eurozone economies and in GIIPS countries particularly affected. The coefficients are 7.330, 8.661 and 14.775, respectively, which are all significant at the 1% level. CDS prices for the group of G-SIBs appear to be strongly influenced by the announcements associated with the ECB's CA. More specifically, the sub-events numbered 4, 11, 12, 13 and 15 show an inverse relation with the dependent variable, which suggests that the market positively perceived the contribution of the exercise in reducing the risk associated with banking activity.

Table 3.16 - Determinants of CARs (CDS market)

VARIABLES	(1) model	(1) model	(1) model	(1) model	(1) model
	ALL	EU_ERZ	PIIGS	EU_NONERZ	GSIBS
TIER1_RATIO	-0.023	-0.118	-1.881	-0.167	1.726**
	(0.188)	(0.422)	(1.140)	(0.165)	(0.679)
NPL	-0.050	-0.098	-0.311	1.100**	3.163***
	(0.184)	(0.204)	(0.207)	(0.395)	(0.649)
TOT_ASSET	-14.218	-17.789	-15.032	-6.662	15.590
	(8.828)	(11.116)	(12.420)	(7.083)	(12.947)
ST_FUND	0.272**	0.286	0.131	0.128	-0.355**
	(0.124)	(0.186)	(0.254)	(0.141)	(0.140)
LOAN_TA	-0.362*	-0.382	0.325	0.009	0.047
	(0.207)	(0.265)	(0.443)	(0.177)	(0.481)
INTEREST	0.597	0.366	-3.687	-3.914**	-3.010
	(0.856)	(1.109)	(2.247)	(1.568)	(4.176)
NON_INTEREST	0.085	0.068	0.310*	-0.097***	-0.475***
	(0.068)	(0.159)	(0.171)	(0.033)	(0.145)
RWA_TA	-0.001	0.003	0.239*	-0.070*	0.505
	(0.109)	(0.146)	(0.135)	(0.040)	(0.455)
2.event	1.438	2.238	6.389	-0.959	-6.567**
	(3.002)	(3.966)	(5.308)	(2.374)	(2.384)
3.event	3.235	4.593	9.195**	-1.684	-1.794
	(2.393)	(3.227)	(4.144)	(1.938)	(2.695)
4.event	2.654	3.797	8.928**	-1.618	-2.089
	(2.323)	(3.215)	(4.273)	(1.796)	(2.732)
5.event	-2.691	-2.691	0.959	-3.536*	-6.580***
	(2.610)	(3.544)	(4.802)	(1.822)	(2.381)
6.event	0.870	1.526	7.301	-1.600	-5.966**
	(2.341)	(3.223)	(4.632)	(1.956)	(2.414)
7.event	0.862	0.856	5.630	0.212	-5.279**
	(2.540)	(3.479)	(5.029)	(2.047)	(2.523)
8.event	1.753	2.455	8.501*	-0.844	-5.261**
	(2.303)	(3.176)	(4.582)	(2.002)	(2.375)
9.event	7.330***	8.661***	14.775***	3.002	1.826
	(2.361)	(3.222)	(4.672)	(2.224)	(2.610)
10.event	1.343	2.203	7.301	-1.687	-4.705*
	(2.362)	(3.264)	(4.739)	(2.006)	(2.689)
11.event	-1.479	-0.728	6.108	-4.208*	-10.674***
	(2.381)	(3.264)	(4.718)	(2.227)	(2.432)
12.event	0.189	1.192	7.054	-3.234	-8.867***
	(2.369)	(3.260)	(4.722)	(2.040)	(2.381)
13.event	-1.044	-0.913	5.165	-2.071	-9.502***
	(2.389)	(3.272)	(4.666)	(2.094)	(2.517)
14.event	1.441	1.826	7.959	-0.285	-6.403**
	(2.376)	(3.266)	(4.768)	(2.169)	(2.541)
15.event	-2.723	-2.929	1.237	-2.824	-6.488**
	(2.555)	(3.524)	(5.039)	(1.987)	(2.451)
16.event	2.561	3.644	9.385*	-1.085	-3.095
	(2.490)	(3.433)	(5.085)	(2.062)	(2.569)
17.event	0.023	0.114	6.408	-0.896	-5.250**
	(2.662)	(3.641)	(5.088)	(2.001)	(2.418)
Constant	179.271	222.773	160.964	97.752	-219.581
	(120.541)	(149.415)	(158.817)	(101.700)	(182.490)
Observations	520	384	248	136	170
R-squared	0.300	0.313	0.369	0.456	0.625
Adjusted R-squared	0.217	0.217	0.251	0.293	0.534

Description: For the CDS market, this table reports the results for the regression model presented in Equation 3.21, for the entire sample and the bank sub-groups. The dependent variable is the bank CAR calculated over a 3-day event window. Robust standard errors are clustered at bank-year level (in parentheses).

Note: Due to a limited number of observations (below 120), the sub-groups of GAP banks and credit institutions located in core Eurozone countries were not considered.

*** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level.

3.9 Conclusions

The objective of this thesis chapter was to investigate the market reactions to several events in the implementation of the European BU project, considering their effects on banks' share prices and CDS spreads. The focus was on the impact of the overall reform, as well as each sub-event associated with the regulatory changes. Furthermore, the analysis was conducted both on the whole samples of banks and bank sub-groups, using both univariate and multivariate techniques.

The results indicated that the stock market did not anticipate all phases of the announcements on regulatory reforms. Credit institutions located in Eurozone countries (both in peripheral and core economies) demonstrated a positive significant stock price reaction in response to the implementation of the new project at the European level. Share prices of banks reported to have capital shortfalls during the ECB's 2014 CA revealed the most pronounced reactions, although not statistically significant. Share prices of credit institutions situated outside the Eurozone, alongside those of systemically important banks, negatively reacted to the regulatory changes. Nevertheless, the reactions were marginal and not statistically significant.

Considering the banks' stock market reaction to the sub-events, announcements on the implementation of the supervisory element of the new regulatory framework had a negative effect on banks' share prices, possibly because of the compliance costs associated with the tighter supervision. The market responses to the sub-events connected to the ECB's 2014 CA were markedly positive for all sub-groups of banks (especially for GAP banks) and nearly zero for the credit institutions located outside the Eurozone. The increased level of transparency, following the Eurozone financial health check, as well as the fact the several banks improved their capital position with consequent beneficial effects for the stability of the entire system, can explain the positive market response. The impact of the announcements about the new European bank resolution rules was negative on all banks' shares, with the GAP banks showing the strongest reaction. While the sub-group of GAP banks was the most affected by the regulatory reform, the share prices of banks located in European but non-Eurozone countries showed the most limited reaction. Share prices of G-SIBs did not show any significant reaction.

With regard to the bank CDS market, the overall evidence suggests that market participants have anticipated the information contained in the announcements associated with the implementation of the BU project. Also, the new regulatory framework was perceived as beneficial in lowering the level of bank debt riskiness, especially with regard to the most distressed institutions. However, additional insights were gained from analysing the different groups of announcements.

The announcements associated with the new supervisory framework led to a general increase in banks' CDS prices, except for the sub-group of GAP institutions. The positive aggregate coefficients, especially high for the sub-groups of banks located in core euro area economies and the G-SIBs, might be explained by their impending subjection to enhanced supervision. The market responses to the sub-events connected to the ECB's 2014 CA were of the opposite direction compared to that for the stock market and therefore had a similar underlying implication. The impact of the announcements about the new bank resolution rules revealed positive coefficients and, thus, reflected a rise in the CDS quoted prices. This evidence suggested a potential increase in the perceived level of banks' debt riskiness as consequence of the bail-in philosophy implied in the new European procedures for the resolution of distressed banks. When considering the CDS market, also the category of G-SIBs, which have been perceived to benefit from implicit government guarantees, were shown to significantly react to the implementation of the BU project.

The analysis proceeded to consider the cross-section of the CARs for the stock market. This revealed positive associations with capital levels and with the business model orientation. A higher level of capitalization, especially when captured by a non-risk based leverage measure, was associated with positive abnormal performance in the stock market. The same consideration held for the share prices of credit institutions with a business model more oriented to traditional activities. The impact of the bank's size on the stock market responses was mixed. Bank specific factors characterizing the sub-group of institutions reported to have capital shortfalls under the ECB's 2014 CA were shown to influence the shareholders' reaction the most.

The multivariate analysis related to the CDS market demonstrated that the degree of capitalization, generally in a negative association with the level of CDS spreads, for the G-SIBs revealed a positive influence. This evidence might indicate that

market investors perceived a higher riskiness connected to increasing levels of capital. Furthermore, the imposition through regulatory actions of raising costly capital because future profitability is uncertain might increase the probability of potential non-viability. Regardless of their levels of capital, institutions which are incapable of generating profits are not safe (Financial Times, 2016).[120] For banks located in non-EMU countries and the G-SIBs, weak credit quality appears to be a relevant factor in explaining abnormal increases in CDS quoted spreads.

Abnormal changes in CDS spreads, following the announcements related to the BU project, do not appear to be influenced by either the type of bank business model nor the bank's size. In line with the earlier literature (e.g. see, among others, Altunbas et al., 2011; Köhler, 2014) it is not clear whether a more diversified income structure and a higher reliance on the non-interest component have a beneficial impact in lowering the banking risk.

Bank specific elements associated with the sub-sample of systemically important banks were demonstrated to particularly affect the investors' reaction in the CDS market.

The need for strengthening bank supervisory and regulatory integration in Europe represented the inevitable outcome of recognising an inner contradiction existing in its financial structure. On the one hand, the singleness of the financial markets and, on the other hand, the fragmentation, along domestic lines, of banking oversight and banking safety nets (Angeloni, 2012). Fostering financial stability and integration in Europe was thus the aim of BU. The euro area sovereign debt crisis revealed the impossibility of effectively handle financial stability at the national level, due to the presence of the vicious loop between sovereigns and banks on a cross-country basis (Schoenmaker and Siegmann, 2013). Indeed, in a monetary union characterized by domestic supervision, resolution and safety nets, fragility and stress in national banking systems can determine spillovers to the domestic fiscal sector, triggering a negative fiscal/financial loop that weakens both. The BU topic has arisen as one of the possible ways to address the incompleteness of EMU.

[120] See https://www.ft.com/content/058b4ee0-d0c9-11e5-831d-09f7778e7377.

While the rationale for a BU, which includes all the three components, is broadly recognized, controversy has recently developed with regard to the features and timing of the third pillar (i.e. the EDIS). Opponents of the recent EC proposal assert that the establishment of a mutualised scheme cannot occur until the risks characterizing the national banking sectors have been limited and have become more homogeneous (Angeloni, 2016). More specifically, the large exposures of domestic banks to their own governments ("home bias") is perceived as a significant source of asymmetry in the level of risk faced by the national banking sectors. Under this perspective, the progress towards the completion of the euro area BU is strongly linked to the prudential (preferential) treatment of sovereign exposures (Basel accords, first pillar).[121] The latter aspect represents another remarkable issue, which is currently faced by global regulators. While seriously addressing these concerns, it is also fundamental to recognise that "an incomplete BU, if allowed to persist for long, can easily become an additional source of uncertainty and risk" (Angeloni, 2016). Therefore, European policymakers should develop a coherent strategy with the aim of limiting these risks, which involves clear objectives and a reasonably fast implementation timeline. The creation of a level playing field and the reduction of the (unevenly distributed) risk in the banking system, require sound and stable arrangements at the European level, which strongly rely on trust and on balanced commitments and responsibilities. This, in turn, re-calls the controversial debate on a possible fiscal and political union in the Eurozone to enhance and complete the EMU (e.g. Pisani-Ferry et al., 2012; Alphandéry, 2013; Gros, 2013; Rey, 2013; Financial Times, 2016).[122]

[121] Currently, banks' exposures to their domestic sovereigns are considered risk-free and are exempt from the limits applied to large exposures (Enria et al., 2016).
[122] See https://www.ft.com/content/95aaddfa-29ad-11e6-8ba3-cdd781d02d89.

Appendix 3.A: The case of the Portuguese Novo Banco

The Portuguese Novo Banco was created after the collapse of the largest private sector bank Banco Espírito Santo (BES) in August 2014, following the disclosure of €4.9bn of losses arising from the exposure to its major shareholder (i.e. the Espírito Santo Group).[123]

Novo Banco, which represents the so-called "good bank" which emerged from the ruins of BES, is currently owned by the Portuguese resolution fund, which had to sell, as required by European regulators, the totality of the bank by August 2017.[124]

In December 2015 the Bank of Portugal decided to cover a €1.4bn capital shortfall at Novo Banco, found during the ECB's 2015 stress test, by imposing losses of almost €2bn on certain senior bondholders and transferring their investments to the bad company BES.[125] Following this event, some of the bank's investors have threatened legal actions, advocating the existence of discrimination among holders within the same class of bonds and, thus, a violation of the key *pari passu* principle of equal treatment between debt securities. Moreover, a further criticised aspect was also related to the decision taken by the Bank of Portugal to only select, for the bad bank, bonds falling under Portuguese jurisdiction, resulting therefore in an unequal treatment of creditors.

The ECB declared not to have had interference in the Bank of Portugal's decision, saying that it "neither requested nor approved the move" (Reuters, 2016).[126] According to some analysts, although the ECB did not endorse the plan, the fact that it was permitted has raised investors' concerns in providing funds to the euro area banking system (Financial Times, 2016).[127]

[123] Banco Espírito Santo was the largest Portuguese listed bank in terms of assets. For further details, see https://www.ft.com/content/a63a4a56-32c0-11e4-93c6-00144feabdc0.

[124] Novo Banco's rescue by the country's bank resolution fund - created by the contribution of all Portuguese credit institutions - was financed by a €3.9bn state loan. The troubled lender BES was split, by the Portuguese central bank, into good and bad bank as part of the €4.9bn bailout.

[125] More specifically, the five senior bonds transferred mature in July 2016, May 2017, January 2018, January 2019 and June 2024.

[126] See https://www.reuters.com/article/ecb-novobanco/ecb-says-didnt-ask-for-or-approve-novobanco-bail-in-idUSL8N14X3S320160113.

[127] See https://www.ft.com/content/da45fb10-aede-11e5-993b-c425a3d2b65a#myft:saved-artic les:page.

Moreover, this controversial situation has generated doubts on the effective functioning of the new European resolution regime, which came into force at the beginning of 2016.

Commerzbank analysts stated that the unequal treatment of creditors, with a preferential treatment for retail debt holders over large foreign institutional ones, was questioning creditors' safeguarding under the new European bank resolution framework (Reuters, 2016).[128]

The Bank of Portugal's bail-in decision was taken at the end of 2015 before the new European BRRD came into force in January 2016. The Directive, under which the responsibility for resolving European failing banks was moved from national authorities to the SRM, was likely to make that procedure more difficult. Since the bail-in occurred before the Directive came into force, it was still managed at the national level and did not require the ECB's approval.

[128] See https://uk.reuters.com/article/uk-portugal-novo-banco/bank-of-portugal-resumes-novo-banco-sale-after-bond-transfer-idUKKCN0UT21X.

Appendix 3.B: The case of four Italian regional banks

The first Italian case of bail-in, largely unknown abroad, occurred on the 17 July 2015 when the Italian authorities started the liquidation of Banca Romagna Cooperativa (BRC), a small mutual bank in trouble since 2013. In the BRC resolution process, both equity and junior debt (entirely held by retail depositors) were bailed-in.[129] According to Fitch (2015) the liquidation of BRC underlined the increased level of credit loss risk together with the questionable conduct by the Italian banks in funding with hybrid capital instruments and subordinated debt raised through their retail branches.[130]

In late November 2015, four small Italian regional banks (Banca Etruria, Banca Marche, CariFerrara and CariChieti), accounting for around 1 per cent of the total deposits in the Italian banking system, were rescued. Shareholders and holders of subordinated debt were forced to absorb part of the losses (for the minimum bail in amount required by the (applicable at the time) State Aid regime, which covered the transition period until the full implementation of the BRRD in 2016, whilst senior bondholders and depositors were not hit.[131] After that, the four small lenders were split into "good" and "bad" companies, with the latter entities capitalized through the Italian resolution fund. As in the Portuguese case of Novo Banco the timing of the procedure was designed to avoid tougher upcoming European bail-in rules, which might also have affected unsecured depositors. Nevertheless, the subsequent damage was greater than expected (Financial Times, 2015).[132] Investors negatively reacted to the way the Italian government and the Central Bank of Italy managed the rescue. The banks' governance was also questioned, whilst the issue of potential mis-selling of risky banks' debt to (uniformed) retail customers arose.

[129] For further details see https://www.fitchratings.com/site/pressrelease?id=988610.
[130] See https://www.fitchratings.com/site/pressrelease?id=988610.
[131] See http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52013XC0730(01)&from=EN.
[132] See https://www.ft.com/content/cec1f9da-9f4b-11e5-8613-08e211ea5317.

Appendix 3.C: Estimation with leverage ratio

Table 3.C.1 presents the estimated results for a slightly different specification of the baseline regression model (Equation 3.21) presented in Section 3.7.2 (for the stock market). More specifically, rather than the Tier1 capital ratio, a non risk-weighted capital ratio is employed, i.e. the leverage ratio.

Table 3.C.1 - Determinants of CARs (stock market)

VARIABLES	(2) model	(2) model	(2) model	(2) model	(2) model	(2) model	(2) model
	ALL	EU_ERZ	PIIGS	CORE	EU_NONERZ	GAP	GSIBS
LEVERAGE_T	0.465***	0.577***	0.546**	-2.358	-0.259	0.714**	-1.057**
	(0.148)	-0.158	-0.22	(1.679)	-0.425	-0.336	-0.474
NPL	-0.065	-0.031	-0.095	-0.457	-0.155	-0.136	0.303
	(0.055)	-0.079	-0.081	(0.537)	-0.169	-0.239	-0.316
TOT_ASSET	-3.658*	-2.682	-3.46	24.329*	-6.728**	-12.049**	1.691
	(2.021)	-3.293	-3.704	(12.395)	-3.298	-4.874	-4.614
ST_FUND	-0.036	-0.048	-0.056	0.135	0.03	-0.026	-0.066
	(0.041)	-0.055	-0.069	(0.114)	-0.064	-0.135	-0.057
LOAN_TA	0.115**	0.112	0.024	0.982***	0.198**	0.016	0.611***
	(0.051)	-0.068	-0.091	(0.298)	-0.091	-0.122	-0.191
INTEREST	0.442	0.706	0.321	2.369	-0.06	0.084	-3.594***
	(0.667)	-0.823	-0.893	(1.599)	-0.412	-0.856	-1.193
NON_INTEREST	-0.014	-0.014	-0.091*	-0.035**	0.109***	-0.023	-0.02
	(0.010)	-0.011	-0.046	(0.013)	-0.032	-0.02	-0.058
RWA_TA	-0.055*	-0.001	0.057	0.198	-0.064**	0.005	-0.013
	(0.030)	-0.048	-0.055	(0.189)	-0.03	-0.11	-0.086
2.event	0.807	1.158	1.247	0.440	-0.096	2.183	-0.058
	(0.836)	-1.139	-1.583	(1.542)	-0.776	-3.008	-1.121
3.event	-0.455	-0.234	0.788	0.091	-1.031	-0.26	-1.031
	(0.772)	-1.101	-1.462	(1.494)	-0.692	-3.077	-0.961
4.event	-0.310	-1.16	-0.95	1.511	1.35	-0.532	-0.65
	(0.807)	-1.128	-1.572	(1.211)	-0.82	-2.877	-1.358
5.event	-1.014	-1.07	-0.569	2.181	-0.87	-3.066	-0.855
	(0.820)	-1.159	-1.521	(1.599)	-0.831	-3.323	-0.992
6.event	-0.707	-0.777	0.082	-1.047	0.17	-0.703	-0.903
	(0.780)	-1.13	-1.633	(1.938)	-0.816	-4.055	-0.825
7.event	0.451	0.402	1.249	0.568	1.423	0.842	-0.39
	(0.688)	-0.99	-1.492	(1.273)	-1.01	-3.685	-0.794
8.event	1.514	2.527**	3.809**	2.595	-0.818	5.94	0.044
	(0.945)	-1.264	-1.767	(2.321)	-0.936	-3.953	-1.558
9.event	-1.307*	-1.388	-0.99	-0.820	-0.62	-2.992	-0.412
	(0.717)	-1.032	-1.462	(2.003)	-1.116	-3.805	-0.873
10.event	-1.974**	-2.442**	-2.167	-0.637	-0.009	-2.933	-0.209
	(0.771)	-1.105	-1.668	(1.369)	-0.758	-3.947	-0.802
11.event	-1.129	-1.466	-1.23	0.228	0.313	-1.168	-0.495
	(0.763)	-1.077	-1.622	(1.469)	-0.973	-3.845	-0.953
12.event	-0.502	-0.4	-0.041	1.018	-0.257	-1.129	0.014
	(0.672)	-0.994	-1.525	(1.295)	-0.736	-3.716	-0.789
13.event	-0.473	-0.547	-1.333	2.331	0.338	-2.252	-0.557
	(0.786)	-1.147	-1.601	(1.556)	-0.813	-3.947	-0.787
14.event	0.850	1.611	2.317	2.005	-0.566	1.402	0.066
	(0.763)	-1.049	-1.586	(1.413)	-1.025	-3.751	-0.893
15.event	-0.309	-0.362	-0.872	3.070*	0.338	-2.138	-0.012
	(0.844)	-1.216	-1.765	(1.494)	-0.811	-4.128	-0.8
16.event	-2.650***	-4.407***	-5.751***	-0.176	3.518***	-8.554**	0.199
	(0.960)	-1.226	-1.772	(1.249)	-1.002	-3.863	-1.482
17.event	-0.382	-0.494	-0.644	1.565	0.59	0.935	0.031
	(0.806)	-1.162	-1.775	(1.301)	-0.649	-4.005	-0.758
Constant	39.783	24.157	39.782	-372.256**	73.281*	132.207**	-27.508
	(26.856)	-42.523	-46.766	(178.594)	-41.913	-63.752	-65.001
Observations	809	595	396	148	197	204	182
R-squared	0.121	0.194	0.265	0.303	0.28	0.345	0.119
Adjusted R-squared	0.034	0.106	0.166	0.109	0.118	0.208	-0.085

Description: The table reports the results for the regression model presented in Equation 3.21, including the leverage ratio instead of the Tier1 ratio. It displays the outcomes for the entire sample and the bank sub-groups. The dependent variable is the bank CAR calculated over a 3-day event window. Robust standard errors are clustered at bank-year level (in parenthesis).

Note: *** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level.

Appendix 3.D: Sovereign CDS market reaction

Table 3.D.1 illustrates the sovereign CDS market's reaction to the 17 sub-events associated with the implementation of BU. The full sample (ALL) is composed of 17 countries, of which 11 are Eurozone countries (EU_ERZ), 6 European non-Eurozone countries (EU_NONERZ), 5 core euro area economies (CORE) and 4 peripheral distressed countries (GIIPS).

Table 3.D.1 - Sovereign CDS market reaction to BU by sub-event

#	Date		ALL	EU_ERZ	PIIGS	CORE	EU_NONERZ
1	12/09/12	Coefficient (*CAAR*)	-3.7967	-6.3578	-19.6006	-2.7827	0.8986
	Supervision	p-value (adjBMP)	0.9725	0.9490	0.1065	0.4702	0.7736
		p-value (GENSIGN)	0.3021	0.0547 *	0.0426 **	0.0306 **	0.3890
2	13/12/12	Coefficient (*CAAR*)	-1.1888	-1.3812	-8.4633	3.1314	-0.8362
	Supervision	p-value (adjBMP)	0.9880	0.6851	0.5775	0.0001 ***	0.6024
		p-value (GENSIGN)	0.7596	0.2421	0.2612	0.0368 **	0.2853
3	12/09/13	Coefficient (*CAAR*)	0.4746	2.3740	7.4675	-0.8189	-3.0076
	Supervision	p-value (adjBMP)	0.6200	0.8564	0.0521 *	0.4104	0.4231
		p-value (GENSIGN)	0.9273	0.7582	0.0545 *	0.0685 *	0.7900
4	23/10/13	Coefficient (*CAAR*)	3.9129	-0.3040	-0.3651	0.0820	11.6439
	Comprehensive Assessment	p-value (adjBMP)	0.8655	0.2817	0.2665	0.6474	0.4679
		p-value (GENSIGN)	0.7756	0.5529	0.3116	0.8570	0.1966
5	08/11/13	Coefficient (*CAAR*)	8.8719	11.1255	25.4860	1.0950	4.7403
	Resolution	p-value (adjBMP)	0.0103 **	0.0387 **	0.0002 ***	0.2794	0.0141 **
		p-value (GENSIGN)	0.0010 ***	0.0120 **	0.0455 **	0.2468	0.0313 **
6	03/02/14	Coefficient (*CAAR*)	0.0343	-0.5884	-1.9292	0.6081	1.1760
	Comprehensive Assessment	p-value (adjBMP)	0.6182	0.6886	0.6126	0.5878	0.4664
		p-value (GENSIGN)	0.6773	0.1794	0.0357 **	0.9040	0.2555
7	07/02/14	Coefficient (*CAAR*)	-0.8102	-1.0395	-2.3198	0.8681	-0.3897
	Supervision	p-value (adjBMP)	0.9146	0.8190	0.4642	0.0065 ***	0.6322
		p-value (GENSIGN)	0.3118	0.6603	0.2646	0.0553 *	0.2642
8	11/03/14	Coefficient (*CAAR*)	-0.0742	0.2949	1.0824	-0.2402	-0.7508
	Comprehensive Assessment	p-value (adjBMP)	0.4722	0.9136	0.8346	0.7051	0.1980
		p-value (GENSIGN)	0.1796	0.4449	0.3893	0.1124	0.2201
9	20/03/14	Coefficient (*CAAR*)	-0.2475	-0.4338	0.3859	0.4455	0.0942
	Resolution	p-value (adjBMP)	0.7399	0.8478	0.9436	0.1072	0.6744
		p-value (GENSIGN)	0.1109	0.2698	0.4084	0.0353 **	0.2328
10	25/04/14	Coefficient (*CAAR*)	2.2416	3.6149	4.4472	0.0101	-0.2761
	Supervision	p-value (adjBMP)	0.7895	0.6043	0.0258 **	0.9143	0.4189
		p-value (GENSIGN)	0.6432	0.6484	0.0716 *	0.5766	0.1562
11	29/04/14	Coefficient (*CAAR*)	-0.0037	0.6473	-0.5508	-0.1021	-1.1973
	Comprehensive Assessment	p-value (adjBMP)	0.8714	0.9440	0.9920	0.7036	0.6091
		p-value (GENSIGN)	0.6418	0.4732	0.2294	0.6995	0.8425
12	17/07/14	Coefficient (*CAAR*)	1.2802	1.6699	1.0536	0.2719	0.5658
	Comprehensive Assessment	p-value (adjBMP)	0.5788	0.7219	0.5683	0.9762	0.3640
		p-value (GENSIGN)	0.2797	0.4278	0.5037	0.9348	0.4483
13	08/08/14	Coefficient (*CAAR*)	0.2273	-0.3837	-2.4043	-0.4851	1.3474
	Comprehensive Assessment	p-value (adjBMP)	0.9699	0.9300	0.8631	0.5098	0.8217
		p-value (GENSIGN)	0.4671	0.7211	0.6862	0.5406	0.4532
14	04/09/14	Coefficient (*CAAR*)	-2.5305	-3.4360	-7.3934	-2.2367	-0.8706
	Comprehensive Assessment	p-value (adjBMP)	0.0959 *	0.1363	0.0544 *	0.0606 *	0.0183 **
		p-value (GENSIGN)	0.0044 ***	0.0089 ***	0.0139 **	0.0347 **	0.2110
15	27/10/14	Coefficient (*CAAR*)	0.7852	0.9835	1.8316	-0.1779	0.4215
	Comprehensive Assessment	p-value (adjBMP)	0.4644	0.5990	0.6924	0.7162	0.3483
		p-value (GENSIGN)	0.7276	0.7618	0.5680	0.6484	0.8603
16	30/10/14	Coefficient (*CAAR*)	-0.2899	-1.2188	-1.8209	-1.9423	1.4130
	Supervision	p-value (adjBMP)	0.7949	0.6086	0.3917	0.6044	0.2690
		p-value (GENSIGN)	0.3579	0.1389	0.1465	0.6969	0.6502
17	04/11/14	Coefficient (*CAAR*)	1.4472	2.2793	4.1985	1.1428	-0.0785
	Supervision	p-value (adjBMP)	0.6407	0.3101	0.3532	0.4906	0.4514
		p-value (GENSIGN)	0.1201	0.1176	0.5578	0.1647	0.6167

Description: The table reports the CAARs in the sovereign CDS market (in bps) in response to the sub-events relating to the BU. It indicates whether each event is related to supervision, resolution or CA. It shows CAARs for (i) the entire sample of countries (ALL); (ii) European Eurozone countries (EU_ERZ); (iii) Eurozone peripheral countries (GIIPS); (iv) core Eurozone countries (CORE); and (v) European non-Eurozone countries (EU_NONERZ). Significance is tested according to the adjusted version of the BMP (1991) test by Kolari and Pynnönen (2010), and the generalized sign test developed by Cowan (1992).

Note: *** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level.

Chapter 4: The European Bank Resolution and Recovery Directive: A market assessment

4.1 Introduction

The global financial crisis and the European sovereign debt crisis highlighted structural weaknesses and distortions in the architecture of the European financial system. In early 2012, increasing pressures in funding and lending markets led to a fragmentation of the euro area banking sector, along national borders, comparable to that existing before the introduction of the single currency (Nouy, 2015). A mutually reinforcing vicious loop between sovereign and banking risk also emerged (De Bruyckere et al., 2013; Acharya et al., 2014; Farhi and Tirole, 2017). Several reforms and policy initiatives aimed at strengthening the institutional framework in Europe were therefore undertaken. Among these, the launch of the Banking Union (BU) project in mid-2012, which became effective in November 2014, represented a milestone in European banking integration (Schoenmaker, 2015). Transferring banking supervision and resolution responsibilities to the European level, while weakening the significant sovereign-bank nexus, was the essence of the project.[133]

In the post-crisis environment, the Bank Recovery and Resolution Directive (BRRD), which came into force in January 2015, represents the legal basis of the new European bank resolution framework. The Directive provides a minimum set of common rules and tools for addressing bank failures. One of its fundamental elements, the bail-in mechanism, foresees that external funds can only be used after a bail-in of shareholders and (unsecured) creditors amounting to at least 8% of the total liabilities of a distressed bank, including own funds. This is intended to protect taxpayers' money and avoid costly state-funded bailouts. To facilitate orderly resolutions, the BRRD prescribes that institutions are also required to maintain, at all times, a robust minimum requirement for own funds and eligible liabilities (MREL) as a percentage of their total liabilities and own funds.

In cases of bank distress, public resources (national or pan-European) can only be employed as an ultimate resource after the activation of extensive bail-in tools,

[133] Further details on the rationale for BU can be found in Section 2.3 of Chapter 2.

thus making this option extremely rare. Ideally, countries with solid public finances can no longer provide implicit subsidies of public support to their national banks, while countries with weak public finances and smaller institutions are no longer able to support and promote their national champions (Constâncio, 2014).

According to Enria (2016), the establishment of a reliable and harmonized framework to handle banks' failures across the BU is essential. Such a framework provides scope for the successful management of a future resolution procedure and, more generally, a situation of crisis. Otherwise, achieving a desired level playing field in terms of funding conditions, resolution planning and other costs is not achievable. Moreover, in a time of distress, a lack of coordination would translate into a destruction of value. In the case of a cross-border crisis, without the required confidence amongst different authorities on the adoption of a mutual solution, strong incentives to ring-fence local activities would prevail (with the aim of providing further protection to national depositors). The concern of negative externalities in times of turmoil would undermine market integration in good times, thus significantly reducing the benefits of the European Single Market. Essentially, any successful application of the new European resolution rules requires that financial markets perceive them as credible and effective. If there is no confidence that bank failures can be managed in an orderly manner and market participants still expect government intervention, the resolution procedure could lead to major and more severe turmoil (Mikosek, 2016).[134]

The aim of this empirical chapter is to examine the short-run impact of the new EU resolution regime upon the sovereign-bank nexus. To this end, drawing evidence from the Credit Default Swap (CDS) market, a Difference-in-Differences (DiD) analysis is conducted where banks act as the treatment group and non-financial corporates as the control group. The January 2015 implementation of the BRRD, considered as an exogenous shock that involved the whole European banking system, provides the setting for a natural experiment to test the markets' perception about the effectiveness of the new resolution rules in weakening the sovereign-bank nexus. The main hypothesis underlying the analysis conducted in this chapter is that the

[134] To a large extent, the issue of credibility has already been tested in Italy with the 2017 winding up of two Veneto banks and the State Aid to Banca Monte dei Paschi (MPS). For further details on these cases, refer to Chapter 5 of this thesis.

intervention (i.e. the BRRD) is expected to impact the nexus in the case of banks, while leaving unaffected the sovereign-corporate link. Therefore, a priori, the link between sovereigns and banks can be regarded as special compared to that between sovereigns and non-financial firms. In this light, a decoupling trend between sovereign and bank risk, captured by CDS spreads, is anticipated. Based on different model specifications and for the period from January 2011 to mid-2016, the investigation is performed both on a pooled sample of seven major European countries and on each country separately.

To briefly preview the main findings, there are overall indications that market participants did not assess the implementation of the BRRD as credible in loosening the negative loop between sovereign and bank risk across Europe. A notable exception is that the Italian case deviates somewhat from the findings for other countries.

The remainder of this chapter is organized as follows. Section 4.2 reviews the relevant literature on sovereign-bank spillovers and the mutually-reinforcing feedback loop in the euro area. Section 4.3 focuses on some methodologies to measure the sovereign-bank feedback loop. Section 4.4 introduces the main elements of the BRRD and the bail-in mechanism. Section 4.5 presents the identification strategy and outlines the hypotheses. Section 4.6 discusses the data, the sample and the empirical methodology. Section 4.7 reports the empirical results and Section 4.8 concludes the chapter.

4.2 The Sovereign-bank spillover and the mutually-reinforcing feedback loop in the euro area

The strong inter-linkage between banking and sovereign risk emerged as a troublesome feature of the euro area debt crisis, which started in Greece in late 2009. “Financial integration, bank fragility and contagion have been at the core of the crisis” (Bolton and Jeanne, 2011, p. 5). The spillover between government and bank credit risk can occur in both directions (from sovereign to banking sector and *vice-versa*), presenting the potential for mutual contagion effects.

4.2.1 Spillover from sovereign to bank risk

According to BIS (2011), there are four main transmission channels through which sovereign risk affects banking risk. In particular, some of these work *via* the

asset side of bank's balance sheets, whilst others arise on banks' liabilities side (Angelini et al., 2014).

First, a deterioration in a sovereign's creditworthiness can directly cause mark-to-market losses on banks' portfolios of government debt securities.[135] In advanced countries, financial intermediaries often hold a sizeable portion of their assets in the form of government bonds on their balance sheets (for risk and liquidity management reasons), showing a "strong home bias in their sovereign portfolios" (BIS, 2011, p.14). This evidence is significant because around 30 per cent of total euro area government debt was held by the banking sector at the end of March 2010 (Bolton and Jeanne, 2011).[136] Gros (2013) highlights a number of regulatory incentives for banks to hold domestic government bonds, particularly in the euro area, also suggesting possible ways to reduce this excessive concentration. In fiscally distressed countries, the increasing exposure of national banks to their home sovereigns was partially a consequence of governments' moral suasion strategy, according to Ongena et al. (2016). Reducing these exposures is central to ongoing debates on a more complete and effective BU in Europe (Véron, 2016).[137]

International financial integration also plays a substantial role, as both direct and indirect exposures to foreign sovereigns can foster contagion across borders and different banking sectors. In this context, during the 2009-12 European sovereign debt crisis, direct and indirect international spillover effects from countries with the weakest public finances (the so-called GIIPS countries, i.e. Greece, Italy, Ireland, Portugal and Spain) negatively affected banks located in Belgium, France and Germany.[138] As a result of increasing financial integration in the euro area, banks are exposed to a larger common risk, implied in the euro area sovereign debt, and not only to the risk of their home country. Therefore, during a period of financial tensions at a sovereign government level, the distress associated with one government's debt potentially becomes a liability for all the other euro area governments. International

[135] See Angeloni and Wolff (2012) for a detailed analysis of this first transmission channel.
[136] Higher values (around 50 per cent) were observed for Germany and Spain (data based on the 2010 EU banking stress test conducted by the European Banking Authority, EBA).
[137] The creation of the third key pillar of the BU project, i.e. the European Deposit Insurance Scheme (EDIS) is strongly dependent on the reduction of banks' domestic sovereign exposures. See Chapter 2.
[138] E.g. Société Générale and Crédit Agricole in France, Dexia in Belgium and different Landesbanken in Germany.

diversification, through an integrated banking system, can thereby lead to a greater systemic risk (Bolton and Jeanne, 2011). Based on a sample of developed countries during 2004-10, Kallestrup et al. (2016) demonstrate that sovereign CDS premia are significantly affected by the foreign exposures of their large domestic banks.

Beyond the impact on bank funding conditions in terms of credit risk, sovereign tensions also affect the banking sector in terms of liquidity and funding risks. Since banks can use government paper as collateral in the interbank lending market, for instance in repo transactions and central bank refinancing operations, an increase in sovereign risk reduces the value of this collateral, thereby weakening banks' funding capacity. In this context, a remarkable role is also played by the current capital and liquidity regulation, i.e. Basel III agreement, Capital Requirements Regulation (CRR) and Capital Requirement Directive (CRD) IV.[139]

Another possible transmission channel able to affect banks' funding conditions is represented by the actions of Credit Rating Agencies (CRAs).[140] Sovereign rating downgrades normally impact the rating of domestic banks negatively, leading to an increase in their wholesale funding costs and potentially impairing their market access. According to Arezki et al. (2011), rating downgrades involve statistically significant spillover consequences both across countries and financial markets. This aspect implies that CRAs' announcements could boost financial instability, spreading the contagion risk, especially among countries with weak fiscal conditions (De Santis, 2012). It is worthwhile to note that credit ratings are adopted by regulators to set banks' capital requirements and may therefore impact banks' portfolios because only high rated assets are eligible as collateral in funding operations. A downgrade can cause a portfolio variation to significantly affect bond yields (De Santis, 2012). Moreover, decrease in the creditworthiness can make banks' liabilities no longer suitable as investments for certain institutional investors, such as pension funds and insurance firms. In investigating the risk transmission channel from sovereigns to banks, Alsakka et al. (2014) consider data for three major CRAs before and during the

[139] Basel Committee on Banking Supervision (BCBS) 2013. On this topic, see Nouy (2012).
[140] The credit rating actions include rating changes (upgrades and downgrades), revision of outlook (positive and negative) and review for future rating changes.

euro area debt crisis. They find that, during the crisis, sovereign rating downgrades and negative watch signals heavily impact on bank rating downgrades.

Finally, BIS (2011) identifies a transmission channel via the implicit and explicit government guarantees to banks, especially to those deemed systemically important (G-SIBs).[141] When a deterioration of the fiscal position of sovereigns occurs, both implicit and explicit government guarantees could lose value, reducing the funding benefits that banks draw from them (Schich and Lindh, 2012; Allen et al., 2015; Cordella et al., 2017).

4.2.2 Spillover from bank to sovereign risk

The direction of the contagion can also be considered in the reverse way, from the banking system to the sovereign level. A banking crisis can induce an increase in sovereign risk, as observed in Iceland and Ireland (2008) and in Cyprus (2013).[142] Adverse effects of government support to banks (i.e. guarantee channel) can run from banks to sovereign debt quality. A fragile banking system can negatively affect the soundness of the government through two main channels: draining public finances (through bank rescue packages) and reducing economic growth, with consequently negative effects of limiting capacity to absorb new shocks (BIS, 2011). Bank support measures might necessitate additional fiscal disbursements and, therefore, guarantees for bank liabilities (explicit and implicit), leading to a surge in the actual or potential amount of sovereign debt. In addition, a highly burdened banking sector, undertaking significant deleveraging is harmful to real economic growth and tax revenue, hampering the sovereign's capability to service its own debt (OECD, 2012).

According to Reinhart and Rogoff (2011), there is confirmation that banking crises often lead to sovereign crises. Ejsing and Lemke (2011) provide evidence of a possible credit risk shift from the banking system to the sovereign level, following bank

[141] Global Systemically Important Banks (G-SIBs) are those banks whose default can trigger a financial crisis, involving wider spillover risks. Several negative externalities, especially in terms of costs borne by the taxpayers, are connected to these institutions, perceived as "too big to fail". Externalities are due to their size, interconnectedness, complexity, lack of substitutability or global scope (BIS, November 2011). To maximize their profitability, these institutions can undertake moral hazard behaviours in the awareness of the existence of implicit government guarantees.

[142] In Ireland, sovereign spreads began to widen after the government issued an implicit guarantee on the private debt of the Irish banking sector on 30 September 2008 (Bolton and Jeanne, 2011; Gennaioli et al., 2014). In these countries, the dimension of the banking sector's distress was sufficiently extended to threaten the government stability (Angelini et al., 2014).

bailouts announcements. Analysing the co-movement between the CDS spreads of a sample of euro area countries and their domestic banks, for 2008-09, they demonstrate that public rescue plans in support of the banking sector lead to associated increases in the sovereign risk (also making sovereign CDS spread more vulnerable to future shocks). Gerlach et al. (2010) document the key role played by the size and the organization of banking sectors, alongside international aggregate risk, in terms of changes in sovereign risk. More specifically, countries with large banking systems and low equity ratios show a greater increase in yield spreads when aggregate risk surges. This evidence reflects the increased investors' perception on potential banks' bailouts by national governments.

4.2.3 The mutually-reinforcing feedback loop

The interdependence and spillovers between sovereign and bank balance sheets, in the euro area context, has been the subject of extensive literature. A systemic banking crisis can lead to shrinkage of the whole economy, weakening public resources and transferring the tensions to the government. This potential mutual contagion effect, from the banking system to the sovereign, is amplified in the presence of state guarantees for the financial sector. Consequently, risk is further transmitted to holders of government debt and an increase in the cost of this debt will involve a depreciation effect, which will damage the balance sheets of banks holding government bonds (Gray, 2009).

For 2007-10, Acharya et al. (2014) provide empirical evidence for a two-way feedback between sovereign and banking risk in the euro area. Specifically, these authors highlight a significant post-bailout co-movement between the CDS spreads of sovereign countries and financial firms ("the bailouts spilled banks' credit risk onto the sovereigns and triggered the rise in sovereign credit risk", Acharya et al. 2014, p. 5). Alter and Shuler (2012) analyse the so-called "guarantee channel" for seven euro area countries and their domestic banks during June 2007 and May 2010. They suggest that the pre-bailout direction of spillover is from the financial sector to sovereign, while during the post-bailout periods the trend is opposite where the government CDS spreads are the drivers of banks' CDS. Dieckmann and Plank (2012), find evidence of a public-to-private risk transfer in European countries providing government support to

the banking system. In addition, they argue that this transfer is more significant in euro area member countries due to their higher sensitivity to the health of the integrated financial system.

The justification of the bank-country spillovers arises, as mentioned above, from the existence of explicit and implicit government support to domestic banks. During periods of banking crisis, the implicit public guarantee to the domestic sector take an influential role, inducing negative consequences for sovereign risk (Gray, 2009; Gerlach et al., 2010; Pisani-Ferry, 2012). De Bruyckere et al. (2013) document the presence of contagion between bank and sovereign credit risk in Europe for 2007-10. Moreover, they also provide evidence of the existence of different risk transmission channels (i.e. asset holding channel, guarantee channel and collateral channel) and highlight some bank-country specific variables potentially able to drive contagion. The latter are identified in (i) the Tier1 capital ratio; (ii) the ratio of short-term funding to total funding; and (iii) the percentage of non-interest income to total revenues, on the bank level, while at the country level the debt ratio plays the main role in driving contagion.

Avino and Cotter (2014) study the relationship between sovereign and bank CDS spreads, focusing their attention on the ability of these credit risk measures to provide timely signals on the potential default risk of European governments and their banking systems. For a sample of six European countries in 2004-13, these authors find evidence of inter-linkages between sovereigns and their respective banking sectors. Furthermore, in investigating the underlying price discovery mechanism, they find that bank and sovereign CDS spreads contribute differently across time and countries. For more stable countries (Germany and Sweden), bank CDS spreads show a leading role over the entire sample period, while in the case of peripheral distressed countries (Portugal and Spain), the leading role is assumed by sovereign CDS spreads, during both the sub-prime and European sovereign debt crises

Alter and Beyer (2014) propose an empirical approach to measure the spillover effects between sovereign credit markets and systemically important banks in the euro area. Using bank and sovereign CDS spreads for 2009-12, they document increasing spillovers (and potential contagion) before key financial market episodes and policy actions during the European debt crisis. In addition, they argue that the

peripheral countries' contribution to systemic risk is high before their bailouts but then decreases rapidly. Spillovers from sovereigns to banks and *vice versa* tend to increase during periods of turmoil, reflecting the close sovereign-bank link in the euro area. Fratzscher and Rieth (2015), using CDS data from 2003 to 2013 in a structural VAR model, explore the link between sovereign and bank default risk in the euro area. They find evidence of a two-way causality between adverse shocks at sovereign and bank level, with the sovereign distress being more relevant in explaining the bank fragility, than *vice versa*. The authors also find that bank bailouts lowered the level of credit risk in the banking system, while raising the sovereign risk.

Gross and Kok (2013), considering CDS spreads of sovereigns and banks from Europe, the US and Japan, measure the potential spillover between bank and sovereign credit risk. They find that (i) the potential spillover was more evident in 2008 and then in 2011-2012; (ii) in 2008 the direction of contagion was from banks to sovereigns, whilst in 2011-2012 (during the sovereign debt crisis) the direction reversed; and (iii) the potential spillover index suggests that the interlinkages between banks and sovereigns increased over time. Bicu and Candelon (2013), using cross-border data and CDS premia in a GVAR framework, investigate the potential spillover between banking and sovereign distress in the euro area, focusing particularly on the importance of direct and indirect financial exposures. They notice that indirect connections represent a significant channel for risk transfer and that aggregate vulnerabilities of national banking systems are much larger than estimated. Moreover, decreasing financial cross-border links do not significantly lower the adverse impact of foreign distress and deleveraging policies are not always effective in reducing risk.

Cooper and Nikolov (2014), apply a framework to evaluate sovereign debt fragility and to assess bank instability. In analysing the likelihood of bank runs and the interaction between vulnerability in financial agreements and debt markets, they suggest two ways to break the negative feedback loop between banks and sovereigns: (i) larger bank capital buffers; and (ii) limited commitment by the government in supporting the banking sector.

Farhi and Tirole (2017) develop a theoretical framework for the doom loop between banks and their respective sovereigns. They identify that a weak banking sector can negatively affect the level of sovereign indebtedness because of potential

bailouts, which increase the stock of public debt. At the same time, a weak sovereign has a direct effect on the health of domestic banks because of their holdings of government debt. The magnitude of the effect depends on the extent of banks' home bias. They also provide a rationale for externalizing the function of banking supervision (a key pillar in the structure of different banking unions). Breckenfelder and Schwaab (2017) analyse the spillover effect between bank and sovereign risk in the euro area. In a multi-country framework, they provide evidence of the existence of a significant cross-border component in explaining the nexus between bank and sovereign distress.

4.3 The sovereign-bank feedback loop: An overview of methodologies

The selected contributions are classified based on the adopted approach to investigate the nature and the significance of the sovereign-bank nexus. More specifically, there are four major strands highlighted: (i) theoretical models; (ii) Vector Autoregressive (VAR) frameworks; (iii) panel regressions with fixed effects; and (iv) regressions with breaks and time-varying parameters.

4.3.1 Theoretical models

Acharya et al. (2014), having their motivation from the 2008 Irish crisis, propose a theoretical model, with empirical tests, to examine three closely interconnected questions associated with the link between sovereign credit risk and bank bailouts. By considering CDS spreads on European governments and banks, they first seek to understand whether banking sector rescue packages represented a key factor in triggering the increase of sovereign credit default risk. Second, they investigate the transmission mechanism working between the default risks of governments and banks. Lastly, they explore the nature of the nexus between sovereign and banking risk. They propose a model consisting of three economic sectors, where the public sector can fund a bailout (either through increasing taxation or thinning the existing sovereign debt holdings). With this, they demonstrate that, although beneficial, a bailout is costly and has negative effects on sovereign creditworthiness.

The authors also provide empirical evidence of a two-way feedback loop between sovereign and banking credit risk during the 2007 financial crisis, highlighting a significant post-bailout co-movement between the sovereign and banks CDS

spreads. The bailouts transferred credit risk from banks to sovereigns, triggering the rise in sovereign credit risk, which "in turn weakened the financial sector, confirming the bank-sovereign feedback loop" (Acharya et al. 2014, p. 2737). More specifically, this feedback loop is due to (i) the presence of state (implicit and explicit) guarantees for the financial sector; and (ii) banks' government debt holdings. The authors focus on the crisis period 2007-10, employing a wide panel of bank and government CDS data.

Cooper and Nikolov (2014) set a theoretical model which is the combination of a framework to assess banking instability, based on Diamond and Dybvig (1983), and a framework to evaluate sovereign debt fragility, as in Calvo (1988). In a general equilibrium model, based on three time periods, they consider two types of interactions between the banking sector and the government debt. First, a large portion of (national) sovereign debt is held by banks, both for liquidity purposes and as a long-term asset. Second, there are implicit or explicit guarantees provided by the governments to the domestic banking sector. The model considers four types of agents: banks, households, government and investors. Their setting identifies a vulnerability in debt markets due to multiple self-fulfilling evaluations of government debt's value, based on the interaction of domestically held debt and public guarantees. In the case of an increase in the interest rate on sovereign debt, or an increase in its risk of default, the prices of government bonds decrease and banks holding these securities experience losses. In such circumstances, public banks' bailouts occur due to the high costs of bank defaults, thereby further increasing the amount of government debt and reaching a situation where the high level of interest rates makes repayment problematic. This, in turn, results in a further decline in government bond prices, which again negatively affects banks' balance sheets, implying a larger bailout than originally necessary.

Fontana et al. (2014), extending the framework of Mody and Sandri (2011), propose a model to capture the strong interdependence between bank and sovereign credit risk in the euro area. Based on bank balance sheet data, they run the model on 64 European banking groups, across 21 countries. In their framework, when the financial sector experiences large and unexpected losses, the government issues new debt in order to recapitalize distressed banks. The increases in gross government debt

lead to upsurges in sovereign risk, which in turn generate additional bank losses through government bond holdings (i.e. haircuts).[143] Therefore, an initial shock in the banking sector or at country level is then amplified by a vicious cycle.

The authors set their model on the Mody and Sandri (2011) framework, where the default of the government occurs in case the debt-to-GDP ratio goes beyond a pre-determined threshold. The dynamics of both GDP and government debt directly determine the level of sovereign credit risk, whilst the GDP is determined, among other factors, by the quantity of bank capital provided to the real economy. Fontana et al. (2014) extend the original framework also including the direction of risk transmission from sovereigns to banks, mainly through the channel of government debt holdings. They attempt to capture the circular nature of the link between bank and sovereign risk. In the proposed two-period model, the authors focus on the feedback loops existing among (i) government debt; (ii) haircuts; (iii) bank capital; and (iv) recapitalization actions.

Their analysis, based on data as of December 2012, consists of two stages. In the first step, they investigate the impact of a banking crisis on both bank and sovereign credit risk. The Systemic Model of Banking Originated Losses (SYMBOL) generates the bank (unexpected) losses and the framework only includes those losses able to impact on public finances.[144] In response, the government can recapitalize banks up to either 4.5% or 8% of their risk-weighted assets. The latter case (i.e. the most extreme case) reflects a situation where the private sector does not generate enough capital and the European Stability Mechanism (ESM) does not directly recapitalize banks. In a second step of the analysis, they investigate the impact of an adverse shock originating at the country level on both bank and sovereign credit risk. As initial shock, they consider an exogenous and unexpected shift by 40% in the level of the government credit spread term structure, for all the euro area countries. Bank

[143] Haircuts, expressed as percentages, refer to the reduction applied to an asset's market value (e.g. loan, security).

[144] SYMBOL is developed by the European Commission (EC) in order to safeguard financial stability and prevent financial crises. It simulates potential banking crises under different conditions and it enables assessment of the aggregate effects associated with the introduction of new regulatory frameworks. It employs banks' balance sheet data and, through Monte Carlo simulations, estimates the distribution of potential losses for a given banking system (Muresano and Pagano, 2014).

unexpected losses in distressed conditions are worsened by the losses on sovereign debt holdings due to the application of haircuts.

Fontana et al. (2014), for a group of seven European countries, find that: (i) the sovereign-bank feedback loop effect is substantial and it amplifies the initial effect, on both banking and sovereign risk, arising from a shock in the banking sector (however it is not explosive, as one would expect); and (ii) the significance of the sovereign-bank feedback loop varies across countries (i.e. it is relatively benign in euro area core countries, such as France and Germany, and very pronounced in peripheral economies, such as Spain, Portugal and Ireland). Furthermore, the model permits to evaluate the effectiveness of the ESM intervention, as an instrument to weaken the negative sovereign-bank feedback loop.

Farhi and Tirole (2017) build up a model based on three time periods and which includes four different agents, i.e. domestic bankers, domestic consumers, international investors and a domestic government. They provide a theory about the feedback loop that foreseen both bailouts of national banks and sovereign debt forgiveness by international creditors. The authors' main contribution is to offer a detailed representation of dynamics underlying the sovereign-bank loop and the re-nationalization process of sovereign debt holdings. In their view, the fact that banks hold sovereign debt, as a source of liquidity, might affect the government solvency in the event of a shock. More specifically, the shock might have a direct impact on the economic activity and, thus, on the government's fiscal capacity. Otherwise, the shock might indirectly impact the overall economy through banks' balance sheets. The initial decrease in the price of sovereign bonds adversely affects banks' bond holdings, their investment capability and their solvency condition. The government might therefore decide to rescue the distressed financial institutions, by issuing additional public debt, and thereby reinforcing a vicious circle.

4.3.2 Vector Autoregressive frameworks

Alter and Schuler (2012) analyse the interdependence between the default risk of seven euro area sovereigns and their domestic banks. In the context of the global financial crisis, they focus on the effect of banks' bailouts and on the link between government and bank credit risk. With the aim of modelling the dynamics of the inter-

linkages between the selected CDS series, in both the short and long term, the authors employ Vector Autoregressive (VAR) and a Vector Error Correction (VEC) frameworks, respectively. To obtain a comprehensive view of interactions between the variables of interest, they also perform Granger-causality tests and consider GIRFs. Their results suggest that the pre-bailout direction of contagion is from banks to sovereigns, while during the post-bailout periods the trend is the opposite and government CDS drive bank CDS. In addition, after government rescue packages, a shock in the financial sector affects sovereign CDS spreads more strongly in the short term, while becoming irrelevant in the long term. Finally, the inter-linkage between sovereign and bank risk is heterogeneous across countries, but uniform within the same country.

Bicu and Candelon (2013) focus their attention on the importance of direct and indirect financial links between banks and sovereigns during the European sovereign debt crisis. The aim of their work is to analyse the international links and sectoral spillover effects, within the EMU, arising from integrated banking sectors. They employ BIS cross-border banking data to connect sovereigns in a GVAR framework, while modelling sectoral CDS spreads. They account for both direct and indirect cross-border bank exposures, based on the rationale that the aggregate risk of euro area financial intermediaries is much higher than what would prevail if only considering simple bilateral claims. They indeed document a significant contribution of indirect financial links in connecting the selected countries. Italy and Spain are identified as countries having the largest impact on core euro area economies. Moreover, the authors find that reducing direct banking flows and aggressive deleveraging strategy are not sufficient to protect domestic economies from negative external shocks. Under this perspective, they therefore highlight the crucial role of indirect transmission channels fostered by cross-border banking activity. Adverse shocks impacting government and banking borrowing costs are transferred via balance sheet channels existing between sectors and countries. During distressed times, the euro area banking sector, through both direct and indirect financial exposures, fostered the transmission of risk within single countries and across borders. To reduce the impact of negative shocks and potential contagion, is therefore crucial to estimate the real level of banks' interconnection within the EMU.

Gross and Kok (2013) set up a Global Vector Autoregressive (GVAR) framework for two combined cross-sections, i.e. banks and sovereigns, to model the dynamics of their CDS spreads. They consider a sample of 23 countries and 41 international credit institutions (from Europe, US and Japan) for 2008-13, covering both the most intense phase of the global financial crisis and the European sovereign debt crisis. The Mixed-Cross-Section GVAR (MCS-GVAR) model permits to capture endogenous sovereign-bank feedback loops both within and across cross-sections. Systematic shock simulations are performed in order to obtain an index of potential spillover for within and across the sample of sovereigns and banks. They find that (i) the potential spillover in the CDS market was more evident in 2008 and then again in 2011-2012; (ii) in 2008 the direction of contagion was from banks to sovereigns, whilst in 2011-2012 (during the European debt crisis) the direction reversed; and (iii) the inter-linkages between banks and sovereigns increased over time.

While extending the framework of Diebold and Yilmaz (2014), Alter and Beyer (2014) analyse the dynamics of sovereign-bank financial contagion and try to identify the main drivers of contagion in the euro area, for 2009-12. The authors, relying on Generalized Impulse Response Functions (GIRFs), seek to quantify the sovereign-bank spillover effects based on a vector autoregressive model with exogenous variables (VARX). The latter variables, accounting for common trends in the data, enable to capture and measure the systemic contributions of governments and banks in the euro area. They consider spillovers as the "transmission of unexpected but identified shocks from one variable to other variables in the system" (Alter and Beyer, 2014, p. 147). Following Allen and Gale (2000), they define contagion as the outcome of excess spillover effects and generate contagion indices as aggregated measures of potential spillover effects. More specifically, the indices consist of four components, which account for excess spillover (i) among sovereigns; (ii) among banks; (iii) from sovereigns to banks; and (iv) from banks to sovereigns. In addition, the adopted empirical framework permits to determine over-time changes in the inter-linkages among the selected variables and to assess the effectiveness of the associated policy responses. The authors document increasing spillovers (and consequent potential contagion) before key financial market episodes and policy interventions, during the European sovereign debt crisis. Also, they identify a large contribution to systemic risk

by the peripheral countries under international rescue programmes. The risk then decreases rapidly after the bailouts. Spillovers from sovereigns to banks and *vice-versa* tend to increase during distressed periods, reflecting the close sovereign-bank link in the euro area.

Fratzscher and Rieth (2015) asses the effect of both bank bailout policies, by national governments, and ECB's unconventional policies on the sovereign-bank nexus in the euro area. Preliminarily, they investigate the causality between shocks occurring at bank and sovereign level to then analyse the effect, and its variation over time, of the two different policies upon non-stressed countries compared to the distressed ones. They also seek to capture potential cross-country spillover effects and flight-to-safety phenomena within the EMU. By relying on a set of structural VAR models for 2003-13, the authors document the presence of a two-way feedback loop between bank and sovereign risk, with a greater contribution of the latter in explaining the former, than *vice versa*. Also, if banks' bailouts reduced credit risk in the banking sector, they also contribute in increasing the credit risk associated with sovereigns. ECB non-standard interventions effectively lowered the risk at both sovereign and bank levels. Lastly, the direction of spillover effects was mostly from peripheral to core euro area countries.

4.3.3 Panel regressions with fixed effects

De Bruyckere et al. (2013) investigate the potential spillover effects between bank and sovereign credit risk in Europe for 2007-12. Defining contagion as the correlation over and above what can be explained by economic fundamentals, the authors explore the presence of contagion, among banks and sovereign, and its time-varying intensity. Moreover, relying on panel regressions with different fixed effects, they investigate the potential drivers of contagion, including both country and bank specific variables. Their findings document the presence of contagion between bank and sovereign credit risk in the selected sample period. In addition, they also provide evidence of the existence of different risk transmission channels (i.e. asset holding channel, guarantee channel and collateral channel) and highlight some bank-country specific variables potentially able to drive contagion. The latter are identified in (i) the Tier1 capital ratio; (ii) the ratio of short-term funding to total funding; and (iii) the

percentage of non-interest income to total revenues, on the bank level, while at the country level the debt ratio plays the main role in driving contagion.

Dieckmann and Plank (2012) for 2007-10 find evidence of a strong degree of co-movement in CDS spreads across European countries, especially during the global financial crisis. Performing a preliminary Principal Component Analysis (PCA) the authors explore the source of common variation in CDS spread across the selected countries. To then measure the explanatory power of global variables on CDS spreads, beyond country-specific factors, they perform panel regressions with different fixed effects. For the time period since the beginning of the crisis, they document a significant contribution of the *status* of both the domestic and global financial sectors in explaining the pattern of CDS spreads.[145] Their results also highlight a private-to-public risk transfer through which market agents embed their expectations about bank bailouts and their associated costs. In this context, they demonstrate that the degree of the private-to-public risk transmission channel depends on the significance of the pre-crisis country's exposure to the financial sector. Furthermore, a deteriorated financial sector impacts the level of sovereign CDS spreads and this effect is stronger in economies where the financial sector plays a dominant role, especially in the post-crisis time. The private-to-public risk transfer is more significant in EMU Member States due to their higher vulnerability to the overall conditions of the integrated financial system. Lastly, the exposure of a country to the US sub-prime sector does not influence the private-to-public risk transfer.

4.3.4 Regressions with breaks and time-varying parameters

Ejsing and Lemke (2011) for 2008-09 focus on the co-movement between euro area bank and sovereign CDS spreads in response to government rescue packages. In a first step, they conduct a common factor analysis to quantify the degree of co-movement among bank and sovereign CDS time series. This initial analysis, over the period from January 2008 to mid-October 2008 (i.e. before the various bank bailouts

[145] Principal Component Analysis (PCA) is a statistical technique used for identifying patterns in dataset of high dimensions. This type of analysis can be performed to synthetize the information contained in a dataset since it permits the identification of a minimum number of common factors able to adequately explain the correlations among the variables. The aim of the PCA is to reduce the dimensionality of the dataset, while preserving most of its original variability (Brooks, 2014).

announcements by the euro area governments), shows a common trend among the CDS spreads likely because of deteriorated macroeconomic outlook and increasing investor risk aversion. After mid-October 2008, as a consequence of a potential credit risk shift from the banking to the sovereign level, there is a decrease in the CDS spreads of financial corporates and an increase in sovereign CDS premia.

In a second step of their analysis, the authors perform regressions with both breaks and time-varying parameters, documenting a dynamic nature in the private-to-public risk transfer occurred in late 2008-beginning of 2009. More specifically, after the announcements of bank rescue plans, they find that (i) the response of bank CDS spreads to further aggravation of the crisis is lower than before; while (ii) the opposite is observed for sovereign CDS spreads. Therefore, public support effectively limit the surge in CDS spreads for the financial sector, but increased the sensitivity of sovereign CDS spreads to future shocks.

Table 4.1 summarizes the evidence from academic studies on the sovereign-bank feedback loop in the euro area.

Table 4.1 – Sovereign-bank feedback loop: evidence from the academic literature

Authors	Year	Methodology	Sample period	Sample countries	Database
Ejsing & Lemke	2011	Common factor analysis/Regression analysis with stuctural breaks & time-varying parameters	2008-2009	Eurozone	Datastream
Alter & Schuler	2012	Vector Error Correction model/Vector Autoregressive model/Generalized Impulse Responses	2010-2012	Eurozone	Datastream
Dieckman & Plank	2012	Principal component analysis/Regression analysis with time fixed effects	2007-2010	Eurozone/European non-Eurozone/Israel	Markit, Bloomberg, Datastream, OECD, IMF, ICI
Bicu & Candelon	2013	Global Vector Autoregressive model	2008-2012	Eurozone	Datastream, BIS, EBA
De Bruyckere et al.	2013	Factor model/Panel regression analysis with time fixed effects	2007-2012	Eurozone/European non-Eurozone	Bloomberg, Thomson Reuters Worldscope, Eurostat, Oxford Economics, ECB, EBA
Gross & Kok	2013	Mixed-Cross-Section Global Vector Autoregressive /Generalized Impulse Response Functions /Network analysis	2008-2013	Eurozone/European non-Eurozone/US/Japan	-
Alter & Beyer	2014	Vector Autoregressive model with exogenous variables /Generalized Impulse Response Functions	2009-2012	Eurozone	Datastream, Bloomberg, Markit
Acharya et al.	2014	Theoretical framework	2007-2010	Eurozone/European non-Eurozone	Bankscope, Datastream, Markit, Bloomberg, OECD, EBA, BIS
Avino & Cotter	2014	Vector Error Correction model	2004-2013	Eurozone	Datastream
Cooper & Nikolov	2014	Theoretical framework	-	-	-
Fontana et al.	2014	Theoretical framework	End 2012	Eurozone/European non-Eurozone	SNL Financial, Bankscope, Datastream, Markit, EBA
Fratzscher & Rieth	2015	Structural VAR model	2003-2013	Eurozone	Datastream, Bloomberg, ECB's website
Farhi & Tirole	2017	Theoretical framework	-	-	-

4.4 The BRRD as a natural experiment and the bail-in mechanism

The sovereign debt and bank crises in 2009-2012 highlighted the necessity of deeper integration and centralization of the euro area banking system. Therefore, in mid-2012, the EU authorities agreed on the establishment of a BU. The main aim of the project was to break the sovereign-bank nexus and restore confidence in the euro area banking system. The BU and its three main pillars, i.e. the Single Supervisory Mechanism (SSM), the Single Resolution Mechanism (SRM) and a European Deposit Insurance Scheme, rely on a set of common rules, which apply to all the 28-EU Member States. More specifically, these are the CRR and CRD IV approved in 2013, the Directive on Deposit Guarantee Schemes (DGS) adopted in 2014 and the BRRD agreed in 2014 and which came into force in January 2015.[146]

The BRRD introduced a common framework and tools to quickly and effectively wind up failing European banks and investment firms.[147] Broadly, the EU Directive entails four key pillars:

- the preparation and prevention of failures through recovery and resolution planning (so-called "living wills");[148]
- the early intervention powers;
- the application of resolution tools and powers in a case of bank failure;
- the cooperation and coordination between national authorities.

The range of resolution instruments referred to in the Directive comprise (i) the sale of business; (ii) the bridge institution; (iii) the asset separation; and (iv) the bail-in tool. The bail-in tool, which is intended to ensure that both shareholders and (unsecured) creditors suffer the losses arising from a bank's failure, plays a relevant role in protecting taxpayers' money, while restoring market discipline.[149]

[146] Regulation (EU) No 575/2013, Directive 2013/36/EU, Directive 2014/49/EU and Directive 2014/59/EU, respectively.

[147] In the euro area, the BRRD has been implemented through the SRM.

[148] Banks are required to prepare and maintain recovery plans that indicate the measures to adopt in various potential risk scenarios. Resolution authorities, in cooperation with supervisory authorities, are instead required to develop resolution plans for individual banks, identifying the actions to be undertaken for resolving the institution (Boccuzzi, 2016).

[149] Bank's shareholders and creditors (junior, unsecured senior and insured depositors above €100,000) must bear losses equivalent to at least 8% of the bank's liabilities, including own funds. Writing down and/or converting stakeholders' claims into equity represents a precondition to access to the national resolution fund or to ESM's direct recapitalization (up to 5% of the bank's total liabilities). Refer to

Under the BRRD's prescriptions, banks are required to maintain, all the times, a robust MREL as a percentage of their total liabilities and own funds (TLOF).[150] This requirement is set in order to prevent the possibility of a liability structure that undermines the effectiveness of the bail-in or other resolution instruments, and to avoid the risk of spillover or bank run. Therefore, the MREL guarantees a sufficient loss absorbing capacity, which in turn should permit an orderly resolution, without causing financial instability and the recourse to public money.

At the global level, defined by the Financial Stability Board (FSB), the Total Loss Absorbing Capacity (TLAC) is applied to G-SIBs with the aim of dealing with the too-big-to-fail dilemma and allow for smoother resolutions of large and complex banks (Reuters, 2016).[151] Although both the MREL and the TLAC address the same overall goal, they differ under many aspects (e.g. timeline, scope, operational features).[152] Table 4.2 provides a brief comparison of the main elements of the two requirements.

Appendix 4.A for an example of loss absorption and recapitalization following a bail-in. For the Member States, the legal basis for the bail-in mechanism is provided by the SRM Regulation (Article 27).

[150] Article 45 of the BRRD.

[151] In November 2015, the FSB together with the Basel Committee on Banking Supervision (BCBS) proposed the TLAC standard. The final version of the agreement was released in October 2016. http://www.bis.org/bcbs/publ/d387.pdf

[152] The coexistence of the two requirements, without creating double standards, is a crucial aspect in order to avoid potential uncertainty for banks (i.e. EU G-SIBs) and market agents (e.g. investors and credit rating agencies) (Berger et al., 2016).

Table 4.2 - Main elements of MREL and TLAC requirements

	MREL	TLAC
Objective	Ensure that, in case of failure, banks have an adequate loss absorbing capacity in order to avoid the use of public money	
Scope	All EU banks and investment firms	G-SIBs
Requirements and timeline	MREL is set for each bank individually by the resolution authorities (case-by-case approach - Pillar 2 measure)* MREL must be at least 8% of total liabilities and own funds (TLOF) From 1 January 2016 (at the latest) with 48 months phase-in	TLAC is a common minimum standard for all relevant banks (Pillar 1 measure) From 1 January 2019: at least 16% of RWAs and at least 6% of the Basel III leverage ratio denominator From 1 January 2022: at least 18% of RWAs and at least 6.75% of the Basel III leverage ratio denominator G-SIBs headquartered in emerging market economies (EMEs) have to meet the 16% RWA / 6% leverage ratio denominator no later than 1 January 2025 and the 18% RWA / 6.75% leverage ratio denominator no later than 1 January 2028 **

* The Regulatory Technical Standards (RTS), which specify the criteria to set the MREL, are defined by the EBA (http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016R1450&from=EN)
** Not even in the official FSB's documents it is possible to retrieve a clear definition for EMEs.
Description: The table presents a brief comparison of the main elements of the MREL and TLAC requirements.
Source: ECB (2014) and Deutsche Bank (2016). Own elaboration.

Based on the BRRD, the new EU resolution regime and the bail-in mechanism represent a vital step in safeguarding financial stability in Europe, particularly in mitigating moral hazard and other issues associated with a strong reliance on public bailouts (Hüser et al., 2017). In this context, the implementation in January 2015 of the BRRD can be considered as an exogenous shock, which involved the whole European banking system.[153] This event provides, therefore, the setting for a natural experiment in order to test markets' perception about the effectiveness of the new resolution rules in weakening the sovereign-bank nexus.

[153] The BRRD applies to all credit institutions (i.e. banks) and large investment firms, including their EU incorporated holding companies and their EU incorporated subsidiaries (Article 1).

4.5 The identification strategy

In the DiD estimation framework employed in this chapter's analysis, the treatment (intervention) is represented by the BRRD which came into effect on 1 January 2015. [154] The potential treatment group consists of all the European financial companies (i.e. banks) falling under the remit of BRRD. In the implementation in this chapter, the latter group is restricted to those for which CDS data were available. The control group is composed of non-financial corporates, with the rationale that they do not fall under the remit of BRRD. Again, the composition of the control group is based on CDS data availability. The entire sample of firms, both financial and non-financial, are located across different European countries (i.e. France, Germany, Italy, Netherlands, Spain, Sweden and the UK) subject to BRRD requirements. The analysis is conducted for each country separately, as well as for the whole sample of countries.

The model specification must capture the effect of the intervention (i.e. implementation of BRRD) on the CDS market and on the vicious cycle between sovereign and financial stress in Europe. The baseline estimation model is represented by the following equation:

Equation 4.1

$$\mathrm{GAP}_{i,t} = \alpha_0 + \beta_1 \mathrm{BRRD}_t + \beta_2 \mathrm{Treat}_i + \beta_3 \mathrm{BRRD}_t \times \mathrm{Treat}_i + \varepsilon_{i,t}$$

where the dependent variable $\mathrm{GAP}_{i,t}$ (the outcome of interest) is the difference, in price levels, between the non-sovereign CDS spreads and the sovereign CDS spreads (henceforth, "GAP"). [155] *i* indexes the firm (both treated and untreated) and *t* indicates time (days/weeks/months). BRRD and Treat are two dummy variables. The BRRD variable represents the treatment, which assumes the value of 1 during the period

[154] Member States are required to transpose the Directive into national law by 31 December 2014 and apply its provisions as of 1 January 2015. Therefore, in this context, the decision of selecting a single date (i.e. 1 January 2015), rather than a different date for each country (based on the effective transposition process and/or implementation of the bail-in provision) seemed to be the most appropriate. Moreover, this choice was also supported by the aim of capturing the short-run effect associated with the implementation of the Directive.

[155] Initially, a part from the GAP variable specified here, three other dependent variables were considered: (i) the difference between the non-sovereign and sovereign CDS log prices; (ii) the ratio of non-sovereign CDS prices to sovereign CDS prices; and (iii) the ratio of non-sovereign CDS log prices to sovereign CDS log prices. The final decision of considering the difference between non-sovereign and sovereign (raw) prices as dependent variable was motivated by its greater consistency and stability.

spanning from 1 January 2015 to 30 June 2016 (post-treatment period) and 0 otherwise. Treat represents the dummy variable for the treatment/control group. Treat equals 0 for the control group (i.e. non-financial corporates) and Treat equals 1 for the treatment group (i.e. banks). α_0 represents the level of GAP in the control group prior to the treatment. β_1 captures any change in GAP in the control group following the implementation of the BRRD (1 January 2015). β_2 captures GAP differences between the treatment and control groups before the intervention. β_3 represents the main coefficient of interest, because it captures the effect of the treatment (BRRD) on the treatment group (banks). More specifically, it captures the difference in the GAP from the pre-treatment to the post-treatment period, between banks relative to non-financial corporates. A positive (negative) and statistically significant coefficient for $\beta_3$would imply *ceteris paribus* the GAP widens (narrows) more for banks than non-financial corporates. Finally, $\varepsilon_{i,t}$ is the error term.

The main model specification for the analysis conducted in this chapter includes a dummy variable controlling for the 2009-2012 European sovereign debt crisis and firm-specific fixed effects:[156]

Equation 4.2

$$\mathrm{GAP}_{i,t} = \alpha_0 + \beta_1 \mathrm{BRRD}_t + \beta_2 \mathrm{BRRD}_t \times \mathrm{Treat}_i + \beta_3 D_{crisis} + \gamma_i + \varepsilon_{i,t}$$

In the above specification, differently from Equation (4.5), Treat does not appear on its own because its effect is subsumed in the firm fixed effects. D_{crisis} is set as a binary variable equal to 1 from January 2011 to September 2012. γ_i are firm fixed effects, which rule out the influence of unobserved firm specific differences e.g. firm size, between the treated and non-treated groups. Robust standard errors are used.[157]

The crisis period is set as the time period before 1 September 2012, which represents a date of compromise between the three key dates associated with the

[156] The same specification is adopted for the investigation on each country separately and for the whole sample of countries.

[157] When considering the whole sample of countries, robust standard errors are clustered at firm level to account for serial correlation within each panel (Bertrand et al., 2004). Moreover, country, year and country-year fixed effects are included in alternative specifications. The results presented in Section 4.7 are based on the baseline estimation model (Equation 4.5) and on the preferred model specification (Equation 4.6).

ECB's Outright Monetary Transactions (OMT) program.[158] Several authors (e.g. Ferrando et al., 2015; Zaghini, 2016; Acharya et al., 2017) acknowledge that the announcement of the OMT by the ECB in summer 2012 led to a period of reduced tensions in both the euro area banking system and sovereign debt market.[159] Although the bond-buying program has still not been activated as at February 2018, its announcement had an immediate positive impact in lowering spreads of sovereign bonds issued by troubled European countries.[160] Multiple authors (Krishnamurthy et al., 2014; Szczerbowicz et al., 2015; Altavilla et al., 2016) find that the ECB's unconventional monetary policy reduced peripheral sovereign bond yields, especially for distressed countries such as Italy and Spain. The consequent increase in the value of these securities contributed in restoring the stability of the European banking system. In fact, banks with sizeable shares of these bonds in their sovereign debt portfolios experienced important windfall gains, which essentially resulted in an indirect recapitalization (Acharya et al., 2017; Véron, 2017). The ECB's intervention, with the aim of easing the tensions and lowering the pricing of extreme risks (i.e. the collapse of the euro area), resulted from mid 2012 in an improvement of the market access for both sovereigns and corporations (Zaghini, 2016). Fratzscher and Rieth (2015) consider the announcement of the OMT program to have been the most effective measure in reducing default risks, both at sovereign and bank level, in the euro area.

For robustness purposes, this chapter also considers two additional model specifications based on Equation (4.6). The first excludes the categorical variable

[158] On 26 July 2012, the ECB President Draghi stated that the ECB was ready to do "whatever it takes to preserve the euro" (https://www.ecb.europa.eu/press/key/date/2012/html/sp120726.en.html). On 2 August 2012, there was the announcement of the launch of the OMT Program, while its technical features were officially presented on 6 September 2012.

[159] Under the OMT program, the ECB is committed to purchasing, in the secondary market, a theoretically unlimited amount of (short-term) debt of an eligible euro area government (Krishnamurthy et al., 2014). The Member States, in order to access to the programme, must be already under financial assistance (i.e. subjected to a ESM programme).

[160] The ECB's Quantitative Easing (QE), which started in January 2015, is a different unconventional monetary policy than the OMT programme. Its aim is to increase the quantity of money through the purchase of financial assets (usually, government bonds) other than short-term assets, across all Member States. The OMTs are also implemented through bond-buying, but since the liquidity created is fully sterilized by offsetting any debt purchases, the aim is not to increase the quantity of money. OMTs aim to safeguard the ECB monetary policy transmission and reduce fragmentation by avoiding speculation and the tail risk of break-up of the euro area (Pacces and Repasi, 2015).

controlling for the crisis. The second, based on a sample period starting from 1 September 2012, excludes the crisis period from the estimation. Moreover, the same specifications but with different data frequencies (i.e. daily, weekly and monthly) are also investigated.

4.5.1 Hypotheses

Public rescues of troubled banks are a source of moral hazard and they undermine market discipline. Bailouts create expectations about future government responses to financial turmoil. More specifically, the subsidization of bank stakeholders' risk-taking through the externalization of the costs connected to failures exerts a distorting effect on *ex ante* incentives, defining moral-hazard. This could potentially create instability, fragility and risk in the banking sector (Hadjiemmanuil, 2017). Moreover, state-funded bailouts of insolvent banks produce a severe destabilizing effect on public finances and sovereign indebtedness.[161] In order to overcome the implicit principle of resolution, which characterized the crisis period and led to the privatization of banks' profits and the socialization of their losses, there were two major responses at European level. Firstly, based on the BRRD, a clear framework for dealing with failing banks was established, together with a central responsible resolution authority (i.e. the SRM). Secondly, it was made sure that the potential burdens of bank failure were internalized and borne by shareholders and bondholders, rather than by taxpayers. The bail-in concept was introduced with the intention of eliminating calls on the bailout mechanism.

Ultimately, any successful application of the resolution rules requires that financial markets perceive them as credible and effective. If there is no confidence that bank failures can be managed in an orderly fashion and the market participants still expect a public bailout, the resolution procedure could lead to further turmoil. In this light, some viewpoints (Avgouleas and Goodhart, 2015; Reuters, 2016) suggest that the bail-in mechanism might be inappropriate in the case of a systemic banking crisis. However, the bail-in approach might work better than bailout policies in the

[161] Since the outset of the global financial crisis, the fiscal cost of recapitalization and asset relief of 22 large European credit institutions amounted to €298bn, while the cash injections to UK banks were up to £133bn (Schoenmaker, 2016). During 2008-14, the direct fiscal costs associated with the banking crisis accounted for 4.8% of euro-area GDP (ECB, 2015).

case of idiosyncratic distress, but not when there is a threat of systemic crisis or in the event of the collapse of a large cross-border European institution. Eventually, it might also intensify the potential systemic effect of minor idiosyncratic turbulences (Navaretti et al., 2016). De Grauwe (2013) suggests that the resolution framework could increase systemic risk in the euro area, thus making banking crises more likely, as a consequence of bank runs and large economic costs associated with the bail-in mechanism. This author emphasizes the negative effect of the bail-in provision on deposit holders, who are treated under the BRRD as being the holder of any other type of investment.[162]

In investigating whether the new resolution rules had an impact in weakening the doom loop between banks and sovereigns in the euro area, the main hypothesis underlying the analysis in this chapter is that the intervention (i.e. the BRRD) is expected to impact the nexus in case of banks (treatment group), whereas the sovereign-corporate link should not be affected.[163] The underlying assumption is that, a priori, the link between sovereigns and banks (regardless of the direction of causality) is considered as special compared to that between sovereigns and non-financial firms. Therefore, a decoupling trend, between sovereign and bank risk, measured by CDS spreads, is anticipated. A relative widening of the GAP variable, as described in Equation 4.5, is expected if the BRRD is perceived as credible by the market participants, especially in peripheral euro area countries.[164] Otherwise, in case the BRRD is not perceived as effective and reliable in limiting the use of public resources, for instance, in dealing with a potential distress of a systemic proportion, the gap between bank and sovereign CDS spreads might, instead, be unchanged or decrease.

[162] Under the BRRD, the bail-in of the most junior depositor class remains a possibility. More specifically, the Directive establishes a hierarchy in liquidation between different categories of deposit: those protected by deposit protection schemes ("covered deposits", and the most senior), deposits by individuals and SMEs which are eligible for protection but exceed the maximum amounts ("eligible and uncovered", second most senior) and finally other deposits, essentially from large corporates and institutions, i.e. junior deposits (Moody's, 2015).

[163] In this context, it is worthwhile to mention that non-financial corporates with traded CDS are commonly large, blue-chip companies, with little reliance on the bank credit channel (Angelini et al., 2014).

[164] For the purpose of this analysis, it was not relevant to establish whether the widening of the GAP measure was driven by a change in the levels of bank CDS spreads or in the sovereign CDS quotes.

Summarizing, the main testable hypothesis of this empirical analysis is as follows:

H_0: GAP widens for banks

while the alternative is:

H_1: GAP unchanged or narrows for banks

4.6 Data, sample and empirical methodology

The following section provides a description of the data, the sample construction and the adopted empirical methodology.

4.6.1 Data

The primary aim of this empirical chapter is to analyse the CDS market response to the implementation of the EU BRRD in January 2015. The focus is also on assessing the effectiveness of the Directive in its objective of weakening the sovereign-bank nexus in the euro area. To this end, daily CDS data for European sovereigns and corporates (both financial and non-financial) are employed. As standardized products with pre-specified and comparable terms, CDS contracts allow for a reliable comparison of credit risk across corporates and sovereigns (Breckenfelder and Schwaab, 2017).[165]

Specifically, 5-year CDS mid-quotes on senior unsecured debt contracts are selected, since this type of contract is commonly considered to be the most liquid and to represent the largest share of the entire CDS market (Ballester et al., 2016; Black et al., 2016). The restructuring clause is the full-restructuring credit event (CR) for the sovereign entities and the modified-modified restructuring (MM) clause for the non-sovereign entities, which correspond to the standard (and, therefore, most liquid) conditions for CDS contracts traded on European reference entities (Bedendo et al., 2015). The currency denomination of the contracts is mostly the Euro.[166] The sample

[165] A CDS is a bilateral agreement between two parties under which the seller seller "sells protection" to the buyer (in exchange for the payment of a fixed periodic premium) against the credit risk of the reference entity (the protection component is activated when a previously specified credit event occurs). In other words, they represent a form of insurance against the risk of default of the reference entity, such as a firm or a sovereign.

[166] Due to constraints on data, some exceptions in terms of reference currency apply for the data for the following firms: (i) the Italian Intesa Sanpaolo (USD), Banca Italease (USD) and Telecom Italia (USD); (ii) the Dutch KPN (USD), ING Bank (USD); (iii) the German Lufthansa (USD); (iv) the British Bank of Scotland (USD), Natwest (GBP) and Standard Chartered (USD); (v) the French Credit Lyonnais (USD).

period, which spans from January 2011 to June 2016, covers both the troubled time characterized by the European sovereign debt crisis as well as the relatively more tranquil post-crisis time.[167]

4.6.2 Sample construction

The construction of the sample was not a straightforward process. The necessity of combining CDS time series for financial entities, non-financial entities and the corresponding sovereigns, made the task more complex than anticipated. Different steps were conducted with the purpose of building a reliable and exhaustive sample (Table 4.3).

Initially all the available CDS prices, for all the EU-28 Member States, were downloaded from Thomson Reuters Datastream. The data availability for a given country was assessed by requiring the existence of both the CDS prices for the sovereign and those of at least two financial (banks) and non-financial firms. The limited number of European corporate CDS reference entities influenced the size of the sample. For instance, for countries such as Belgium, Finland, Greece, Ireland and Portugal, it was not possible to retrieve sufficient data either for the financial firms or for the non-financial institutions. At this stage the sample comprised CDS data on 217 entities (166 non-financial and 51 financial) across 7 sovereigns (representing about 70% of the iTraxx Europe Index).[168,169]

In a second step, CDS prices were also collected from Bloomberg. The underlying rationale was the potential to increase the sample size by utilizing an alternative data source. In this context, it is noteworthy to highlight the possibility of discrepancies among the price series provided by different data sources. This arises

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Regarding the sovereign entities, Netherlands is the only case where the CDSs are denominated in USD (Datastream only provides the sovereign time series denominated in Euros). In principle, currency differences can be ignored as CDS data are expressed as a rate, thus without units (Ang and Longstaff, 2013; Buchholz and Tonzer, 2016).

[167] See Section 4.6 for a more detailed discussion about these two time periods.

[168] The qualifying non-financial corporates, according to the Datastream classification, were from the following sectors: (i) consumer goods; (ii) electric power; (iii) energy; (iv) manufacturing; (v) services; (vi) telecommunications; and (vii) transportation.

[169] The Markit iTraxx Europe index includes the most liquid 125 equally-weighted European investment-grade reference entities (the weight is 0.8%). Every six months, on 20 March and 20 September, the index is "rolled" and a new series is created. The traded maturities are 3, 5, 7 and 10 years (Augustin et al., 2014).

because the information on CDS prices are collected from different contributors (e.g. brokers) based on their voluntary participation in periodic surveys. Leland (2009) reports that Bloomberg's CDS data is often revisited weeks after and can differ substantially from other data sources, such as Datastream. In considering such shortcomings and their impact on the validity of the associated empirical analyses, Mayordomo et al. (2014) compare five main databases for CDS prices (i.e. GFI, Fenics, Reuters, CMA and Markit). Using 5-year CDS included in the European iTraxx and in the US CDX, they investigate the consistency among the data sources in both the cross section and time series dimensions. They underline the existence of systematic deviations, thus not purely random, from the common trend across different datasets. For certain entities, especially during periods of turmoil, there are significant divergences in the respective quoted prices. They find that the CMA quotes lead the price discovery process with respect to the prices provided by other data sources. Following a comprehensive investigation, the final decision was to only employ the data obtained from Thomson Reuters Datastream (which was found to be the source providing the richest amount of information).[170]

Only the entities with price series without missing observations were retained, while the others were removed from the data sample. This led to a sample of 190 entities across 7 sovereigns. The UK accounts for 30% of the dataset, and France and Germany, around 19% and 20%, respectively. These are the most heavily represented countries in the sample.

A further adjustment was made to the data. In considering price levels and the relation between sovereign CDS spreads and non-sovereign CDS spreads, there were several cases when the former exceeds the latter. This condition is difficult to be economically justified (especially after investigating the associated credit ratings).[171] The decision was to remove the companies for which this evidence was very frequent (21 in total) and to adjust the less affected cases.[172] The adjustment consisted of

[170] It is noteworthy to report on evidence that emerged while collecting sovereign CDS data from the two databases. Datastream only provides data denominated in Euros (except for Netherlands), while Bloomberg only provides data denominated in US Dollars. A truly consistent comparison was, therefore, not possible.

[171] Credit ratings for both the companies and the respective sovereigns were obtained from Moody's website.

[172] Among these 21 companies, only one is a bank (the Italian BNL).

considering as missing the observations, over the entire time period, when a firm's CDS price was lower than that of the corresponding sovereign.[173]

Table 4.3 - Sample construction

Initial data sample						After selection				After adjustment			
Country		Corporates	Banks	Total	%	Corporates	Banks	Total	%	Corporates	Banks	Total	%
Germany	DE	31	10	41	18.89%	26	10	36	18.95%	25	10	35	20.71%
Spain	ES	6	6	12	5.53%	5	6	11	5.79%	3	6	9	5.33%
France	FR	36	6	42	19.35%	32	6	38	20.00%	26	6	32	18.93%
Italy	IT	9	9	18	8.29%	5	9	14	7.37%	3	9	12	7.10%
Netherlands	NL	15	4	19	8.76%	14	4	18	9.47%	12	4	16	9.47%
Sweden	SE	13	4	17	7.83%	12	4	16	8.42%	12	4	16	9.47%
United Kingdom	UK	56	12	68	31.34%	45	12	57	30.00%	38	12	50	29.59%
Overall		166	51	217	100.00%	139	51	190	100.00%	119	50	169	100.00%

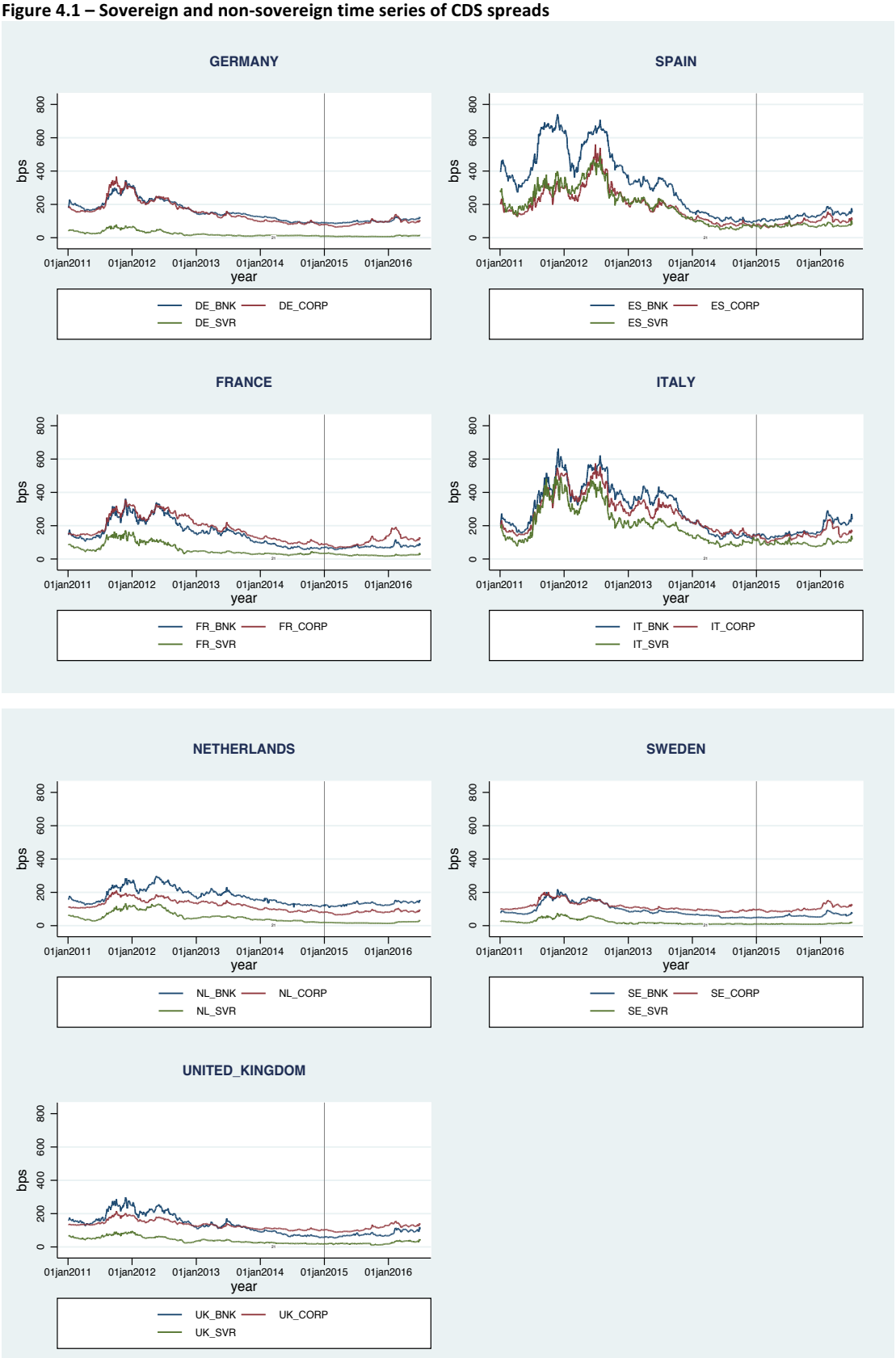
Description: The table presents (i) the original data sample obtained from Datastream; (ii) the sample after the selection based on the frequency of trading and liquidity of the price time series; and (iii) the final sample following the adjustment made to account for the presence of sovereign CDS spreads exceeding non-sovereign CDS spreads. For each country, it reports (i) the number of corporates; (ii) the number of banks; (iii) the total number of corporates and banks; (iv) the weight i.e. proportion of the total number of companies. Overall totals are also provided.

The final sample used in the analysis comprises 169 corporates (119 non-financial and 50 financial) across seven countries (i.e. Germany, France, Italy, Netherlands, Spain, Sweden and the United Kingdom).

Figure 4.1 shows the time series of sovereign and non-sovereign CDS spreads for the seven selected countries over the entire sample period (January 2011-June 2016). Each graph also displays a vertical line at the date of implementation of the EU-wide BRRD (1 January 2015). More distressed countries, such as Spain and Italy, have higher (and more volatile) data than the other countries. This is particular evident during the most acute phase of the European debt crisis, i.e. between August 2011 and August 2012 (Ongena et al., 2016). In the Italian case, a more pronounced interlinkage among the three CDS spreads time series is evident. Overall, sovereign CDS spreads are relatively lower than the other two time series for all the countries except for Italy and Spain. In Germany, banks and non-financial corporates share a similar pattern over the entire sample period.

[173] See Table 4.B.1 in Appendix 4.B for a detailed list of the corporates, both financial and non-financial, included in the data sample.

Figure 4.1 – Sovereign and non-sovereign time series of CDS spreads



Description: The figure illustrates average daily time series of CDS spreads for (i) sovereigns; (ii) banks; and (iii) non-financial corporates (in bps) for to the seven selected EU countries.
Note: For comparability reasons, all the graphs have the same scaling on the vertical axis.

Table 4.4 provides the descriptive summary statistics for each CDS price time series (related to sovereigns, banks and non-financial corporates) for the full time period (Panel A) as well as for the pre- and post-BRRD periods (Panel B and C, respectively). Daily data are expressed in basis points (bps).[174]

Table 4.4 - Summary statistics for the CDS price series

Panel A - Full sample period (Jan. 2011 - June 2016)								
	Obs.	Min	Max	Mean	Median	5th Pct	95th Pct	Std.Dev.
Sovereigns								
Germany	1434	6.64	79.29	21.53	13.95	6.95	59.83	16.19
Spain	1434	45.42	492.07	171.42	149.93	59.15	387.57	110.52
France	1434	16.80	171.56	52.07	36.93	19.96	134.25	36.08
Italy	1434	69.25	498.66	183.70	127.75	80.13	423.51	111.04
Netherlands	1434	13.57	133.84	46.65	36.94	14.57	114.68	31.26
Sweden	1434	7.65	75.71	20.40	13.66	8.63	55.58	15.37
United Kingdom	1434	11.66	94.99	37.68	31.76	17.61	78.30	19.45
Banks								
Germany	1434	84.84	345.10	151.77	137.30	89.13	275.69	61.00
Spain	1434	87.81	741.07	295.67	253.41	99.47	659.16	191.19
France	1434	56.54	361.39	139.01	119.32	62.49	291.55	76.10
Italy	1434	116.81	662.25	279.37	231.54	130.74	549.51	136.33
Netherlands	1434	107.49	297.58	168.56	151.06	119.06	260.48	46.12
Sweden	1434	45.30	218.61	86.75	74.56	47.30	169.24	40.00
United Kingdom	1434	53.55	298.12	127.51	113.43	60.01	247.26	60.00
Non-financial corporates								
Germany	1434	63.37	367.21	143.72	124.81	72.13	300.65	67.45
Spain	1434	60.56	560.05	172.66	142.69	71.24	384.75	99.52
France	1434	66.19	355.26	167.92	146.48	74.21	309.34	74.02
Italy	1434	97.34	573.82	246.84	202.44	122.68	498.63	116.23
Netherlands	1434	64.96	210.94	116.25	108.05	72.96	182.74	34.71
Sweden	1434	79.75	202.05	112.34	102.80	84.23	175.11	26.40
United Kingdom	1434	88.69	215.62	129.12	126.58	93.82	186.00	26.43

[174] This is in line with different contributions, e.g. Avino and Cotter (2014), Augustin (2016), Ballester et al. (2016).

Panel B - Pre-BRRD period (Jan. 2011 - Dec. 2014)								
	Obs.	Min	Max	Mean	Median	5th Pct	95th Pct	Std.Dev.
Sovereigns								
Germany	1043	7.77	79.29	26.23	18.79	10.15	61.64	16.64
Spain	1043	45.42	492.07	208.09	204.16	55.27	407.31	108.79
France	1043	21.03	171.56	62.58	46.86	27.46	139.96	37.11
Italy	1043	69.25	498.66	216.75	199.70	84.04	436.90	113.55
Netherlands	1043	18.33	133.84	57.41	50.14	21.53	118.00	30.22
Sweden	1043	7.65	75.71	24.02	17.02	8.28	57.57	16.57
United Kingdom	1043	16.91	94.99	43.14	39.41	18.74	81.11	19.68
Banks								
Germany	1043	86.94	345.10	171.29	152.51	90.54	288.60	60.70
Spain	1043	87.81	741.07	357.63	342.61	99.35	664.85	189.77
France	1043	56.79	361.39	163.61	154.27	63.39	298.23	75.57
Italy	1043	116.81	662.25	318.93	341.50	132.16	556.99	138.38
Netherlands	1043	109.91	297.58	182.41	177.53	121.49	266.79	46.73
Sweden	1043	45.30	218.61	96.98	83.04	47.30	177.85	42.15
United Kingdom	1043	54.80	298.12	146.27	137.19	64.31	251.65	59.71
Non-financial corporates								
Germany	1043	74.23	367.21	163.89	154.71	82.55	306.80	68.26
Spain	1043	67.17	560.05	202.51	191.93	75.62	409.04	101.05
France	1043	83.69	355.26	190.49	173.98	93.03	314.67	72.78
Italy	1043	129.71	573.82	284.82	280.09	144.95	503.04	113.79
Netherlands	1043	77.98	210.94	129.20	128.74	82.80	184.80	31.83
Sweden	1043	79.75	202.05	116.07	105.78	84.65	178.06	28.21
United Kingdom	1043	96.28	215.62	134.98	132.68	99.93	188.53	26.83
Panel C - Post-BRRD period (Jan. 2015 - June 2016)								
	Obs.	Min	Max	Mean	Median	5th Pct	95th Pct	Std.Dev.
Sovereigns								
Germany	391	6.64	15.56	8.97	7.78	6.67	13.18	2.46
Spain	391	54.06	105.03	73.59	72.46	63.09	88.31	8.04
France	391	16.80	37.73	24.03	23.08	17.85	33.57	4.39
Italy	391	71.85	139.80	95.55	94.07	77.10	118.75	12.00
Netherlands	391	13.57	31.94	17.93	16.06	14.06	23.51	3.67
Sweden	391	8.00	20.30	10.73	9.95	8.64	14.32	2.41
United Kingdom	391	11.66	46.38	23.10	20.86	12.38	37.81	7.86
Banks								
Germany	391	84.84	126.26	99.70	96.98	86.95	117.93	9.62
Spain	391	97.24	190.33	130.39	129.20	101.68	171.78	20.94
France	391	56.54	117.54	73.40	71.66	60.75	92.68	9.40
Italy	391	118.84	291.87	173.85	156.15	128.32	257.64	42.24
Netherlands	391	107.49	154.35	131.61	131.92	116.24	147.71	9.95
Sweden	391	46.07	92.74	59.47	57.44	47.58	80.78	10.28
United Kingdom	391	53.55	119.48	77.49	72.30	57.14	106.18	15.87
Non-financial corporates								
Germany	391	63.37	141.16	89.94	90.99	66.24	120.64	16.77
Spain	391	60.56	155.63	93.05	92.00	67.26	129.93	19.36
France	391	66.19	191.74	107.72	108.92	70.63	177.84	31.38
Italy	391	97.34	239.88	145.53	140.57	109.69	218.90	29.93
Netherlands	391	64.96	104.88	81.70	82.09	66.17	96.72	8.54
Sweden	391	80.78	153.11	102.42	96.80	83.88	137.58	17.24
United Kingdom	391	88.69	154.76	113.50	114.48	90.36	142.91	17.49

Description: The table reports the descriptive summary statistics (expressed in bps) for sovereign CDS, bank CDS and non-financial corporate CDS (daily data). For each group, the following metrics are reported: the number of observations (Obs.), the minimum (Min), the maximum (Max), the mean (Mean), the median (Median), the 5th and 95th percentiles (5th Pct and 95th Pct, respectively) and the standard deviation (Std.Dev.). Panel A provides the statistics for the full sample period (Jan. 2011 – June 2016), Panel B for the pre-BRRD period (Jan. 2011 – Dec. 2014) and Panel C for the post-BRRD period (Jan. 2015 – June 2016).

There is considerable heterogeneity in the sample, both across time (pre-BRRD and post-BRRD periods) and across countries. Prior to January 2015, when the EU-Directive came into force, Sweden and Germany show the lowest levels of sovereign CDS spreads (7.65 and 7.77 bps as minimums, 75.71 and 79.29 bps as maximums) (Table 4.4 - Panel B). In contrast, Italy and Spain are perceived as the riskiest governments and the related distributions are the most volatile (the standard deviation is of 108.79 bps for Italy and 113.55 bps for Spain). Overall, bank CDS premiums present a higher mean and volatility compared to sovereign CDS spreads. More specifically, Italy and Spain again show the highest volatility and the highest levels of CDS spreads. Swedish and Dutch banks are considered as the least risky, although the minimum price value for the distribution of Netherlands is quite high (109.91 bps). Regarding the non-financial sector, the United Kingdom and Sweden show the lowest volatility in the CDS prices (26.83 and 28.21 bps, respectively). Italy and Spain are the countries with the riskiest non-financial corporates. France, with a price volatility of 72.78 bps, follows Spain and Italy, which exhibit values of 101.05 and 113.79 bps, respectively.

In the post-BRRD period, from January 2015 till June 2016 (Table 4.4 - Panel C), the level of sovereign CDS spreads, and its variability, has generally decreased for all the countries. Nevertheless, Italy and Spain still display the highest mean values (95.55 and 73.59 bps, respectively). For the banking sector, the record peaks reached in the pre-BRRD period have significantly reduced to values lower than those previously recorded (e.g. the maximum value for the Spanish distribution is now 190.33 bps compared with 741.07 bps during the pre-BRRD period). Italy and Netherlands, immediately followed by Spain, show the highest mean values (162.70 and 131.60 bps, respectively), while Sweden and France present the lowest mean values (59.47 and 73.40 bps, respectively). Regarding the non-financial corporates, Spanish CDS prices have reduced far enough to fall in line with the ranges recorded for other countries, such as Germany. The distributions of CDS quotes for firms in Italy and the UK show the highest mean values (145.53 and 113.50 bps, respectively), whereas Dutch companies, with a mean value of 81.70 bps and a standard deviation of 8.54 bps, are perceived as the less risky.

Over the entire sample period (Table 4.4 - Panel C), Italy and Spain are the sovereigns with the highest average CDS quoted spreads (183.70 and 171.42 bps, respectively). Sweden, instead, exhibits the lowest mean value (20.40 bps), immediately followed by Germany (21.53 bps). In the banking system, the average value for all the countries is above 120 bps, with the only exception of Sweden (86.75 bps). Average 5-year CDS prices for Spanish and Italian banks are the highest (295.67 and 279.37 bps, respectively). Finally, Italian non-financial companies present the highest average of daily CDS price (246.84 bps), followed by Spain and France (172.66 and 167.92 bps, respectively).

4.6.3 Empirical methodology

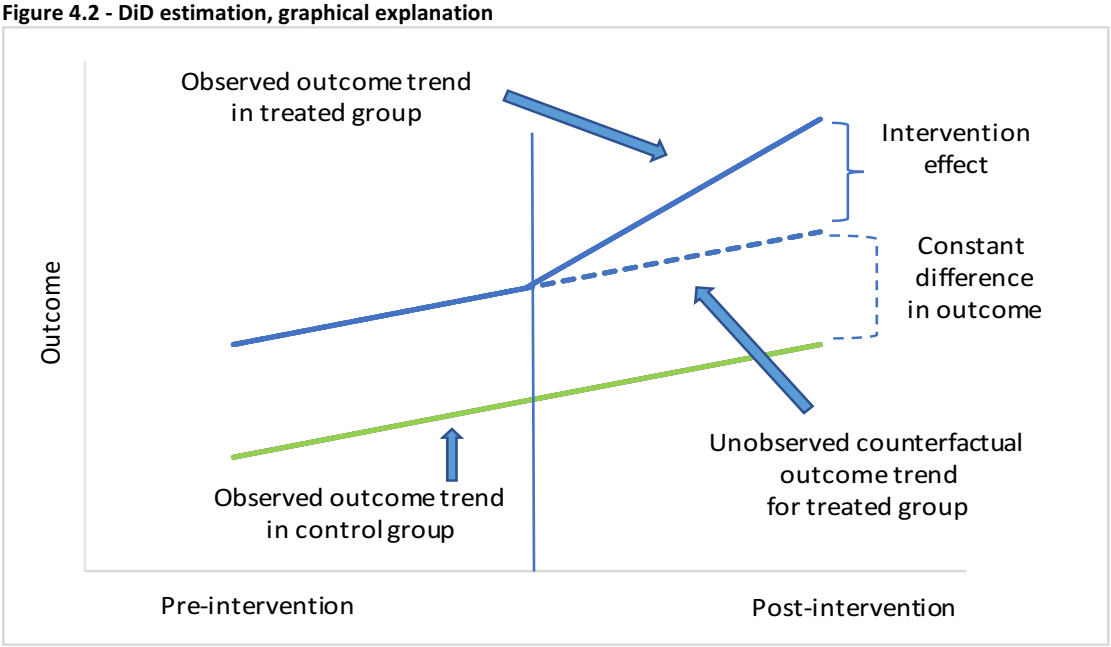
In order to consider the impact of the implementation of the BRRD on the CDS market and on the link between European banks and sovereign debt, a DiD approach is adopted.

4.6.3.1 Difference-in-Differences approach

The DiD technique, a version of fixed-effects estimation, has become a widely accepted non-experimental tool for estimating causal relationships.[175] The DiD research design requires, initially, the identification of a specific intervention or treatment (e.g. the implementation of a new law, enactment of a new policy). Afterwards, the treatment effect is modelled by comparing the difference (change) between the outcome before and after the intervention for the group affected by the intervention (i.e. treatment group) to the corresponding difference for the unaffected group (i.e. control group) (Figure 4.2).[176] This approach of double differencing ensures that any unobserved time-invariant variables, which are correlated with the selection process and the outcome of interest, will not bias the estimated effect.

[175] The DiD methodology was made popular by Card and Krueger (1994). For a detailed review on this topic, see Imbens and Wooldridge (2009).
[176] More generally, there might be multiple groups as well as multiple time periods.

Figure 4.2 - DiD estimation, graphical explanation



As described in Athey and Imbens (2006) and Imbens and Wooldridge (2009), in case of repeated cross-sections (or a panel), the standard design for the DiD is the following. The individual *i* belongs to a group $G_i \in \{0, 1\}$ (where group 1 represents the group subjected to the intervention) and is observed in time period $T_i \in \{0, 1\}$. In this generalized specification, the outcome of interest for individual *i* in the absence of the intervention, $Y_i(0)$, can be written as:

Equation 4.3

$$Y_i(0) = \alpha + \beta \times T_i + \gamma \times G_i + \varepsilon_i$$

where α, β and γ are unknown parameters. More specifically, β represents the time effect common to both groups and γ represents a time-invariant group (or individual) specific effect. The error term ε_i corresponds to the individual's unobservable characteristics.[177]

By combining the equation for the outcome without the treatment and that for the outcome given the treatment, the following equation is obtained:

[177] The mean zero error term is expected to be independent of the group indicator and constantly distributed over time.

Equation 4.4

$$Y_i(1) = Y_i(0) + \tau_{did}$$

where $\tau_{did} = E[Y_i(1)] - [Y_i(0)]$

$$= (E[Y_i|G_i = 1, T_i = 1] - E[Y_i|G_i = 1, T_i = 0])$$

$$-(E[Y_i|G_i = 0, T_i = 1] - E[Y_i|G_i = 0, T_i = 0])$$

Therefore, with the aim of removing the biases associated with a potential common time trend unrelated to the intervention, the population average difference over time in the control group ($G_i = 0$) is subtracted from the population average difference over time in the treatment group ($G_i = 1$). The parameter τ_{did}, measuring the estimated impact of the intervention, can be obtained through Ordinary Least Squares (OLS) methods based on:

Equation 4.5

$$Y_i = \alpha + \beta_1 \times T_i + \gamma_1 \times G_i + \tau_{did} \times W_i + \varepsilon_i$$

where the treatment indicator W_i is equal to the interaction of the group and time indicators, $I_i = G_i \, x \, T_i$. Thus, the treatment effect is estimated through the coefficient on the interaction between the indicators for the second time period and the treatment group. This leads to:

Equation 4.6

$$\hat{\tau}_{did} = (\bar{Y}_{11} - \bar{Y}_{10}) - (\bar{Y}_{01} - \bar{Y}_{00})$$

where $\bar{Y}_{gt} = \sum_{i|G_i=g,T_i=t} Y_i/N_{gt}$ is the average outcome among units in group *g* and time period *t*.

The major assumption underlying the DiD methodology is represented by the fact that the average change in the outcome is expected to be the same for both the non-treated individuals and, counterfactually, for the treated ones if they had not participated. In other words, it should hold the assumption that unmeasured factors,

such as changes in the economic environment, affect both treated and non-treated individuals in a similar fashion, referred to as the parallel trend assumption (Buckley and Shang, 2003).

In the analysis conducted in this empirical chapter, the above principles apply in the following manner. In the absence of the treatment (i.e. BRRD), the behaviour of the bank CDS (the treatment group) would have evolved similarly to that of the non-financial corporate CDS in the control group. The parallel trend assumption can be investigated, through visual inspection, using pre-treatment data.[178]

The possibility of avoiding many of the endogeneity issues (which usually arise from the comparison of heterogeneous individuals) represents the main advantage of the DiD method. Limitations are instead related to the randomness of the treatments, conditional on time and group fixed-effects. Thus, a large part of the debate about the validity of a DiD estimation usually relates to the possible endogeneity of the interventions themselves. More recently, some attention has also been focused on biases connected to the standard error of the estimate (Bertrand et al., 2004).

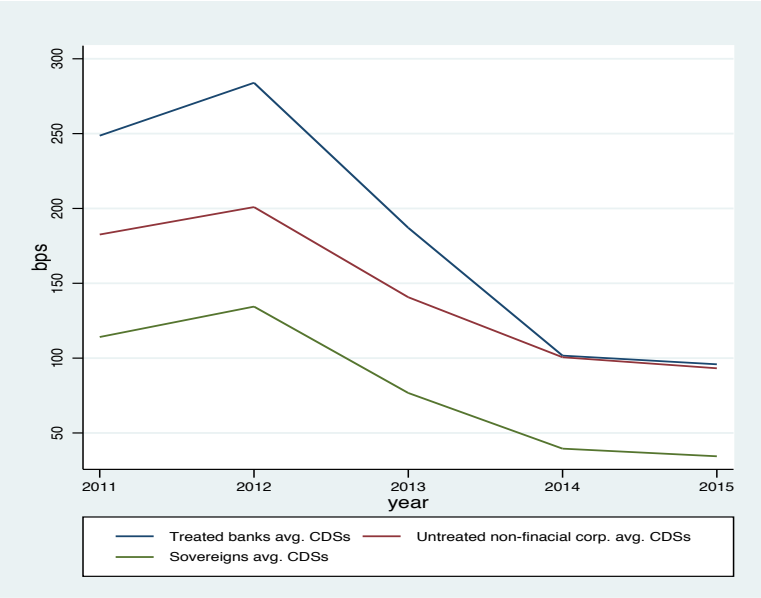
4.7 Empirical results

This section discusses how the new European resolution framework, and specifically the BRRD, impacted upon the sovereign-bank nexus, drawing evidence from the CDS market. It provides the results both for the analysis conducted on all the seven EU countries pooled together (Section 4.7.1), as well as on the countries separately (Section 4.7.2). The investigation performed country by country was motivated by the aim of better capturing country-specific dynamics, mainly for those countries less represented in the whole sample.

Figure 4.3 displays the trend over the years 2011-2014 (pre-treatment period) for the average CDS spreads for banks, non-financial firms and related sovereigns. From a visual inspection, it is possible to infer that the parallel trend assumption is overall valid, since both the treated and untreated groups exhibit a common trend in the absence of intervention.[179]

[178] Refer to the section on the empirical results for more details about this assumption.
[179] Appendix 3.C reports a more detailed graphical analysis about the parallel trend assumption.

Figure 4.3 - CDS trends (pre-treatment period)



Description: The figure illustrates annual average CDS spreads (bps) for (i) treated firms; (ii) untreated firms; and (iii) respective sovereigns in the pre-treatment period (i.e. from January 2011 to December 2014).

4.7.1 Cross-country analysis

This subsection documents the impact of the implementation of the BRRD, on the sovereign-bank nexus, considering all seven selected European countries pooled together. The estimation results for the preferred DiD specification (controlling for the crisis event – Equation 4.6) as well as two other specifications (without the crisis dummy and excluding the crisis period, respectively) are presented. The latter are based on the baseline specification model of Equation 4.5. To reduce the impact of outliers, both sovereign and non-sovereign CDS spreads are winsorized at the 1 per cent level in each tail of the distribution. Moreover, different types of fixed effects (e.g. firm, year, country and country-year) to account for various sources of heterogeneity, are included in alternative specifications (see Jiménez et al., 2012; Ongena et al., 2016). Finally, robust standard errors are clustered at firm level to control for potential serial correlation within each panel (Bertrand et al., 2004).

The selected sample comprises 50 banks as the treatment group and 119 non-financial corporates as the control group. The intervention (i.e. the implementation of the BRRD) occurred on 1 January 2015. Table 4.5 presents the summary statistics for the dependent variable GAP, for all the countries, over the entire sample period and for two sub-periods (i.e. pre- and post-BRRD).

Table 4.5 - Summary statistics for the outcome of interest (GAP variable)

Full sample period (Jan. 2011 - June 2016)	Obs.	Min	Max	Mean	Median	5th Pct	95th Pct	Std.Dev.
All	234,368	0.003	962.030	102.092	61.859	17.120	343.610	114.471
Banks	70,297	0.010	698.751	105.719	77.730	22.940	300.500	87.130
Non-financial corporates	164,071	0.003	962.030	100.538	55.830	15.750	373.372	124.327
Pre-BRRD period (Jan. 2011 - Dec. 2014)								
All	169,112	0.003	950.390	111.168	67.240	16.248	373.284	122.214
Banks	50,991	0.010	698.751	119.074	93.253	23.111	315.194	92.391
Non-financial corporates	118,121	0.003	950.390	107.755	57.704	14.350	400.212	132.894
Post-BRRD period (Jan. 2015 - June 2016)								
All	65,256	0.020	962.030	78.572	52.250	18.860	226.070	87.107
Banks	19,306	0.020	585.250	70.446	53.290	22.120	173.130	58.157
Non-financial corporates	45,950	0.140	962.030	81.986	51.500	18.480	239.070	96.515

Description: Based on the whole sample of countries, the table reports the descriptive summary statistics (expressed in bps) for the dependent variable GAP (i.e. difference between sovereign CDS and non-sovereign CDS spreads) on daily frequency. It provides the statistics for the full sample period (Jan. 2011 – June 2016), for the pre-BRRD period (Jan. 2011 – Dec. 2014) and for the post-BRRD period (Jan. 2015 – June 2016). The following metrics are reported: the number of observations (Obs.), the minimum (Min), the maximum (Max), the mean (Mean), the median (Median), the 5^{th} and 95^{th} percentiles (5^{th} Pct and 95^{th} Pct, respectively) and the standard deviation (Std.Dev.). "All" refers to banks and non-financial corporates together.

Panel A of Table 4.6 displays the estimation results, for daily data, for five different specifications (without any fixed effect and with different sets of fixed effects) relative to the DiD estimation model which includes the dummy for the crisis. In all cases, the coefficient on the interaction variable $BRRD\ x\ Treat$ is negative and statistically significant (at the 5% or 10% level). This evidence suggests a more pronounced narrowing in the GAP variable for banks than for non-financial corporates (following the intervention). Therefore, in contrast to the prior expectations, it seems that market participants did not assess the implementation of the BRRD as credible in loosening the negative loop between sovereign and bank risk across Europe. Column (2), which reports the estimated results for the DiD model accounting for firm fixed effects, appears to be the most appropriate specification in describing the relation between the GAP variable and the regressors (the associated R-squared is 66.7%), supporting the idea of a relatively wide heterogeneity across firms. In contrast, heterogeneity across countries is more limited (column 3).[180] The crisis episode, accounted for an indicator variable that takes the value of one from 1 January 2011 to 1 September 2012 and zero otherwise, positively contributes in explaining the

[180] This evidence is further confirmed by the small differences between the estimated coefficients in column 1 (simple OLS regression) and those in column 3 (a specification accounting for country fixed effects). Moreover, single country dummies included in the simple OLS specification are not statistically significant (this evidence is not reported).

variation in the dependent variable. The associated coefficient is about 37 bps in column 1 and 3 (simple OLS regression without any fixed effect and regression accounting for country fixed effects, respectively) and about 32 bps when controlling for firm fixed effects (column 2).

Panel B of Table 4.6 depicts the estimated coefficients, for daily data, for five different versions of the DiD model performed on the entire sample period, but without controlling for the crisis event. The variable measuring the DiD effect ($BRRD\ x\ Treat$) is negative and statistically significant at the 5% level, indicating a narrowing in the dependent variable GAP which is more marked in the banking sector than in the non-financial segment. The coefficient associated with the BRRD binary variable, which captures the differences for the control group before and after the intervention, has a negative and significant sign. Moreover, and different from findings reported in Panel A, this is highly statistically significant in every specification where is not spanned either by time or country fixed effects (columns 1, 2 and 3).[181]

Panel C of Table 4.6 reports the estimated coefficients, for daily data, for five different variants of the DiD estimation model applied on a time period which does not cover the crisis episode (i.e. from 1 September 2012 onwards). With the same underlying implication as for the previous two model specifications (presented in Panels A and B), the DiD estimator maintains a negative sign, but is statistically insignificant.[182]

[181] $BRRD$ and $Treat$ only appear in the specification on their own in versions of Equation 4.5 that do not consider firm and time fixed effects (and their interactions), respectively, because otherwise the effect of $BRRD$ is subsumed in the time fixed effects and the effect of $Treat$ is subsumed in the firm fixed effects (Cerqueiro et al., 2016).

[182] The estimated results for the DiD model (both the preferred and the other two specifications), applied on data with different frequency (i.e. weekly and monthly), are overall in line with those presented in this section. Nevertheless, when considering the specification that excludes the crisis episode, applied on monthly data, the negative coefficient on the variable of interest ($BRRD\ x\ Treat$) turns out to be always statistically significant when controlling for time and firm fixed effects (these results not reported in the chapter).

Table 4.6 - The impact of the BRRD on the sovereign-bank nexus for the whole sample of countries

Panel A - Preferred DID specification					
	(1)	(2)	(3)	(4)	(5)
BRRD	-11.194	-10.58	-11.196		
	(6.942)	(6.918)	(6.935)		
Treat	10.675		10.328	10.484	8.269
	(14.229)		(13.179)	(14.246)	(13.006)
BRRD x Treat	-22.215**	-24.028**	-22.263**	-22.081**	-18.151*
	(10.758)	(10.681)	(10.745)	(10.775)	(9.369)
Crisis	36.798***	32.533***	36.674***	12.936***	12.421***
	(6.283)	(5.988)	(6.272)	(4.641)	(4.547)
Constant	93.180***	97.596***	93.325***	97.020***	97.510***
	(9.468)	(1.808)	(9.169)	(8.903)	(8.670)
Observations	234,368	234,368	234,368	234,368	234,368
R-squared	0.036	0.667	0.051	0.057	0.098
Firm FE	NO	YES	NO	NO	NO
Country-Year	NO	NO	NO	NO	YES
Year FE	NO	NO	NO	YES	NO
Country FE	NO	NO	YES	NO	NO

Panel B - Alternative DID specification without crisis dummy					
	(1)	(2)	(3)	(4)	(5)
BRRD	-25.769***	-23.357***	-25.702***		
	(8.067)	(7.955)	(8.078)		
Treat	11.319		11.129	10.534	8.346
	(14.235)		(13.169)	(14.243)	(13.000)
BRRD x Treat	-22.859**	-24.677**	-22.919**	-22.130**	-18.228*
	(10.777)	(10.708)	(10.764)	(10.775)	(9.365)
Constant	107.755**	110.628**	107.799**	100.756**	101.091**
	(10.943)	(1.668)	(10.610)	(9.542)	(9.266)
Observations	234,368	234,368	234,368	234,368	234,368
R-squared	0.018	0.653	0.033	0.057	0.098
Firm FE	NO	YES	NO	NO	NO
Country-Year	NO	NO	NO	NO	YES
Year FE	NO	NO	NO	YES	NO
Country FE	NO	NO	YES	NO	NO

Panel C - Alternative DID specification on recent time period (no crisis episode)					
	(1)	(2)	(3)	(4)	(5)
BRRD	-13.988**	-13.841**	-13.892**		
	(6.451)	(6.452)	(6.447)		
Treat	1.217		1.672	0.953	0.465
	(12.344)		(11.655)	(12.366)	(11.548)
BRRD x Treat	-12.757	-12.757	-12.840	-12.550	-10.347
	(7.833)	(7.841)	(7.821)	(7.855)	(6.814)
Constant	95.974***	96.276***	95.812***	90.545***	90.434***
	(8.802)	(1.854)	(8.542)	(7.903)	(7.689)
Observations	166,494	166,494	166,494	166,494	166,494
R-squared	0.010	0.686	0.019	0.047	0.073
Firm FE	NO	YES	NO	NO	NO
Country-Year FE	NO	NO	NO	NO	YES
Year FE	NO	NO	NO	YES	NO
Country FE	NO	NO	YES	NO	NO

Description: The table reports the results for the DiD estimation applied on the whole sample of countries. Panel A presents the results for the specification controlling for the crisis event. Panel B presents the results for the specification which does not account for the crisis period. Panel C presents the results for the specification applied on a time period which does not include the crisis. The dependent variable is the GAP (i.e. difference between non-sovereign CDS and sovereign CDS spreads) calculated on daily data and expressed in bps. Firm, country-year, year and country fixed effects are included alternatively. Robust standard errors, clustered at firm level, are reported in parentheses.
Note: The crisis dummy takes the value one from 1 January 2011 to 1 September 2012, zero otherwise.
*** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level.

Weakening the sovereign-bank nexus in the euro area, which is a salient objective of both the BRRD and the wider BU project, might have been limited by the fact that most EU banks still hold large amounts of their own sovereign debt (Fitch, 2016b). As of June 2015, according to the EBA EU-wide transparency exercise, EU banks held €2.3tn in government debt and 65% of these exposures were to domestic sovereigns.[183] Therefore, revisiting the regulatory (preferential) treatment of sovereign exposures would represent a relevant step towards weakening the tight interconnection between sovereign and bank risk, while avoiding large-scale public bailouts (Andritzky et al., 2016).[184]

[183] Under the current prudential regulation (i.e. Basel III) for calculating capital requirements, sovereign debt (denominated in domestic currency) is treated as risk-free and large exposure limits (usually set at 25% of a bank's capital) do not apply.
[184] Positive risk weights would tackle counterparty credit risk, while large exposure limits would tackle concentration risk. Proposals about the subjection of banks' sovereign exposures to capital requirements and/or large exposure limits were examined by the ECOFIN in April 2016 (Fitch, 2016b).

Moreover, some flexibility in the use of the bail-in tool with the aim of preserving financial stability, as established under the BRRD and the EU norms on State Aid, might entail sufficient political influence such as to threaten the credibility of the mechanism.[185] Thus, discretionary exceptions should be permitted only under extraordinary and precisely defined conditions (Buch, 2016).

In Moody's (2015) view, national deviations from the EU-BRRD led to a more complex and fragmented framework which could delay the process of resolving banks, while making the outcomes less predictable for market participants.[186] In addition, there was some delay in the incorporation into national law of the BRRD across different countries. While some Member States, such as France, Germany and UK, met the transposition date at the beginning of 2015, other countries experienced delays in the transposition process. [187] A potential effect of such a delay is the risk that a bank failure in a country where the Directive was not implemented might have resulted in a conflict between EU and national law, with an associated high legal risk.

Another consequence, which negatively affects investors, is also represented by the persistent uncertainty about the insolvency hierarchies that apply in case of a bank failure. According to Fitch (2016c), the use of exemptions can lead to more complex resolutions due to increased legal risk and compensation costs. Indeed, under the BRRD, in exceptional circumstances the resolution authority can discretionally decide to exclude, fully or partially, certain instruments from the bail-in, based on their maturities and/or holders. The lack of a EU standard defining this exceptionality might imply different interpretations of these options across different jurisdictions. The possibility that bail-in will proceed heterogeneously in each EU Member State represents a potential source of uncertainty for market participants, while raising the cost of banks' funding (CEPS, 2016). As Fitch (2016c) reports, bailing-in senior liabilities with a retail investor base might result in a difficult and politically

On the potential costs and trade-offs associated with these two policy options to address the regulatory gap in the treatment of sovereign exposures, see Lenarčič et al., 2016.

[185] On the State Aid rules to support measures in favour of banks, see the 2013 EC "Banking Communication" (http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52013XC0730(01)&from=EN).

[186] Germany and Italy, for instance, have modified the BRRD script by supplementing the hierarchy that defines on which asset classes are firstly imposed losses in case of bank failure (Moody's, 2016).

[187] See ISDA BRRD Implementation Monitor (https://www.isda.org/a/4OEDE/icm-23960939-v17-isda-brrd-implementation-monitor-4th-edition.pdf).

sensitive task for resolution authorities. The prospect of unequal treatment of creditors within the same class can lead to significant legal consequences (e.g. the cases of Portuguese Banco Espirito Santo and four small Italian banks at the end of 2015 – reported in Appendices 3.A and 3.B of Chapter 3).[188]

In addition, in a weak banking context characterized by widespread distress, the bail-in of a single institution may induce other banks' claimholders to review their positions, with a consequent across the board flight-to-quality effect. This, in turn, might imply a significant increase in the cost of funding for the whole banking sector (Hadjiemmanuil, 2017). Together with potential contagion arising from market reactions, the more direct transmission channel of losses from the resolved bank and other institutions holding bail-inable liabilities will also be relevant. In fact, losses experienced by those institutions could harm their own viability, along with inducing negative effects for the entire financial system (Hüser et al., 2017).

Finally, the BRRD came into force in a period of high fragmentation of the EU banking system, and more generally of the euro area, as a consequence of the 2009-12 sovereign debt crisis. A common framework applied to markedly different contexts, characterized by different backgrounds, could increase divergences across countries.

4.7.2 Country-level analysis

This subsection presents the results for the country-level investigation. It provides the results for three model specifications outlined above: (i) excluding the crisis dummy variable; (ii) including the crisis dummy variable; and (iii) based on a sample period that omits the crisis episode.

To reduce the impact of outliers, both sovereign and non-sovereign CDS spreads are winsorized at 1 per cent in each tail of the distribution. Firm-specific fixed effects, to account for unobserved heterogeneity across firms, are included and robust standard errors are employed.

[188] Regarding the Italian case, Visco (Governor of the Bank of Italy) stated that when the bail-in mechanism is not enough to achieve resolution goals and there are threats to financial stability, the possibility of public support should not be ruled out. Specifically, the confidence in the whole banking sector was weakened by the write-down of subordinated debt held by retail customers and the associated national media coverage. This, in turn, resulted in deposit outflows from weaker banks in late 2015 and early 2016 (Visco, 2016).

4.7.2.1 France

For France, CDS spreads of 26 non-financial corporates (control group) and 6 banks (treatment group) are considered. Table 4.7 presents the summary statistics for the dependent variable, i.e. the GAP variable. Based on daily data, the reported statistics refer to the entire sample period, as well as the pre- and post-BRRD periods. Moreover, descriptive statistics are provided for both banks and non-financial firms pooled together and for the two categories separately.

Table 4.7 - Summary statistics for the outcome of interest (GAP variable)

Full sample period (Jan. 2011 - June 2016)	Obs	Min	Max	Mean	Median	5th Pct	95th Pct	Std.Dev.
All	44,442	0.010	962.030	111.297	59.750	16.220	422.790	150.784
Banks	8,603	1.649	294.950	87.051	71.523	28.340	179.960	50.383
Non-financial corporates	35,839	0.010	962.030	117.117	57.643	14.390	504.510	165.557
Pre-BRRD period (Jan. 2011 - Dec. 2014)								
All	32,003	0.010	950.390	125.017	69.130	15.962	501.560	160.725
Banks	6,257	1.649	294.950	101.185	99.456	28.480	190.840	51.951
Non-financial corporates	25,746	0.010	950.390	130.809	63.459	13.450	556.650	176.871
Post-BRRD period (Jan. 2015 - June 2016)								
All	12,439	1.280	962.030	75.998	48.930	16.570	227.880	114.192
Banks	2,346	18.690	105.530	49.355	49.215	28.040	70.360	12.521
Non-financial corporates	10,093	1.280	962.030	82.190	48.560	15.570	242.460	125.822

Description: The table reports the descriptive summary statistics (expressed in bps) for the dependent variable GAP (i.e. difference between sovereign CDS and non-sovereign CDS spreads) on daily basis. It provides the statistics for the full sample period (Jan. 2011-June 2016), for the pre-BRRD period (Jan. 2011-Dec. 2014) and for the post-BRRD period (Jan. 2015-June 2016). The following metrics are reported: the number of observations (Obs.), the minimum (Min), the maximum (Max), the mean (Mean), the median (Median), the 5^{th} and 95^{th} percentiles (5^{th} Pct and 95^{th} Pct, respectively) and the standard deviation (Std.Dev.). "All" refers to banks and non-financial corporates pooled together.

Table 4.8 reports the results for the main DiD model and two further specifications, applied on daily data. The implementation of BRRD led to a more pronounced narrowing in the GAP variable for banks than non-financial corporates. More specifically, the estimated coefficient on the interaction variable $BRRD\ x\ Treat$ is negative and statistically significant, at the 1% level (see columns 1 and 2). In the last specification, which considers the sample period without the crisis time, the estimated coefficient on the treatment effect retains a negative sign, but turns insignificant and is relatively small (-0.778 bps). Furthermore, the results in column (2) indicate a positive and strongly significant contribution of the crisis dummy variable (26.879 bps).

Table 4.8 - The impact of the BRRD on the sovereign-bank nexus in France

	(1)	(2)	(3)
BRRD	-45.101***	-34.775***	-35.712***
	(1.333)	(1.339)	(1.225)
BRRD x Treat	-6.728***	-5.846***	-0.778
	(1.508)	(1.493)	(1.434)
Crisis		26.879***	
		(1.099)	
Constant	124.275***	113.730***	111.656***
	(0.504)	(0.571)	(0.599)
Observations	44,442	44,442	31,862
R-squared	0.598	0.604	0.556

Description: The table reports the results for the main DiD model, which includes the dummy variable for the crisis, and the two further specifications (i.e. without the crisis dummy, without the crisis episode) presented in Section 4.5. The dependent variable is the GAP variable (i.e. difference between sovereign CDS and non-sovereign CDS spreads) calculated on daily data and expressed in bps. Firm fixed effects are used. Robust standard errors are reported in parentheses.
Note: The crisis dummy takes the value one from 1 January 2011 to 1 September 2012, zero otherwise.
*** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level.

4.7.2.2 Germany

For Germany, CDS spreads of 25 non-financial corporates (control group) and 10 banks (treatment group) are selected. Table 4.9 displays the summary statistics for the GAP variable, referring to the entire sample period, as well as the pre- and post-BRRD periods. Moreover, statistics are provided for both banks and non-financial firms pooled together and for the two categories separately.

Table 4.9 - Summary statistics for the outcome of interest (GAP variable)

Full sample period (Jan. 2011 - June 2016)	Obs.	Min	Max	Mean	Median	5th Pct	95th Pct	Std.Dev.
All	50,063	0.160	675.050	122.491	83.510	25.830	367.270	113.408
Banks	14,340	29.580	464.490	130.270	108.844	47.135	338.658	82.280
Non-financial corporates	35,723	0.160	675.050	119.368	72.700	23.240	386.206	123.584
Pre-BRRD period (Jan. 2011 - Dec. 2014)								
All	36,378	0.160	675.050	136.970	93.180	26.050	398.390	126.222
Banks	10,430	29.580	464.490	145.092	124.694	51.860	361.730	88.300
Non-financial corporates	25,948	0.160	675.050	133.705	75.890	23.690	433.492	138.438
Post-BRRD period (Jan. 2015 - June 2016)								
All	13,685	11.840	429.110	84.003	69.830	25.080	176.810	51.586
Banks	3,910	29.790	238.690	90.733	74.880	45.600	180.040	43.388
Non-financial corporates	9,775	11.840	429.110	81.311	66.760	20.730	174.850	54.290

Description: The table reports the descriptive summary statistics (expressed in bps) for the dependent variable GAP (i.e. difference between sovereign CDS and non-sovereign CDS spreads) on daily basis. It provides the statistics for the full sample period (Jan. 2011-June 2016), for the pre-BRRD period (Jan. 2011-Dec. 2014) and for the post-BRRD period (Jan. 2015-June 2016). The following metrics are reported: the number of observations (Obs.), the minimum (Min), the maximum (Max), the mean (Mean), the median (Median), the 5th and 95th percentiles (5th Pct and 95th Pct, respectively) and the standard deviation (Std.Dev.). "All" refers to banks and non-financial corporates together.

The results reported in Table 4.10, based on daily data, show that the implementation of BRRD led to a narrowing in the GAP variable more pronounced for banks than non-financial firms. The estimated coefficient on the interaction variable $BRRD\ x\ Treat$ is negative and in column (1) and (2), with statistical significance at the 5% and 10% levels, respectively. In the final specification, which considers the sample period excluding the crisis, the coefficient estimate for the treatment effect retains a negative sign, but is insignificant and small (-0.858 bps). Furthermore, the results in column (2) indicate a positive and strongly significant contribution of the crisis dummy variable (68.891 bps).

Table 4.10 – The impact of the BRRD on the sovereign-bank nexus in Germany

	(1)	(2)	(3)
BRRD	-51.955***	-23.436***	-23.817***
	(0.844)	(0.787)	(0.569)
BRRD x Treat	-2.403**	-2.190*	-0.858
	(1.206)	(1.137)	(0.915)
Crisis		68.891***	
		(0.809)	
Constant	136.881***	108.292***	108.065***
	(0.405)	(0.345)	(0.333)
Observations	50,063	50,063	34,965
R-squared	0.587	0.652	0.659

Description: The table reports the results for the main DiD model, which includes the dummy variable for the crisis, and the two further specifications (i.e. without the crisis dummy, without the crisis episode) presented in Section 4.5. The dependent variable is the GAP variable (i.e. difference between sovereign CDS and non-sovereign CDS spreads) calculated on daily data and expressed in bps. Firm fixed effects are used. Robust standard errors are reported in parentheses.
Note: The crisis dummy takes the value one from 1 January 2011 to 1 September 2012, zero otherwise.
*** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level.

4.7.2.3 Italy

For Italy, constraints on data availability limited the sample to 9 banks as the treatment group and 3 non-financial companies as the control group. Table 4.11 reports the summary statistics for the dependent variable GAP related to both the entire sample period, as well as the pre- and post-BRRD sub-periods.

Table 4.11 - Summary statistics for the outcome of interest (GAP variable)

Full sample period (Jan. 2011 - June 2016)	Obs	Min	Max	Mean	Median	5th Pct	95th Pct	Std.Dev.
All	13,933	0.020	585.250	101.594	79.230	9.260	296.059	89.244
Banks	10,594	0.020	585.250	105.367	76.336	9.350	321.010	96.982
Non-financial corporates	3,339	0.060	306.310	89.621	85.800	8.860	186.650	56.614
Pre-BRRD period (Jan. 2011 - Dec. 2014)								
All	10,040	0.030	505.220	110.240	88.365	9.200	308.515	91.488
Banks	7,619	0.030	505.220	114.161	84.600	9.280	325.880	99.276
Non-financial corporates	2,421	0.060	306.310	97.902	100.750	8.520	191.237	59.125
Post-BRRD period (Jan. 2015 - June 2016)								
All	3,893	0.020	585.250	79.294	59.440	9.590	185.900	78.932
Banks	2,975	0.020	585.250	82.847	58.110	9.520	199.020	86.891
Non-financial corporates	918	0.270	204.640	67.782	63.820	9.600	161.330	42.229

Description: The table reports the descriptive summary statistics (expressed in bps) for the dependent variable GAP (i.e. difference between sovereign CDS and non-sovereign CDS spreads) on daily basis. It provides the statistics for the full sample period (Jan. 2011-June 2016), for the pre-BRRD period (Jan. 2011-Dec. 2014) and for the post-BRRD period (Jan. 2015-June 2016). The following metrics are reported: the number of observations (Obs.), the minimum (Min), the maximum (Max), the mean (Mean), the median (Median), the 5^{th} and 95^{th} percentiles (5^{th} Pct and 95^{th} Pct, respectively) and the standard deviation (Std.Dev.). "All" refers to banks and non-financial corporates together.

Table 4.12 provides the estimation results for the preferred model specification (column 2) and two other specifications (column 1 and 3). This is crucially different from the French and German cases, in that the coefficient on the variable of interest ($BRRD\ x\ Treat$) is positive and statistically significant in the last specification, which excludes the crisis period (7.196 bps, significant at the 1% level). This evidence suggests that the implementation of the EU-BRRD in January 2015 might have been perceived by the markets as beneficial in weakening the link between Italian banks and their government. Indeed, a widening of the GAP variable implies a potential decoupling trend between sovereign and bank risk (consistent with the main hypothesis of this empirical chapter). The Italian banking system, hampered by a large volume of Non-Performing Loans (NPLs) and numerous fragile banks, represents a unique case.[189] The reduced opportunities for these banks to be rescued, under the BRRD, could logically be reflected in a widening of the gap existing between bank and sovereign CDS spreads, at least initially. In model (2), the crisis dummy has a negative, statistically significant at the 1% level (-11.187 bps).

[189] At the end of 2015, the level of NPLs in the Italian banking system was €360bn (Garrido et al., 2016). The Italian government has implemented different reforms to address the issue of high NPLs, including state-backed guarantee on senior tranches of securitized bad loans (so-called "GACS") and the creation of two Atlante funds with the aim of supporting capital raising and acquisition of mezzanine and equity tranches in securitization of bad loans (PWC, 2016). Refer to Section 5.3 of Chapter 5 for further details on this topic.

Table 4.12 - The impact of the BRRD on the sovereign-bank nexus in Italy

	(1)	(2)	(3)
BRRD	-31.238***	-35.746***	-39.783***
	(1.557)	(1.569)	(1.443)
BRRD x Treat	1.811	1.879	7.196***
	(2.142)	(2.132)	(2.150)
Crisis		-11.187***	
		(1.369)	
Constant	109.935***	114.416***	113.776***
	(0.661)	(0.860)	(0.845)
Observations	13,933	13,933	9,903
R-squared	0.472	0.474	0.532

Description: The table reports the results for the main DiD model, which includes the dummy variable for the crisis, and the two further specifications (i.e. without the crisis dummy, without the crisis episode) presented in Section 4.5. The dependent variable is the GAP variable (i.e. difference between sovereign CDS and non-sovereign CDS spreads) calculated on daily data and expressed in bps. Firm fixed effects are used. Robust standard errors are reported in parentheses.
Note: The crisis dummy takes the value one from 1 January 2011 to 1 September 2012, zero otherwise.
*** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level.

4.7.2.4 Netherlands

For Netherlands, the analysis is based on a sample of 4 banks (treatment group) and 12 non-financial corporates (control group). Table 4.13 presents the descriptive summary statistics for the outcome of interest, i.e. the GAP variable. More specifically, it reports the statistics, based on daily data, for the whole sample period and the two sub-periods, i.e. before and after the implementation of BRRD.

Table 4.13 - Summary statistics for the outcome of interest (GAP variable)

Full sample period (Jan. 2011 - June 2016)	Obs	Min	Max	Mean	Median	5th Pct	95th Pct	Std.Dev.
All	21,791	0.003	567.988	87.466	46.360	13.763	319.886	103.148
Banks	5,734	1.870	384.013	121.992	73.970	19.971	320.470	105.593
Non-financial corporates	16,057	0.003	567.988	75.136	43.630	11.650	307.960	99.399
Pre-BRRD period (Jan. 2011 - Dec. 2014)								
All	15,535	0.003	567.988	91.949	46.440	10.982	335.754	110.670
Banks	4,170	1.870	384.013	125.117	94.315	18.120	323.250	101.748
Non-financial corporates	11,365	0.003	567.988	79.779	42.100	9.150	388.223	111.321
Post-BRRD period (Jan. 2015 - June 2016)								
All	6,256	13.520	349.330	76.332	46.260	21.500	302.810	80.455
Banks	1,564	19.220	337.330	113.661	51.200	27.650	319.270	114.836
Non-financial corporates	4,692	13.520	349.330	63.890	45.240	20.530	244.540	60.148

Description: The table reports the descriptive summary statistics (expressed in bps) for the dependent variable GAP (i.e. difference between sovereign CDS and non-sovereign CDS spreads) on daily basis. It provides the statistics for the full sample period (Jan. 2011-June 2016), for the pre-BRRD period (Jan. 2011-Dec. 2014) and for the post-BRRD period (Jan. 2015-June 2016). The following metrics are reported: the number of observations (Obs.), the minimum (Min), the maximum (Max), the mean (Mean), the median (Median), the 5th and 95th percentiles (5th Pct and 95th Pct, respectively) and the standard deviation (Std.Dev.). "All" refers to banks and non-financial corporates together.

As shown in Table 4.14, the estimated coefficient on the interaction variable (*BRRD x Treat*) is positive in the first two specifications (with and without the crisis dummy) and negative in the last one. Nevertheless, in none of the three cases are the relatively small coefficient statistically significant. The crisis dummy variable has a positive and significant coefficient (5.022 bps), yet considerably smaller in magnitude than the corresponding figure for other core euro area countries, such as France and Germany.

Table 4.14 - The impact of the BRRD on the sovereign-bank nexus in Netherlands

	(1)	(2)	(3)
BRRD	-12.105***	-10.331***	-9.934***
	(0.688)	(0.684)	(0.533)
BRRD x Treat	0.694	1.013	-0.581
	(1.233)	(1.232)	(0.861)
Crisis		5.022***	
		(0.800)	
Constant	90.891***	89.017***	86.470***
	(0.341)	(0.339)	(0.311)
Observations	21,791	21,791	15,967
R-squared	0.84	0.841	0.902

Description: The table reports the results for the main DiD model, which includes the dummy variable for the crisis, and the two further specifications (i.e. without the crisis dummy, without the crisis episode) presented in Section 4.5. The dependent variable is the GAP variable (i.e. difference between sovereign CDS and non-sovereign CDS spreads) calculated on daily data and expressed in bps. Firm fixed effects are used. Robust standard errors are reported in parentheses.
Note: The crisis dummy takes the value one from 1 January 2011 to 1 September 2012, zero otherwise.
*** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level.

4.7.2.5 Spain

For Spain, the investigation is conducted on a relatively small sample, consisting of 6 banks (treatment group) and 3 non-financial firms (control group). The data availability, as well as its reliability, heavily influenced the size of the final sample. Table 4.15 illustrates the summary statistics for the banks and non-financial companies pooled together, as well as for the two categories separately (for the whole sample period and two sub-periods).

Table 4.15 - Summary statistics for the outcome of interest (GAP variable)

Full sample period (Jan. 2011 - June 2016)	Obs	Min	Max	Mean	Median	5th Pct	95th Pct	Std.Dev.
All	10,658	0.010	698.751	106.422	56.185	4.039	407.626	128.933
Banks	8,082	0.010	698.751	132.589	79.145	7.510	441.430	137.656
Non-financial corporates	2,576	0.043	127.200	24.324	17.154	1.870	66.210	20.995
Pre-BRRD period (Jan. 2011 - Dec. 2014)								
All	7,402	0.010	698.751	131.947	69.440	4.410	449.710	145.419
Banks	5,827	0.010	698.751	160.934	100.070	8.707	472.983	150.978
Non-financial corporates	1,575	0.043	127.200	24.705	17.640	1.680	66.410	21.014
Post-BRRD period (Jan. 2015 - June 2016)								
All	3,256	0.140	184.260	48.393	41.090	3.440	118.370	38.671
Banks	2,255	0.210	184.260	59.345	55.500	5.810	129.380	39.678
Non-financial corporates	1,001	0.140	105.840	23.723	15.980	2.190	65.420	20.961

Description: The table reports the descriptive summary statistics (expressed in bps) for the dependent variable GAP (i.e. difference between sovereign CDS and non-sovereign CDS spreads) on daily basis. It provides the statistics for the full sample period (Jan. 2011-June 2016), for the pre-BRRD period (Jan. 2011-Dec. 2014) and for the post-BRRD period (Jan. 2015-June 2016). The following metrics are reported: the number of observations (Obs.), the minimum (Min), the maximum (Max), the mean (Mean), the median (Median), the 5th and 95th percentiles (5th Pct and 95th Pct, respectively) and the standard deviation (Std.Dev.). "All" refers to banks and non-financial corporates together.

Table 4.16 provides the estimation results for the preferred DiD model (column 2) and for other two specifications (column 1 and 3, respectively). The estimated coefficient on the variable of interest ($BRRD\ x\ Treat$) is large in all three models and highly statistically significant (at the 1% level). The negative sign suggests that the implementation of BRRD led to a more pronounced narrowing in the GAP variable for banks than for non-financial firms. The coefficient estimate on the crisis dummy is large (117.295 bps) and highly statistically significant.

Table 4.16 - The impact of the BRRD on the sovereign-bank nexus in Spain

	(1)	(2)	(3)
BRRD	1.357*	25.327***	3.951***
	(0.769)	(1.317)	(0.732)
BRRD x Treat	-99.460***	-75.797***	-45.135***
	(2.226)	(2.245)	(1.563)
Crisis		117.295***	
		(2.766)	
Constant	127.051***	84.908***	78.240***
	(1.244)	(1.045)	(0.895)
Observations	10,658	10,658	7,949
R-squared	0.424	0.552	0.489

Description: The table reports the results for the main DiD model, which includes the dummy variable for the crisis, and the two further specifications (i.e. without the crisis dummy, without the crisis episode) presented in Section 4.5. The dependent variable is the GAP variable (i.e. difference between sovereign CDS and non-sovereign CDS spreads) calculated on daily data and expressed in bps. Firm fixed effects are used. Robust standard errors are reported in parentheses.

Note: The crisis dummy takes the value one from 1 January 2011 to 1 September 2012, zero otherwise.

*** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level.

4.7.2.6 Sweden

For Sweden the sample consists of 4 banks (treatment group) and 12 non-financial corporates (control group). Table 4.17 presents the summary statistics for the dependent variable during the various time periods.

Table 4.17 - Summary statistics for the outcome of interest (GAP variable)

Full sample period (Jan. 2011 - June 2016)	Obs	Min	Max	Mean	Median	5th Pct	95th Pct	Std.Dev.
All	22,944	6.080	741.850	84.624	49.610	24.400	399.600	118.488
Banks	5,736	25.550	188.560	66.385	56.997	33.495	133.533	30.071
Non-financial corporates	17,208	6.080	741.850	90.704	48.309	22.650	451.890	135.167
Pre-BRRD period (Jan. 2011 - Dec. 2014)								
All	16,688	6.080	710.610	86.258	51.899	24.490	386.330	115.015
Banks	4,172	26.260	188.560	73.002	65.290	33.070	138.392	32.321
Non-financial corporates	12,516	6.080	710.610	90.676	49.238	22.650	417.670	131.195
Post-BRRD period (Jan. 2015 - June 2016)								
All	6,256	17.060	741.850	80.267	46.790	23.680	469.120	127.195
Banks	1,564	25.550	88.040	48.732	46.835	35.270	70.410	10.070
Non-financial corporates	4,692	17.060	741.850	90.779	46.700	22.650	504.940	145.247

Description: The table reports the descriptive summary statistics (expressed in bps) for the dependent variable GAP (i.e. difference between sovereign CDS and non-sovereign CDS spreads) on daily basis. It provides the statistics for the full sample period (Jan. 2011-June 2016), for the pre-BRRD period (Jan. 2011-Dec. 2014) and for the post-BRRD period (Jan. 2015-June 2016). The following metrics are reported: the number of observations (Obs.), the minimum (Min), the maximum (Max), the mean (Mean), the median (Median), the 5^{th} and 95^{th} percentiles (5^{th} Pct and 95^{th} Pct, respectively) and the standard deviation (Std.Dev.). "All" refers to banks and non-financial corporates together.

Table 4.18 shows the estimation results for the preferred DiD model and other two specifications. The estimated coefficient on the variable of interest ($BRRD\ x\ Treat$) is negative in all three models and statistically significant at the 1% level. This evidence suggests that the implementation of the BRRD on the 1 January 2015 produced a more marked narrowing in the GAP variable for banks than for non-financial firms. Moreover, the results in column (2) indicate a positive and statistically significant contribution of the crisis dummy variable (15.180 bps).

Table 4.18 - The impact of the BRRD on the sovereign-bank nexus in Sweden

	(1)	(2)	(3)
BRRD	0.103	6.434***	4.163***
	(0.631)	(0.648)	(0.674)
BRRD x Treat	-24.373***	-24.373***	-15.289***
	(0.854)	(0.829)	(0.823)
Crisis		15.180***	
		(0.612)	
Constant	86.258***	79.927***	79.927***
	(0.294)	(0.329)	(0.262)
Observations	22,944	22,944	15,984
R-squared	0.906	0.909	0.922

Description: The table reports the results for the main DiD model, which includes the dummy variable for the crisis, and the two further specifications (i.e. without the crisis dummy, without the crisis episode) presented in Section 4.5. The dependent variable is the GAP variable (i.e. difference between sovereign CDS and non-sovereign CDS spreads) calculated on daily data and expressed in bps. Firm fixed effects are used. Robust standard errors are reported in parentheses.
Note: The crisis dummy takes the value one from 1 January 2011 to 1 September 2012, zero otherwise.
*** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level.

4.7.2.7 United Kingdom

The investigation for the United Kingdom is performed on a sample of 12 banks as intervention group and 38 non-financial firms as control group. Table 4.19 displays the descriptive summary statistics for the GAP variable over the whole sample period, as well as the two sub-periods (pre- and post-BRRD).

Table 4.19 - Summary statistics for the outcome of interest (GAP variable)

Full sample period (Jan. 2011 - June 2016)	Obs	Min	Max	Mean	Median	5th Pct	95th Pct	Std.Dev.
All	70,537	0.010	498.029	91.460	61.270	18.230	269.650	86.707
Banks	17,208	10.346	319.310	89.880	73.575	27.480	228.655	59.390
Non-financial corporates	53,329	0.010	498.029	91.970	56.780	15.790	308.390	93.834
Pre-BRRD period (Jan. 2011 - Dec. 2014)								
All	51,066	0.010	485.479	95.267	65.000	16.319	280.310	89.118
Banks	12,516	10.346	319.310	103.183	87.319	27.790	244.039	63.225
Non-financial corporates	38,550	0.010	485.479	92.697	56.482	13.290	330.380	95.895
Post-BRRD period (Jan. 2015 - June 2016)								
All	19,471	1.550	498.029	81.477	52.890	21.520	239.260	79.177
Banks	4,692	11.880	194.120	54.391	49.070	27.040	99.110	23.265
Non-financial corporates	14,779	1.550	498.029	90.076	57.980	20.150	263.890	88.208

Description: The table reports the descriptive summary statistics (expressed in bps) for the dependent variable GAP (i.e. difference between sovereign CDS and non-sovereign CDS spreads) on daily basis. It provides the statistics for the full sample period (Jan. 2011-June 2016), for the pre-BRRD period (Jan. 2011- Dec. 2014) and for the post-BRRD period (Jan. 2015-June 2016). The following metrics are reported: the number of observations (Obs.), the minimum (Min), the maximum (Max), the mean (Mean), the median (Median), the 5th and 95th percentiles (5th Pct and 95th Pct, respectively) and the standard deviation (Std.Dev.). "All" refers to banks and non-financial corporates together.

The estimation results for the preferred DiD model, together with further two specifications, are reported in Table 4.20. The estimated coefficient on the outcome of interest ($BRRD\ x\ Treat$) is negative in all the variants and statistically significant at the 1% level. This evidence suggests that the implementation of BRRD led to a more pronounced narrowing in the GAP variable for banks than for non-financial corporates. The coefficient on the crisis dummy variable is positive and highly significant (20.489 bps).

Table 4.20 - The impact of the BRRD on the sovereign-bank nexus in the United Kingdom

	(1)	(2)	(3)
BRRD	-1.474***	6.700***	1.273***
	(0.496)	(0.501)	(0.444)
BRRD x Treat	-47.318***	-46.947***	-24.308***
	(0.860)	(0.836)	(0.692)
Crisis		20.489***	
		(0.399)	
Constant	95.015***	86.729***	85.931***
	(0.186)	(0.189)	(0.195)
Observations	70,537	70,537	49,864
R-squared	0.733	0.742	0.775

Description: The table reports the results for the main DiD model, which includes the dummy variable for the crisis, and the two further specifications (i.e. without the crisis dummy, without the crisis episode) presented in Section 4.5. The dependent variable is the GAP variable (i.e. difference between sovereign CDS and non-sovereign CDS spreads) calculated on daily data and expressed in bps. Firm fixed effects are used. Robust standard errors are reported in parentheses.
Note: The crisis dummy takes the value one from 1 January 2011 to 1 September 2012, zero otherwise.
*** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level.

Table 4.21 summarizes the evidence found in the country-level analysis, as presented in the current section.[190] The investigation reveals limited evidence of heterogeneity across different European banking systems in terms of financial market responses to the implementation of BRRD.

[190] The estimated results for the DiD model (both the preferred and the other two specifications), applied on data with different frequency (i.e. quarterly and monthly), are overall consistent with those presented in this section (results not reported).

Table 4.21 – Findings for country-level analysis

Country	BRRD x Treat			Crisis
	Specification without crisis dummy	Preferred specification with crisis dummy	Specification on recent time period (no crisis episode)	
France	(-) significant ***	(-) significant ***	(-) insignificant	(+) significant ***
Germany	(-) significant **	(-) significant *	(-) insignificant	(+) significant ***
Italy	(+) insignificant	(+) insignificant	(+) significant ***	(-) significant ***
Netherlands	(+) insignificant	(+) insignificant	(-) insignificant	(+) significant ***
Spain	(-) significant ***	(-) significant ***	(-) significant ***	(+) significant ***
Sweden	(-) significant ***	(-) significant ***	(-) significant ***	(+) significant ***
UK	(-) significant ***	(-) significant ***	(-) significant ***	(+) significant ***

Description: The table summarizes the results presented in the current section. For each selected country, it shows the sign of both the coefficient on the variable of interest (*BRRD x Treat*) and that on the dummy controlling for the 2009-12 European sovereign debt crisis. It also specifies whether the coefficient estimates are statistically significant and at which level. The findings for the preferred DiD specification as well as other two specifications (i.e. excluding the crisis dummy variable and based on a sample period that omits the crisis period) are reported.

4.8 Conclusions

The objective of this thesis chapter was to investigate the short-run impact of the new European bank resolution regime on the sovereign-bank nexus. More specifically, the main research question was: Did market participants evaluate the new resolution rules as effective in severing the link between sovereign and bank risk in Europe?

Considering the implementation of the BRRD in January 2015 as an exogenous shock, which affected the whole European banking system, a DiD approach was adopted to measure the effectiveness of this new regulatory framework in weakening the tight interconnectedness between sovereign and bank risk.

Drawing evidence from the CDS market, for the period 2011-2016, the treatment group consisted of European financial companies (i.e. banks), while the control group was composed of European non-financial corporates. Furthermore, to better capture country-specific dynamics, both a cross-country analysis, based on a sample of seven major European countries, as well as an investigation on each country separately was performed.

The main findings, which are robust in various model specifications, did not indicate any significant decoupling trend of bank CDS spreads from sovereign CDS spreads, compared to the corresponding evidence for the European non-financial sector. Contrary to prior anticipation, an overall narrowing of the gap between bank and sovereign risk, as reflected in CDS quoted prices, was evident. The preferred model estimation controlled for the 2009-12 European sovereign debt crisis. In addition, controlling for firm fixed effects within this model produced the most appropriate specification. The latter point implies the presence of a relatively large extent of time-varying firm heterogeneity. Based on the country-level analysis, Italy was the only case where the CDS market seems to have perceived the implementation of the BRRD as effective in weakening the vicious sovereign-bank nexus. According to the new rules, a reduced probability to be publicly rescued for the Italian banks, overwhelmed by large stocks of NPLs, might have been reflected in a widening of the gap existing between bank and sovereign CDS spreads, at least initially.[191]

[191] With hindsight, this market perception seems misplaced and over-optimistic given recent events in the Italian banking sector. Refer to Section 5.3 of Chapter 5 for a detailed review on this topic.

The evidence on the overall lack of confidence about the potential for the new resolution rules to weaken the sovereign-bank nexus might be the result of multiple factors. Firstly, the persistent strong exposures of EU banks to their own sovereign debt. Moreover, the presence of several "ambiguous" provisions under the BRRD, which confer considerable discretion on the supervisory and resolution authorities, might entail sufficient political influence such as to undermine the credibility of the new regime (Hadjiemmanuil, 2017).[192] The bail-in provision does not completely remove the possibility of the injection of public funds where there is a threat of systemic distress or in the case of the collapse of a large cross-border European bank (Avgouleas and Goodhart, 2015). Debt holders of G-SIBs and other institutions considered as relevant in the domestic markets might continue to benefit from a moderate probability of public support (Moody's, 2015). Finally, a weak European banking environment, hampered by extensive amounts of NPLs, might entail the risk of reigniting the strong sovereign-bank link that characterized the 2009-12 European sovereign debt crisis (Enria, 2017).

In sum, the reforms and policy initiatives adopted in response to both the financial and sovereign debt crises, provided a robust framework to address the failure of banks across Europe. In this context, the shift from the reliance on taxpayers' money to explicitly imposing losses on the banks' shareholders and (unsecured) creditors, represented a crucial change. However, as highlighted in various recent contributions (e.g. Schoenmaker, 2015; Buch, 2016; Enria, 2016; Hüttl and Schoenmaker, 2016), additional reforms (e.g. creating both a common fiscal backstop and a common deposit insurance scheme, limiting banks' exposures to sovereign debt) must be implemented in order to further improve the resilience of the European financial system, while enhancing the consistency of the new regulatory framework. Indeed, some distance remains before achieving a situation characterized by the existence of feasible and credible plans in place to ensure an adequate level of comfort in terms of preparation for dealing with future crises (Enria, 2016).

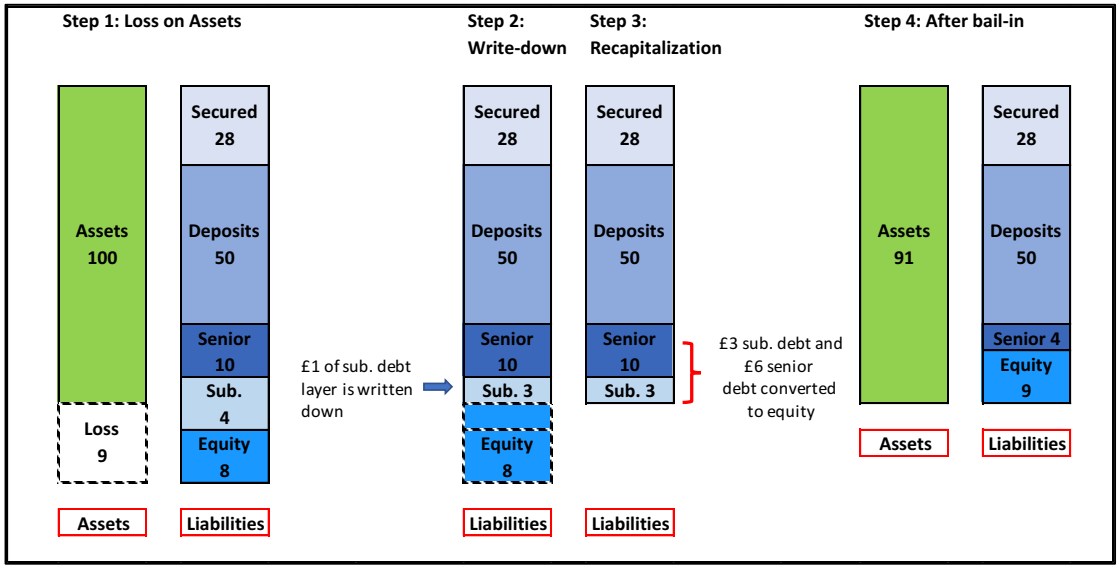
[192] In this regard, recent comments from the Bank of Italy's Governor as well as the IMF argued that a greater flexibility in the new resolution rules would be desirable. A review of the BRRD is expected by mid-2018 (Fitch, 2016a).

Removing embedded impediments to effective and successful resolution procedures will not be immediate and the transition phase to the new regime is likely to raise significant challenges. Nevertheless, adhering to its key principles is essential to avoid uncertainty among market participants and deviations from the long-term objectives of the new institutional framework. This chapter offers new insight, which contribute to the policy debate.

Appendix 4.A: The bail-in mechanism

Figure 4.A.1 illustrates a schematic example of loss absorption and recapitalization following a bail-in. Initially (step 1), the hypothetical bank suffered a loss of £9 on its assets side, thereby breaking the pre-defined threshold (8%) triggering a bail-in. In a second step, a write-down of its liabilities occurs in order to absorb the losses. In this specific case, the whole amount of equity (£8) and part of the subordinated debt (£1) is written-down, without hitting the senior layer. In a third step, the bank is recapitalised to 10.5% CET1 through the conversion of the entire subordinated debt (£3) and part of the senior unsecured debt (£6).[193] The last step shows the bank's balance sheet after the bail-in process.

Figure 4.A.1 – Example of loss absorption and recapitalization following a bail-in



Source: Hüser et al. (2017), own elaboration.

[193] Contingent Convertible Capital Instruments (CoCos), which are financial instruments with debt features (e.g. coupons) that can be written down or converted into equity automatically when a certain trigger is breached, are different from bail-in. The latter is not a financial instrument, but a resolution tool to address the failure of a bank. It can apply to various liabilities, including both subordinated and unsecured senior debt. It is a statutory resolution instrument not subjected to form of permission from the bank's management or stakeholders, but part of the resolution authority's tools. Moreover, a wider restructuring of the firm is associated with the bail-in than when the triggering of a CoCo occurs (Chennelss and Wingfield, 2015).

Appendix 4.B: Data sample

Table 4.B.1 - Data sample

Panel A					
Germany			**Spain**		
Company	**Code**	**Sector**	**Company**	**Code**	**Sector**
Suedzucker AG	DE_SZU	Consumer Goods	Altadis SA	ES_ALT	Consumer Goods
E.ON SE	DE_EON	Electric Power	Endesa SA	ES_ELE	Electric Power
EnBW Energie Baden-Württemberg AG	DE_EBK	Electric Power	Iberdrola	ES_IBE	Electric Power
RWE AG	DE_RWE	Electric Power	Gas Natural SDG	ES_GAX	Energy
BASF Personal Care & Nutrition	DE_COG	Manufacturing	Respsol	ES_REP	Energy
BASF SE	DE_BAS	Manufacturing	Telefónica SA	ES_TEF	Telecomm.
BAYER	DE_BAG	Manufacturing	**Italy**		
BMW	DE_BMW	Manufacturing	Edison	IT_EDN	Electric Power
Continental	DE_CON	Manufacturing	Enel	IT_EEI	Electric Power
Daimler	DE_DCX	Manufacturing	Eni	IT_ENI	Energy
Evonik Degussa Gmbh	DE_DGG	Manufacturing	Fiat	IT_FIA	Manufacturing
Grohe Holding Gmbh	DE_GRO	Manufacturing	Finmeccanica	IT_SIF	Manufacturing
HeidelbergCement	DE_HEI	Manufacturing	Pirelli	IT_PIR	Manufacturing
Lanxess	DE_LXS	Manufacturing	Gruppo Espresso	IT_ESP	Services
NXP B.V.	DE_NXP	Manufacturing	Seat PG	IT_PGX	Services
SAP SE	DE_SPG	Manufacturing	Telecom	IT_TLI	Telecomm.
Siemens	DE_SIE	Manufacturing	**Netherlands**		
ThyssenKrupp	DE_TKA	Manufacturing	Colgate	NL_UN	Consumer Goods
Voith	DE_VOI	Manufacturing	Heineken	NL_HEN	Consumer Goods
Volkswagen	DE_VOW	Manufacturing	Alliander	NL_NUO	Electric Power
Adidas	DE_ADS	Services	Eneco Holding	NL_ENC	Electric Power
Bertelsmann SE & Co. KGaA	DE_BTG	Services	Essent	NL_ESS	Electric Power
Fresenius SE & Co. KGaA	DE_FRE	Services	Airbus Group	NL_AER	Manufacturing
Merck KGaA	DE_MRC	Services	Akzo Nobel	NL_AKZ	Manufacturing
Metro AG	DE_MEB	Services	Philips	NL_PGH	Manufacturing
ProSiebenSat.1 Media Ag	DE_PSM	Services	STMicroelectronics	NL_STM	Manufacturing
TUI AG	DE_TUI	Services	Ahold	NL_AHO	Services
UPC Germany	DE_UNT	Services	Unibail-Rodamco	NL_UNB	Services
Deutsche Telekom	DE_DTA	Telecomm.	Upc Holding	NL_LBT	Services
Deutsche Bahn	DE_DBA	Transportation	Wolters Kluwer	NL_WLS	Services
Lufthansa	DE_LHA	Transportation	PostNL	NL_TNT	Transportation
			KPN	NL_KPN	Telecomm.

France			UK		
Company	**Code**	**Sector**	**Company**	**Code**	**Sector**
Danone	FR_DAN	Consumer Goods	Allied Domeq	UK_ALD	Consumer Goods
L'oreal	FR_LOR	Consumer Goods	British American Tobacco	UK_BAT	Consumer Goods
Pernod Ricard	FR_PER	Consumer Goods	Colgate	UK_DIG	Consumer Goods
Alstom	FR_ALO	Electric Power	Imperial Tobacco	UK_IMT	Consumer Goods
Électricité de France	FR_EDF	Electric Power	Sabmiller	UK_SAX	Consumer Goods
GDF Suez - Engie	FR_GDF	Energy	Scottish & Newcastle	UK_SCT	Consumer Goods
Technip	FR_TEC	Energy	Tesco	UK_TSC	Consumer Goods
Total	FR_TOT	Energy	International Power	UK_IPR	Electric Power
Air Liquide	FR_AIL	Manufacturing	National Grid	UK_NTG	Electric Power
Bouygue	FR_BOU	Manufacturing	National Grid Electricity	UK_NTE	Electric Power
Ciments Français	FR_CMF	Manufacturing	Severn Trent	UK_SVT	Electric Power
Cap Gemini	FR_CPM	Manufacturing	BP	UK_BP	Energy
Arcelormittal France	FR_ISC	Manufacturing	Shell	UK_RDS	Energy
Lagardère	FR_LAG	Manufacturing	The Shell Petrol	UK_RDB	Energy
Legrand	FR_LGF	Manufacturing	National Grid Gas	UK_NGA	Gas Distribution
LVMH	FR_LVM	Manufacturing	BAE Systems	UK_BXX	Manufacturing
Michelin	FR_MIP	Manufacturing	Corus Group	UK_CS	Manufacturing
Peugeot	FR_PEU	Manufacturing	DSG International	UK_DSG	Manufacturing
Renault	FR_REN	Manufacturing	Gates Worldwide	UK_TOM	Manufacturing
Schneider Electric	FR_SCN	Manufacturing	Hammerson	UK_HMS	Manufacturing
Vinci	FR_SGE	Manufacturing	Imperial Chemical Industries	UK_ICI	Manufacturing
Saint -Gobain	FR_SGO	Manufacturing	Invensys	UK_ISY	Manufacturing
Valeo	FR_VLF	Manufacturing	Pilkington	UK_PLK	Manufacturing
Accor	FR_ACC	Services	Rexam	UK_REX	Manufacturing
Casino	FR_CAP	Services	Rio Tinto	UK_RIB	Manufacturing
Carrefour	FR_CRR	Services	Rolls-Royce	UK_RRO	Manufacturing
Havas	FR_FID	Services	Xstrata	UK_XTA	Manufacturing
Rallye	FR_GEN	Services	AstraZeneca	UK_AZN	Services
Kering	FR_PRT	Services	Carlton Communications Limited	UK_IVC	Services
Publicis Groupe	FR_PUP	Services	Compass Group	UK_CPG	Services
Sanofi	FR_SAY	Services	Daily Mail	UK_DMG	Services
Sodexo	FR_SOD	Services	Emi Group	UK_EMI	Services
Vivendi	FR_VIV	Services	GlaxoSmithKline	UK_GSK	Services
Alcatel	FR_ALA	Telecomm.	InterContinental Hotels	UK_IHC	Services
Orange	FR_FTE	Telecomm.	ITV	UK_ITV	Services
Air France	FR_AIS	Transportation	Kingfisher	UK_KGF	Services
Sweden			Ladbrokes	UK_LAD	Services
Swedish Match	SE_SWM	Consumer Goods	Marks & Spencer	UK_MKA	Services
Fortum Power & Heat	SE_FUA	Electric Power	Next	UK_NXT	Services
Vattenfall	SE_VTB	Electric Power	Pearson	UK_PSN	Services
Assa Abloy	SE_ASS	Manufacturing	Reed Elsevier	UK_REL	Services
Atlas Copco	SE_ATC	Manufacturing	Rentokil Initial	UK_RTO	Services
Electrolux	SE_ELL	Manufacturing	Rentokil Initial 1927	UK_RTI	Services
Svenska Cellulosa AB SCA	SE_SCA	Manufacturing	Safeway	UK_MRW	Services
Scania AB	SE_SCV	Manufacturing	Sainsbury	UK_SBR	Services
SKF	SE_SKF	Manufacturing	Six Continents	UK_IHG	Services
Volvo	SE_VOL	Manufacturing	The Rank Group	UK_RNK	Services
Securitas AB	SE_SEC	Services	United Utilities	UK_UUW	Services
TeliaSonera	SE_TLS	Telecomm.	Yorkshire Water	UK_YOL	Services
Stena AB	SE_STN	Transportation	BT Public	UK_BTC	Telecomm.
			MMO2	UK_OOM	Telecomm.
			Virgin Media Secured Finance	UK_VMA	Telephone
			Vodafone	UK_VOD	Telephone
			British Airways	UK_BAY	Transportation
			Smiths Group	UK_SMI	Transportation
			Stagecoach Group	UK_SGC	Transportation

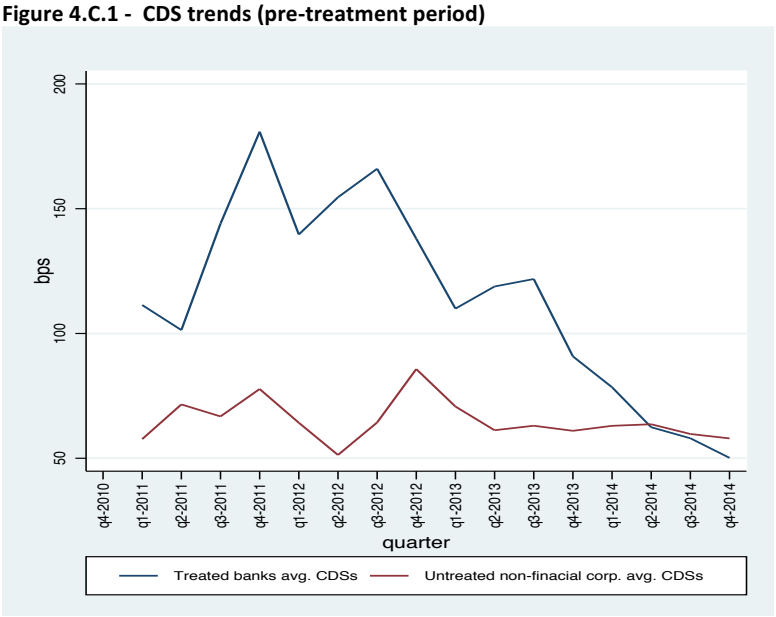
Panel B			
Germany		**Netherlands**	
Bank	**Code**	**Bank**	**Code**
BayernLB	DE_BLB	ING Bank	NL_INB
Commerzbank	DE_CBG	Rabobank	NL_RAB
Deutsche Bank	DE_DB	SNS Bank	NL_SNS
HSH Nordbank	DE_HSH	RBS N.V.	NL_RBN
IKB Deutsche Industriebank	DE_IKB	**Sweden**	
Landesbank Baden-Württemberg	DE_LBB	Nordea	SE_NDA
Landesbank Hessen-Thüringen Girozentrale	DE_HEL	Skandinaviska Enskilda Banken	SE_SEB
Norddeutsche Landesbank Girozentrale	DE_NOL	Svenska Handelsbanken	SE_SHB
Portigon	DE_WDL	Swedbank	SE_SWE
UniCredit Bank AG	DE_UCB	**UK**	
France		Alliance & Leicester	UK_AL
Banque Fédérative du Crédit Mutuel	FR_BFC	Bank of Scotland	UK_BST
BNP Paribas	FR_BNP	Barclays	UK_BCS
Crédit Agricole	FR_CAR	HBOS	UK_HBS
Crédit Lyonnais	FR_CRL	HSBC Bank	UK_HBC
Natixis	FR_CNT	Lloyds Bank	UK_LLT
Société Générale	FR_SG	NatWest	UK_NWB
Spain		Royal Bank of Scotland	UK_RBR
Banco Bilbao Vizcaya Argentaria	ES_BBV	Royal Bank of Scotland Group	UK_RBS
Banco Popular Español	ES_POP	Santander UK	UK_SNT
Banco Sabadell	ES_SAB	Standard Chartered Bank	UK_STA
Banco Santander	ES_SAN	Standard Life	UK_SLA
Bankinter	ES_BKT		
Caja de Ahorros del Mediterráneo	ES_CDA		
Italy			
Banca Italease	IT_BIL		
Banca Monte dei Paschi di Siena	IT_BMP		
Banca Popolare di Milano	IT_PII		
Banco Popolare	IT_BCV		
BNL	IT_BCN		
Intesa Sanpaolo	IT_BCI		
Mediobanca	IT_MDB		
UBI Banca	IT_UBI		
Unicredit	IT_UNI		

Description: The table presents the list of non-financial corporates (Panel A) and banks (Panel B) included in the sample and their country of origin. It also reports the relevant code and industrial sector. The different colours indicate that the reference entity was removed from the sample either because of missing observations (red colour) or because the firm CDS spreads were exceeding those of the corresponding sovereign (orange colour).

Appendix 4.C: The parallel trend assumption

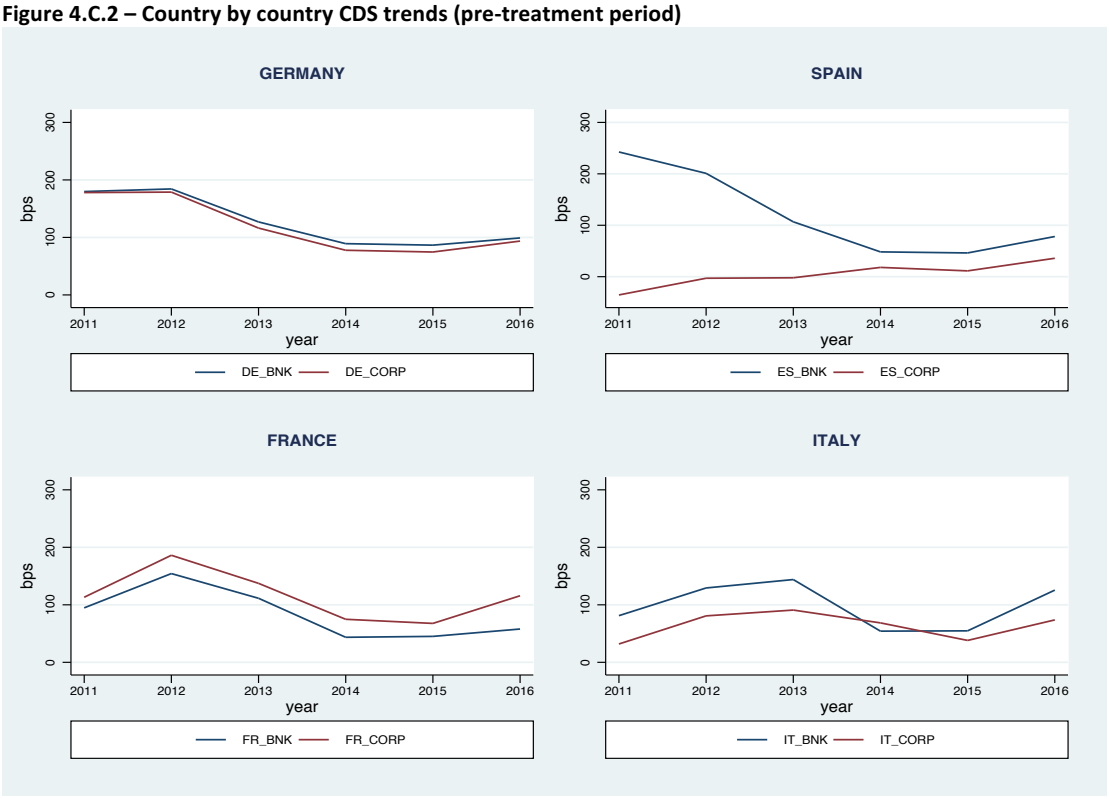
Regarding the parallel trend assumption underlying the DiD approach, the following figures present: (i) a graph reporting the evolution of the outcome variable, i.e. GAP variable, based on quarterly data (Figure 4.C.1); (ii) country-level graphs which illustrate the evolution of the outcome variable (Figure 4.C.2); and (iii) a graph showing the evolution of the outcome variable, excluding Spain (based on yearly data – Figure 4.C.3). The exclusion of the Spain is motivated by the evidence arising from the country-level visual inspection. In all cases, the considered time period is the pre-intervention phase (i.e. 2011-14).

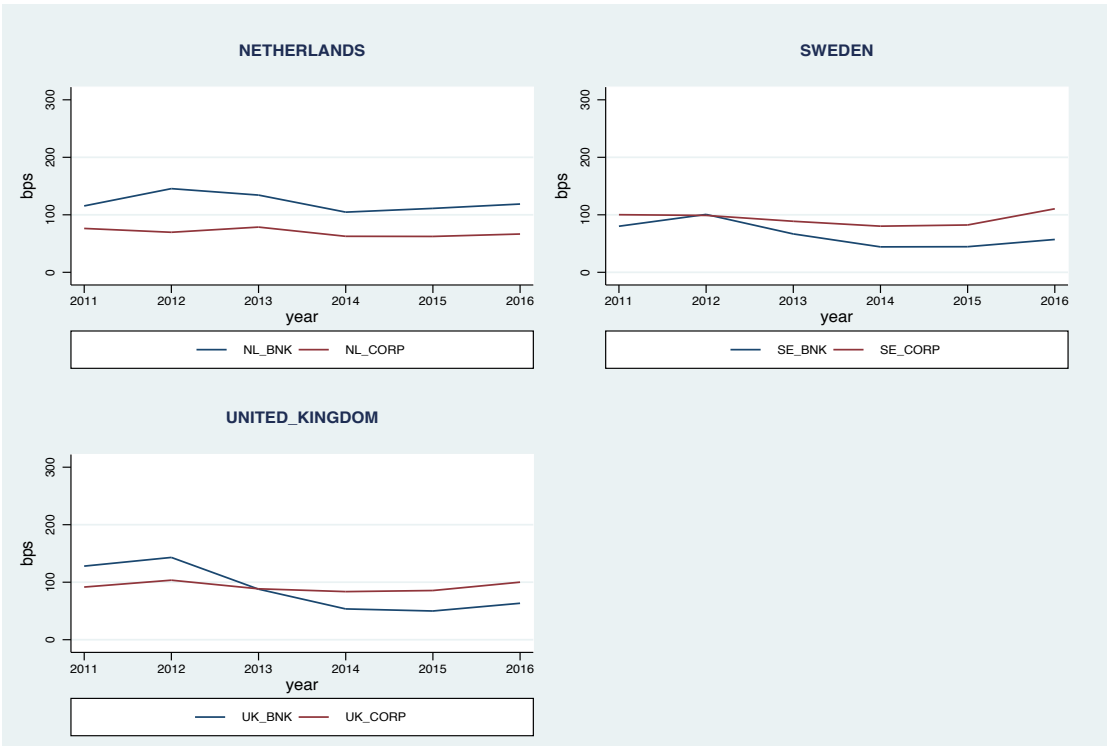
Figure 4.C.1 - CDS trends (pre-treatment period)



Description: The figure illustrates quarterly average CDS spreads (bps) for treated firms and untreated firms in the pre-treatment period (i.e. from January 2011 to December 2014).

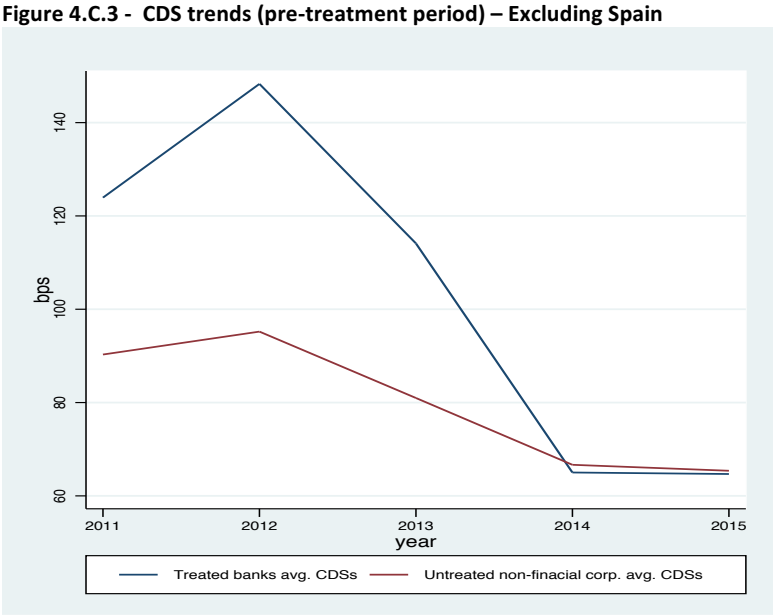
Figure 4.C.2 – Country by country CDS trends (pre-treatment period)





Description: The figure illustrates annual average CDS spreads (bps) for treated firms and untreated firms in the pre-treatment period (i.e. from January 2011 to December 2014) for the seven selected EU countries.
Note: For comparability reasons, all the graphs have the same scaling on the vertical axis.

Figure 4.C.3 - CDS trends (pre-treatment period) – Excluding Spain



Description: The figure illustrates quarterly average CDS spreads (bps) for treated firms and untreated firms in the pre-treatment period (i.e. from January 2011 to December 2014), excluding Spain.

Chapter 5: The evolution and determinants of the non-performing loan burden in Italian banking

5.1 Introduction

Since early 2016, the Italian banking sector, hampered by large stocks of Non-Performing Loans (NPLs), has witnessed several high-profile events. Different initiatives have been undertaken by the Italian government to address the NPL problem, such as the creation of two private asset funds (Atlante 1 and Atlante 2) and the introduction of a state-backed guarantee on senior tranches of securitized bad loans ("Garanzia Cartolarizzazione Sofferenze", GACS). Further, an urgent decree of law (237/2016) was adopted with the aim of supporting the Italian banking system, especially Banca Monte dei Paschi di Siena (MPS), with up to €20bn in 2017 (legislated in Law 15/2017 in February 2017). Academic research on these developments during 2016-17 is very limited.[194] However, there have been many initiatives in the policy sphere. At the European level, the Chairman of the European Banking Authority (EBA) proposed the creation of a European bad bank to buy NPLs (Financial Times, 2017), while the European Central Bank (ECB) released a guidance to banks, subsequently reinforced by an addendum, on tackling NPLs (ECB, 2017).[195,196] A comprehensive strategy at the European level, along with national structural reforms, is therefore necessary to resolve NPLs (Constâncio, 2017).

Tougher rules, such as higher collateral requirements and levels of provisions, represent a necessary step to address one of the main issues in the euro area financial system.[197] Nevertheless, if applied to the outstanding stock of NPLs, the proposed

[194] Recently the Bank of Italy, in Accornero et al. (2017), analyses the effect of NPLs on banks' credit supply to the non-financial sector for the years 2008-2015. Garrido et al. (2016), from the IMF, investigate the nature of the NPL problems in the Italian banking system during the period 2005-2014, while also providing an overview of some recent reforms and policy responses.

[195] See https://www.ft.com/content/3b18e5ec-d047-36b2-a35a-10ae8e6a76ed.

[196] In October 2017, with the aim of promoting timely provisions and reinforcing write-off practices, a supplement to the guidance published in March 2017 was released by the ECB. The new measures will apply to all new NPLs classified according to the EBA definition as of 1 January 2018. Furthermore, in the first quarter of 2018, the ECB is expected to provide insights on further policies to deal with the existing stock of NPLs (https://www.bankingsupervision.europa.eu/press/pr/date/2017/html/ssm.pr171004.en.html).

[197] According to the European Commission (EC) proposal, banks will have two years to fully cover the unsecured amount of new NPLs and seven years for the secured amounts. See https://ec.europa.eu/info/sites/info/files/2017-non-performing-loans-backstops-consultation-document_en.pdf.

rules might severely hit the banking sectors of the weakest European economies. In Italy, negative effects in terms of banks' profitability and new lending could, in an extreme scenario, lead to a new credit crisis, hindering the already slow economic recovery (Financial Times, 2017).[198]

The investigations in this chapter begins by providing an exhaustive analysis of the recent developments, in terms of NPLs, which affected both the European and Italian banking systems. This overview reports data on distressed debt across European countries and more specifically in Italy. It then progresses to illustrate the impediments to NPL resolution, their implications and the potential strategies to address them. Subsequently, identifying the idiosyncratic and systemic factors that affect the volumes of NPLs across Italian banks, represents the main research question of the chapter. Understanding the underlying determinants of ex-post credit risk is essential for both regulatory authorities seeking financial stability, and for the management of banks. This analysis becomes crucial in the Italian context, characterized by high uncertainty and several capital raising exercises during 2017 and early 2018. The situation has adversely impacted banks' market performance, whose book value per share remains at the crisis levels (Financial Times, 2017).[199] To this end, difference and system Generalized Method of Moments (GMM) estimations, in a dynamic panel context, are employed on a sample of Italian banks over the years 2010-2016, including both macro-level and bank-specific variables.

The analysis undertaken in this chapter contributes to the existing literature on NPLs in several ways. First, it provides a deep insight on the problems and challenges within the euro area country with the highest volumes of NPLs. Despite the recent efforts of the Italian government and banks to actively address the NPL problem, the Italian banking sector is still overwhelmed by large stocks of NPLs (€300bn as of June 2017).[200] The specific features of the Italian case provide a unique framework to investigate the factors contributing to the build-up of NPLs. The core analysis of this study is supported by a comprehensive analysis of the very recent policy developments. This represents an extension compared with the analysis in

[198] See https://www.ft.com/content/d9177a14-acfe-11e7-aab9-abaa44b1e130.
[199] See https://www.ft.com/content/5dd6562e-662a-11e7-9a66-93fb352ba1fe?mhq5j=e7.
[200] See https://www.pwc.com/it/it/publications/npl/doc/pwc-npl-december17.pdf.

Garrido et al. (2016) that does not include significant events such as the cases of MPS and Veneto banks.[201]

Second, the chapter includes both macroeconomic and bank-level variables in a dynamic framework. The empirical analysis focuses on the role of both types of factors in influencing the levels of NPLs over time. The estimation strategy consists of alternative econometric techniques (i.e. OLS regression, fixed-effects model and difference/system GMM estimations) applied on two different specifications.[202] Similarly to Louzis et al. (2012), this approach enables the isolation of the contribution of the idiosyncratic factors from those arising from the general economic conditions. The importance of research in this area should be framed in the context where the banking sector provides a substantial portion of funds to the private sector. In Italy, according to the World Bank data, the 2016 bank credit to the private sector was 85.3% of GDP.

To briefly preview the main findings, the countercyclical nature of the NPL volumes is confirmed. A negative relationship is observed between real GDP growth, as an indicator of the country's general economic conditions, and the levels of banks' NPLs. Therefore, enhancing growth and productivity, while adopting structural reforms, are fundamental elements to help restoring banks' balance sheets. Among bank-specific variables, as anticipated, a higher level of profitability is negatively associated with the volumes of NPLs, providing support to the hypothesis that better managed banks tend to have fewer incentives to engage in poor lending practices. Finally, an inverse link between credit growth and NPLs is observed. In this perspective, it is possible to assume a credit growth driven by demand factors, rather than by an aggressive supply policy.

The remainder of this chapter is organized as follows. Section 5.2 discusses the NPL problem at the European level, its implications and potential solutions. Section 5.3 frames the issue in the Italian banking system, providing data, while illustrating recent initiatives and special cases. Section 5.4 reviews the related literature on the

[201] The IMF authors discuss policy initiatives which occurred up to May 2016 and conduct their empirical analysis for the time period 2005-2014.

[202] The adoption of different econometric techniques, which contributes in adding robustness to the findings, also represent an element of originality with respect to some related works. The latter (e.g. Louzis et al., 2012; Garrido et al., 2016) employ only one or two alternative approaches.

determinants of NPLs. Section 5.5 discusses the data, the preliminary tests and formulates the hypotheses. Section 5.6 presents the econometric methodology. Section 5.7 reports the results of the empirical analysis and Section 5.8 concludes the chapter.

5.2 NPLs in Europe

Following the global financial and sovereign debt crises (and subsequent recession period), many European banks have experienced a deterioration in their balance sheets often characterized by high volumes of NPLs.[203] The deep and prolonged economic downturn weakened borrowers' capacity to service their debt obligations. This was especially true for those with accumulated excessive debt relative to their assets, leading to a sharp surge in loan defaults. Besides revealing a limited capacity of most of the euro area banking sector to manage distressed debt, this phenomenon also reflected the existence of impediments in the resolution of NPLs, which weakened banks' incentives in dealing with the problem (Constâncio, 2017). These impediments are mainly attributable to (i) the supply side; (ii) the demand side; and (iii) structural inefficiencies in the European environment (ESRB, 2017).

The following sub-section clarifies some aspects relevant to the NPL concept in Europe and reports some data on NPLs across European countries. Subsequently, the impediments in the NPL resolution, the implications of the problem and relevant potential solutions will briefly be illustrated.

5.2.1 The concept of NPL in Europe

In the current context, the commonly employed term "Non-Performing Loans" is built on various definitions across Europe (PC, 2016a). In order to avoid potential mis-interpretation and for supervisory reporting purposes, the EBA provided a

[203] Based on CEPR (2017) findings, the second of the two European recessions, which followed the global financial crisis, started after the third quarter of 2011 and lasted for six quarters (until the first quarter of 2013). The total decline in output from peak to trough was 1.5 per cent. The first recession began in the first quarter of 2008 and ended in the second quarter of 2009 with a total decline in output of 5.5 per cent. For further details, see https://cepr.org/content/euro-area-business-cycle-dating-committee.

standard definition of Non-Performing Exposures (NPEs) in 2014.[204] This harmonized definition was intended to improve NPEs measurement and ensure comparability across banks and countries.[205] Any exposure that is more than 90 days past due or unlikely to be repaid without realization of the collateral is classified as non-performing.[206] Moreover, restructured ("forborne") exposures might be included in the non-performing category.[207] For the latter, even when the borrower complies with a new payments' schedule and all the conditions for being identified as performing, the exposures continue to be included in the non-performing class for a period of at least one year ("cure period").

The harmonization, across jurisdictions and banks, of the application of the NPL concept is currently not fully achieved. Involving some qualitative key elements, especially regarding the "unlikely to pay" criterion (part of the default definition), the NPL classification remains potentially subject to different interpretations (ESRB, 2017). With the aim of mitigating this issue, there is currently ongoing coordinated work by national and European supervisory teams and additional EBA guidelines on the application of the definition of default, which are expected to come into force in 2021.[208] In this empirical chapter, in line with common practices and due to the fact

[204] This is also relevant in the 2014 Asset Quality Review (AQR), conducted by the EBA, as part of the wider Comprehensive Assessment (CA). According to the EBA, "exposures" are all debt instruments (loans and advances and debt securities) and off-balance sheet exposures (loan commitments, financial guarantees and other commitments), except for those held for trading. See "EBA Implementing Technical Standards on Non-Performing Exposure and Forbearance" based on Commission Implementing Regulation (EU) 2015/227 of 9 January 2015 amending Implementing Regulation (EU) No 680/2014 laying down implementing technical standards with regard to supervisory reporting of institutions according to Regulation (EU) No 575/2013.

[205] Besides the supervisory definition of NPEs, there is the accounting definition of "impaired" based on IAS 39, as well as the prudential definition of "default" in accordance with the Regulation (EU) No 575/2013 ("The Capital Requirement Regulation", CRR).

[206] Based on Article 178 of CRR, defaulted and impaired exposures are always considered as NPEs.

[207] It is worth mentioning that the forborne exposures do not represent a further category of credit quality, but rather a cross-sectional category to the existing classes of risk, which can include both performing and NPEs. Specifically, exposures considered as forborne are those that have been subjected to the modification of the contractual terms and conditions or refinancing.

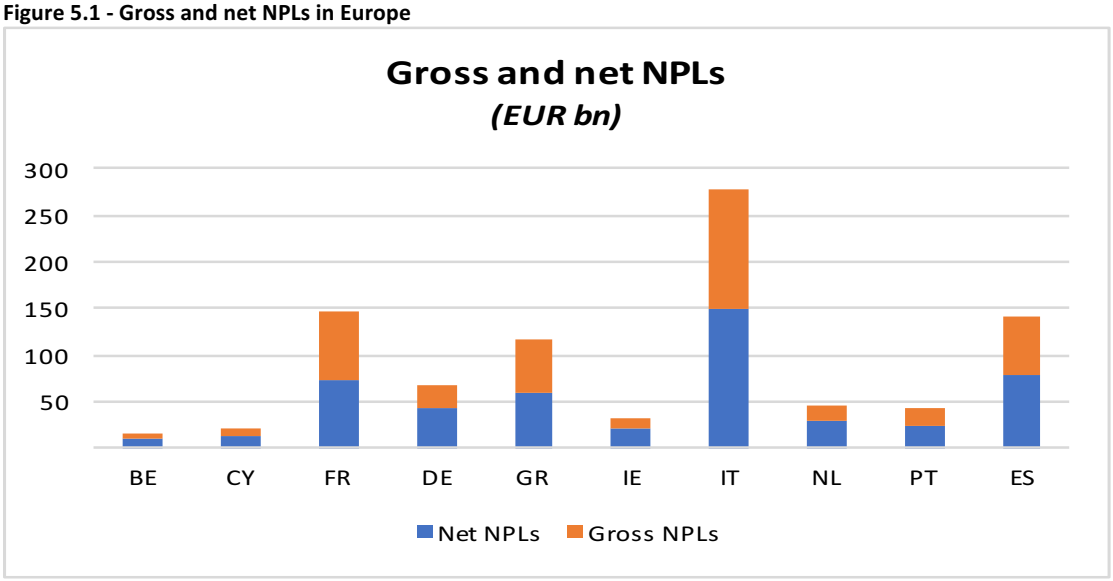
[208] In December 2017, the EBA released templates aimed at creating a common EU dataset for the assessment of NPL transactions. The following fundamental factors will contribute to the development of the NPL secondary market in the EU: widening the investor base, lower entry barriers, improving the availability and quality of the data, and supporting the price discovery process.

that loans represent the majority of the distressed exposures, the term NPLs is adopted rather than that of NPEs.[209]

5.2.2 Data on NPLs

In June 2016, based on the results of the EBA's transparency exercise, the gross prevailing stock of NPLs in Europe was around €1.0tn. The net prevailing amount (or book value) was of about €600bn.[210] Italian banks, followed by French, Spanish and Greek institutions, recorded the largest stocks of NPLs (gross value of around €280bn - Figure 5.1).

Figure 5.1 - Gross and net NPLs in Europe



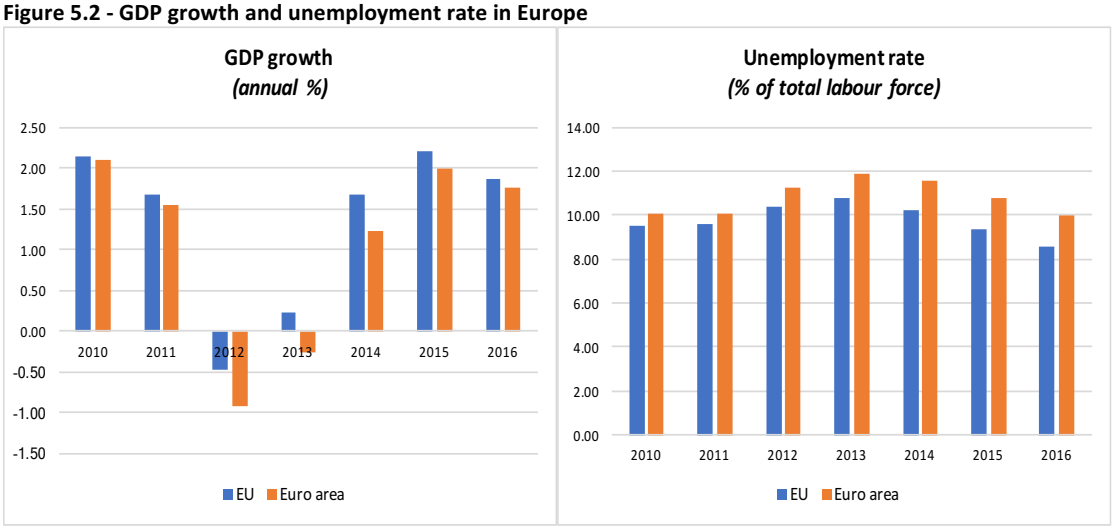
Source: EBA Transparency Exercise (2016). Own elaboration.
Description: The chart displays, for each country, the gross and net stock of NPLs as at 30 June 2016 (billions of Euros).

The average level of NPLs in the EU (as a percentage of total gross loans) increased from 2.8 per cent in 2008 to a peak of 7.5 per cent in 2012/2013 (8.1 per cent in the euro area) before starting to gradually decline (KPMG, 2017).[211] As the

[209] This approach is also adopted in the 2017 ECB guidelines and in other reporting documents (see, for instance, PC 2016a).
[210] The debtor's total amount, which has not been written off, represents the gross carrying amount. The corresponding net figure is obtained by adjusting the gross figure for the accumulated impairments (or changes in fair value due to credit risk) and provisions. As the net carrying amount does not include losses already recognized by the institution, it represents the further potential loss. Impairment and provisioning imply a substantial discretion by the bank's management, making the comparisons among banks and jurisdictions less reliable than when considering gross figures.
[211] However, in five euro area countries (i.e. Cyprus, Greece, Ireland, Italy and Portugal) the ratio of NPLs to gross loans remained above 10 per cent in 2015.

economy recovered, GDP growth resumed and the unemployment rate slowly fell, the average NPL ratio started to decline (Figure 5.2).

Figure 5.2 - GDP growth and unemployment rate in Europe

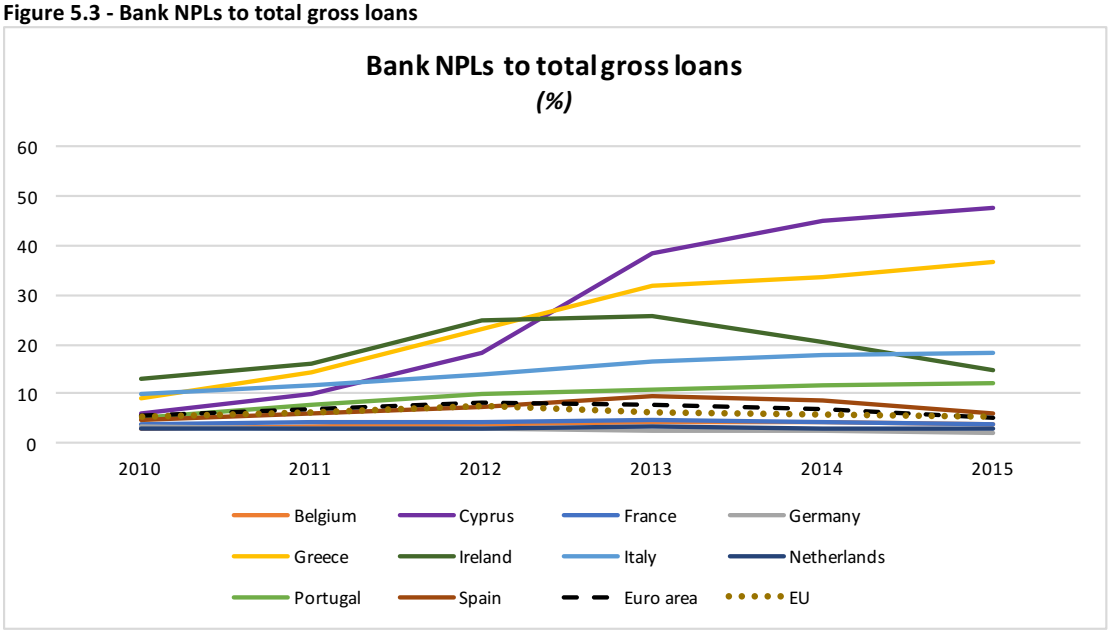


Source: World Bank and OECD databases. Own elaboration.
Description: The left chart displays, for the period 2010-2016, the real GDP growth rate (annual percentage). For the same time period, the right chart reports the unemployment rate (as percentage of the total labour force). Both the figures present data for the EU (28 countries) and the euro area (19 countries).

Nevertheless, substantial cross-country heterogeneity exists, which is especially evident when comparing core (i.e. Belgium, France, Germany and Netherlands) and peripheral (i.e. Greece, Ireland, Italy, Portugal and Spain) euro area economies (Figure 5.3).[212] The highest NPL ratios are concentrated in countries characterized by weak economic activity and public finances, which were most affected by both the economic crisis (from 2008 onwards) and the subsequent debt crisis (implying a risk of reigniting negative feedbacks between banks and sovereigns, according to Angeloni, 2017). In Cyprus, during 2015, about half of total loans were non-performing, while in Greece around one-third (47.75 and 36.65 per cent, respectively). Italy reported NPL ratios of about 20 per cent. Several countries maintained NPL ratios close to 3 per cent (e.g. Belgium, Germany and Netherlands). Despite these differences across countries, NPLs are a problem needing to be addressed at a Europe-wide level, because even countries with healthier banking sectors are potentially affected by cross-border spillovers, both financial and real (Constâncio, 2017).

[212] Banks from some Central and Eastern European countries (e.g. Bulgaria, Hungary and Romania) also show high levels of NPLs.

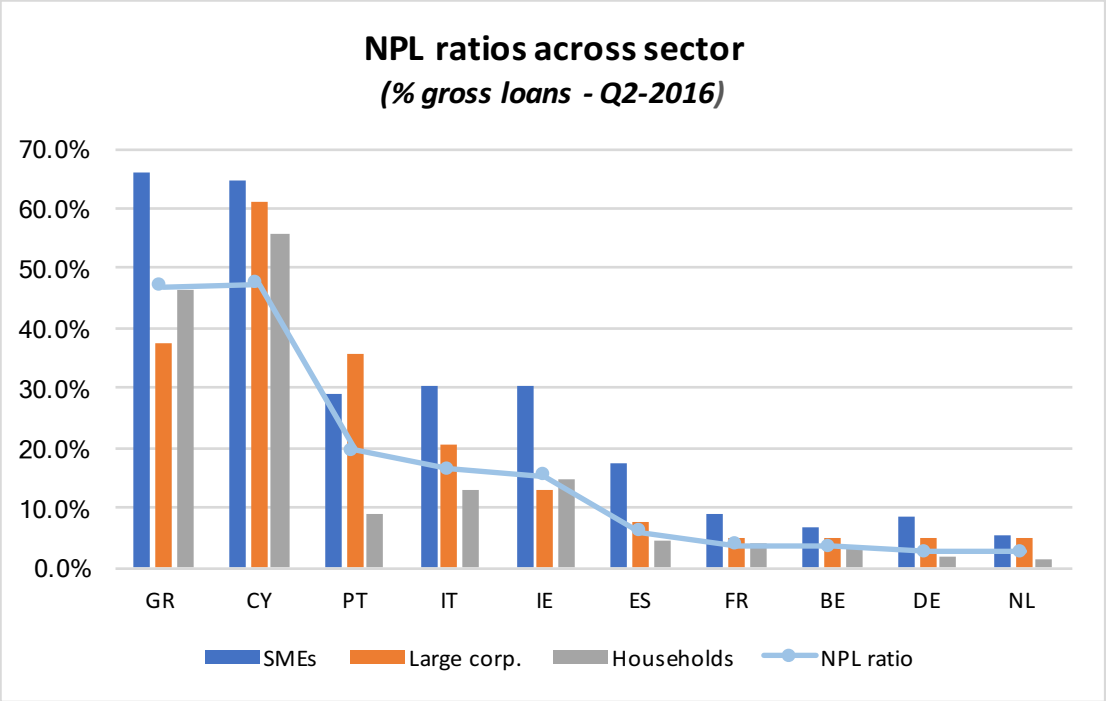
Figure 5.3 - Bank NPLs to total gross loans



Source: World Bank database. Own elaboration.
Description: The chart displays, by country, the ratio of NPL to total gross loans (in percentage). The two dashed lines represent the average values for the euro area and the European Union (EU).

The distribution of NPLs across sectors in different countries also shows considerable variation (Figure 5.4). The average NPL ratio relevant to exposure to SMEs (28.6 per cent) is higher than the corresponding figures for large corporates (19.6 per cent) and households (15.5 per cent). This evidence is observed for all the countries considered, except for Portugal where the NPL ratio of exposures to large corporates is higher than that to SMEs (35.6 and 29 per cent, respectively). In Greece and Ireland, the average NPL ratios of households (46.4 and 14.9 per cent, respectively) are higher than those associated with the exposures to large corporates (37.4 and 13.1 per cent, respectively).

Figure 5.4 - NPLs ratios across sector



Source: EBA Risk Assessment Report (2016). Own elaboration.
Description: The chart displays, for each country and as percentage, the ratio of NPL to gross loans across sectors (i.e. SMEs, large corporates, households). The line represents the weighted average, by country, of the NPL ratios.

5.2.3 Supply-side impediments

The existing accounting rules, set by International Accounting Standard (IAS) 39, potentially contribute to the deferred recognition of credit losses.[213] This is mainly due to the fact that the current impairment system is based on an "incurred loss approach", according to which credit losses are only recognized when a credit loss event occurs. Considering that typically losses are not uniformly spread over a loan's lifetime, there is a potential mismatch between the timing of adjustment of the charged interest rates and the recognition of any impairment losses (EY, 2014).[214] Moreover, in the low interest rate context of 2012-17, the interest income flow associated with NPLs (which the IAS 39 permits to be recognized) is expected to be higher than that related to new loans, whilst the funding cost of NPLs remains low.[215]

[213] IAS 39 ("Financial Instruments: recognition and measurements") outlines the principles for the recognition and measurements of financial assets, financial liabilities, derivatives and other instruments.
[214] From January 2018, IAS 39 will effectively be replaced by International Financial Reporting Standard (IFRS) 9 ("Financial Instruments"), which introduces a new impairment approach based on expected rather than incurred losses.
[215] This accounting treatment leads to overvalued interest income and provisioning ratio (Jassaud and Kang, 2015).

Consequently, there exists a favourable opportunity cost in holding NPLs, which hinders the banks' incentives in accelerating NPL disposals (ESRB, 2017). Beyond the current accounting regime, the treatment of some operating expenses associated with the disposal of NPLs (only reported when incurred), as well as tax disincentives (arising from the treatment of provisions and write-offs) might discourage the timely recognition of losses and the resolution of NPLs.[216]

Opacity and significant information asymmetry characterize secondary markets for distressed debt across Europe. This contributes to the widening of the gap between the market price set by potential investors and the banks' net NPL book value (i.e. bid/ask spread).[217] This discrepancy may arise from a series of factors that potential investors incorporate in their price decisions (and associated discount rates) to account for (i) scarce data and lack of transparency; (ii) time and cost to recover the value of a NPL or to realise the value of a collateral, which negatively impact on the long-term economic value of NPLs; (iii) expectations about the macroeconomic outlook (which might differ from that of the selling bank).[218] According to Ciavoliello et al. (2016), the main drivers of the pricing gap are the higher return rate (compared to the original effective interest rate mandatorily adopted by banks) that market investors use to discount the expected cash flows associated with NPLs and the differences in the treatment of indirect costs associated with NPL management. Potential acquirers, unlike banks, can immediately deduct these costs from the asset value, thus lowering the bid price. The illiquidity of EU secondary markets for NPLs might also imply a first mover disadvantage, as the benefit of moving towards higher efficiency would be firstly exploited by competitors.[219] Lastly, the effective

[216] For a discussion on the tax obstacles to NPLs resolution, see the document produced by the European Banking Coordination "Vienna" Initiative (2012). See https://www.imf.org/external/region/eur/pdf/20 12/030112.pdf.

[217] Over recent years, a substantial bid/ask spread has represented a major obstacle to the NPL market activity in Italy (KPMG, 2016).

[218] As discussed by Constâncio (2017), there are several sources of informational asymmetry when considering NPLs. Firstly, banks enjoy an advantage, compared to market investors, arising from the previous relationship with the client. Then, the existence of collateral contributes to increasing the informational gap and the burden of investor due diligence. Moreover, market agents might be concerned by banks' cherry-picking of assets for sale (i.e. banks would deliberately retain the best assets, selling low quality portfolios).

[219] With a volume of transactions of €100bn in 2015 (representing less than 10 per cent of the outstanding stock), the overall level of NPL transactions across Europe has been relatively limited (KPMG, 2017).

management of NPLs might be hindered by banks' internal lack of preparedness in terms of resources, expertise and optimized strategies to tackle the NPL issue.[220]

5.2.4 Demand-side impediments

On the demand side, barriers to entry (e.g. licensing requirements) exist in several EU countries' secondary markets for NPLs. These barriers promote concentration, while inhibiting the demand from prospective investors and servicers. Furthermore, the lack of an efficient NPL servicing segment in many EU countries (as part of the wider credit management industry), contributes to the existence of a bias towards the largest and most specialized players, creating the settings for an oligopoly. The poor quality and the scarce availability of data on NPLs might also compromise potential investors' evaluation processes, resulting in higher uncertainty about the real asset values and therefore lower bid prices (Fell et al, 2016). Moreover, also the quality of (i) NPL documentation; (ii) legal agreements; and (iii) public information (e.g. property registers and corporate financial data) is often mediocre and difficult (therefore costly) to access. Further legal restrictions and uncertainty (regarding rules on consumer protection and data privacy), as well as tax rules on the transfer of NPLs, might also limit the potential for NPLs resolutions (ESRB, 2017).

5.2.5 Structural impediments

Weak legal frameworks supporting debt recovery and collateral enforcement might also strongly contribute to limit the demand for NPL portfolios and of a widening in the bid/ask spread. Debt enforcement and foreclosure procedures differ significantly across countries both in terms of effectiveness and duration. Excessively burdened and complex legal systems and judiciary proceedings limit the volume of investment in impaired assets. Indeed, significant delays, high associated costs and uncertainty about the outcome of insolvency processes and collateral enforcement actions represent detrimental elements. While the average foreclosure time-length in most of the EU countries is around three-five years, in some cases (e.g. Cyprus and

[220] The issue of banks' strategies to deal with NPLs is widely addressed in the 2017 ECB guidelines ("Guidance to banks on non-performing loans"), which constitute recommendations for all credit institutions. Besides the resolution strategy, the guide addresses other key elements regarding governance and operations in tackling NPLs. See https://www.bankingsupervision.europa.eu/ecb/pu b/pdf /guidance_on_npl.en.pdf.

Greece) it can last between 10 and 20 years (ESRB, 2017). This aspect might also imply higher moral hazard due to the debtors' awareness about the difficulties related to the collateral enforcement. In this context, Fell et al. (2016) argue that long duration and high costs of legal procedures significantly reduce the market value of NPLs.[221]

Additional legal constraints in some countries, for instance on (i) the sale of some types of collateral; (ii) the transfer of credit contracts; and (iii) holders of NPLs, might also prevent the development of an efficient secondary market for NPLs. Lastly, restrictions on government intervention in resolving the NPL issue are imposed by both the EU rules on State Aid and by the BRRD. Nevertheless, in practice almost all national Asset Management Companies (AMCs) have obtained some form of public support (KPMG, 2017).[222]

5.2.6 Implications of the NPL problem and possible solutions

The NPL problem presents implications from both micro-prudential and macro-prudential perspectives. As highlighted by Constâncio (2017), the NPL issue is one of the main factors explaining the low level of profitability of many banks across Europe.[223] The presence of high NPLs on a bank's balance sheet adversely impacts its profitability because increased provisions are required, which in turn lower the net income. By definition, NPLs do not produce income flows comparable to other performing assets. Impaired assets might also constrain significant amounts of capital due to the associated higher risk-weights. Deterioration in asset quality increases banks' funding costs (due to lower expected revenue flows) thus increasing investors' risk perception (Aiyar et al., 2015).[224] Besides micro-level concerns, large stocks of NPLs on banks' books also impair their capability in providing new lending to the real

[221] According to EBA (2017, p. 6), the "lengthy and expensive judiciary process to resolve insolvency" is the most important structural impediment to solve NPLs. The second main obstacle is represented by the lack of a functional secondary market for NPLs/collaterals. Refer to https://www.eba.europa.eu/documents/10180/1898284/Risk+Assessment+Questionnaire++June+2017.pdf/fe1990a6-91af-40b3-b381-85908e64a6bb.

[222] Recent examples are the government-sponsored NAMA (Ireland, 2009), SAREB (Spain, 2012) and BAMC (Slovenia, 2013). Italy has started to consider the possibility of establishing a national bad bank, jointly controlled by the state-owned SGA and Rev (SNL Financial, 2018). See https://www.snl.com/interactivex/article.aspx?KPLT=7&id=43491734.

[223] According to the Vice-President of the ECB, low returns on equity in the euro area are also attributable to overbanking and/or high costs.

[224] The management of high levels of NPLs also consume staff resources, shifting the focus from banks' (more remunerative) core activities.

economy (Angeloni, 2016). This aspect is particularly relevant in the European economic context which is mainly based on the functioning of SMEs, typically dependent on bank financing. Subsequent impediments to the effectiveness of monetary policy transmission can also occur, given that credit offerings are strongly conditioned by banks' lending behaviour. A vicious circle can therefore arise, as a credit contraction would imply lower economic growth, slower recovery and therefore further fragility in banks' balance sheets (Accornero et al., 2017). The negative implications of this loop might undermine overall financial stability, also leading to the extreme situation of "zombification" of the wider-system.[225] Lastly, efforts towards ensuring that banks dispose of sizable NPL portfolios should be accompanied by reducing excessive debt from borrowers' balance sheets (Demertzis and Lehmann, 2017).[226]

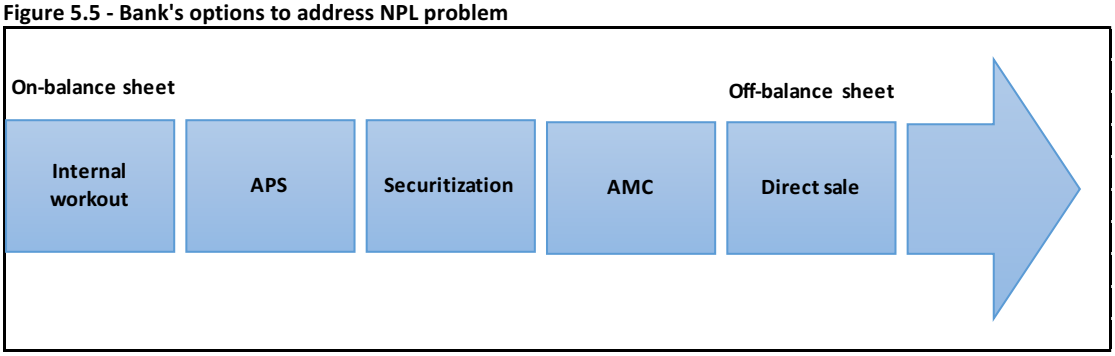
Reducing the impediments to an active and effectively functioning NPL secondary market requires a comprehensive strategy, harmonised at EU level but with country-specific elements in order to consider different conditions (Constâncio, 2017). Banks employ several potential options in order to manage NPLs, which are both on and off-balance sheet: (i) establish an internal work-out unit; (ii) enter in a risk-sharing agreement with a third party (Asset Protection Scheme, APS); (iii) securitization (including the synthetic alternative); (iv) creation of (state-backed) AMCs; and (v) direct sales to investors (Figure 5.5).[227] The Spanish case represents a suitable example of a relatively successful reduction of NPL volumes (KPMG, 2017). Nevertheless, all the outlined alternatives require a substantial impulse towards structural reforms.

[225] Zombie banks are institutions with sizeable amounts of NPLs, not large enough to consider them insolvent, but large enough to severely impair their capacity in providing new lending to productive firms (Gandrud and Hallerberg, 2017). These kind of banks do not support economic growth, but rather represent a burden for the economy. The Japanese experience of the 1990s is an example of such a condition (Caballero et al., 2008).

[226] The authors argue that excessive debt contributes in depressing the demand for new credit (i.e. "debt overhang" effect).

[227] See Fell et al. (2016, 2017) for a more detailed discussion about these options and especially about the functioning and benefits of AMCs.

Figure 5.5 - Bank's options to address NPL problem



Source: ECB (2017). Own elaboration.
Description: The figure displays a bank's range of options to address the NPL problem (on and off balance-sheet).

The 2017 ECB guidelines on NPLs, which are expected to improve banks' capabilities, more active secondary NPL markets in some countries and slightly improved overall macro-economic conditions contribute in mitigating the issue (KPMG, 2017). Actions to enhance debt enforcement and to reduce information asymmetries are also crucial in this perspective. Aiming at promoting timely restructuring and the restoration of potentially viable firms, the set of options available to distressed creditors should also be enlarged (Constâncio, 2017). On the other hand, a rapid exit from the market of non-viable firms and an eased access to collateral should be ensured. The introduction and implementation of a more balanced insolvency regime is necessary. This should deliver increased certainty about timing and outcomes of legal processes, sufficient capacity of the court system and enhanced out-court frameworks (Aiyar et al., 2015).

Facilitating the access and circulation of financial information on insolvent borrowers, collateral assessment and NPL transactions is fundamental for the development of a more active market of NPLs.[228] Extending the range of potential investors in distressed debt markets is also a target (through the removal of the relevant obstacles). Furthermore, (i) enhancing prudential oversight; (ii) strengthening the range of regulatory sanctions; (iii) clarifying the parameters for the EU State Aid and the BRRD; (iv) promoting privately-led alternatives are all desirable elements for an effective and comprehensive EU solution.

[228] The creation of a European NPL-information platform is envisaged in order to reduce the information asymmetry and facilitate transactions (Constâncio, 2017).

Lastly, the creation of a EU-wide AMC (as proposed by the EBA's Chair in January 2017) represents a possibility, which would promote raising private funds. Nevertheless, in the short term, the vision of a European AMC appears difficult and unlikely to occur, mainly due to legal constraints (Fell et al., 2017).[229] Providing European countries with a blueprint for national AMCs currently seems to be a more feasible option.

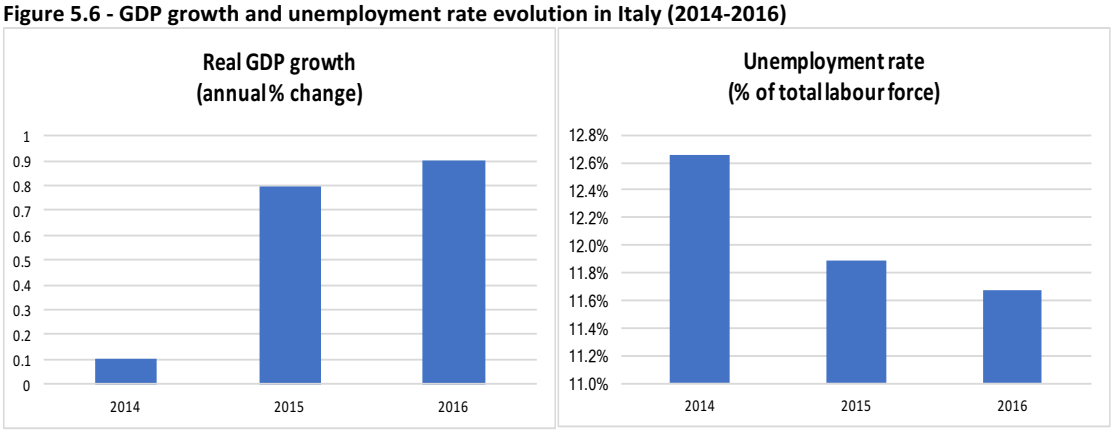
5.3 NPLs in the Italian banking system

Following the global financial crisis, the protracted period of recession has tested the resilience of Italian companies and consumers, creating the preconditions for the deterioration of banks' balance sheets and a significant increase in the volume of NPLs.

Italy is currently among the world's largest markets for distressed debt. Since 2009, the total amount of NPLs on Italian credit institutions' books has more than doubled, from €133bn to €349bn at the end of 2016 (EY, 2017). Nevertheless, both the European and Italian economies are gradually recovering from the economic crisis. A low level of inflation and a weak currency, together with sustained fiscal and monetary policies are contributing in supporting their moderate growth. The Italian GDP growth is predicted to be stable at 0.9 per cent in 2017 and to increase to 1.1 per cent in 2018, mainly supported by a low interest rate environment and stronger external demand.[230] Structural weaknesses still hamper a more sustained pace in the recovery. Moreover, political uncertainty and the slow adjustment of the banking sector represent elements which hinder growth prospects.[231] A gradual decline in the unemployment rate from 11.9 per cent in 2015 to 11.7 per cent in 2016 (11.6 per cent is the value expected for 2017), contributes towards boosting private consumption (PC, 2017 - Figure 5.6).[232]

[229] An EU-wide AMC would probably be a more feasible possibility after the implementation of a European insolvency framework (KPMG, 2017).
[230] Recent S&P's estimations expect the Italian GDP growth to be 1.4 per cent in 2017 and 1.3 per cent in 2018/2019 (Reuters, 2017).
[231] According to the IMF (2016), (i) more incisive structural reforms; (ii) a faster revival of the financial sector; and (iii) enhanced fiscal buffers are the elements that the Italian authorities need to focus on in order to support the still modest and fragile recovery.
[232] Improvements in the unemployment rate are the results of recent labour reforms (i.e. the "Jobs Act" approved in late 2015).

Figure 5.6 - GDP growth and unemployment rate evolution in Italy (2014-2016)



Source: IMF and World Bank databases. Own elaboration.
Description: The charts display the evolution over the years 2014-2016 of the real GDP growth (annual percentage change) and the unemployment rate (as percentage of the total labour force).

Starting from 2018, the Italian government gross debt ratio, as well as the corresponding European figure, are expected to slightly reduce (Table 5.1).

Table 5.1 - Government gross debt ratio: Cross-country evolution

	2014	2015	2016	2017F	2018F
France	94.9	95.6	96.3	96.8	97.0
Germany	74.7	70.9	68.1	65.0	61.8
Italy	131.8	132.1	132.6	133.0	131.4
Spain	100.4	99.8	99.4	98.7	97.2
United Kingdom	88.1	89.0	89.3	89.5	89.7
Europe	78.1	78.6	78.2	76.6	75.4

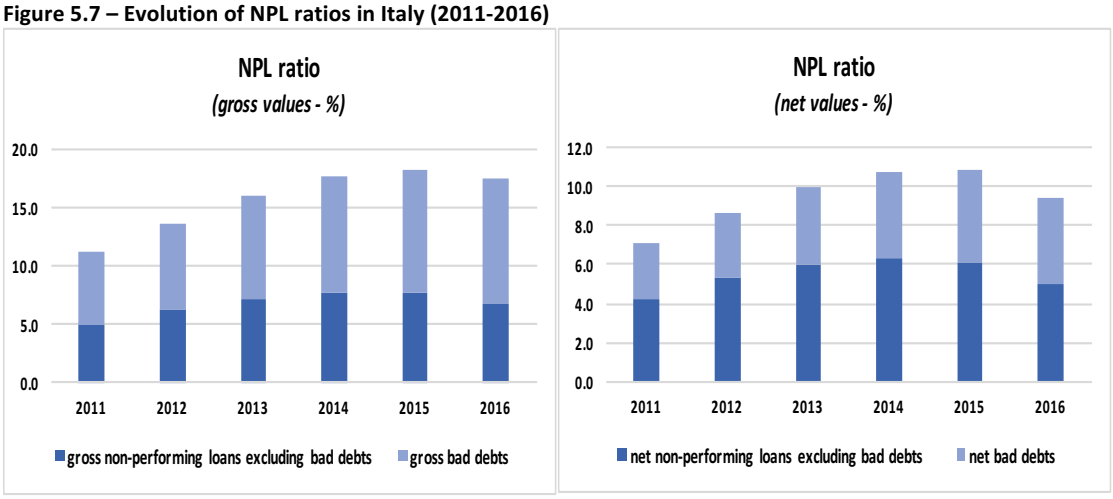
Source: IMF database. Own elaboration.
Description: The table reports the evolution over the years 2014-2018 of the government gross debt ratio (as percentage of the GDP) for different European countries (the values for the 2017 and 2018 are forecasted values).

In 2016, Italian banks recorded the first decline in gross NPLs in eight years (DBRS, 2017).[233] The balance sheets of Italian credit institutions, traditionally focused on lending to SMEs, benefited from the gradual economic recovery, which has contributed in reducing the default rate of households and firms close to pre-crisis levels (Bank of Italy, 2017). At the end of 2016, the stock of NPLs, net of provisions, was 9.4 per cent of outstanding loans (the same figure at the end of 2015 was 10.9 per cent). Gross of provisions, the stock of NPLs was 17.4 per cent of outstanding loans in 2016 and 18.2 per cent in 2015 (Figure 5.7). The NPL coverage ratio (the amount of provisions to the entire stock of NPLs) increased by 5.2 percentage points from 2015

[233] See https://www.dbrs.com/research/310015/dbrs-italian-banks-asset-quality-update-evolution-in-gross-npls.

to 2016 (from 45.4 to 50.6 per cent).[234] Bad loans ("sofferenze" in Italian) represent the largest share of the whole stock of NPLs (10.7 per cent of the gross amount in 2016, around €215bn).[235] Unlikely to pay (UTP) exposures at the end of 2016 were still lower than bad loans in terms of gross book value (€126bn) but not in terms of net book value (€85bn compared to €81bn of bad loans). These became the new challenge faced by the Italian banks.

Figure 5.7 – Evolution of NPL ratios in Italy (2011-2016)

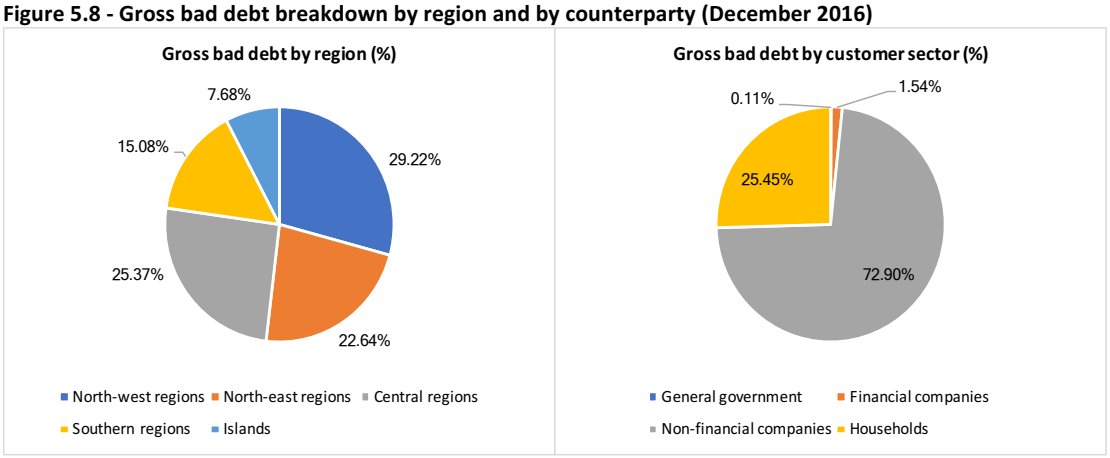


Source: FSR, Bank of Italy (2017). Own elaboration.
Description: The charts display the evolution over the years 2011-2016 of the NPL ratios (gross and net values).

Considering the composition of the stock of banks' bad debt, in 2016 more than 50 per cent of the whole amount was concentrated in the north regions. The corresponding figure for the central regions was about 25 per cent, while southern regions and islands had about 15 and 8 per cent, respectively (Figure 5.8). About three quarters of the Italian bad debt are attributable to non-financial corporates (73 per cent), with the highest concentration in the construction sector (about 28 per cent) followed by the manufacturing sector (20 per cent) and real estate (16.50 per cent) (Figure 5.8).

[234] A large portion of these provisions is attributable to UniCredit SpA ("Project Fino"), which improved its coverage ratio in order to facilitate the sale, in July 2017, of a significant amount of bad debt (€17.7bn).
[235] In 2016 around 48 per cent of bad loans were secured (PC, 2017).

Figure 5.8 - Gross bad debt breakdown by region and by counterparty (December 2016)

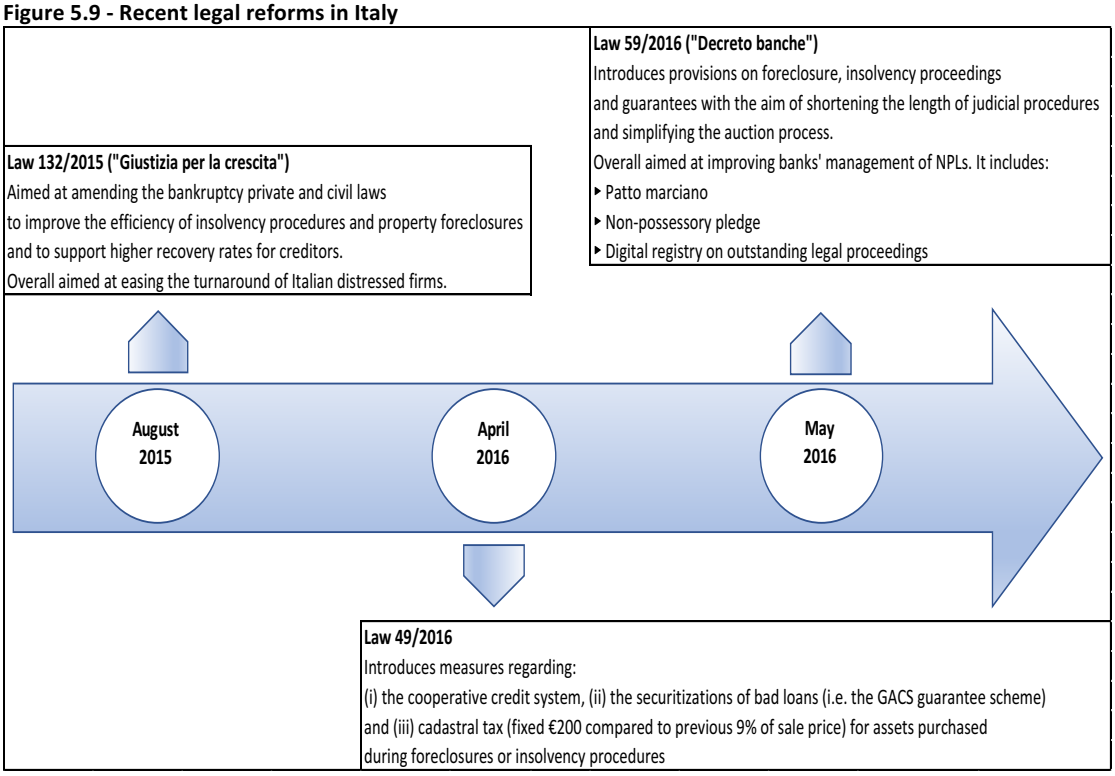


Source: Statistical Bulletin, Bank of Italy (2017). Own elaboration.
Description: The charts display the breakdown of banks' gross bad debt by region and by counterparty as at December 2016.
Note: The households category includes both producer and consumer households.

Italy has been the most active loan sale market in 2016 with €36bn in 43 completed deals (about €40bn in deals are expected for 2017 - Deloitte, 2017).[236] An improved transaction environment together with a political commitment to the resolution of the NPL issue (and more realistic pricing expectations) contributed to the development of the distressed debt market. Throughout 2016 and 2017, the Italian government has introduced new measures designed to improve the efficiency and speed of both judicial and extra-judicial insolvency procedures with the aim of boosting the reduction of bad loans volumes, while increasing the price of NPL portfolios (Figure 5.9). The introduction of the state GACS, the creation of two Atlante funds, as well as the amendments to bankruptcy foreclosure proceedings and the beneficial tax treatments on banks' loan provisions represent some of the newly activated initiatives supported by the Italian government.[237]

[236] PC estimates for the volume of deals in 2017 are more than €60bn and especially driven by the massive MPS deleveraging (€29.4bn). Moreover, PC foresees the inclusion of other categories of NPEs, such as the UTP and foreborne, in the overall volume of transaction for the 2017.
[237] In mid-2015, the Bank of Italy also conducted a survey of 25 large banking groups to assess the effectiveness of the procedures for managing NPLs. The exercise was aimed at obtaining information on (i) recovery times and rates; (ii) the adoption of the various procedures; and (iii) the major obstacles to effective credit recovery.

Figure 5.9 - Recent legal reforms in Italy



Source: EY (2017). Own elaboration.

5.3.1 The State-Guarantee Scheme (GACS)

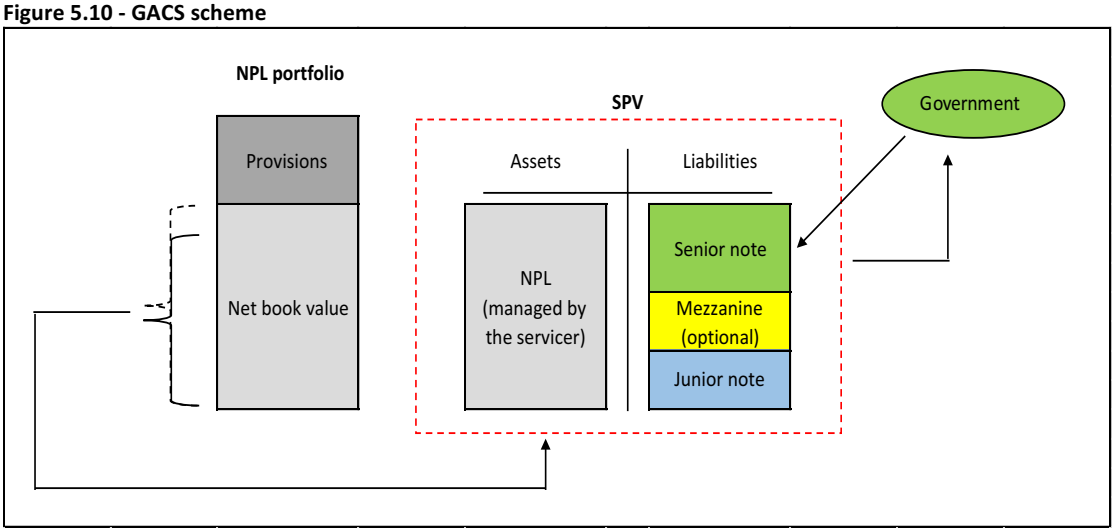
In January 2016, the Italian government agreed with the EC on a scheme that provides state guarantees for the securitization of bad loans. The aim of the government-sponsored solution was to increase the liquidity in the NPL market by easing the portfolio disposal processes. Based on the mechanism, which is applicable only to bad loans ("sofferenze"), banks have the option to transfer their NPLs to a Special Purpose Vehicle (SPV) that can finance the purchase through the issuance of a junior tranche (without guarantee) and a senior tranche for which a state guarantee can be acquired (Figure 5.10).[238] In the latter case, the condition is that senior notes are rated as investment grade or above (i.e. low level of risk) by an External Credit Assessment Institution (ECAI). Therefore, the government intervention is only limited to the coverage of interest and capital payment obligations on the senior tranches of notes.[239] The guarantee can be called on the amount outstanding on the senior

[238] The option is permitted to both banks and financial intermediaries under Article 106 of the Italian Banking Law.

[239] To receive the guarantee on the senior notes, the bank (or financial intermediary) must (ii) sell at least 51% of the junior tranche, (ii) obtain deconsolidation/derecognition of the transferred assets and (iii) be separated from the servicer. The repayment of the principal on the senior notes is subordinated only to the payment of interest on the mezzanine tranche, if issued (PC, 2017).

tranches at their legal maturity date and the payment occurs between four and nine months from the request of payment. In order to avoid the guarantee to be classified as State Aid, its (annual) price is determined at market conditions on the basis of a set of CDS on Italian companies with comparable risk profiles (PC, 2017). Furthermore, the guarantee fee increases over time, if the senior tranches are not completely repaid within the third or fifth year after the granting of the state guarantee. This element should represent an incentive to expedite the securitized debt recovery (Garrido et al., 2016). The Italian Ministero dell'Economia e delle Finanze (MEF) has established a GACS-related fund, with an initial budget set at €100m for 2016 and subsequently increased to €120m to reflect the extension of the state-sponsored guarantee scheme to financial intermediaries. The annual fees of the granted GACS also contribute to financing the fund.

Figure 5.10 - GACS scheme



Source: EY (2017). Own elaboration.

In October 2016, the Italian Banca Popolare di Bari completed the first securitization assisted by the GACS scheme. The securitized portfolio, which included both retail and corporate bad loans (63 per cent secured and 37 per cent unsecured), had a total GBV of about €480m and was transferred to the SPV at a price of about 31 per cent of the portfolio value (€150.5m).[240]

[240] The operation involved the issue of three classes of notes: (i) a senior tranche worth €126.5 m (26 per cent of GBV), rated by DBRS and Moody's as BBB/Baa1, which benefited from the state guarantee; (ii) a mezzanine tranche worth €14 m (3 per cent of GBV) and rated B/B2 by DBRS and Moody's; and (iii) a junior, unrated, tranche worth €10 m (2 per cent of GBV) (PC, 2016a).

5.3.2 The Atlante Fund(s)

In April 2016, several Italian banks, financial institutions and institutional investors agreed to contribute to the launch of the Italian private asset fund named Atlante, managed by Quaestio Capital Management Company SGR SpA.[241] The "entirely private operation", as defined by the current Italian Minister of Finance Pier Carlo Padoan, was designed with the intention of restoring stability and confidence in the Italian banking sector. With a capacity of €4.25bn of equity collected by 67 institutions (with UniCredit SpA and Intesa Sanpaolo SpA holding the largest share), the purpose of the fund is to participate in the ongoing subscription of banks' capital increases (by acting as a buyer of last-resort).[242] Moreover, the fund can purchase non-investment grade tranches (i.e. junior tranches and mezzanine) arising from operations of NPL securitization. The fund has a five-year horizon with the possibility of extension until 8 years and offers approximately a 6 per cent return on annual basis. A relevant role was also attributed to the fund in reducing the bid-ask spread in the Italian NPL market, by stimulating competition and mitigating pre-existing information asymmetries.

Atlante 1 was mostly used for the bailout of two mid-size regional lenders, Banca Popolare di Vicenza (BPVI) and Veneto Banca, which were among the Italian banks that failed the 2014 ECB CA. Amounts of approximately €1.5bn and €1bn, respectively, were used to recapitalize the struggling institutions (over half of the fund's overall capacity).[243] In August 2016, Atlante 2 was created (renamed as the "Italian Recovery Fund" in October 2017) with the objective of playing a key role in resolving Italy's banking troubles, mainly related to MPS. To the expected target of €3.5bn, financial institutions contributed for €1.7bn, while around €900m were transferred by the original Atlante fund.[244] During 2017, Italian banks, have significantly written down

[241] Cassa Depositi e Prestiti (CDP), a joint-stock company under public control, participates to the fund with an 8 per cent minority stake (about €250m).

[242] No investor's share is exceeding 20 per cent. Banks contributed for about €3bn, banking foundations for €500 m and others for €450m (PC, 2016b).

[243] According to Merler (2016), the initiative of the fund arose from concerns of potential systemic implications in case of failing re-capitalization attempts by BPBI and Veneto Banca. The project was aimed at avoiding bank runs due to fears about bail-in, increasing funding costs, banks losses and negative effects for the wider economy.

[244] An important element in explaining the relatively low contribution of the private sector, in both Atlante 1 and 2, is related to the unattractive incentives for the markets to invest (Gandrud and

the value of their investments in the rescue fund (Reuters, 2017).[245] In May 2017 the fund acquired NPLs for €2.2bn of Banca Marche, Banca Etruria and CariChieti at a price of €713m.[246]

5.3.3 MPS, the Veneto banks and the most recent developments

5.3.3.1 The MPS case

MPS is the oldest worldwide bank and the third largest Italian bank. Since 2008, it has received multiple assistance packages to recapitalize, it has been at the centre of several accounting scandals and has experienced difficulties in resolving its NPLs (Gandrud and Hallerberg, 2017). In 2009, MPS participated to the Italian bank recapitalization scheme under which the government subscribed hybrid bonds ("Tremonti bonds") for an amount of €1.9bn.[247] The institution also received liquidity provision in the form of state guarantees. MPS started to suffer substantial losses in 2011, most of which were arising from the acquisition, from Santander, of Banca Antonveneta in 2008 for an amount of €9bn.[248] After writing down high amounts of goodwill related to past deals, including Antonveneta, MPS reported a loss of around €4.7bn in 2011. Moreover, two controversial derivative trades with the Japanese Nomura Bank and Deutsche Bank (i.e. the "Alexandria" and "Santorini" transactions), forced the bank to book further losses in 2011 and 2012, for a total amount of €1.2bn.[249]

Hallerberg, 2017). As at November 2016, the fund raised €750m only (Reuters, 2016). See https://www.reuters.com/article/uk-italy-banks-m-a/italian-bank-rescue-fund-atlante-to-buy-more-bad-loans-idUKKBN13H0TX.

[245] UniCredit SpA cut the value of its stake in Atlante by 80%. See https://www.reuters.com/article/us-italy-banks-unicredit-atlante/italys-unicredit-devalues-atlante-stake-by-80-percent-idUSKBN17012X.

[246] These three Italian small lenders, together with Cassa di Risparmio di Ferrara, were rescued by the Italian government in late 2015 and subsequently acquired, for €1, by Unione di Banche Italiane SpA in May 2017.

[247] In November 2008, following a first unused attempt (Decree of Law n. 155/2008 converted into Law 190/2008), a second recapitalization scheme was launched by the Italian authorities to strengthen the capital buffers of distressed banks and to support bank lending (Decree of Law n.185/2008 converted into Law 2/2009). Only four institutions, including MPS, accessed the scheme, issuing so-called "Tremonti bonds" (eligible as core Tier 1 capital) for a total of €4bn (IMF, 2013).

[248] The Spanish bank, just a few months before the MPS takeover, paid for the regional lender (i.e. Antonveneta) €6.6bn as part of the wider acquisition-scheme of the Dutch ABN AMRO.

[249] In October 2014, the MPS former chairman (Giuseppe Mussari), chief executive (Antonio Vigni) and finance chief (Gianluca Baldassari) were sentenced, for fraud, to three years and six months in jail. They were proved guilty of misleading regulators about risky derivative transactions undertaken to cover increasing book losses (Reuters, 2015). In a wider held view, doubtful was the Bank of Italy's behaviour in this context. In late 2017, an appeal court acquitted the tree former managers of MPS (Reuters,

A second public recapitalization occurred in 2013, when the government replaced the Tremonti bonds with the "Monti bonds" for an amount of €4.1bn. The new scheme, approved by the EC, was envisaging the implementation of a restructuring plan, which involved (i) restoring services; (ii) cutting staff and administrative expenses; (iii) closing branches; (iv) defining limits on compensation and dividends; and (v) raising new private capital (IMF, 2013). Due to its significant exposure to the Italian government (€32.6bn in 2012) and the aftermath of the European sovereign debt crisis, MPS lost €3.2bn in 2012 (Reuters, 2015). In March 2013, after making new provisions for bad debt, the bank accounted a further net loss of €1.4bn.

Ahead the 2014 ECB CA, MPS decided to strengthen its capital position by raising €5bn, which included €3.1bn intended at repaying a large portion of the Monti bonds previously subscribed by the Italian government. Despite this attempt, the bank was found to have the highest capital shortfall among all the participating banks in the EU-wide exercise (more than 20% of the entire amount of shortfall of €9.5bn was attributable to MPS). The institution was highly penalized for the poor quality of its loan portfolio and the AQR led to a write-down of €4.2bn (Mesnard et al., 2017a). A still significant loss (€5.5bn) was booked again in 2014 (Table 5.2). In 2015, the fourth rights issue since 2008 occurred and the bank raised €3bn of capital, in accordance with the capital plan agreed with the ECB after the CA. It also repaid the residual Monti bonds (€1bn) and prepared a new restructuring plan, which was approved by the EC. During the period 2011-2014, MPS reported net losses of approximately €14.7bn, raised private funds of €8bn and repaid about €2bn of State Aid. Its total assets was reduced by 36% between 2010-2016 and, over 2011-2016, the number of employees decreased by 22% (Table 5.2).

After four consecutive years of losses, in 2015 MPS returned to a profit of €390m. The restatement of the Alexandria derivative contract contributed the most

2017). See https://www.reuters.com/article/us-italy-banks-monte-dei-paschi-sentence/court-acquits-three-former-monte-dei-paschi-managers-in-derivatives-case-idUSKBN1E12KB.

to this annual profit, involving the transfer of €500m to the income statement (previously set aside as reserves, Reuters, 2016).[250]

Table 5.2 - MPS financial highlights (2010-2016)

		2010	2011	2012	2013	2014	2015	2016
Total Assets	th €	239,161,755	240,793,876	218,886,073	198,460,805	179,917,528	169,011,977	153,178,466
Tier 1 ratio	%	8.37	10.34	10.17	11.44	8.45	12.85	8.17
Net Profit	th €	986,983	(4,697,804)	(3,189,821)	(1,432,281)	(5,403,046)	389,868	(3,231,372)
NPL ratio	%	11.62	12.90	16.12	21.10	28.95	32.66	33.61
N. Employees		n.a.	31,542	30,266	28,009	26,548	25,237	24,560

Source: S&P Global Market Intelligence and Orbis Bank Focus.
Description: The table reports some relevant financial data for MPS, over the years 2010-2016.

Following the 2016 EBA EU-wide stress test, which viewed it as the most fragile bank in Europe, MPS announced the disposal of gross bad loans of €27.6bn (through a securitization supported by the Atlante fund), together with a plan to raise new capital.[251] After the negative outcome of the constitutional referendum (4 December 2016) and the associated political uncertainty (following the Italian Prime Minister's resignation), MPS failed in raising capital from private investors and the ECB refused to grant further time to the bank. Therefore, MPS announced its intention to request a precautionary recapitalization from the Italian government and on the 23 December 2016 an urgent decree of law (237/2016) was adopted.[252] The decree was aimed at supporting the Italian banking system, and especially MPS, with up to €20bn in 2017.[253]

[250] See https://www.reuters.com/article/montepaschi-results/monte-dei-paschi-2015-profit-helped-by-one-off-gain-idUSI6N15301Q.

[251] Among the banks subjected to the exercise, MPS was the only case for which losses were exceeding the entire capital base under the "adverse" scenario. According to the results published on 29 July 2016, the bank was expected to have a negative fully-loaded CET1 ratio (-2.44 per cent) at the end of 2018 (Financial Times, 2016). See https://www.ft.com/content/b1c93b2d-9ccb-3faf-a4ae-7b676fe7c015.

[252] A precautionary recapitalization, provided for under the BRRD, involves the injection of public funds into a solvent bank to avoid serious distress for the economy of a Member State and to maintain overall financial stability. It represents an exceptional measure, which must receive the approval from the EC under the State Aid framework. This type of measure does not trigger the resolution of the institution (and consequent bail-in mechanism), although it implies a burden-sharing mechanism. The amount of requested precautionary capital can only cover the gap deriving from the adverse scenario of a stress test.

[253] The Decree Law 237/2016 mainly includes liquidity support measures (i.e. public guarantees for liabilities issued after the decree law's entry into force and on Bank of Italy emergency liquidity assistance, ELA) and public recapitalization measures, i.e. precautionary recapitalization (Bank of Italy, 2017). For further details, see https://www.bancaditalia.it/pubblicazioni/interventi-vari/int-var-2017/Barbagallo_audizione_20171701_eng.pdf?language_id=1.

The initially proposed €5bn capital increase (the "market solution", as estimated by MPS) was subsequently revisited by the ECB (i.e. the Single Supervisory Mechanism, SSM) and increased to €8.8bn, as a consequence of the bank's worsening capital and liquidity position (Financial Times, 2016).[254] Different views between the ECB and the EC, in terms of (i) degree of state support; (ii) amount of losses on creditors; and (iii) magnitude of necessary restructuring to make the bank viable, delayed the agreement on the MPS recapitalization (Financial Times, 2017).[255] Finally, in July 2017, the EU approved the bank's five-year restructuring plan, paving the way for the State Aid in the form of precautionary recapitalization. The plan foresees the disposal of €28.6bn of gross bad loans, 5,500 job cuts and the closure of 600 branches.[256] The bank is also expected to meet a 9.44 per cent transitional CET1 ratio and 12.94 per cent transitional total capital ratio, on a consolidated basis, by January 2018 (SNL Financial, 2017).[257] A precautionary recapitalization of €5.4bn was agreed, while shareholders and junior creditors are intended to absorb €4.3bn of losses.[258] At the end of October 2017, the Italian Minister of Finance Pier Carlo Padoan signed a decree to convert the MPS junior bonds into shares.[259] In early November 2017, the institution reported third-quarter reclassified net profit of €241.9m to which contributed burden-sharing measures and reduced costs associated with the exit of over one thousand employees (SNL Financial, 2017).[260]

5.3.3.2 The two Veneto banks

With a key role in the development of the Veneto region, BPVI and Veneto Banca loans, represented a large part of the local companies' external finance over the past years (especially the 1960s and 1970s). These two unlisted medium-sized lenders had the legal form of "popolari", i.e. a mix between mutual and cooperative banks, with a

[254] According to the Bank of Italy (2016), €3bn out of the €5bn were directed to cover the losses arising from the sale of the bad debt, while the remaining €2bn were aimed at increasing the coverage ratio of the UTP loans (see https://www.bancaditalia.it/media/approfondimenti/2016/ricapitalizzazione-mps/index.html).
[255] See https://www.ft.com/content/9635b04c-f923-11e6-bd4e-68d53499ed71.
[256] In October 2017, Quaestio Capital Management, on behalf of Atlante 2, reached an agreement with Cerved for the management of €13bn of MPS's NPLs.
[257] See https://www.snl.com/interactivex/article.aspx?KPLT=7&id=41207895.
[258] Retail bondholders can claim compensation from a separate pool of approximately €1.5bn.
[259] After about 10 months, in October 2017, the bank's shares were re-listed.
[260] See https://www.snl.com/interactivex/article.aspx?KPLT=7&id=42521933.

one-vote per capita governance structure.[261] The banks' share prices were determined by the management board, assisted by auditors, on an annual basis and subject to the shareholders' ("soci") meeting approval. Relationship lending, often based on trust rather than objective criteria, and accompanied by "self placement" practices, were among the factors that led to financial distress for the two banks.[262] Moreover, poor management, corruption and soft supervision contributed substantially in fostering the troubles.[263] The misleading practice of inducing customers to underwrite new shares in the bank (so-called "kissing shares") in return for loans, made the institutions appear sound and with a stronger capital position than the reality.

In 2014, BPVI and Veneto Banca were among the institutions which failed the EU-wide stress test. Since becoming directly supervised by the SSM (in 2014), both the banks have reported significant losses (Tables 5.3 and 5.4). Losses were mostly due to impairments on the NPLs portfolios (Mesnard et al., 2017b). Veneto bank's share value dropped from €40.75 in 2014 to €0.10 in late 2016, while the BPVI's share value, in the same period, decreased from €62.50 to €0.10 (Financial Times, 2016).[264]

Table 5.3 - Veneto Banca financial highlights (2010-2016)

		2010	2011	2012	2013	2014	2015	2016
Total Assets	th €	33,077,183	37,968,622	40,164,641	37,306,665	36,166,705	33,349,346	28,078,254
Tier 1 ratio	%	8.70	7.63	7.93	7.69	9.56	7.23	6.39
Net Profit	th €	123,232	154,950	(71,947)	(99,501)	(984,303)	(907,190)	(1,581,571)
NPL ratio	%	8.58	8.35	11.25	15.53	19.38	27.46	38.24
N. Employees		n.a.	n.a.	6,222	6,192	6,179	6,263	6,089

Source: Orbis Bank Focus.
Description: The table reports some relevant financial data for the Veneto Banca, over the years 2010-2016.

[261] Banche Popolari can be considered as "banks with a limited propensity to mutuality" (Bongini and Ferri, p.2, 2009). In January 2015, the Italian government started a process to promote the consolidation process and improve the efficiency in the banking system. In March 2015, based on Law 33/2015, the ten largest cooperative banks (i.e. "banche popolari") were transformed into joint stock companies. In February 2016, a reform regarding the smaller cooperative banks ("BCC"), with equity less than €200 m, was also approved. The reform envisages the establishment of a parent company with a minimum equity of €1bn, the majority of which is owned by the cooperative banks (PC, 2016b).
[262] The "self-placement" conduct involves the sale to the clients of base financial instruments (issued by the institution), which are eligible to comply with the prudential requirements under the CRR IV Directive, the BRRD and Solvency 2 (for insurance companies).
[263] Vincenzo Consoli, former CEO of Veneto Banca, was arrested in August 2016 for misleading regulators and manipulating markets. See https://www.reuters.com/article/italy-banks-veneto-banca/update-1-italian-police-arrest-veneto-bancas-former-ceo-idUSL8N1AJ4LY.
[264] See https://www.ft.com/content/04869eca-b15e-11e6-9c37-5787335499a0.

Table 5.4 - Banca Popolare di Vicenza financial highlights (2010-2016)

		2010	2011	2012	2013	2014	2015	2016
Total Assets	th €	34,424,200	39,783,370	46,474,867	45,234,576	46,709,378	41,878,711	35,533,194
Tier 1 ratio	%	8.05	8.16	8.23	9.21	10.44	6.65	7.47
Net Profit	th €	95,960	96,525	101,138	(26,570)	(757,587)	(1,406,179)	(1,901,000)
NPL ratio	%	8.05	8.24	10.41	13.41	18.46	30.41	35.51
N. Employees		n.a.	n.a.	5,296	5,267	5,275	5,273	5,147

Source: Orbis Bank Focus.
Description: The table reports some relevant financial data for the BPVI, over the years 2010-2016.

In August 2016, after failed attempts to attract private capital, the two lenders were bailed out by the Atlante fund, which injected €2.5bn of capital in becoming the majority shareholder in the two banks (a further €0.9bn was provided in January 2017).

Although the rescue prevented the bank resolution in the short-term, it anyway contributed in spreading the risk across the Italian banking system, causing losses to shareholders of the fund. Moreover, the intervention did not solve the issues of the banks, which still needed additional capital (Merler, 2017). The question about the treatment of retail bondholders was also raised, as a large portion of the two banks' bonds was held by retail investors, many of whom had little awareness of the associated risks.[265] From this perspective, based on an IMF estimates, for most of the 15 largest Italian banks (i.e. the institutions directly supervised by the SSM), the 8% bail-in requirement of BRRD would entail losses on retail investors holding subordinated debt. For around two-thirds of the selected lenders, the bail-in would also include some senior debt (€200bn of which is in retail investors' portfolios).[266] The issue of mis-selling practices also represented a relevant element in the Italian context, which was central to debate on how to practically address banks' failures. [267]

In April 2017, the two regional lenders announced their aim to apply for a precautionary recapitalization, being compliant with the criteria for requiring the state

[265] This element characterizes the entire Italian banking sector, where about a third of bank senior debt securities (and almost half of subordinated ones) is held by households. Therefore, the perspective of bank resolution, as foreseen under the BRRD, entails specific elements of difficulty in the Italian landscape. National authorities have been particularly concerned about the social and confidence costs connected with potential resolution procedures (IMF, 2016).
[266] For MPS, the 8% minimum requirement would involve losses on almost all junior creditors, which account for €5bn (Merler, 2017).
[267] For instance, MPS agreed to sell its junior bonds (due in 2018) to any investor willing to commit at least €1,000, which is the same minimum amount required to acquire (safer) government bonds, i.e. Buoni Ordinari del Tesoro, BOT (Merler, 2016).

intervention (e.g. solvent status).[268] They also confirmed the amounts of capital shortfall estimated by the 2016 stress test (a combined amount of €6.4bn, under the adverse scenario). The banks' plan was to merge and apply for public support, reporting that the January 2017 capital injection sufficiently covered the capital gap under the baseline scenario. The EC required the institutions to raise €1.2bn of private capital, in the view of the combined capital increase (Mesnard et al., 2017b). On 23 June 2017, the ECB declared the two institutions as "failing or likely to fail". On the same day, the Single Resolution Board (SRB) assessed that their failure would not have resulted in significant adverse effects on financial stability, and decided therefore that resolving the entities was not of public concern. Accordingly, it was deemed that the banks should be wound down under the national insolvency framework, managed by Bank of Italy (because a EU insolvency law is currently still lacking).[269] On 25 June 2017, the Italian government approved an emergency decree to liquidate BPVI and Veneto Banca to prevent a disorderly failure of the institutions. The performing businesses of the two banks (e.g. performing loans, assets, deposits and senior debt) were acquired by Intesa San Paolo (ISP) SpA for a token price of €1, while the NPLs, equity (mostly held by the Atlante fund) and junior debt were bailed-in.[270] On the same day, the EC approved State Aid measures undertaken by the Italian government, which were including: (i) a cash injection to ISP of about €4.8bn (to maintain its capital ratios and manage the restructuring costs); and (ii) €400m in guarantees against the risk of insolvency of some of the credits acquired by ISP.[271] Moreover, the state offered additional guarantees up to €12bn to cover potential losses arising from the two banks' NPLs (for a total amount of about €17bn).

The rescue of the Veneto banks raised widespread concerns and objections. From the national perspective, the liquidation of the two banks was in some extent also functional to free up funds of Altante 2 to be directed towards securitizing further

[268] Moreover, precautionary recapitalization must: (i) be a temporary measure; (ii) not be used to cover losses (actual and expected); (iii) be requested only after failed attempts to raise private capital; and (iv) approved by the EC also based on a credible and detailed bank restructuring plan (Bank of Italy, 2017).

[269] The SRB decision raised doubts about the initial request for precautionary recapitalization on the basis of an element of systemic relevance (Merler, 2017).

[270] Retail junior bondholders will be subsequently reimbursed.

[271] According to Merler (2017), the Italian approach to deal with banking issues is to delay solutions to persistent problems (e.g. MPS case) and to prefer political to economic logic.

NPLs of MPS. Specifically, the €450m which was intended to be used for the Veneto banks, were in this way available for supporting MPS' cause in obtaining the precautionary recapitalization (Merler, 2017). In a wider view, the way the crisis was addressed, employing once again taxpayers' money, highlighted the incompleteness and fragility of the European Banking Union (BU), potentially creating a precedent to by-pass the common rules in the future (Angeloni, 2017). The effectiveness and consistency of the new European bank resolution regime, which foresees the burden sharing by private investors in case of a bank failure, was strongly questioned.[272] Furthermore, the already difficult path towards the creation of a European deposit guarantee scheme, a cornerstone of the Banking Union project, was potentially compromised due to the still unequal conditions across countries.

5.4 Literature review

5.4.1 Determinants of the level of NPLs

The existing literature suggests two main categories of factors which are potentially able to explain the evolution of NPLs over time. The first category considers variables associated with the overall macroeconomic environment, which are expected to influence the borrowers' abilities to fulfil their obligations. The second set of determinants, which are more focused on the variation in NPLs across institutions, links the level of problem loans to bank-specific factors. The empirical literature finds evidence supporting the relevance of both sets of factors (Klein, 2013).

5.4.1.1 Macroeconomic factors

An extensive strand in the related literature investigates the relationship between macroeconomic (systematic) factors and the credit quality of banks' loan portfolios. Theoretical frameworks, which develop business cycle models while also considering the role of financial intermediation, find a connection between asset quality and economic activity. The financial accelerator theory, as discussed in Bernanke and Gertler (1989), Bernanke and Gilchrist (1999) and Kiyotaki and Moore (1997), represents the most influential theoretical framework to link NPLs with the

[272] In the case of the Spanish Banco Popular's resolution, which took place at the beginning of June 2017, the use of taxpayers' funds was avoided.

macroeconomic environment.[273] Pesaran et al. (2006) propose a model which establishes a relationship between the value of a credit portfolio and the global macroeconomic context. They attribute a primary role to the linkage between firms and business cycles in driving default probabilities. The key macroeconomic determinants of NPLs can also be drawn from the theoretical literature on life-cycle consumption models. Lawrence's (1995) model, which introduces explicitly the probability of default, implies that low income household borrowers face higher probability of default due to increased risk of unemployment. Moreover, under equilibrium conditions, banks tend to demand higher interest rates from riskier customers. Rinaldi and Sanchis-Arellano (2006), in extending such a model, argue that the household borrowers' probability of default depends, among other things, on current income and the unemployment rate. This, in turn, is related to the uncertainty about future income and the lending rates.

From the empirical perspective, Salas and Saurina (2002), considering Spanish commercial and saving banks in the period 1985-1987, find that GDP growth has a negative association with NPLs.[274] Jimenez and Saurina (2006), for the period spanning from 1984 to 2002, also examine the determinants of NPLs for Spanish commercial and savings banks. Their findings indicate a significant impact on loan quality of credit growth and the economic cycle. Cifter et al. (2009) document a lagged influence of industrial production on NPLs in the Turkish banking system, over the period 2001-2007. Espinoza and Prasad (2010), employing data for the Gulf Cooperation Council (GCC) region over the period 1995-2008, find that lower economic growth and higher interest rates are associated with rising NPLs. Moreover, they find evidence of a short-lived feedback effect from deteriorated bank balance sheets on the economy.

Nkusu (2011) analyses a sample of 26 advanced countries for the period 1998-2009 using two approaches. Firstly, he investigates the macroeconomic factors able to explain NPLs and confirms that adverse economic conditions are associated with increasing NPLs. Secondly, he assesses the interaction between NPLs and the

[273] The financial accelerator theory, based on the role of information asymmetry in financial markets, implies that developments in credit markets may potentially amplify and propagate shocks to wider economic activity.

[274] The authors also find that credit risk is significantly influenced by bank level variables related to growth policies and managerial incentives.

macroeconomic determinants and suggests that a strong increase in NPLs weakens macroeconomic performance. De Bock and Demyantes (2012) examine data for 25 emerging market economies during 1996-2010 and find evidence of an inverse relation between the NPL ratio and economic growth. The authors also highlight the presence of significant feedback effects running from the banking sector to the real economy. Specifically, economic growth slows down as a result of increasing NPLs or credit contraction.

For a large panel of Italian banks during the period 1985-2002, Quagliarello (2007) shows that the evolution of the macroeconomic environment impacts on banks' riskiness. Further evidence on the Italian banking sector (based on quarterly proprietary data) is provided by Bofondi and Ropele (2011), who find that for 1990-2010 the quality of banks' loans, both to corporates and households, is inversely related to improvements in business cycle conditions. Beck et al. (2015) analyse the role of key macroeconomic factors in 75 advanced and emerging countries for the period 2000-2010 and find that real GDP growth represents the major driver of NPL volumes. They also suggest significant contributory effects of nominal effective exchange rates (NEER), share prices and real lending rates.

Buncic and Melecky (2013) is positioned in the strand of literature related to stress testing of bank balance sheets (e.g. Čihák, 2007; Schmieder et al., 2011). They estimate the macroeconomic determinants of NPLs for a panel of 54 high and middle income countries, over the period 1994-2004. These authors find evidence of an inverse relation between GDP growth and NPLs and a positive association between NPLs and both lending rates and inflation. Jakubik and Reininger (2014), using quarterly data, investigate the macro determinants of NPLs in nine Central, Eastern and South-Eastern European (CESEE) countries from 2004 to 2012. They find a negative relation between NPLs and both real GDP growth and the stock price index and a positive association with the exchange rate and the credit-to-GDP ratio. Škarica (2014), employing quarterly data, explores the macroeconomic drivers of NPLs for seven Central and Eastern European (CEE) economies during the period 2007-2012. Their results suggest that the economic slowdown represents the primary driver of high levels of NPLs, as indicated by the significance of the coefficients on GDP, unemployment and the inflation rate.

Summarizing the above studies, a common element is represented by the countercyclical nature of NPLs with respect to the country-specific macroeconomic features (De Bock and Demyantes, 2012; Ghosh, 2015).

5.4.1.2 Bank-specific factors

Beyond the macroeconomic conditions, the second relevant strand of the prior literature emphasizes the influence of bank-specific (idiosyncratic) factors on the level of NPLs.

In a seminal paper, Berger and DeYoung (1997) explore the existence of linkages among loan quality, cost efficiency and the level of capitalization for a large sample of US commercial banks spanning the period from 1985 to 1994. Specifically, in formulating and testing different hypotheses, they find evidence supporting the "bad management hypothesis" and the "moral hazard hypothesis". The former suggests that low cost efficiency is positively associated with future rising NPLs. The latter, originally discussed by Keeton and Morris (1987), implies an inverse relation between the level of capitalization and NPLs.[275]

Louizis et al. (2012), using quarterly proprietary data, analyse the determinants of NPLs across different loan categories (i.e. mortgages, businesses and consumer loans) for nine large banks during the period 2003-2009. Their findings suggest that both macroeconomic factors and bank-specific variables should be employed when modelling the evolution of NPLs. The level of impaired loans is positively associated with the unemployment and real lending rates, while negatively related to the GDP growth. Moreover, for all the loan types, poor management quality (both in terms of cost efficiency and past profitability) contributes to increasing the level of NPLs.

Klein (2013) investigates the determinants of the level of NPLs in CESEE countries over the period 1998-2011. The results confirm that both macroeconomic and bank-level factors contribute in explaining NPLs, although the latter set of variables show a relatively low explanatory power. Additionally, in evaluating the feedback effects from the banking system to the real economy, he provides evidence of the existence of significant macro-financial interconnections.

[275] For a detailed formulation of the considered hypotheses, see Berger and DeYoung (1997, pp. 852-854).

Messai and Jouini (2013) investigate the role of both macroeconomic and bank-level variables on NPLs for 85 banks located in Greece, Italy and Spain for the period spanning from 2004-2008. Their findings indicate a negative relation between NPLs and both economic growth and bank profitability. Unemployment and real interest rates, as well as loan losses reserves are positively associated with the level of NPLs.

Ghosh (2015) examines both state banking-industry specific and regional determinants of NPLs for all commercial and savings banks in the US for the period 1984-2013. The results indicate that higher levels of capital, liquidity risks, low credit quality, inefficient cost management and large bank size contribute to increased NPL volumes. Further variables positively associated with the level of NPLs are the unemployment and inflation rates, as well as the US public debt. Bank profitability, real GDP and housing price index are instead inversely linked with NPLs.

Garrido et al. (2016) investigate the determinants of NPLs in the Italian banking system during the period 2005-2014. For a sample of 57 banks they consider both macroeconomic and bank-specific variables and find that the profound and prolonged recession (between 2008 and 2014) had a strong negative impact on banks' asset quality, which was worsened by some bank-specific factors. In particular, weak past profitability (measured by return on equity) and rapid credit expansion (measured by loan growth) are associated with higher NPLs.

Anastasiou et al. (2016), using quarterly data, explore the determinants of NPLs for 15 commercial banks in the euro area over the period 1990-2015. They employ both country and bank-specific variables and find a significant negative association between real GDP growth and NPLs and a positive link between the rate of unemployment and problem loans. Additionally, the income tax rate and the output gap (proxy for the business cycle) significantly influence banks' loan quality, respectively showing a positive and a negative association with NPLs. Makri (2016) examines the determinants of NPLs in the euro area for the period 2000-2012 and finds a significant influence of both categories of factors on NPLs.

Miyajima (2016) evaluates the determinants of NPLs for 9 banks in Saudi Arabia over the period 1999-2014. Using both macroeconomic and bank-level variables, the author identifies an inverse relation between NPLs and both oil price

and economic growth. Additionally, he documents the presence of a feedback loop between bank-balance sheets variables and economic activity; weakening macroeconomic conditions lead to more fragile bank balance sheet conditions, which in turn further weaken macroeconomic conditions.

5.5 Data and preliminary tests

The aim of this element of the analysis is to investigate Italian banks' asset quality over the period 2010-2016. Specifically, considering both macroeconomic and bank-specific variables, the core idea is to investigate the determinants of the level of NPLs, as an ex-post measure of credit risk. The following section provides a description of the data and the sample construction. It also addresses the rationale underlying the selection of the variables and their expected sign in the estimated results. Finally, it reports the results of the preliminary statistical tests.

5.5.1 Data and sample construction

With the aim of focusing on the largest institutions operating in the Italian banking sector, similarly to Louizis et al. (2012), the selected sample consists of 31 entities. More specifically, it includes the 16 constituents of the FTSE Italia All-Share Banks Index (as at the end of March 2017) plus other banks chosen according to their relevance and/or total assets value.[276] In this view, institutions with total assets greater than 10 million Euros (as at the end of 2016) are added to the sample. The latter group also includes the troubled MPS, BPVI and Veneto Banca.[277] Entities with different institutional forms, i.e. commercial, savings and cooperative banks, were considered.[278] Overall, the sample accounts for about 72 per cent of the total of Italian banking assets (as at the end of 2016).

Bank-level data are collected from Orbis Bank Focus for the period 2011-2016 and from S&P Global Market Intelligence for 2010.[279] As in Beck et al. (2015), potential

[276] Banca Popolare di Milano Scrl and Banco Popolare were considered separately, although from 1 January 2017 a merge of the two entities created Banco BPM.
[277] See Table 5.A.1 in Appendix 5.A for a detailed list of the banks within the data sample.
[278] Publicly owned banks, specialized and dissolved banks were excluded from the sample. From the initial sample of 67 institutions, 36 entities were dropped (see the Appendix 5.B for a comprehensive overview about the sample construction).
[279] Orbis Bank Focus, formerly Bankscope, only reports 5 years of historical balance-sheet data for non-US listed banks.

methodological discrepancies in the definition of the balance sheet items were accounted for by analysing the overlapping periods of the two databases. The macroeconomic variables are gathered from different data sources, such as the International Monetary Fund (IMF) and the World Bank. Both bank-specific and macroeconomic data are sampled on an annual basis.[280]

The dependent variable is the ratio of impaired/NPLs (to customers) to total gross loans.[281] NPLs are exposures to counterparties unable to fulfil all or part of their contractual obligations due to their weakened economic and financial conditions (Bank of Italy, 2017).[282] Nevertheless, it is worth mentioning that Orbis Bank Focus provides data on the level of "impaired loans," which may differ from the regulatory concept of "NPL". "Impaired loans" is an accounting definition, which includes cases where it is very likely that the creditor will not be repaid the entire amount as specified in the contract. In contrast, "NPL" commonly refers to loans that are in arrears 90 days or more past their due date (Klein, 2013). Moreover, there is no universal standard for classifying loans either as "impaired" or as "non-performing" because the relevant rules vary across jurisdictions, firms and time (Bholat et al., 2016). In the analysis performed in this empirical chapter, taking into consideration these elements, "impaired loans" (from Orbis Bank Focus) are treated as equivalent to NPLs.

Following the common practice in the related prior literature (e.g. Salas and Saurina 2002; Jimenez and Saurina, 2006; Espinoza and Prasad, 2010; Klein, 2013; Ghosh, 2015; Miyajima, 2016), the dependent variable for NPLs is logit transformed and expressed as $log(NPLs/(1-NPLs))$. As the ratio of NPLs is by construction bounded between 0 and 1, this transformation aims at creating an unrestricted variable which spans over the interval $[-\infty; +\infty]$ and is distributed symmetrically. Additionally, as highlighted in Wezel et al. (2014), it also enables to avoid non-

[280] A graphical representation of the selected variables is reported in Appendix 5.C.

[281] Possible alternative measures of bank asset quality are: (i) the expected default frequency (EDF); (ii) the loan loss provision (LLP); and (iii) the loss given default (LGD).

[282] Three sub-categories of NPLs are recognized in the Italian banking system (Circular 272/2008 – 8th amendment):

- Bad loans ("sofferenze");
- UTP ("inadempienze probabili");
- Past-due and/or overdrawn exposures ("esposizioni scadute e/o sconfinanti deteriorate").

In Italy, the term NPLs commonly refers to bad loans only, which represent those exposures to borrowers that are insolvent or in substantially equivalent financial conditions.

normality in the error component and accounts for potential nonlinearities (e.g. larger shocks to the regressors may imply a large, nonlinear reaction in the transformed dependent variable).

Table 5.5 displays the set of explanatory variables employed in the analysis, as well as the dependent variable, their corresponding sources and the expected sign of their coefficients in the estimated models.

Table 5.5 - Description of variables

Label	Description	Indicator	Source	Exp. sign
NPL	Non-performing Loans to Gross Loans (%)	Asset Quality	Orbis Bank Focus / S&P Glo. Mkt. Intell.	Dep. var.
	Bank variables			
TIER1	TIER 1 Capital to Risk-weighted Assets (%)	Capitalization	Orbis Bank Focus / S&P Glo. Mkt. Intell.	(-)
TOT_ASSET	Total Assets (Ln)	Size	Orbis Bank Focus / S&P Glo. Mkt. Intell.	(+)
ROE	Net Income to Total Equity (%)	Profitability	Orbis Bank Focus / S&P Glo. Mkt. Intell.	(-)/(+)
LOAN_G	Annual growth in Gross Loans (%)	Lending Activity	Orbis Bank Focus / S&P Glo. Mkt. Intell.	(+)
NII	Non interest income to total income (%)	Diversification	Orbis Bank Focus / S&P Glo. Mkt. Intell.	(-)
	Macroeconomic variables			
GDP_G	Real GDP growth (%)		IMF	(-)
DEBT	General government gross debt to GDP (%)		IMF	(+)
UNEMPL	Unemployment rate (% of total labor force)		World Bank	(+)
LENDING	Lending interest rate (%)		World Bank	(+)

Description: The table presents the variables employed in the analysis (both bank-specific and macroeconomic), their definition, the source and the expected coefficient sign.

5.5.2 Bank-specific variables

The bank-specific variables include (i) the ratio of Tier1 capital to total weighted-assets (Tier1) as a proxy for capitalization; (ii) the natural logarithm of total assets (Total_Asset) as a bank size indicator; (iii) the ratio of return to equity (ROE) as proxy for the profitability; (iv) the loan growth rate (Loan_g) as a proxy for credit expansion; and (v) the ratio of non-interest income to total income (NII) as a proxy for bank diversification. All the variables are constructed as ratios, except for (i) the bank size indicator, which is measured as the natural logarithm of total assets (in thousands

of Euros); and (ii) the loan growth rate, calculated as the yearly percentage change in gross loans.

Bank capitalization: the bank management of less capitalized institutions has a potential incentive (based on the moral hazard hypothesis) to increase riskier lending practices, associated with poor evaluation of borrowers' creditworthiness and weak monitoring processes (Keeton and Morris, 1987). This is reflected in an expected inverse link between capitalization and NPLs, since the higher the banks' capital strength, the lower the propensity to assume extra risk (Salas and Saurina, 2002).

Bank size: based on the "too big to fail" (TBTF) assumption, large banks may engage in excessively risky activities (i.e. granting credit to lower quality borrowers) expecting government protection in a subsequent case of distress. This perception is based on the potential threat to the overall financial stability connected to the failure of a large-sized bank with a systemic nature (Laeven et al., 2016). Furthermore, an institution of large dimensions might experience more difficulties in accessing (soft) information about the borrowers' financial conditions (Nakamura, 1994; Berger et al., 2005).[283] Therefore, a positive association between bank size and NPLs is expected.[284]

Bank profitability: high levels of profitability imply reduced incentives to undertake excessively risky activities. Therefore, based on the Berger and DeYoung (1997) "bad management" hypothesis, profitability is expected to be negatively associated with NPLs.[285] Nevertheless, higher performance might also cause increases in NPLs. According to Rajan's (1994) model, which links bank credit policy not only to the earnings' maximisation objective but also to the short-term reputation interests of (rational) banks' managers, current earnings might be subjected to manipulative actions appealing to liberal credit policies.[286] In this view, the bank management may attempt to influence the market perceptions by altering current earnings at the

[283] According to Liberti and Petersent (2017, p.2), soft information is that which is "difficult to completely summarize in a numeric score" as opposed to hard information, which is instead "easily reduced to numbers".

[284] Some authors (e.g. Salas and Saurina, 2002; Jimenez and Saurina, 2006; Louzis et al., 2012) employ a relative size measure (an individual bank's total assets relative to the aggregate assets of the banking sector and/or considered sub-group) rather than an absolute measure.

[285] Moreover, increases in loan loss provisions as a result of rising levels of NPLs depress banks' profitability, which can consequently turn to be negative (Accornero et al., 2017).

[286] In these circumstances, banks might finance negative net present value (NPV) projects.

expense of future bank loan quality. Consequently, a positive relation between the performance ratio (ROE) and NPL levels would be expected.

Loan growth: a rapid increase in the volume of lending represents a major cause of problem loans (Salina and Saurina, 2002). A fast loan portfolio expansion is positively linked with a future increase in the level of NPLs (Jimenez and Saurina, 2006). In increasing their lending supply, especially in a competitive environment, banks are likely to reduce their borrowers' quality levels. To obtain additional business, banks reduce the level of rates charged on loans and lower credit standards, e.g. relaxing collateral requirements (Keeton, 1999).[287] Moreover, due to the time necessary for the credit institution to know the risk profile of a new customer, banks are negatively affected by adverse selection, which might imply higher probability of borrower defaults. The loan growth indicator is therefore expected to be positively related with NPLs.

Bank diversification: the level of diversification in banking activities might also influence the quality of the loan portfolio. A negative relationship between the degree of diversification and NPLs is expected, based on the inherent aim of the diversification strategy in lowering credit risk. Under this perspective, the ratio of non-interest income to total income reflects the banks' reliance on other sources of income beyond that arising from traditional lending activity (refer to e.g. Louzis et al., 2012 and Ghosh, 2015).[288] Together with the indicator for the loan expansion, the selected ratio provides insights on the type of business conducted by the bank and therefore on its positioning in both the industry and selected sample.

To deal with the presence of potential extreme data points (i.e. outliers) which are able to bias the results, all bank-level explanatory variables, as well as the dependent variable (NPL), are winsorized at 1 per cent in each tail of the distribution. Table 5.6 reports the summary statistics for the variables before and after the winsorization process (Panels A and B, respectively).

[287] In extending credit, banks usually receive requests either by clients promoting new and experimental projects or by those whose ideas have already been evaluated and rejected by other banks (Dell'Ariccia and Marquez, 2006).

[288] As in Salas and Saurina (2002), an alternative proxy for the degree of diversification can be seen in the bank size indicator, based on the assumption that a larger balance sheet allows for greater diversification.

Table 5.6 - Descriptive statistics of bank-specific variables: Before and after the winsorization

Panel A - Before the winsorization							
Variables	**Obs.**	**Min**	**Max**	**Mean**	**Std.Dev.**	**Kurtosis**	**Skewness**
NPL	213	1.07	38.24	12.87	8.07	3.31	0.81
Total Asset	217	13.15	20.65	17.23	1.40	3.93	0.11
ROE	217	-108.12	31.09	-1.55	18.36	14.49	-2.85
Tier1	215	5.71	34.14	12.52	5.55	6.16	1.78
Loan_g	213	-42.18	76.28	2.30	11.72	14.01	2.06
NII	215	13.00	88.37	45.80	11.63	5.30	1.19
Panel B - After the winsorization							
Variables	**Obs.**	**Min**	**Max**	**Mean**	**Std.Dev.**	**Kurtosis**	**Skewness**
NPL	213	1.11	35.51	12.85	8.02	3.19	0.78
Total Asset	217	13.71	20.65	17.23	1.39	3.80	0.18
ROE	217	-87.71	29.18	-1.44	17.70	12.57	-2.62
Tier1	215	6.07	31.77	12.51	5.49	5.90	1.74
Loan_g	213	-24.97	45.30	2.20	10.43	8.36	1.60
NII	216	25.31	84.35	45.86	11.33	4.98	1.29

Description: The table presents the descriptive statistics on both the dependent variable (NPL) and bank explanatory variables, before and after the winsorization at the 1st and 99th percentiles (percentage points). Obs. refers to the number of observations. The reported variables are: (i) non-performing loan ratio; (ii) natural logarithm of total assets (thousands of Euros); (iii) return on equity ratio; (iv) tier1 capital to total risk-weighted assets ratio; (v) loan growth ratio; and (vi) non-interest income to total income ratio. Sample period: 2010-2016.

The NPL ratio, after the winsorization, ranges from 1.11 and 35.51 per cent with an average value of 12.85 per cent. More specifically, the average value increased from 7.91 per cent in 2010 to 17.82 per cent in 2016. The bank size indicator (log of total assets), with an average value of 17.23, presents a minimum value of 13.71 and a maximum of 20.65.[289] The profitability ratio (ROE) records negative values (the minimum value after the winsorization is -87.71) and exhibits a significant dispersion around the expected value (17.70). The capital Tier1 ratio spans from a minimum value of 6.07 per cent to a maximum of 31.77 per cent and the average figure is 12.51 per cent. The loan growth rate, with a volatility of 10.43 per cent, shows a mean value of 2.20 per cent, a negative lowest value of 24.97 per cent and a highest value of 45.30 per cent. Lastly, the ratio of non-interest income to total income varies between 25.31 and 84.35 per cent, with 45.86 as average value.

[289] The maximum value for the variable Total Asset appears unchanged after the winsorization (Panel B, Table 5.6) only due to the number of reported decimal digits.

5.5.3 Macroeconomic variables

The set of macroeconomic variables comprises (i) the real GDP growth (GDP_g); (ii) the ratio of general government gross debt to GDP (Debt); (iii) the ratio of unemployment to total labour force (Unemp); and (iv) the lending interest rate (Lending).

Aggregated economy activity: substantial empirical evidence supports the anti-cyclical nature of the NPLs (Klein, 2013). The underlying justification arises from the fact that a growing economy is usually associated with higher available income, which in turn improves the borrowers' capability of repaying their debt. In contrast, when there is downturn in the general economy, the level of NPLs is likely to increase, as consequence of the unemployment increase, and borrowers experience more difficulties in serving their obligations (Salas and Saurina, 2002; Rajan and Dhal, 2003; and Jimenez and Saurina, 2006; Louzis et al., 2012). Accordingly, the real GDP growth, as indicator of general state of the economy, is expected to be negatively associated with the level of NPLs for banks.

Debt: a vicious feedback effect between banking and sovereign debt crises has been identified as being at the core of the recent financial distress in the euro area (Acharya et al., 2014). In some countries (e.g. Greece and Ireland), substantial sovereign debt tensions led to successive credit rating downgrades. These severely affected the domestic banking sector (in terms of liquidity constraints and/or impaired market access). In this perspective, Alsakka et al. (2014) find that, during the euro area debt crisis, sovereign rating downgrades and negative watch signals heavily impact on bank rating downgrades.[290] Banks, in turn, transfer these pressures onto their clients, typically by impeding their credit supply. Difficulties for the borrowers in refinancing their debts will therefore arise. Additionally, an increase in the sovereign debt burden may lead to fiscal adjustments, especially in the form of expenditure cuts. These commonly target the social welfare area and the wage component of government consumption (Alesina and Perrotti, 1995). The consequent negative impact on households' income may imply failures in the repayment of several outstanding loans

[290] A crucial ingredient here is the fact that ratings assigned to sovereigns typically represent a rigid ceiling for the ratings assigned to non-sovereign entities of the same country.

and, second-order negative effects may involve corporate loans due to a reduction in the level of demand. As in Louzis et al. (2012) and Ghosh (2015), the ratio of public debt to GDP is employed in the analysis in this section. An increasing sovereign debt burden is expected to be associated with increasing levels of NPLs. As pointed out by Reinhart and Rogoff (2011) and Laeven and Valencia (2012), a sharp increase in the level of NPLs often characterizes the beginning of a (systemic) banking crisis.

Unemployment: as anticipated, an upsurge in the unemployment rate adversely impacts the debtors' capability to meet their contractual obligations. In the case of households, an increase in the unemployment constrains their cash flows, boosting their debt burden. When considering businesses, rises in the unemployment rate may reflect a reduction in the level of production due to a decline on the demand side. This may imply a decrease in revenues and a deteriorated debt condition (Bofondi and Ropele 2011; Louzis et al., 2012). The unemployment rate is therefore expected to be in a positive association with the level of NPLs.

Interest rates: a surge in the level of lending interest rates worsens the borrowers' financial conditions and their debt servicing capacity, especially in the case of variable rate agreements. Thus, the level of NPLs is expected to be positively associated with the level of real lending interest rate (Nkusu, 2011; Louzis et al, 2012; Beck et al., 2015).

Table 5.7 presents the descriptive statistics for the selected macroeconomic variables.

Table 5.7 - Descriptive statistics of macroeconomic variables

Variables	Obs.	Min	Max	Mean	Std.Dev.	Kurtosis	Skewness
GDP_g	217	-2.80	1.70	-0.06	1.49	2.21	-0.78
Debt	217	115.40	132.60	125.80	6.90	1.54	-0.50
Unemp	217	8.35	12.65	10.81	1.66	1.71	-0.61
Lending	217	3.50	5.14	4.37	0.51	2.15	-0.11

Description: The table presents the descriptive statistics on the macroeconomic variables (percentage points). Obs. refers to the number of observations. The reported variables are: (i) real GDP growth; (ii) the ratio of general government gross debt to GDP; (iii) the ratio of unemployment to total labour force; and (iv) the lending interest rate. Sample period: 2010-2016.

5.5.4 Stationarity testing and correlation analysis

The first step of the analysis involves performing panel unit root tests to check for stationarity in the variables of interest. Maddala and Wu (1999), in a related study, point out that a Fisher-type unit root test for panel data is superior when compared with other alternatives. Differently from other panel unit roots tests (e.g. Levin et al., 2002; Im et al., 2003), it does not require a balanced panel data set.[291] This last aspect represents an advantage in case of a limited sample in terms of time dimension (Nkusu, 2011). The Fisher test is constructed by combining the *p*-values from independent unit root tests (for each cross-section). The test assumes that all the panels are non-stationary under the null hypothesis against the alternative that at least one panel is stationary. The test statistic is asymptotically distributed a Chi-square with 2N degrees of freedom.

The Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests, with and without time trend, are implemented on the bank-specific variables (Table 5.8). [292,293]

Table 5.8 - Panel unit root tests

Variables (levels)	Fisher-ADF No trend		Fisher-ADF Trend		Fisher-PP No trend		Fisher-PP Trend	
NPL	224.04	***	426.76	***	91.88	***	113.69	***
Total Asset	140.78	***	305.67	***	90.83	***	191.79	***
ROE	244.35	***	235.76	***	242.31	***	301.58	***
Tier1	55.45		121.50	***	120.09	***	160.38	***
Loan_g	204.77	***	121.64	***	357.14	***	338.31	***
NII	267.95	***	623.08	***	56.90		456.05	***

Description: The table reports the test statistics of the Fisher Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) panel unit root tests (with and without time trend). The null hypothesis is that all panels are non-stationary, while the alternative one is that at least one panel is stationary.
Note: *** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level.

The results do not indicate evidence of the presence of a unit root in the examined variables, which can therefore be considered as stationary. The two cases (Tier 1 and NII) when, based on both the tests implemented without time trend, it is

[291] The Im et al. (2003) test, compared to the Levin et al. (2002) test, relaxes the assumption of homogeneity of the root across units, under the alternative hypothesis.
[292] Due to the limited time span of the sample, the tests are performed selecting one lag.
[293] The stationarity of the macroeconomic data series is not tested due to their short time length and the lack of variability across units.

not possible to reject the null hypothesis are balanced by the findings for the corresponding specifications which include the time trend.

Aimed at obtaining a first empirical sight about the relationships existing between the selected variables, as well as to account for potential multicollinearity issues, a correlation analysis was conducted. Table 5.9 shows the pairwise correlation coefficients between the variables (both bank-specific and macroeconomic), also including the dependent variable NPL.

Table 5.9 - Correlation matrix

Variables	NPL	Total Asset	ROE	Tier1	Loan_g	NII	GDP_g	Debt	Unemp	Lending
NPL	1.000									
Total Asset	0.181 ***	1.000								
ROE	-0.546 ***	-0.210 ***	1.000							
Tier1	-0.188 ***	-0.500 ***	0.24 ***	1.000						
Loan_g	-0.352 ***	-0.200 ***	0.3 ***	0.05	1.000					
NII	-0.211 ***	-0.411 ***	0.138 **	0.583 ***	0.112	1.000				
GDP_g	0.079	-0.012	0.042	0.04	0.043	0.062	1.000			
Debt	0.449 ***	0.023	-0.142 **	0.23 ***	-0.15 **	0.263 ***	-0.140 **	1.000		
Unemp	0.390 ***	0.024	-0.135 *	0.2 ***	-0.13 *	0.234 ***	-0.33 ***	0.962 ***	1.000	
Lending	-0.108	0.003	-0.024	-0.049	-0.016	-0.043	-0.415 ***	0.014	0.221 ***	1.000

Description: The table displays the simple pairwise correlation coefficients between the selected variables (both bank-specific and macroeconomic). Sample period: 2010-2016.
Note: *** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level.

Overall, the values reported in the correlation matrix present the expected signs. NPL exhibits a negative (significant) correlation with all the bank variables (except for Total Assets) and a positive correlation with all the macroeconomic variables (except for Lending), significant only in the case of Debt and Unemployment. The latter variables, presenting a correlation coefficient close to the unit (0.962), were considered separately as alternatives.

5.6 Econometric methodology: Dynamic panel data estimators

Based on the relevant literature on panel data studies, a dynamic approach which is able to account for the time persistency in the dependent variable is adopted (this is used in the closely related literature by Salas and Saurina, 2002; Louizis et al., 2012; Ghosh, 2015; Garrido et al., 2016).[294] NPL ratios are usually persistent, which implies that their dynamics exhibit high serial correlation. Moreover, the response of credit losses to the economic environment might take time to appear, also resulting in high levels of cumulated NPLs over time (Klein, 2013).

Dynamic panel data models, unlike static ones, include at least one lagged value of the dependent variable in the set of regressors. This inclusion enables a suitable representation of several economic dynamic adjustment processes (Bun and Sarafidis, 2015). A dynamic panel data specification is commonly written as:

Equation 5.1

$$Y_{it} = \alpha Y_{it-1} + \beta(L)X_{it} + \eta_i + \varepsilon_{it} \qquad |\alpha| < 1,\ i = 1, \dots, N,\ t = 1, \dots, T$$

where Y is the outcome of interest (*i* and *t* index the cross sectional and time dimension of the panel dataset, respectively). α denotes the autoregressive parameter. Y_{it-1} represents the value of the outcome of interest lagged by one period. $\beta(L)$ is the $1 \times k$ lag polynomial vector. X_{it} is the $k \times 1$ vector of explanatory variables (both contemporaneous and lagged values). η_i is the (unobserved) individual effect. Finally, ε_{it} is the error term. The estimation of such a model through a simple Ordinary Least Squares (OLS) or fixed-effects method will produce biased and inconsistent parameter estimates, due to the correlation existing, by construction, between the lagged dependent variable (Y_{it-1}) and the unobservable individual effect (η_i), i.e. $E(\eta_i|Y_{it-1}) \neq 0$.[295]

[294] A variable (or process) is characterized by persistence if the effect of shocks is prolonged through time. Unit root processes are often characterized by high persistence (Brooks, 2014).

[295] The positive correlation existing between an explanatory variable (in this case the lagged dependent variable) and the error component violates a fundamental assumption to ensure the consistency of OLS (Roodman, 2009b). Based on common results for omitted variable bias, the OLS method produces upwards-biased estimates of the autoregressive coefficient (Bond, 2000).

In order to eliminate the unobservable fixed effect (η_i), and thereby avoiding the potential endogeneity issue, one solution could be that of taking first differences of the original equation:

Equation 5.2

$$(Y_{it} - Y_{it-1}) = \alpha(Y_{it-1} - Y_{it-2}) + \beta(L)(X_{it} - X_{it-1}) + (\varepsilon_{it} - \varepsilon_{it-1})$$

which is alternatively expressed as:

Equation 5.3

$$\Delta Y_{it} = \alpha \Delta Y_{it-1} + \beta(L)\Delta X_{it} + \Delta\varepsilon_{it}$$

where Δ is the first difference operator. Although the first difference transformation removes the individual effect (η_i) and its associated omitted variable bias, there remains correlation between the first-differenced lagged dependent variable (ΔY_{it-1}) and the first-differenced error term $(\Delta\varepsilon_{it})$:

Equation 5.4

$$E(\Delta Y_{it-1}\, \Delta\varepsilon_{it}) \neq 0$$

Therefore, the use of least squared based estimation approaches, even when considering the transformed Equation 5.3, is not appropriate. In investigating pooled OLS and fixed-effect estimators for dynamic panel models, Nickell (1981) shows the inconsistency (especially for samples with a small time dimension) and the (negative) bias of the estimators, which result in the underestimation of the coefficient on the lagged dependent variable (termed "Nickell bias").[296] However, instrumental variables can be constructed from lags of order two and more of the dependent variable. Anderson and Hsiao (1982), the first to propose the Instrumental Variable (IV) method in the context of dynamic panel data models, suggest that both Y_{it-2} and ΔY_{it-2}, which are correlated with ΔY_{it-1} but not to $\Delta\varepsilon_{it}$, can be employed as an instrument in the

[296] In a linear regression model $Y_i = \beta_1 + \beta_2 X_{i2} + \cdots + \beta_K X_{iK} + \varepsilon_i$, the OLS estimator b for β is unbiased when, in repeated sampling, it is reasonable to assume that the estimator is on average equal to the true value of β. The estimator b is said to be consistent, even if biased, when the probability of deviating more than ε from the true parameter β tends to zero as the sample size n increases, i.e. $\lim_{N\to\infty} P(|b - \beta| > \varepsilon) = 0$ for all $\varepsilon > 0$ (Verbeek, 2012).

estimation of Equation 5.3, given that ε_{it} are serially uncorrelated.[297] Nevertheless, the level estimator Y_{it-2} is preferred as it maximises the sample size.[298]

Arellano and Bond (1991), in extending the Anderson and Hsiao approach, point out that their estimator, although consistent, does not consider all the possible orthogonality conditions.[299] Therefore, it does not exploit all the information available in the dataset (Baum, 2006).[300] According to the authors, the second lag of the dependent variable and all the subsequent feasible lags represent legitimate instruments for ΔY_{it-1} , satisfying the following moment conditions:

Equation 5.5

$$\mathrm{E}[\mathrm{Y}_{\mathrm{it-s}}\Delta\varepsilon_{\mathrm{it}}] = 0 \quad \text{for } \mathrm{t} = 3, \dots, \mathrm{T} \quad \text{and } \mathrm{s} \geq 2$$

The Arellano and Bond (1991) estimation, based on the Generalized Method of Moments (GMM) introduced by Hansen (1982), also begins by transforming the data through first-differencing so to remove the fixed effects (hence, so called "Difference GMM").[301,302] The model is then specified as a system of equations, one for each time period, and permits the instruments related to each equation to differ (e.g. additional lagged values of the instruments are available in subsequent periods).[303]

[297] There are two requirements that must hold for an instrumental variable to be valid: it must be correlated with the endogenous regressors and orthogonal to the errors (Baum et al., 2003).

[298] Usually ΔY_{it-2} is not available until $t = 4$, which means losing an additional time period compared with the case of using the levels estimator (Verbeek, 2012).

[299] Moreover, the classical IV estimator, although consistent, is inefficient in the presence of heteroscedasticity (Baum et al., 2003).

[300] A key element of the Arellano and Bond (1991) method is the assumption that the necessary and valid instruments are "internal" to the dataset, in the form of lags of the instrumental variables (Baum, 2006). Nevertheless, other external instruments might also be included.

[301] The use of GMM estimators in dynamic panel data models was initially proposed by Holtz-Eakin et al. (1988). In building a set of valid instruments, they resolved the issue arising from the trade-off existing between improved efficiency (due to the introduction of extra information) and reduced sample size (due to loss of observations).

[302] As highlighted in Roodman (2009b), a weakness of the first-difference transformation is represented by the fact that it amplifies gaps present in unbalanced panels. An alternative transformation, which reduces data loss, is the so called "forward orthogonal deviations" proposed by Arellano and Bover (1995).

[303] While the possibility of having a wider set of instruments increases the efficiency of the estimator, it may also involve a proliferation of the instruments (the number of instruments is quadratic in the sample time dimension T) (Baum, 2006). The Stata command "xtabond2", developed by Roodman, allows the user to control and limit the number of instruments.

A further source of potential bias regards the endogeneity of the regressors and the subsequent correlation with the error component. In the case of strictly exogenous regressors, all the realizations (present, past and future) are uncorrelated with the error component, implying the following moment conditions:

Equation 5.6

$$\mathrm{E}[\mathrm{X}_{\mathrm{it}-\mathrm{s}}\Delta\varepsilon_{\mathrm{it}}] = 0 \quad \text{for } \mathrm{t} = 3, \dots, \mathrm{T} \quad \text{and for all } s$$

In the presence of potential causality running in both directions (i.e. reverse causality), such that $E(\varepsilon_{it}|X_{is}) \neq 0$ for $t \leq s$, the assumption of strict exogeneity becomes restrictive and invalid (Louzis et al., 2012). For weakly exogenous (or predetermined) explanatory variables, whose current and past (but not future) values are uncorrelated with the error term, the following moment conditions can be employed:

Equation 5.7

$$E[X_{it-s}\Delta\varepsilon_{it}] = 0 \quad \text{for } t = 3, \dots, T \quad \text{and } s \geq 2$$

A potential shortcoming in the difference GMM model is underlined by Blundell and Bond (1998). These authors suggest that the estimator works badly, showing poor finite sample properties (bias and precision), when the dependent variable behaves similarly to a random walk (in the case of highly persistent series). This arises from the fact that lagged levels of endogenous or predetermined variables inadequately explain subsequent changes. Therefore, untransformed lags represent weak instruments for transformed (first-differences) variables. In order to increase the efficiency of the estimator, while introducing a further restriction, Blundell and Bond (1998) develop an approach defined in Arellano and Bover (1995). Based on the assumption that transformed instruments (i.e. differences) are not correlated to the fixed effects, extra moment conditions become available, leading to improvements in terms of efficiency. A system composed by the original equation in levels, as well as the transformed one, is built and known as “System GMM”.

Strictly exogenous regressors and other possible instruments can enter the instrument matrix in the conventional IV-style, with one column per variable. Predetermined and endogenous regressors, in first-differences/levels, are instrumented using suitable lags of their own levels/first differences, in case of the difference or system GMM, respectively.

Both the GMM estimators have one-step and two-step versions. The one-step GMM estimation generates, subject to the assumption of homoscedasticity and absence of autocorrelation in the residuals, consistent parameter estimates. The two-step GMM procedure, which employs initial parameter estimates to build a consistent weight matrix of the moment conditions, may result in severely downward biased standard errors (and upward biased associated t-statistics) due to its reliance on the first-step estimates. This might, in turn, deliver less reliable asymptotic statistical inference, especially when dealing with small samples (Bond, 2002; Bond and Windmeijer, 2002; Windmeijer, 2005).[304]

As argued in Roodman (2009b), GMM estimators (both difference and system) are developed for situations with:

- (Unbalanced) panels with small T (time dimension) and large N (cross-sectional dimension);
- A linear functional relationship;
- Dynamic dependent variable, whose current values are influenced by past realizations;
- Not strictly exogenous explanatory variables;
- Fixed individual effects;
- Heteroscedasticity and autocorrelation among individuals but not across them.[305]

The possibility of achieving asymptotically efficient inference, based on a limited number of statistical assumptions (particularly that it does not require any

[304] Moreover, although the two-step variant is asymptotically more efficient than the one-step, investigations based on Monte Carlo simulations indicate that the efficiency gains are not that relevant, even when in the presence of heteroscedasticity (Arellano and Bond, 1991; Blundell and Bond, 1998; Blundell et al., 2000).

[305] Most of these features are identifiable in the dataset analysed in this chapter and presented in Section 5.5 (e.g. short panel, potential endogeneity of regressors).

distributional assumption), represents a major reason for the popularity of the GMM estimation approach (Bun and Sarafidis, 2015). On the other hand, the poor finite sample properties of the GMM estimator stemming from weak and/or excessive moment conditions, as well as dependence on crucial nuisance parameters (e.g. the ratio between the variances of the single specific effects and the idiosyncratic errors) represent potential drawbacks. A central practical aspect, in addition to the validity of the instruments, regards the number of moment conditions to use in order to avoid potential overfitting bias (Roodman, 2009b).[306] Either the Sargan (1958) or Hansen (1982) tests of over-identifying restrictions can be employed in order to test the overall validity of the instruments.[307] The fundamental identification assumption of no serial correlation in the error term (ε_{it}) can be verified by testing for no-second order of serial correlation in the first-differenced errors ($\Delta\varepsilon_{it}$) (Arellano and Bond, 1991).[308] Finally, a potential disadvantage in the adoption of the GMM estimation procedures is represented by their complexity in terms of implementation, which might lead to invalid estimates (Roodman, 2009b).

The overall flexibility of the GMM framework, which facilitates dealing with unbalanced panels and potential endongeous regressors, while avoiding the biases of OLS and fixed effects methods, justifies the use of these estimators in the current analysis (Roodman, 2009a). Further support to this decision also arises from the closely related literature (Salas and Saurina, 2002; Jimenez and Saurina 2006; Louzis et al., 2012; Klein, 2013; Ghosh, 2015).

[306] As a general rule of thumb, the number of instruments should be maintained below that of individual units in the panel.

[307] Sargan's statistic, based on the assumption of homoscedasticity, represents a special case of the Hansen's J test (Baum et al., 2003). In both tests, the statistic, under the null hypothesis of joint validity of the moment conditions, is Chi-square distributed with as many degrees of freedom as the degrees of over-identification (i.e. the difference between the number of instruments and the number of endogenous regressors).

[308] First-order serial correlation is expected in the first differenced errors if the errors in levels are effectively serially uncorrelated. Second-order correlation is instead undesirable as it would potentially imply the invalidity of the instruments.

5.7 Model estimation and results

5.7.1 Econometric specification

In order to explore the determinants of the level of NPLs in the Italian banking sector, during the period 2010-2016, a multi-step approach is followed here. Moreover, based on Equation 5.1, two model specifications are employed. The first specification includes only bank-specific variables, while in the second one both bank and macroeconomic regressors are considered. This approach enables the isolation of the contribution of the idiosyncratic factors from that arising from the country's general economic conditions. Accounting for the banking sector's specific features and policies, and exploring their influence in the NPLs' evolution, represents a relevant step in the overall analysis (Louizis et al., 2012).

Alternative econometric estimation techniques are adopted, including OLS regression, fixed effects model and difference/system GMM estimations (one and two-steps variants). The OLS model (with panel clustered standard errors) and the fixed effects framework (with standard errors clustered at firm level), are employed to obtain a valid range for the coefficient on the lagged dependent variable.[309] The latter, consistent with dynamic stability, should lie inside the bounds defined by the values estimated through fixed effects and simple OLS regression models (Baum, 2013). In the difference/system GMM framework, the forward orthogonalization procedure by Arellano and Bover (1995) is adopted to reduce the negative impact of missing data. Finally, to limit the number of instruments, the collapse method is employed (Holtz-Eakin et al., 1988).

The general model presented in Equation 5.1 assumes the following form when selecting only bank-level variables:

Equation 5.8

$$NPL_{it} = \alpha NPL_{it-1} + \beta Total\_Asset_{it-j} + \beta ROE_{it-j} + \beta Tier1_{it-j} + \beta Loan\_g_{it-j} + \beta NII_{it-j} + \eta_i + \varepsilon_{it}$$

where $NPL_{i,t}$, the dependent variable, is the logarithmic transformation of the NPL ratio. $Total\_Asset$ is the natural logarithm of total assets (the proxy for bank

[309] The results for the OLS and fixed effects regressions are not reported in the chapter.

size). ROE is the ratio of return to equity (the proxy for profitability). $Tier1$ is the ratio of tier1 capital to risk-weighted assets (the proxy for capitalization). $Loan\_g$ is the loan growth rate as a proxy for credit expansion. NII is the is the ratio of non-interest income to total income (the proxy for bank diversification). η_i are unobserved bank-specific effects and ε_{it} are the (robust) error terms. *i* indexes the bank, *t* the time and *j* the lag order.

When also including the macroeconomic determinants, the model specification is:

Equation 5.9

$$NPL_{it} = \alpha NPL_{it-1} + \beta Total_{Asset_{it-j}} + \beta ROE_{it-j} + \beta Tier1_{it-j} + \beta Loan_{g_{it}} + \beta NII_{it-j} + \gamma GDP_{g_{it-j}} + \gamma Unemp_{it-j} + Lending_{it-j} + \eta_i + \varepsilon_{it}$$

where, besides the bank-specific variables, GDP_g is the real GDP growth, $Unemp$ is the ratio of unemployment to total labour force and $Lending$ is the lending interest rate. In addition, the variable $Debt$ (ratio of general government gross debt to GDP) is considered, as an alternative to $Unemp$, in order to capture the potential negative effect of sovereign debt tensions on the level of NPLs.[310]

In both model specifications (Equations 5.8 and 5.9), the NPL variable is treated as endogenous (instrumented with lags of order 2 and higher). A weak form of exogeneity is assumed for the bank-specific variables (i.e. predetermined variables – instrumented with lags of order 1 and higher).[311] This refers to a potential endogeneity issue whereby the dependent variable (NPL) might reversely cause the microeconomic determinants employed as regressors (Louizis et al., 2012).[312] Macroeconomic factors, as presented in Equation 5.9, are modelled as strictly exogenous (instrumented themselves in the conventional IV-style). In this manner, as suggested in Roodman

[310] The two variables *Unemp* and *Debt* are not simultaneously included in the same specification due to potential multicollinearity issues (refer to the correlation matrix reported in Section 5.5.4).

[311] With regard to both endogenous and predetermined variables, the maximum lag-order is 6 (consistent with sample time dimension).

[312] For instance, increasing levels of NPLs, which reflects a deterioration in asset quality might entail, in turn, a reduced profitability.

(2009b), every regressor has been included, in some form, in the instrument matrix. Furthermore, with the aim of accounting for the limited time dimension of the sample, the maximum lag-length for the model including only bank-specific variables is 2, while it is 3 for the specification with both types of factors (i.e. micro and macro-economic variables).[313]

In performing the dynamic GMM-based analysis, due attention was paid in (simultaneously) respecting the following conditions:

- Number of instruments < Number of groups (i.e. limit instrument proliferation). In employing GMM estimators, which can potentially generate many instruments, it is recommended to report the number of instruments (Roodman, 2009b);
- P-value associated with the first-order autocorrelation coefficient (AR1) < 0.05 (i.e. first-order serial correlation);
- P-value associated with the second-order autocorrelation coefficient (AR2) > 0.05 (i.e. no second-order serial correlation);[314]
- P-value associated with the Hansen J statistic > 0.05 & < 1.00 (i.e. overall validity of instruments). A 1.00 p-value is considered as an implausible "too-positive" value (Roodman, 2009b);
- Coefficient on the lagged variable from the fixed effects model < Coefficient on the lagged dependent variable from GMM model < Coefficient on the lagged variable from the OLS regression (i.e. dynamic stability).

By adopting a recursive approach, which allowed the variable lag-order to vary, a set of results complying to these listed conditions, for both the model specifications (Equations 5.8 and 5.9), are reported in the next sub-section.

[313] In both model specifications, the contemporaneous value of each variable is also considered.
[314] However, a p-value greater than 0.05 would increase reliability in terms of the absence of second-order serial correlation in the first-differenced residuals (i.e. consistency of the GMM estimators).

5.7.2 Empirical results

This section reports and discusses the results obtained for the two models presented in the previous section (Equations 5.8 and 5.9) applying the difference and system GMM in one and two-steps variants. More specifically, the baseline estimation is performed adopting a difference GMM method applied in the one-step variant. Subsequently, on the same set of variables, for both the models presented in Equations 5.8 and 5.9, two-step difference GMM and system, one and two-step, are also employed.[315] As anticipated in Roodman (2009b), the use of difference/system GMM estimators entails many choices, which should be adequately reported. Therefore, the various steps followed to select the reported specifications and results, as well as the associated criteria, are transparent here.

On the spectrum of results obtained in the previous phase, and aimed at further selecting the specifications to report in the current empirical chapter, the following criteria are respected:

- P-value associated with the Hansen J statistic < 0.25. According to Roodman (2009a, p.142), a 0.25 p-value should raise concerns for researchers, who often tend to consider p-values above the "conventional significance levels" (i.e. 0.05, 0.10) as satisfactory;
- Lowest number of instruments. Although there is not a specific limit to consider the instrument count as relatively safe, it is fundamental to avoid their proliferation to ensure the validity of the results (Roodman, 2009a).

Furthermore, among the selected results, the specifications with higher p-values for the AR(2) test were regarded as better specified.[316]

[315] Cluster-robust standard errors are selected for the one-step estimator, while for the two-step estimations the already robust standard errors are corrected according to Windmeijer (2005). The correction facilitates obtaining standard errors which are less severely downward biased, especially in small samples.

[316] While all the listed criteria are met in the Difference GMM estimations, for the regressions based on the System GMM method this full and rigorous compliance is not always possible.

5.7.3 Results for model with only bank-specific variables

Table 5.10 reports the GMM coefficient estimations for the model with only bank-specific variables. Based on Equation 5.8, the first column presents the results for the baseline estimation (i.e. applying one-step difference GMM), the second column corresponds to the two-step difference GMM, whilst the last columns show the estimates for the system GMM, one and two-step respectively. For each model, the number of observation, groups and instruments is reported, along with the results for the two Arellano and Bond tests and the Hansen J test.

Table 5.10 - GMM estimation results for the model with only bank-specific variables (2010-2016)

Variables	Diff-one		Diff-two		Sys-one		Sys-two	
L.NPL	0.752	***	0.717	***	0.864	***	0.861	***
	(0.000)		(0.000)		(0.000)		(0.000)	
Total Asset	-0.591	***	-0.579	**	-0.001		0.001	
	(0.002)		(0.012)		(0.865)		(0.935)	
ROE	-0.005	*	-0.005		-0.003	***	-0.003	***
	(0.091)		(0.110)		(0.000)		(0.001)	
L.Tier1	0.008		0.012		-0.011		-0.011	
	(0.547)		(0.534)		(0.112)		(0.204)	
Loan_g	-0.009	**	-0.009	*	-0.010	**	-0.011	**
	(0.013)		(0.059)		(0.016)		(0.013)	
L.NII	0.001		0.000		0.001		0.000	
	(0.838)		(0.992)		(0.744)		(0.947)	
N.Obs.	150		150		181		181	
N.Groups	31		31		31		31	
N.Instr.	23		23		27		27	
AR(1) p-value	0.024		0.025		0.074		0.058	
AR(2) p-value	0.206		0.320		0.148		0.159	
Hansen J p-value	0.104		0.104		0.134		0.134	

Description: The table presents the results for the difference and system GMM estimations (one and two-step variants) based on the model presented in Equation 5.8. The sample period is 2010-2016. *NPL* is the logarithmic transformation of the NPL ratio, $Total\ Asset$ *is* the natural logarithm of total assets, ROE is the ratio of return to equity, $Tier1$ is the ratio of tier1 capital to risk-weighted assets, $Loan\_g$ is the loan growth rate and NII is the is the ratio of non-interest income to total income. Number of observations, groups and instruments are also reported. The p-values associated with the two Arellano and Bond tests for autocorrelation of the residuals, as well as the p-value for the Hansen J test are included. Cluster-robust standard errors are corrected according to Windmeijer (2005) in the two-step estimations.
Note: *** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level.

Across the different estimation methods, the number of instruments is maintained to be fewer than the number of groups. Overall, the Arellano and Bond tests for first and second autocorrelation of the residuals (AR(1) and AR(2), respectively), as suggested by the associated p-values, meet the requirements (i.e. presence of one-order autocorrelation and absence of second-order autocorrelation of the residuals).[317] Therefore, as further confirmed by the Hansen test of over-identifying restrictions, the instruments employed in all the specifications are appropriate.[318] According to the Hansen test, also, the models are adequately specified, according to Roodman's (2009a) guidance.

All models produce similar qualitative and quantitative outcomes. Except for the variables Total Assets and ROE, the coefficients are consistently significant across the alternative estimation approaches. As expected, and suggested by the positive and highly significant coefficients on the lagged dependent variable, there is a strong persistence in the level of NPLs (i.e. higher levels of past NPLs are reflected in higher current NPLs). Contrary to a prior assumption, the relatively large coefficient on the contemporaneous Total Assets, employed as a proxy for the bank size, is negative and statistically significant for the difference GMM estimations (first two columns). Therefore, while the TBTF hypothesis does not seem to find support in the Italian banking context, it is possible to argue that large banks, with more resources, might be better equipped to conduct due diligence, to manage NPLs and to deal with poor quality borrowers (Makri, 2016). In line with previous studies (Klein 2013, Ghosh et al., 2015; Garrido et al., 2016) and providing support to the "bad management" hypothesis mentioned in Section 5.5.2, higher profitability is associated with lower levels of NPLs.

Moving to the issue of credit growth, the empirical results do not lend support to an anticipated positive coefficient on the Loan_g variable. Across all the estimation methods, although small, the coefficient is negative and statistically significant at different levels. Nevertheless, a contemporaneous credit growth led by demand

[317] Rather than AR(1), the interesting test to take into account is AR(2), which might be cause of concern (https://www.statalist.org/forums/forum/general-stata-discussion/general/1301176-about-thearellano-bond-test-for-autocorrelation) .

[318] Moreover, as previously discussed and in line with Roodman (2009a), the p-value associated with the Hansen test assume reasonable values (below 0.25).

factors (in a relatively positive phase of the business cycle), rather than an aggressive lending policy, might explain a negative relationship with the level of NPLs (Quagliarello, 2007). Under this perspective, in analysing the Italian banking system, Accornero et al. (2017) find that the negative link between NPLs and bank credit growth is mainly determined by firm-related factors (e.g. contraction in demand for loans). Finally, the effect of bank capitalization, as proxied by the lagged Tier1 ratio, and the degree of bank diversification (i.e. lagged ratio of non-interest income to total income) do not appear to significantly impact the level of NPLs of Italian banks.

5.7.4 Results for model with both bank-specific and macroeconomic variables

Results in Table 5.11 are based on difference and system GMM estimations, applied with one and two-step variants, for the model with both bank-specific and macroeconomic variables (Equation 5.9). The number of instruments is fewer than the number of groups for all the estimation methods. The diagnostic tests (i.e. the two Arellano and Bond tests and the Hansen test) suggest that the model is properly specified and the instruments are appropriate.[319]

[319] For the system GMM estimation, both one and two-step, it was not possible to achieve specifications with lower p-values associated with the Hansen test.

Table 5.11 - GMM estimation results for the model with both bank-specific and macroeconomic variables (2010-2016)

Variables	Diff-one		Diff-two		Sys-one		Sys-two	
L.NPL	0.512	***	0.517	***	0.817	***	0.818	***
	(0.000)		(0.000)		(0.000)		(0.000)	
L3.Total Asset	0.163		0.131		0.014		0.012	
	(0.379)		(0.655)		(0.187)		(0.418)	
ROE	-0.003	*	-0.003		-0.002	*	-0.003	**
	(0.074)		(0.376)		(0.081)		(0.029)	
L.Tier1	-0.022		-0.022		-0.023	**	-0.021	*
	(0.151)		(0.215)		(0.048)		(0.062)	
Loan_g	-0.006		-0.005		-0.015	***	-0.016	***
	(0.235)		(0.320)		(0.001)		(0.007)	
L3.NII	0.006	**	0.006	**	0.003		0.004	
	(0.033)		(0.037)		(0.312)		(0.361)	
L2.GDP_g	-0.046	***	-0.042	**	-0.035	**	-0.034	*
	(0.000)		(0.040)		(0.013)		(0.059)	
L3.Unemp	0.036	**	0.032		-0.001		0.000	
	(0.037)		(0.143)		(0.958)		(0.994)	
L3.Lending	-0.081	**	-0.086		-0.074		-0.081	
	(0.022)		(0.109)		(0.179)		(0.203)	
N.Obs.	91		91		122		122	
N.Groups	31		31		31		31	
N.Instr.	24		24		30		30	
AR(1) p-value	0.017		0.074		0.004		0.028	
AR(2) p-value	0.593		0.581		0.836		0.998	
Hansen J p-value	0.115		0.115		0.401		0.401	

Description: The table presents the results for the difference and system GMM estimations (one and two-step variants) based on the model presented in Equation 5.9. The sample period is 2010-2016. NPL is the logarithmic transformation of the NPL ratio, $Total\ Asset$ is the natural logarithm of total assets, ROE is the ratio of return to equity, $Tier1$ is the ratio of tier1 capital to risk-weighted assets, $Loan\_g$ is the loan growth rate, NII is the is the ratio of non-interest income to total income, GDP_g is the real GDP growth, $Unemp$ is the ratio of unemployment to total labour force and $Lending$ is the lending interest rate. Number of observations, groups and instruments are also reported. The p-values associated with the two Arellano and Bond tests for autocorrelation of the residuals, as well as the p-value for the Hansen J test are included. Cluster-robust standard errors are corrected according to Windmeijer (2005) in the two-step estimations.
Note: *** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level.

As for the model with only bank-level indicators, strong persistence of lagged NPLs is found in all the estimations. Suggesting a prolonged effect of a shock to NPLs, positive and highly significant coefficients on L.NPL range from 0.512 (one-step difference GMM – first column) to 0.818 (two-step system GMM – last column). This

evidence is in line with closely related literature (Salas and Saurina, 2002; Jimenez and Saurina 2006; Klein, 2013; Ghosh, 2015).

In the current model specification, which also accounts for systemic factors, the coefficient on bank size (Total Assets lagged three years) is positive but is not statistically significant. The level of profitability, measured by the contemporaneous ROE, is again negatively linked with banks' asset quality, supporting the bad management assumption. The moral hazard hypothesis, according to which less capitalized banks would increase riskier lending practices, is supported by the coefficients estimated in the system GMM framework. Negative coefficients on L.Tier1, significant at the 5 and 10 per cent levels, are shown in the last two columns of Table 5.11. In line with the model accounting for only bank-level factors, the current credit growth is negatively linked with the level of NPLs. The coefficients on Loan_g are negative across all the estimations, but only significant, at the 1 per cent level, under the system GMM procedure. Credit growth, therefore, could well be influenced by changes in firms' conditions, rather than by supply factors. Turning to the coefficient on the bank diversification variable (NII), contrary to prior expectation, this is positive under all the estimation techniques, but statistically significant only for the difference methodology.[320]

At the macroeconomic level, the real GDP growth, lagged two years, is negatively associated with the level of NPLs. As expected, for all the reported estimations, the coefficients on L2. GDP_g are negative and statistically significant at different levels. A rise in real GDP is reflected in a decline in NPLs and the cyclical effects are not instantaneous, but delayed (see also Quagliarello, 2007; Nkusu, 2011; Louizis et al., 2012; Garrido et al., 2016). The relative magnitude of the coefficients is also remarkable, ranging from 0.034 to 0.046. A positive and significant coefficient (0.036) for the unemployment variable, lagged three years, is found for the one-step difference GMM estimation (column 1). This finding matches with those of Louizis et al. (2012) and Ghosh (2015), according which an upsurge in the unemployment rate adversely impacts the debtors' capability to meet their contractual obligations. Finally,

[320] In analysing the potential benefits of diversification over specialization, Behr et al. (2007) found that less diversified German banks (i.e. more specialised) hold a lower amount of NPLs.

different to a prior expectation, the coefficient for the real lending rates, lagged three years, is negative. It is also barely significant across all the estimations, except for the one-step-difference GMM. The latter appears to be the most suitable procedure both in terms of specification (overall higher significance of the selected variables) and in compliance with the associated diagnostic tests. When accepting a p-value on the Hansen J statistic higher than 0.25, the system GMM approach also performs reasonably.[321] Following the Difference GMM procedure, the macroeconomic variables assume a predominant role in explaining the variation in the dependent variables, while under the System GMM framework the bank-specific determinants contribute more significantly.

Table 5.12 reports the results for the different estimations including the variable Debt as an alternative to the Unemployment variable. In line with expectation, the outcomes, in terms of signs and magnitude of the coefficients, are very similar to those presented in Table 5.11. Nevertheless, the current model specification (including Debt) appears slightly improved in terms of statistical significance. Consistent with the previous table is the contribution of both micro and macro variables in determine the level of NPLs for the sample of analysed institutions. Although only significant in the one-step difference GMM framework, the variable Debt, lagged three years, is overall positively related to the dependent variable. This evidence, in line with hypothesis discussed in Section 5.5.3, might suggest a significant impact of sovereign debt tensions on the level of NPLs in the Italian context.

[321] Nevertheless, it is worth noting that under the system GMM framework, the number of instruments is very close to the number of groups.

Table 5.12 - GMM estimation results for the model with both bank-specific and macroeconomic variables (2010-2016) – Debt inclusion

Variables	Diff-one		Diff-two		Sys-one		Sys-two	
L.NPL	0.512	***	0.517	***	0.817	***	0.817	***
	(0.000)		(0.000)		(0.000)		(0.000)	
L3.Total Asset	0.163		0.131		0.018		0.009	
	(0.379)		(0.655)		(0.401)		(0.729)	
ROE	-0.003	*	-0.003		-0.003	*	-0.003	***
	(0.074)		(0.376)		(0.064)		(0.007)	
L.Tier1	-0.022		-0.022		-0.023	**	-0.022	**
	(0.151)		(0.215)		(0.035)		(0.016)	
Loan_g	-0.006		-0.005		-0.015	***	-0.015	***
	(0.235)		(0.320)		(0.001)		(0.006)	
L3.NII	0.006	**	0.006	**	0.003		0.004	
	(0.033)		(0.037)		(0.292)		(0.402)	
L2.GDP_g	-0.044	***	-0.040	**	-0.035	***	-0.035	**
	(0.000)		(0.041)		(0.008)		(0.048)	
L3.Debt	0.011	**	0.010		-0.001		0.001	
	(0.037)		(0.143)		(0.864)		(0.896)	
L3.Lending	-0.095	**	-0.099	*	-0.072		-0.091	
	(0.013)		(0.094)		(0.184)		(0.187)	
N.Obs.	91		91		122		122	
N.Groups	31		31		31		31	
N.Instr.	24		24		30		30	
AR(1) p-value	0.017		0.074		0.004		0.029	
AR(2) p-value	0.593		0.581		0.839		0.988	
Hansen J p-value	0.115		0.115		0.409		0.409	

Description: The table presents the results for the difference and system GMM estimations (one and two-step variants) based on the model presented in Equation 5.9. The sample period is 2010-2016. NPL is the logarithmic transformation of the NPL ratio, $Total\ Asset$ is the natural logarithm of total assets, ROE is the ratio of return to equity, $Tier1$ is the ratio of tier1 capital to risk-weighted assets, $Loan\_g$ is the loan growth rate, NII is the is the ratio of non-interest income to total income, GDP_g is the real GDP growth, $Debt$ is the ratio of public debt to GDP and $Lending$ is the lending interest rate. Number of observations, groups and instruments are also reported. The p-values associated with the two Arellano and Bond tests for autocorrelation of the residuals, as well as the p-value for the Hansen J test are included. Cluster-robust standard errors are corrected according to Windmeijer (2005) in the two-step estimations.

Note: *** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level.

5.8 Conclusions

In the current European NPL crisis, understanding the evolution and determinants of the high levels of NPLs is a crucial step in order to develop effective policy responses. This exercise undoubtedly assumes an even greater meaning when considering the Italian banking sector, which is overwhelmed by high volumes of NPLs. The first sections of this chapter provide a detailed and up-to-date analysis of the NPL issue across Europe and in the Italian system. This includes analysis of the possible remedies and the current impediments arising from supply, demand and structural perspectives. The specific Italian problems and very recent developments are discussed in detail. Overall, a significant contribution arises from the synthesis of these highly topical issues.

The later sections of this chapter proceed to a more formal econometric investigation of the determinants of NPLs in the Italian banking sector, during the years 2010-2016. This reflects the main research question of this chapter. More specifically, the empirical analysis aimed to evaluate the contribution of both micro and macro economic variables in explaining the level of NPLs held by Italian banks. Following a detailed consideration of methodological issues, dynamic panel data estimators (i.e. Difference and System GMM estimators) were employed to explore the determinants of NPL levels.

Empirical results confirm the time persistence in the level of NPLs, whose current values are strongly related to those of the previous year. This evidence lends favourable support to the selected econometric methodology, which properly accounts for the dynamic nature of the dependent variable. The findings also suggest that volumes of NPLs are influenced by both systemic and idiosyncratic factors, which is coherent with recent contributions in the related literature (Salas and Saurina, 2002; Louzis et al., 2012; Klein, 2013; Garrido et al., 2016). Therefore, considering both types of determinants is the most appropriate choice in order to provide a comprehensive analysis.

Among the macroeconomic variables, as anticipated, real GDP growth is inversely associated with the levels of NPLs. The impact of adverse macroeconomic conditions is relatively strong and delayed (consistent with Quagliarello, 2007; Nkusu,

2011; Louizis et al., 2012). Policies aimed at improving economic conditions, in terms of growth and productivity, significantly contribute in easing the NPL problem (Resti, 2017). This chapter confirms this proposition in the Italian context, where a recent gradual economic recovery led to a decline in the level of NPLs in banks' balance sheets. In alternative model specifications, the unemployment rate, and the level of public debt present positive links with the volumes of NPLs. Although with modest statistical significance, these latter findings confirm that an upsurge in the unemployment rate or in the sovereign debt burden adversely impacts the debtors' capability to meet their contractual obligations, thereby raising levels of banks' NPLs.

With regard to the bank-specific variables, the investigation provides support to the "bad management" hypothesis, under which better managed and more profitable banks hold, on average, smaller amounts of NPLs (Klein, 2013; Ghosh, 2015). In this perspective, as argued in Resti (2017), banks should invest to improve their internal recovery procedures, IT frameworks and professional expertise. In addition, policymakers should promote the development of effective internal credit rating models. A negative relationship between NPLs and credit growth is observed. This evidence might imply credit growth driven by demand factors rather than by an aggressive supply policy (Quagliarello, 2007). Based on Accornero et al. (2017) and Resti (2017), referring to the Italian banking sector over the years 2008-2015, the negative association between NPLs and credit growth could be mostly attributable to firm-related factors and reduced demand for loans.

Overall, this chapter's key academic contributions can be summarised by the following points: an analysis of the evolution of the NPL problem in Europe, a unique review of the NPL issues in the Italian banking sector, and a rigorous analysis of the determinants of NPLs both at the micro- and macro-economic levels.

Appendix 5.A: Sample composition

Table 5.A.1 – Overview of the sample

#	Bank name	Code	Total Asset (ml €)	FTSE Italia All-Share Banks Index
1	Banca Carige	CRGE	26,111	✓
2	Banca Profilo	PROFI	1,778	✓
3	Banca Sella	SELB	11,259	
4	Banco Desio	BDBD	12,366	✓
5	Banco di Napoli	IBSP	30,200	
6	Banco Popolare	BAPP	117,411	✓
7	Banco Sardegna	SARD	12,497	✓
8	BCC di Roma	ROMA	11,100	
9	BNL	BNLI	79,049	
10	BPER	BPMO	64,957	✓
11	Cariparma	CRPP	52,992	
12	Cassa di Risparmio del Veneto	IBSX	16,694	
13	Cassa di Risparmio di Asti	CASR	12,845	
14	Cassa di Risparmio di Firenze	CRFI	31,677	
15	Credem	BACR	39,569	✓
16	Creval	BPCV	25,469	✓
17	Deutsche Bank	DEUT	23,669	
18	Fineco	FEBI	20,986	✓
19	Finnat	FNAT	1,812	✓
20	Intesa Sanpaolo	BCIT	725,100	✓
21	Mediobanca	BAME	69,819	✓
22	Mediolanum	MEDB	41,971	
23	MPS	PASC	153,178	
24	Popolare di Milano	BPMI	51,131	✓
25	Popolare di Sondrio	POSO	37,196	
26	Popolare di Vicenza	BPVI	34,424	
27	Popolare di Bari	BPBA	13,572	
28	UBI	BLOP	112,384	✓
29	UniCredit	UNCR	859,533	✓
30	Unipol Banca	BAEC	12,434	✓
31	Veneto Banca	VEBH	28,078	

Description: The table displays the list of banks included in the sample, the relevant code and the total assets (ml €) as at the end of 2016. It also indicates whether the credit institution is a constituent of the FTSE Italia All-Share Banks Index (as at the end of March 2017).
Note: In February 2017, MPS was removed from the Index.

Appendix 5.B: Sample construction

Table 5.B.1 – Original sample and further adjustments

#	Bank Name	Total Assets m EUR Last avail. yr	Latest accounts date
1.	UniCredit SpA	859,533	12/2016
2.	Banca d'Italia	773,673	12/2016
3.	Intesa Sanpaolo	725,100	12/2016
4.	Cassa Depositi e Prestiti	410,425	12/2016
5.	Cassa di Compensazione e Garanzia SPA	206,384	12/2016
6.	Banco BPM SPA	168,542	12/2016
7.	Exor Spa	156,895	12/2015
8.	Banca Monte dei Paschi di Siena SpA-Gruppo MPS	153,178	12/2016
9.	Banca IMI SpA	150,407	12/2016
10.	Banco Popolare - Società Cooperativa-Banco Popolare	117,411	12/2016
11.	Unione di Banche Italiane Scpa-UBI Banca	112,384	12/2016
12.	Banca Nazionale del Lavoro SpA-BNL	79,049	12/2016
13.	Mediobanca SpA-MEDIOBANCA - Banca di Credito Finanziario Società per Azioni	69,819	12/2016
14.	Banca Infrastrutture Innovazione e Sviluppo SpA-BIIS SpA	56,525	12/2011
15.	BancoPosta-Poste Italiane	65,053	12/2016
16.	BPER Banca S.P.A.	64,957	12/2016
17.	Credit Agricole Cariparma SpA	52,992	12/2016
18.	Banca Popolare di Milano SCaRL	51,131	12/2016
19.	Iccrea Holding SpA	48,704	06/2016
20.	ICCREA Banca SpA - Istituto Centrale del Credito Cooperativo	46,855	12/2016
21.	Mediocredito Italiano SpA	42,967	12/2016
22.	Banca Mediolanum SpA	41,971	12/2016
23.	Credito Emiliano SpA-CREDEM	39,569	12/2016
24.	Credito Emiliano Holding	37,495	12/2015
25.	Monte dei Paschi di Siena Capital Services Banca per le Imprese SpA-MPS Capital Services Banca per le Imprese SpA	38,191	12/2016
26.	Banca Popolare di Sondrio Societa Cooperativa per Azioni	37,196	12/2016
27.	Fideuram-Intesa Sanpaolo Private Banking Spa	34,672	12/2016
28.	Banca Popolare di Vicenza Societa per azioni	34,424	12/2016
29.	Banco di Napoli SpA	30,200	12/2016
30.	Banca delle Marche SpA	22,692	06/2013
31.	Veneto Banca scpa	28,078	12/2016
32.	Banca Carige SpA	26,111	12/2016
33.	Banca Piccolo Credito Valtellinese-Credito Valtellinese Soc Coop	25,469	12/2016
34.	Deutsche Bank SpA	23,669	12/2016
35.	Agos Ducato SpA	18,028	12/2013
36.	Dexia CREDIOP SpA-Gruppo Bancario CREDIOP	23,408	12/2016
37.	FCA Bank SPA	23,284	12/2016
38.	Banca Popolare di Bergamo SpA	21,861	12/2015
39.	Banca popolare dell'Etruria e del Lazio Soc. coop.	16,445	06/2014
40.	FinecoBank Banca FinEco SpA-Banca FinEco SpA	20,986	12/2016
41.	Banca Antonveneta Spa	15,644	12/2012
42.	Mediofactoring Spa	n.a.	12/2013
43.	Credito Bergamasco	13,320	12/2013
44.	Unicredit Leasing Spa	16,912	12/2016
45.	Intesa Sanpaolo Private Banking S.p.A.	16,851	12/2016
46.	Cassa di Risparmio del Veneto SpA	16,694	12/2016
47.	Banca Aletti & C. Spa	15,870	12/2016
48.	Aletti & C. Banca di Investimento Mobiliare SpA-Banca Aletti & C. SpA	15,870	12/2016
49.	CheBanca SpA	14,690	06/2016
50.	Findomestic Banca SpA	15,184	12/2016
51.	Banca Popolare di Bari Soc. Coop.P.A	13,572	12/2016
52.	Banco di Brescia San Paolo Cab SpA-Banco di Brescia SpA	13,473	12/2016
53.	Banca Sella Holding SpA	13,298	12/2016
54.	Cassa di risparmio di Asti SpA	12,845	12/2016
55.	Banco di Sardegna SpA	12,497	12/2016
56.	Unipol Banca Spa	12,434	12/2016
57.	Centrobanca - Banca di credito Finanziario e Mobiliare SpA	9,919	12/2012
58.	Banco di Desio e della Brianza SpA-Banco Desio	12,366	12/2016
59.	Nuova Banca delle Marche SpA	12,207	12/2016
60.	Cassa di Risparmio di Firenze SpA-Banca CR Firenze SpA	11,581	12/2015
62.	Compass SpA	10,966	06/2016
63.	Banca Sella SpA	11,259	12/2016
64.	Banca di Credito Cooperativo di Roma	11,100	12/2016
66.	Iccrea BancaImpresa Spa	10,862	12/2016
67.	Istituto Centrale delle Banche Popolari Italiane	10,662	12/2016

Legend:

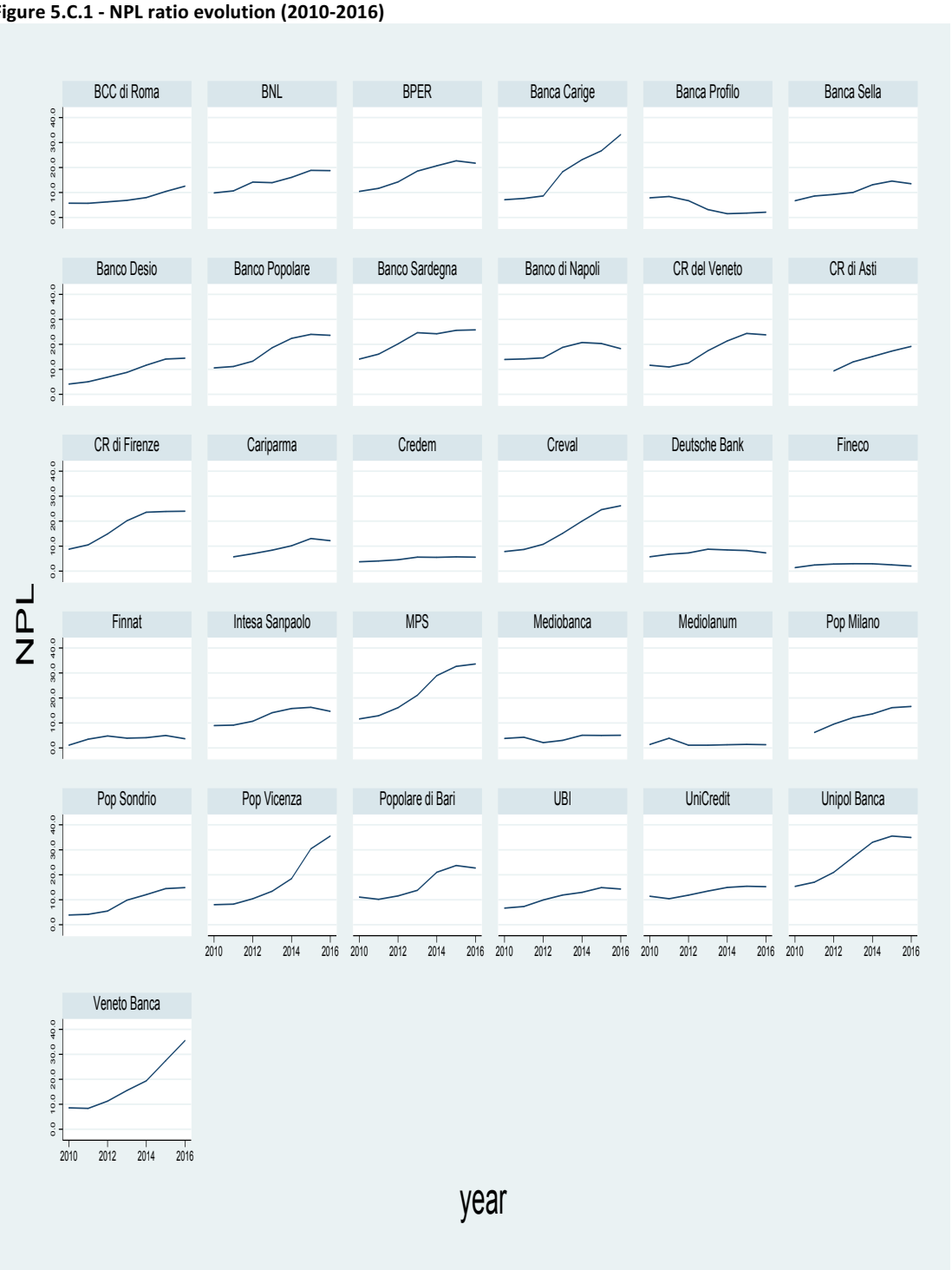
- Publicly owned
- Public relevance/data issue
- Bank Holding
- Investment Bank
- Dissolved
- Private Banking
- Finance Company
- Liquidation

Description: The table reports the list of 67 Italian banks, as collected from Orbis Bank Focus, with total asset greater than 10 million Euros (as at the last available accounting year). The different colouration, as explained in the legend, indicates the reason behind the removal of the institution from the sample.

Appendix 5.C: Trends in the macro and micro economic variables

A graphical illustration of the development, over the period 2010-2016, of the selected bank-specific and macroeconomic variables is shown in the following pages.

Figure 5.C.1 - NPL ratio evolution (2010-2016)

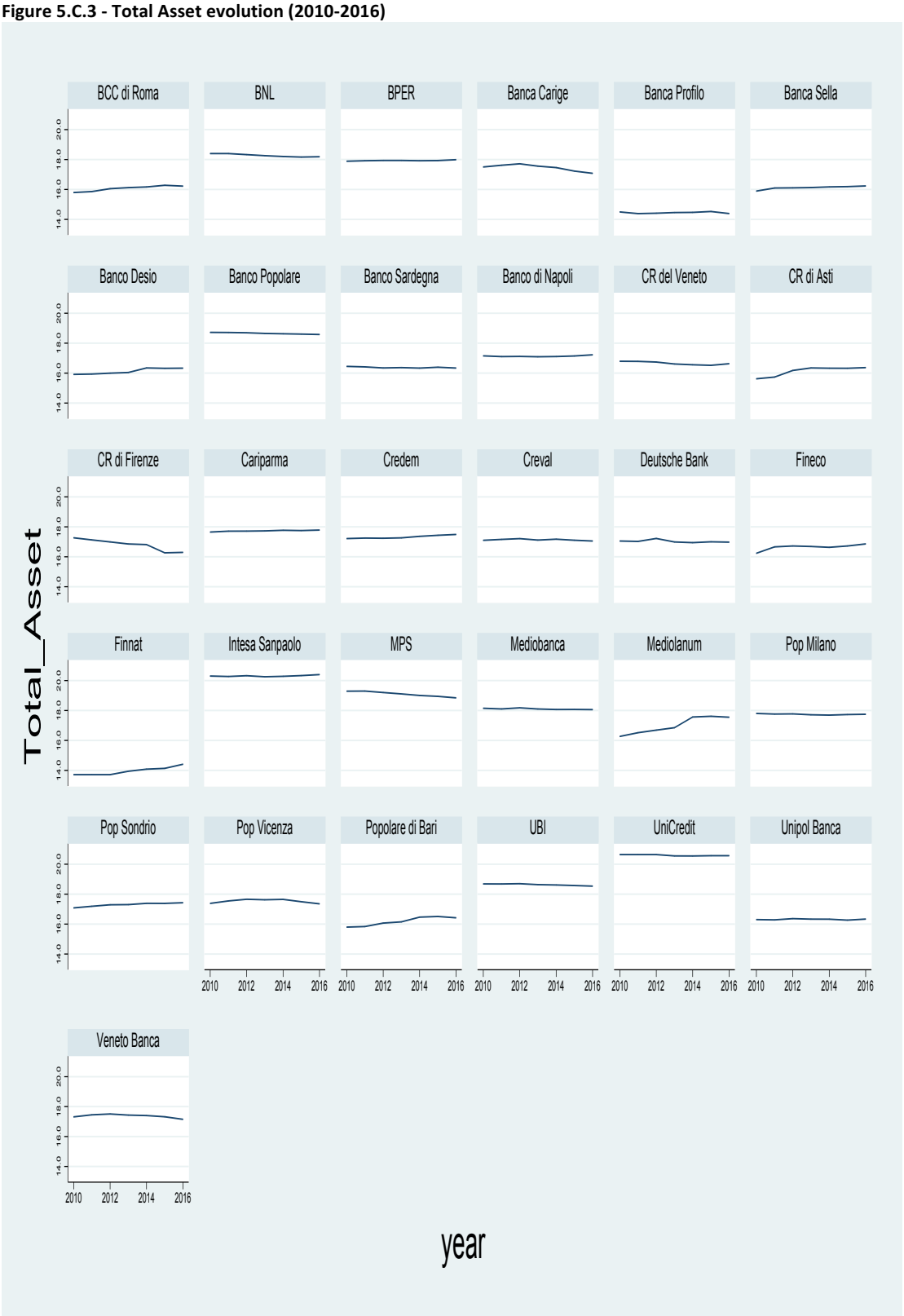


Description: the figures show the development of the NPL ratio for the 31 selected banks, over the period 2010-2016.
Note: the vertical scale, in percentage points, ranges from 0.0 to 40.0.

Figure 5.C.2 - Tier1 ratio evolution (2010-2016)

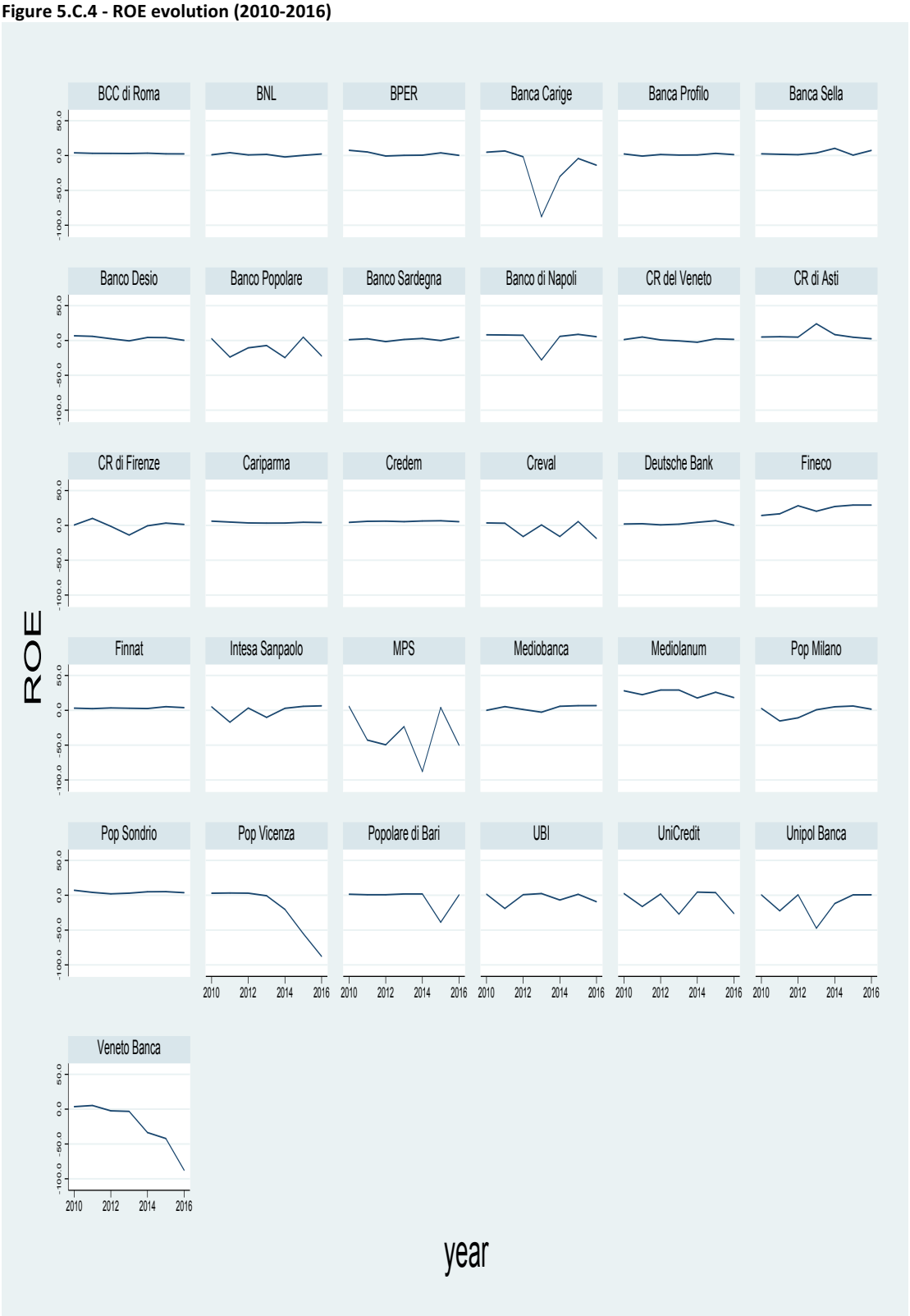
Description: the figures show the development of the Tier1 ratio for the 31 selected banks, over the period 2010-2016.
Note: the vertical scale, in percentage points, ranges from 10.0 to 30.0.

Figure 5.C.3 - Total Asset evolution (2010-2016)



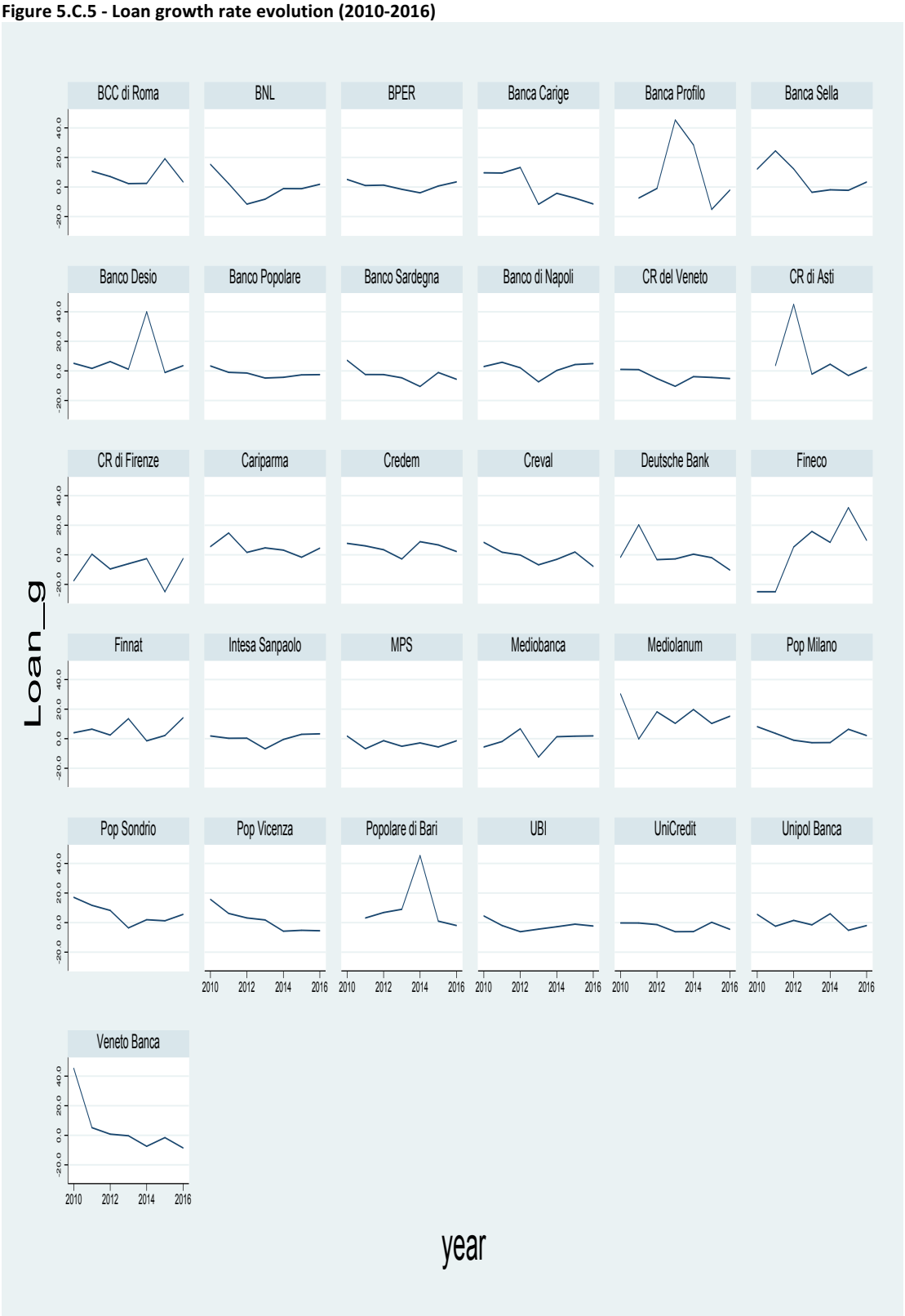
Description: the figures show the development of the natural logarithm of Total Asset (thousands of Euros) for the 31 selected banks, over the period 2010-2016.
Note: the vertical scale ranges from 14.0 to 20.0.

Figure 5.C.4 - ROE evolution (2010-2016)



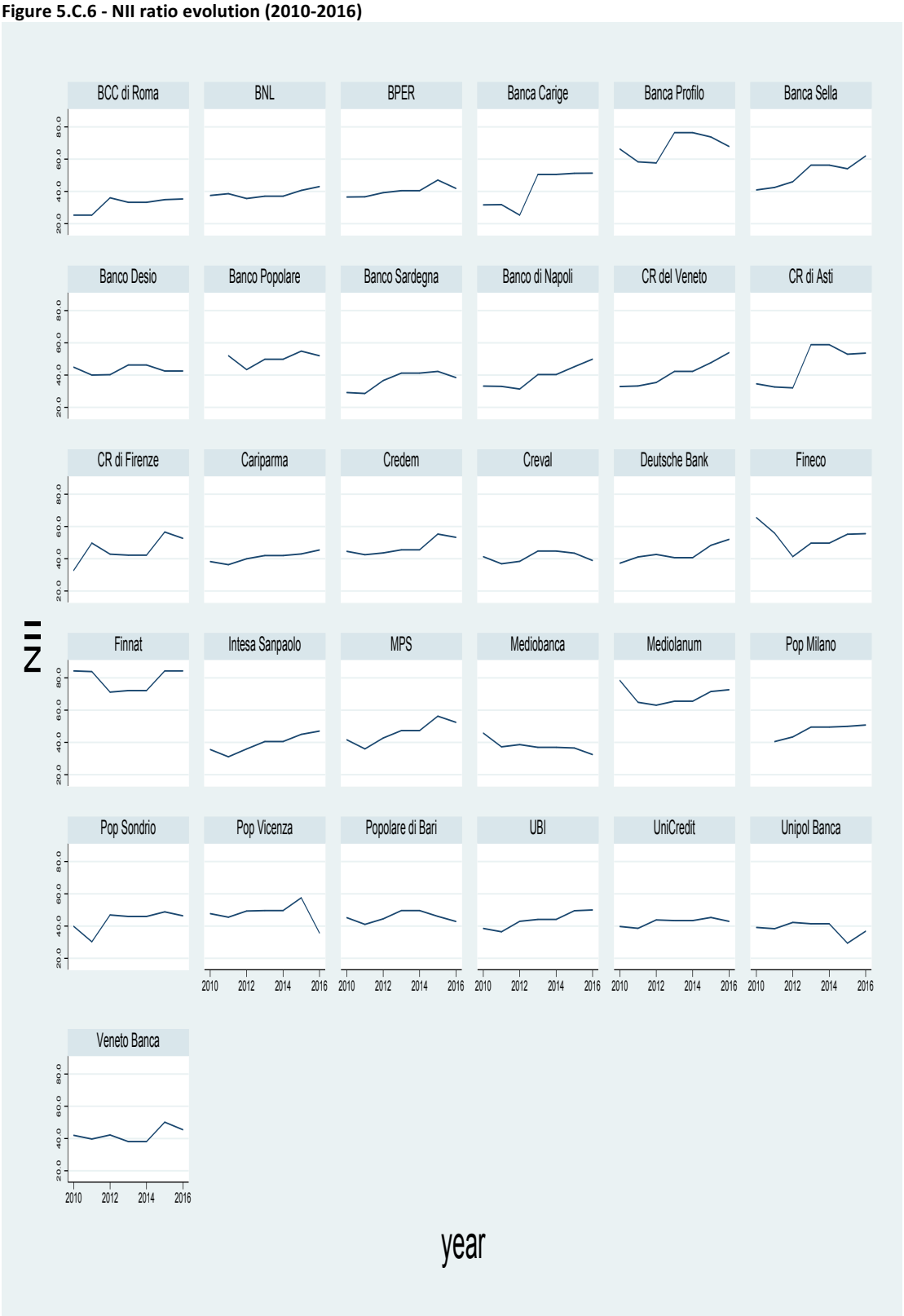
Description: the figures show the development of the ROE for the 31 selected banks, over the period 2010-2016.
Note: the vertical scale, in percentage points, ranges from -100.0 to 50.0.

Figure 5.C.5 - Loan growth rate evolution (2010-2016)



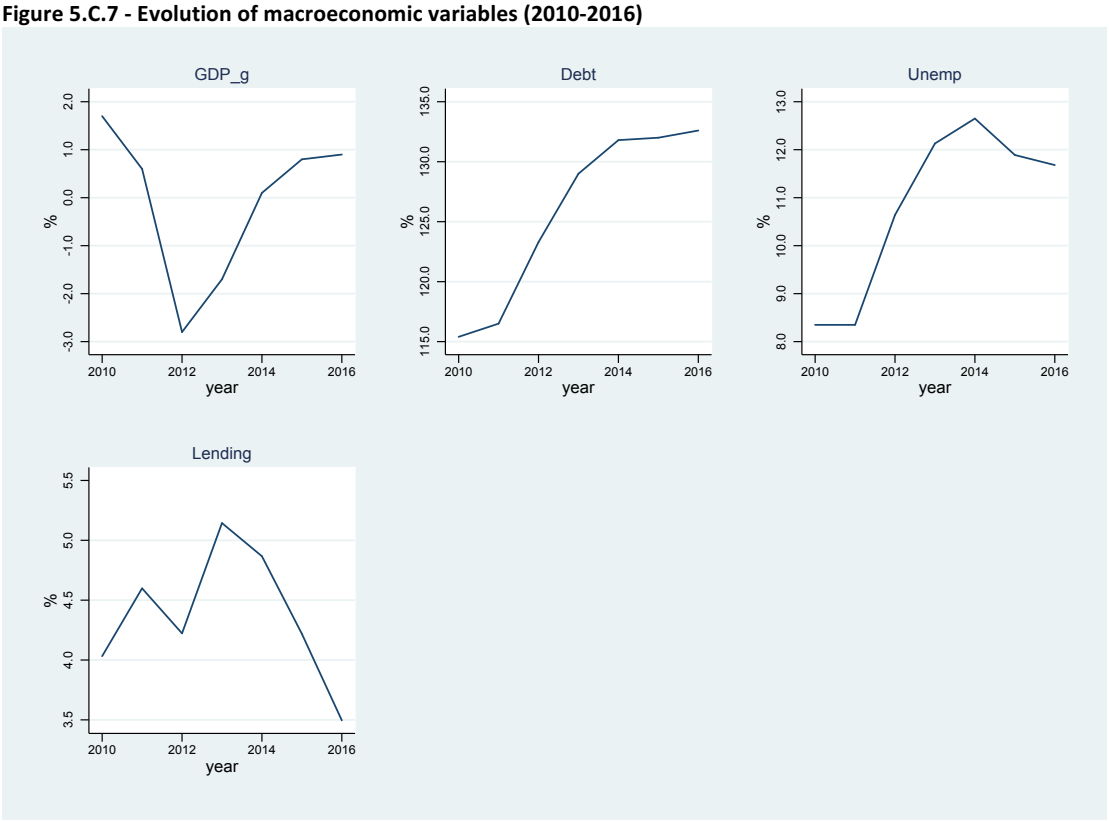
Description: the figures show the development of the Loan growth rate for the 31 selected banks, over the period 2010-2016.
Note: the vertical scale, in percentage points, ranges from -20.0 to 40.0.

Figure 5.C.6 - NII ratio evolution (2010-2016)



Description: the figures show the development of the Non-interest income to Total income ratio for the 31 selected banks, over the period 2010-2016.
Note: the vertical scale, in percentage points, ranges from 20.0 to 80.0.

Figure 5.C.7 - Evolution of macroeconomic variables (2010-2016)



Description: the figures show the development of the selected macroeconomic variables over the period 2010-2016.

Chapter 6: Conclusions

The research presented in the thesis investigates the development and implications of Banking Union (BU) in Europe. Banking supervision at the European level, which started in November 2014, was the first step towards the BU. The second cornerstone of the project, the Single Resolution Mechanism (SRM), became fully operational at the beginning of 2016. The last pillar of BU, the European Deposit Insurance Scheme (EDIS), was proposed by the European Commission (EC) in late 2015, but its implementation is still central to the current policy debate and it remains unlikely to be completely adopted in the foreseeable future. The BU project, which is the main response to the European sovereign debt crisis, is considered as a crucial step in the process of integration of the European banking system.

Two empirical chapters of this thesis analyse the financial market assessment of the new European banking regime and its effectiveness in weakening the sovereign-bank nexus in the euro area. More specifically, the research question for the first empirical chapter is: *How did announcements about the implementation of Banking Union in Europe impact on financial markets?* The research question under investigation in the second empirical chapter is: *Did financial market participants evaluate the new resolution rules as effective in severing the link between sovereign and bank risks in Europe?* Lastly, the third empirical chapter focuses on the Italian banking sector and addresses this main research question: *What factors are most influential in determining the high levels of Non-Performing Loans (NPLs) in the Italian banking sector?*

The overall research addresses topical and ongoing advances in the European banking landscape, while considering the entire journey towards BU and all its mechanisms. The thesis contributes to the academic literature by providing wide-ranging insights on the recent dynamics which affected the euro area banking system. Several strengths and shortcomings of the BU project are discussed, by framing them under different perspectives. In identifying some policy implications, this thesis also provides insights on the necessity of future improvements in order to achieve a fully effective BU.

Chapter 2 introduces the detail of the BU framework and its key pillars. It also highlights the rationale behind the BU project, its main objectives, limitations and implications. Chapters 3, 4 and 5 present the core of the empirical analysis developed in the thesis. Each empirical investigation conducted in the thesis employs a different methodological framework. The aim is to provide multiple perspectives on current and influential policy developments. Reflecting an increasing degree of complexity, the various methodologies include the event study methodology, the Difference-in-Differences (DiD) approach and the Difference and System Generalized Methods of Moments (GMM).

Chapter 3 investigates the impact on financial markets of the implementation of BU. Employing an event study methodology, the analysis seeks to assess the effect of the overall regulatory reform, and the associated specific announcements, on banks' share prices and Credit Default Swap (CDS) spreads during the period 2012-2014. The selected sample period spans from the launch of the BU project, in mid-2012, to the date from which the European Central Bank (ECB) effectively assumed its role as single supervisor for the euro area banking sector. The sample comprises banks subjected to the 2014 ECB Comprehensive Assessment (CA). More precisely, for the analysis on the stock market, the sample consists of 50 entities from 19 European countries, while 33 credit institutions are selected for the CDS market analysis, based on data availability. The investigation is conducted on both the whole samples and on bank sub-groups (e.g. Eurozone banks and Globally Systemically Important Banks, G-SIBs).

The univariate analysis suggests that the stock market investors did not anticipate each step in the regulatory reform, whereas the CDS market anticipated the information content related to the BU-news releases. Furthermore, the findings show that announcements related to the implementation of the supervisory component, as well as those on the new bank resolution regime, had an adverse effect on the wealth of banks' shareholders. On the contrary, the market response to sub-events connected to the ECB's 2014 CA was strongly positive. Banks' CDS prices reacted in a symmetrical fashion compared to the evidence reported for the stock market. Additionally, for CDS spreads, the specific category of G-SIBs were shown to significantly react to the implementation steps in the BU. For the stock market, cross-

sectional analysis reveals positive associations of the Cumulative Abnormal Returns (CARs) with capital levels and with the business model orientation. Relating to the CDS market, the degree of capitalization has a positive influence for the G-SIBs, but a negative association for other groups of banks. Weak credit quality is also a relevant factor in explaining abnormal increases in quoted CDS spreads.

The event study approach is well-suited to investigate the valuation effects of regulatory reforms. Event studies are suitable techniques for assessing the effects of regulations on the market (Sorokina et al., 2013). The analysis of the impact of changes in regulation, through event study methodology, has attracted extensive attention in economics and banking literature. Seminal works on the impact of new regulation include Binder (1985), Dann and James (1982), Posner (1974) and Stigler (1974). More recently, Veronesi and Zingales (2010), Norden et al. (2013), Horváth and Huizinga (2015), Moenninghoff et al. (2015) and Schäfer et al. (2016) adopted event studies to evaluate the impact on financial markets of major international regulatory reforms. A relatively new strand of the academic literature discusses the impact on markets of banking stress tests, both focusing on the US and European context (Petrella and Resti, 2013; Morgan et al., 2014; Neretina et al., 2014; Candelon and Sy, 2015; Flannery et al., 2017).

The adoption of an event study framework, and more specifically of a regulatory event study, is not without challenges (Binder, 1985). First, the prolonged negotiating process between the involved parties can lead the outcome to be known before the assumed event date. Regulatory events typically involve multiple announcements rather than a single well-defined one and, compared to other types of announcements, are more likely to be anticipated. In order to deal with these potential issues and to correctly identify the relevant (information) events, the adopted approach is to consider only official announcements (i.e. ECB press releases). Additionally, to better investigate the extent to which these events conveyed relevant information to the financial markets, detailed research on the associated media coverage is performed. Furthermore, although the event's timing (i.e. announcement dates) might be known to investors, its information content should be assessed in relation to the market's prior expectations (Flannery et., 2017).

Potential biases could arise from using the same set of event dates for all the firms, in turn belonging to the same industry. For this reason, to account for both cross-sectional correlation in the residuals and event clustering, the adjusted version of the Boehmer et al. (1991) test is employed. To test whether the Cumulative Average Abnormal Returns (CAARs) are statistically different from zero, a non-parametric t-statistic (i.e. the generalized sign test by Cowan, 1992) is also employed in conjunction with a standard parametric one.

The announcements during intermediate steps on the journey towards the single European supervision framework could also have been analysed with a different sample of banks. Rather than the banks within the 2014 ECB's CA, banks likely to be subject to the ECB direct supervision could have been selected. Their response, in terms of stock price, could have been compared to that of institutions expected to remain under the national supervision regimes. From this perspective, an alternative approach could have been to apply a DiD methodology (as partially adopted by Fiordelisi et al., 2017).

Chapter 4 provides evidence of the short-run impact of the new European bank resolution regime on the sovereign-bank nexus. The implementation of the Bank Resolution and Recovery Directive (BRRD) is considered as an exogenous shock which provides the setting for a natural experiment. This investigation assesses the markets' perception of the effectiveness of the new rules in weakening the tight interconnectedness between sovereign and bank risk in the euro area. Any successful application of the new European resolution rules (shifting from bailout to bail-in) requires that financial markets perceive them as credible and effective. If there is no confidence that bank failures can be managed in an orderly manner and market participants still expect government intervention, the resolution procedure could lead to major and more severe turmoil (Mikosek, 2016). A DiD methodology is adopted, drawing evidence from the CDS market for banks and non-financial corporates. The sample period spans from 2011 to 2016, covering both the European sovereign debt crisis and the relatively more tranquil post-crisis period. The main hypothesis underlying the investigation is that the intervention (i.e. the BRRD) was expected to impact the sovereign to non-sovereign link in the case of banks, while leaving

unaffected the sovereign-corporate link. In this light, a decoupling between sovereign and bank risk, captured by CDS spreads, was anticipated.

The DiD methodology was considered suitable for the purposes of this second empirical analysis. In order to test the effectiveness of the new European bank resolution regime in weakening the strong sovereign-bank link, CDS spreads for a sample of banks (i.e. treatment group) and non-financial entities (i.e. control group) are selected. As standardized products with pre-specified and comparable terms, CDS contracts allow for a reliable comparison of credit risk across corporates and sovereigns. The choice of a control group consisting of non-financial companies is motivated by the necessity of using a European sample, while noting that the BRRD applies to all EU Member States.

Some unanticipated issues arose in the construction of the overall CDS sample. Several steps were conducted with the aim of building a reliable and exhaustive dataset. The limited number of European corporate CDS reference entities influenced the size of the sample, which ultimately consisted of 169 entities across seven European countries. Finally, the analysis was conducted on all the countries pooled together, as well as on each country separately. The latter investigation was motivated by the aim of better capturing country-specific dynamics, especially for those countries less represented in the whole sample. The main findings do not indicate a significant decoupling of bank CDS spreads from sovereign CDS spreads, compared to the corresponding evidence for the European non-financial sector. An overall narrowing of the gap between bank and sovereign risk occurs, which implies a lack of immediate credibility of the BRRD in financial markets.

Chapter 5 focuses on the Italian banking sector and the NPL issue. It provides an exhaustive analysis of the NPL burden in both the European and Italian contexts. It highlights the impediments to the resolution of the NPLs, the implications of the problem and the corrective initiatives undertaken by policy organisations. Related to the Italian context, the chapter illustrates the recent high-profile events which occurred in 2016-17. It offers a detailed and up to date insight on the creation of the two Atlante funds, the introduction of the “Garanzia Cartolarizzazione Sofferenze” (GACS), as well as the cases of the Monte dei Paschi di Siena (MPS) SpA and the two Veneto banks. The latter represented widely discussed circumstances, which entailed

debates on the effectiveness and credibility of the European resolution regime and the future of the BU itself (Angleoni, 2017).

Shedding light on the factors explaining the ex-post credit risk, as captured by the NPL volumes, is fundamental both for regulatory authorities and bank management. Therefore, the chapter progresses with empirical analysis which aims to identify idiosyncratic and systemic factors affecting the volumes of NPLs across Italian banks. To this end, difference and system GMM estimations, in a dynamic panel context, are employed on a sample of Italian banks over the years 2010-2016, including both macro-level and bank-specific variables. The main findings of the analysis confirm the countercyclical nature of the NPL volumes. There exists a negative relationship between the real GDP growth, as an indicator of the country's general economic conditions, and the levels of banks' NPLs. Thus, enhancing growth and productivity, while adopting structural reforms, are fundamental elements to help restoring banks' balance sheets. Among bank-specific variables, a higher level of profitability is negatively associated with the volumes of NPLs, providing support to the hypothesis that better managed banks tend to have fewer incentives to engage in poor lending practices. Finally, an inverse link between credit growth and NPLs is observed. In this perspective, it is possible to justify a credit growth driven by demand factors, rather than by an aggressive supply policy (Quagliarello, 2007).

The analysis performed in this third empirical chapter combines alternative econometric techniques, such as OLS regression, fixed effects methodology and difference/system GMM. Based on the relevant literature on panel data studies, a dynamic approach which is able to account for the time persistence in the dependent variable (i.e. level of NPLs) was adopted. The overall flexibility of the GMM framework, which facilitates dealing with unbalanced panels and potential endongeous regressors, while avoiding the biases of OLS and fixed effects methods, justifies the use of these estimators in the analysis. Nevertheless, the adoption of the GMM estimation procedure presents different complexities and challenges. Specific attention is paid to maintain the number of instruments lower than the number of groups. To limit instrument proliferation, the collapse method is employed. In this perspective, biased coefficients estimates (close to those obtainable from non-instrumenting estimators) can result from including an excessive number of

instruments (Roodman, 2009b). By overfitting the variables to instrument, there arises a failure to effectively remove their endogenous components.

For robustness and completeness, both the one-and two-step variants of the difference/system GMM are included. To maximise the sample size and therefore reduce the adverse impact of missing data, the forward orthogonalization procedure by Arellano and Bover (1995) are adopted. As suggested in Roodman (2009b), the various steps and choices undertaken in performing the GMM-based analysis are all transparently reported. Finally, two different model specifications are considered; one which only includes microeconomic variables and the second one which also accounts for macroeconomic factors.

The choice of employing a GMM estimator was mainly supported by two considerations: (i) the potential endogeneity issues and persistence in the dependent variable, which entails the inclusion of its lagged value; (ii) the approach followed in the closely related literature (e.g. Salas and Saurina, 2002; Klein, 2013; Louizis et al., 2012; Garrido et al., 2016). Moreover, the GMM estimator, compared to more conventional IV estimators, i.e. two-stage least square (2SLS), can address the often problematic task of specifying valid external instruments.[322]

6.1 Policy implications and future research directions

The empirical analyses conducted in this thesis are framed in the European banking context, its recent developments and specific features. The establishment of the BU, which is considered as the most significant structural institutional change since the introduction of the common currency (Darvas et al., 2016), represented the motivation and the over-arching theme at the basis of the whole research undertaken in this thesis. According to the timing of the various financial regulatory changes and advances, each analysis attempts to capture a different angle on the new framework, while providing evidence from the financial markets. The fact that the implementation of the BU project is still in progress leaves the door open to many future investigations, as well as to potential extensions of the research already undertaken. Future researchers might extend the time sample of the empirical analyses included in this

[322] The 2SLS estimator can be considered as a special case of the GMM estimator (Baum, 2014). For further details on this topic, see http://fmwww.bc.edu/ECC/S2014/823/EC823.S2014.nn02.slides.pdf.

thesis, especially those in Chapter 4, thereby considering the most recent European events and dynamics. The timeliness of the topic makes it central to the current policy debate and contributes to the originality of this thesis. However, it inevitably provides room for additional, complementary studies.

This thesis provides important insights on the establishment of the European BU and the associated newly formed institutions. It embraces different elements of the new policy regime, which started from mid-2012 and involved profound changes for the European banking landscape. It analyses the crucial shift from national to European level of the supervision and resolution of euro area banks. Remarkable advances have been achieved, especially when considering the complexity of the transition from the previous regimes, yet some fragilities and incompleteness still need to be addressed. As highlighted in Gehrig et. (2016), areas of improvements for the new supervisory mechanism include (i) the transparency of procedures and practices (e.g. the Supervisory Review and Evaluation Process, SREP, process); (ii) the limitation of duplication and redundant data requests. Furthermore, the incomplete regulatory framework lacks its third pillar (i.e. the EDIS) and a common fiscal backstop. It is argued that the *status quo* has not effectively broken the vicious circle between sovereigns and banks in the euro area.

Disagreements among different countries, some being critical of risk-sharing mechanisms and the lack of clarity about resolution rules, represent obstacles in disentangling the fate of governments and domestic banks.[323] On the one hand Germany and Finland demand further risk reduction actions to strengthen the euro area banking sector (Financial Times, 2018).[324] Southern economies, on the other hand, are understandably more oriented towards an increased degree of risk-sharing across countries, while also re-launching the proposal of common safe assets (e.g. Eurobonds issued by sovereign euro area countries). The apparent distance between the two positions, i.e. risk-reduction and risk-sharing, might be encompassed by the creation of a credible EDIS, which would enhance market discipline, while reducing

[323] This is also evident when considering cross-border mergers and acquisitions. The implementation of the BU, which was expected to foster the consolidation process across the euro area, did not materially change the *status quo* in this respect (Raposo and Wolff, 2017).
[324] See https://www.ft.com/content/d223fa7c-011b-11e8-9650-9c0ad2d7c5b5.

the room for political crises (Financial Times, 2018).[325] In this perspective, substantial reforms in more distressed countries are fundamental in order to achieve a shared view. Therefore, the genuine completion of a fully effective BU remains a somewhat distant prospect.

The 2017 case of the winding up of two Veneto banks in Italy posed several doubts about the reliability and credibility of the new bank resolution rules in Europe. Unlike the resolution of the Spanish Banco Popular in early June 2017, where no taxpayer's money was employed, the liquidation of the Italian lenders, under national rules, implied the recourse to public funds (up to €17bn).[326] This circumstance, along with the long-standing case of the MPS which in the same year underwent precautionary recapitalisation, undermined the general confidence in the BU project and its capacity of intervention (Financial Times, 2017).[327] State Aid rules and resolution agreements issued at different times and in an uncoordinated manner gave rise to potentially contradictory outcomes. An example of this is the possibility for supervised banks in Europe to be liquidated using national arrangements and resources. Also, concerns arise from the fact that winding-up measures may turn out to be more favourable than resolution processes for the creditors involved (Angeloni, 2017). While a crisis-prevention regime for the euro area is almost completed, the crisis management framework is still partial and potentially subject to different interpretations, with negative effects on overall stability (Shoenmaker, 2016).

The Italian case, worsened by the high burden of NPLs, highlighted the current challenges in creating an effective level playing field. National deviations from the common rules, including discrepancies across countries in terms of (i) degree of risk; (ii) legacy of the two crises; and (iii) type of bank liability holders, became evident over the 2016-2018 period. The trade-off faced by the authorities between maintaining short-term liquidity and solvency and imposing long-term discipline to avoid moral hazard was glaring. The political nature of the shift from public rescues to the bail-in mechanism was also clear (Angeloni, 2017). In specific circumstances, when there are

[325] See https://www.ft.com/content/6dd7703a-0044-11e8-9650-9c0ad2d7c5b5.
[326] For a critical review on the differences between liquidation and resolution procedures in Europe, see http://bruegel.org/wp-content/uploads/2018/01/PC-01_2018.pdf.
[327] See https://www.ft.com/content/3b8bc570-5a7e-11e7-b553-e2df1b0c3220.

too many banks to fail posing a big risk for the entire financial system, a bailout option might still represent the optimal solution, and may also avoid allocation inefficiencies. As expressed in late 2017 by the Italian finance minister Padoan, referring to the MPS case and Italian troubles, flexibility in the new European bank regime is essential to smooth a transition phase which can lead to completion of BU. He also added that bringing back the cost of managing crises to the national level would impair the objectives of the BU itself (Financial Times, 2017).[328]

Furthermore, while the heterogeneous treatment of Less Significant Institutions (LSIs) across different countries might represent an obstacle to effective integration, it is however necessary to recognize the diversity in the euro banking system. The possibility of applying a different set of rules to banks operating in the same market, in order to meet a proportionality criterion, has recently gained attention (Lautenschläger, 2017). Smaller banks, i.e. LSIs, face greater difficulties than larger institutions in complying with complex and more costly regulation (without potentially gaining the associated benefits). This might create disadvantages in terms of competition across the system, while reducing the variations which make the sector more stable. Under this perspective, the concept of proportionality might be fundamental to promote such diversity. Therefore, the "one size fits all" approach might be re-visited towards a more simplified set of rules for locally oriented medium-sized banks, termed by some commentators as the "Small Banking Box" (Dombret, 2017).

The research direction of this thesis, classifiable in the more general framework of empirical banking, might have followed different, but complementary paths. The legal arrangements and their implications, as well as the macro-prudential policies associated with the recent establishment of the BU in Europe, could have been chosen as prominent features. Therefore, future researchers might usefully focused on these elements. In this perspective, the analysis of the impact for financial market participants from the transformation of the European Stability Mechanism (ESM) into a European Monetary Fund (EMF), as proposed by the EC in late 2017, would

[328] See https://www.ft.com/content/3b32f1d4-e403-11e7-97e2-916d4fbac0da.

represent an interesting topic to address.[329] With the deepening of the current European bank regulation, further potential research directions might be undertaken, including evaluation of the consequences of the future adoption of the EDIS. Overall, ongoing developments in European banking imply the presence of a broad and deep future research agenda.

[329] See http://europa.eu/rapid/press-release_IP-17-5005_en.htm.

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