UNIVERSITA' DEGLI STUDI DI PADOVA

DIPARTIMENTO DI SCIENZE ECONOMICHE ED AZIENDALI "M.FANNO"

CORSO DI LAUREA MAGISTRALE IN ECONOMICS AND FINANCE

TESI DI LAUREA

"BRRD and Bail-in: A remedy to the Sovereign-Bank nexus?"

RELATORE:

CH.MO PROF. Bruno Maria Parigi

LAUREANDO: Marco Zardet

MATRICOLA N. 1177240

ANNO ACCADEMICO 2018–2019

Il candidato dichiara che il presente lavoro è originale e non è già stato sottoposto, in tutto o in parte, per il conseguimento di un titolo accademico in altre Università italiane o straniere.
Il candidato dichiara altresì che tutti i materiali utilizzati durante la preparazione dell'elaborato sono stati indicati nel testo e nella sezione "Riferimenti bibliografici" e che le eventuali citazioni testuali sono individuabili attraverso l'esplicito richiamo alla pubblicazione originale.

The candidate declares that the present work is original and has not already been submitted, totally or in part, for the purposes of attaining an academic degree in other Italian or foreign universities. The candidate also declares that all the materials used during the preparation of the thesis have been explicitly indicated in the text and in the section "Bibliographical references" and that any textual citations can be identified through an explicit reference to the original publication.

Firma dello studente

"Men are what their mothers made them."
Ralph Waldo Emerson

Grazie, Mamma.

Table of Contents

List of Figures

Figure…

List of Tables

Table…

1. Introduction

The 2008 financial crisis has led to dramatic consequences in the financial industry. The distress of many credit institutions and the fierce downturn in the real economic activity required governments to adopt exceptional measures, with a tremendous impact on public finances. Since then, the sovereign creditworthiness of many advanced economies worsened, especially in Europe. The weaknesses of the public finances in the European countries, along with the fragility of their banking systems, generated a series of perverse risk transmission mechanisms. In this thesis I refer to these phenomena as the Sovereign-Bank Nexus.

The Sovereign-Bank Nexus constitutes one of the main concerns for the European financial stability. The regulatory authorities are still trying to address this phenomenon by implementing the most suitable policies and a thriving literature has been developed around this problem.

The scope of my work is to investigate in depth the Sovereign-Bank Nexus. In particular, I will perform an empirical analysis to demonstrate that the introduction of the Bail-in provision helped to give some relief to the risk transmission mechanisms in place between banks and sovereigns.

The thesis is organized as follows: in the second chapter I describe the Sovereign-Bank Nexus and its features. I will identify the 3 main risk transmission channels that link sovereigns to their banking systems, namely the "sovereign exposure" channel, the safety net channel and the macroeconomic channel.

In the third chapter I investigate the various measures taken by policymakers in order to handle the Sovereign-Bank Nexus. The post-crisis years have indeed been characterized by a thorough process of financial integration among European member countries. A set of comprehensive directives harmonized the financial industry through the implementation of the European Banking Union. In my description, I will focus in particular on the new banking resolution framework, illustrating the Banking Recovery and Resolution Directive and the Bail-in provision. Moreover, I will also go through some emergency measures which were taken to preserve the financial stability (LTRO, OMT, ESM) and I will discuss some proposals which have been advocated to solve the feedback loop phenomenon (EDIS and SBBS).

The fourth chapter is the focal point of my thesis. By referring to the methodology developed by Acharya et al. (2014) I will test the effectiveness of the Bail-in provision in reducing the Sovereign-Bank Nexus. The empirical analysis will demonstrate that the Bail-in, by lessening the linkages between sovereigns and banks, partially helped in curtailing the feedback loop.

The fifth and last chapter, starting from the conclusions drawn with the empirical analysis, proposes a regulatory improvement which is likely to further slash the Sovereign-Bank Nexus.

Namely, I will describe the proposal to implement capital charges for concentrated sovereign exposures in banks' balance sheets.

1.1 Related literature

My thesis relates to the recent strand of literature that analyzes the interactions between banks and sovereigns balance sheets. In my work, I refer to this phenomenon as the Sovereign-Bank Nexus, while other authors used the terms "diabolic loop", "doom loop" and "feedback loop".

As previously highlighted, the proposed empirical analysis is based on the methodology developed by Acharya et al. (2014). The authors, by using sovereign and bank CDS as a measure of credit risk, developed a straightforward procedure to assess the magnitude of the Sovereign-Bank Nexus. In particular, they demonstrate that the large public expenditures in the form of bank bailouts triggered a threat for the sovereign creditworthiness. The authors concluded that in the post-crisis years the need for an immediate present financial stabilization has been reflected in the potential for a future systemic disruption.

Starting from the relevant contribution of Acharya, a vast literature on the topic of the Sovereign-Bank Nexus has been developed.

Cooper and Nikolov (2017) designed a model in which the Sovereign-Bank Nexus is a Nash Equilibrium stemming from the interaction between banks and sovereigns. In particular, in their model bank equity plays a critical role in the existence of these risk transmission mechanisms. Since in their equilibrium banks rationally expect of being bailed out, they don't issue new equity. According to the authors, this constitute the basis of the feedback loop.

It is also worth mentioning the contribution of Farhi and Tirole (2016), who provided a comprehensive theory of the Sovereign-Bank Nexus that allowed both for the bailout of domestic banks and the possibility for a government not to repay its sovereign debt.

Leonello (2017) theorized a framework where both sovereigns and banks are fragile and in which their credibility is determined endogenously. In this structure, she showed that government guarantees are a key factor in the interconnection between sovereigns and banks, even if the banking sector is not exposed towards governments through sovereign exposures.

A lot of contributions are focused in discussing policy options to address the problem of the Sovereign-Bank Nexus. Worthy of note are the works of Angelini, Grande and Panetta (2014), Alogoskoufis and Langfield (2018) and Dell'Arriccia et al. (2018).

Several works also tried to analytically assess the magnitude of the risk transmission in place from banks to sovereigns and vice versa. Besides the methodology proposed by Acharya et al. (2014), Erce (2015) developed a model to evaluate the Sovereign-Bank Nexus implementing an impulse-response function. Using data on CDS, the author found that sovereign risk translates into bank risk heavily than vice versa. Moreover, in Countries with a high level of

debt and in Countries with a banking sector highly exposed towards the domestic sovereign, the risk transmission mechanism from sovereigns to banks is even stronger. On the other side, the calculations show that public interventions aimed at saving the financial system feed the risk transmission from banks to sovereigns. This mechanism is larger in case of a banking sector with a high level of Non-Performing loans.

Focusing on the Bail-in effectiveness, Galliani and Zedda (2015) proposed a computational approach for assessing the circular relationship between banks and their sovereign riskiness. In particular, they tested if the proposed bail-in tool had the potential to break the Sovereign-Bank Nexus. Their calculations forecasts that a Bail-in adoption for an amount equal to 8% of bank's balance sheet would address the problem of the feedback loop. According to their findings, Bail-in would prevent the contagion between banks and public finances, avoiding the use of public resources to manage a potential banking crisis.

Similarly, Arnal-Martínez and Moreno (2018) tried to assess if the recent policies adopted by the European Authorities were able to tackle the Sovereign-Bank Nexus. In particular, they developed a DCC (Dynamic Conditional Correlation) model to evaluate the short-run dimension of the feedback loop and a Time Varying Cointegration technique to assess its long run evolution. Their calculations reveal that the European policies caused a slight decrease in both the short-run and long-run dimensions for peripheral countries. According to them, however, in order to tackle the Sovereign-Bank Nexus further regulatory interventions are needed.

Considering the existing literature, my work contributes by providing an empirical proof of the effectiveness of the Bail-in provision. I enhance the analysis of Acharya et al. (2014) by updating the time window considered. I provide further interesting clues on the Sovereign-Bank Nexus aspects by separately considering different groups of countries and various time periods. In my thesis I also implement the quantile regression technique, an alternative estimation method that permits to overcome some of the weaknesses of the traditional OLS (Ordinary Least Squares) methodology.

Finally, as an additional improvement, I focus on the particular case of Italy, which constitutes a special case among European countries.

2. Investigating the Sovereign-Bank Nexus

The Sovereign-Bank nexus refers to the relationship between banking and sovereign risk, it consists in the transmission of risks from governments to banks and vice versa. Governments and financial institutions are thus intertwined: governments are exposed to bank risks and banks are exposed to sovereign risks with a two-way risk transmission mechanism that constitutes a vicious cycle.

This phenomenon has been a key feature of various financial sectors since the aftermath of the financial crisis, it was and still is one of the major threats for the European financial stability.

Prior to the 2008 financial crisis there was no sign of sovereign distress among advanced economies, much of the government debt issued by the European countries was considered a risk-free asset. Investors relied on the ability of sovereigns to repay their debt and to continuously fund their expenses through new debt emissions.

The burst of the financial crisis, however, tackled the financial stability in USA and Europe. Governments needed to preserve the smooth functioning of their credit sectors, in order to do this they approved huge public expenditures in the form of bailouts, equity injections and troubled asset relief programs. Since the bailout programs had a severe impact on the government fiscal positions investors started to worry about the sovereign creditworthiness, triggering the onset of the Sovereign-Bank Nexus.

In other Countries, such as Italy, the direction of causality was different, with the stress arising from a worsening in the sovereign creditworthiness. Initially the financial crisis didn't have a severe impact on the credit sector, despite this the government faced a sharp increase in its level of expenditures. Starting from May 2011 investors started to worry about the possibility that the peripheral Euro countries[1] could default on their debt. Consequently, the sharp widening in the sovereign yields had a negative impact on the domestic banks' balance sheets, which in turn led to a negative feedback effect on the government creditworthiness.

Overall, once there's a deterioration in the public finances the government debt loses its status of risk-free asset and the risk transmission channels among sovereigns and banks are likely to be activated.

The loop is still a concern for regulators and authorities, European policy makers tried to manage this vicious cycle implementing different solutions, which will be enlightened in the third chapter.

[1] Greece, Italy, Ireland, Portugal and Spain are considered the peripheral countries (or GIIPS Countries).

2.1 The Stress Transmission channels

By breaking down the Sovereign-Bank nexus it is possible to identify multiple stress transmission channels. It is important to keep in mind that once a risk factor is activated there could be various feedback effects, triggering a self-reinforcing negative spiral.

Overall the negative effects associated to the Sovereign-Bank nexus involve a worsening in the government creditworthiness, the weakening of the financial sector and a recession in the real economic activity.

Multiple linkages are thus in place at the same time, interacting simultaneously along several dimensions. To better understand the phenomenon, it could be helpful to disentangle and individually identify the main stress transmission channels:

1. The "sovereign exposure" channel, linked to the bank's holdings of domestic sovereign debt. Credit institutions are heavily exposed towards their governments, their profitability is thus linked to the credit quality of their domestic sovereign holdings;
2. The safety net channel, sovereigns could be called to provide guarantees and backstops against banks' liability in case of a financial institution's distress. These measures could have a significant impact on the government fiscal account;
3. The macroeconomic channel, the state of the real economy in a Country affects and is affected by the health of its banking system and public finances.

The channels identified could be active simultaneously, influencing and interacting each other, with a reinforcing effect. Nonetheless, it is important to understand the importance of each risk transmission channel analyzing its features, the connected risk factors and the consequences associated to its activation.

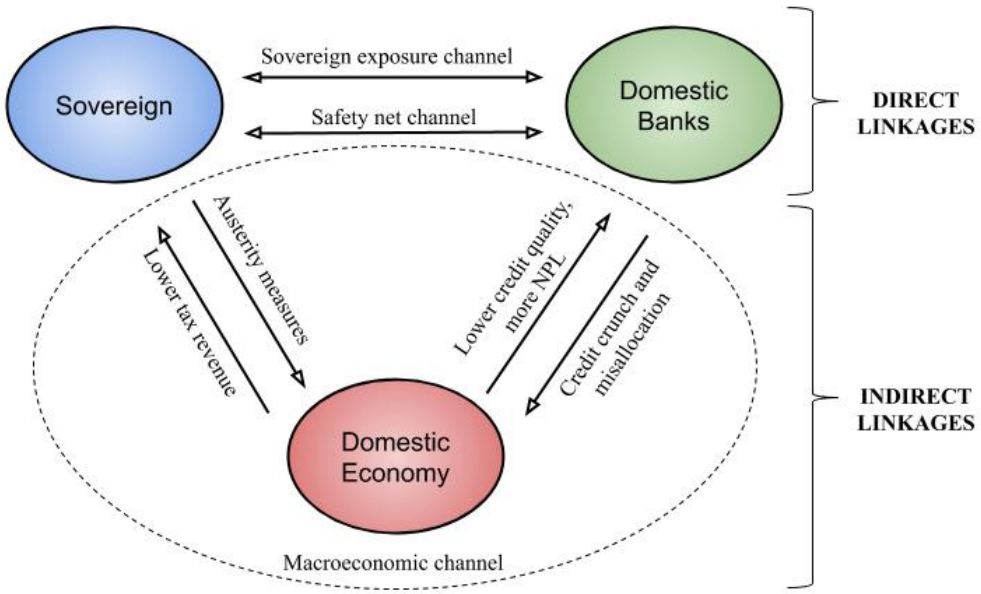

Figure 2.1, A representation of the various risk transmission channels of the Sovereign-Bank Nexus.

2.1.1 Understanding the "sovereign exposure" channel

Banks are typically linked to governments through a large amount of sovereign debt holdings. These direct balance sheet exposures constitute the "asset side" of the Sovereign-Bank Nexus, this risk transmission channel arises indeed from the portfolio's composition of each single bank.

The large domestic sovereign exposure has led banks to be sensitive to variations in creditworthiness of their domestic governments, an increase in the sovereign risk may lead to huge losses in the portfolio of sovereign securities held by banks. A deterioration in the public finances lead indeed investors to require a higher yield on sovereign bonds, causing a reduction in value of the debt already in circulation.

Once investors are aware that a bank is heavily exposed against its government, a worsening of the sovereign risk will be translated in a reduction of banks' assets value. This is true regardless of the accounting classification of the related financial instruments in the bank balance sheet. If a bank measures its government debt portfolio at market value (i.e. fair value) gains and losses connected to the position are immediately reflected in its Income Statement. Moreover, if the government bonds are booked at amortized cost the risk transmission channel is still active: an impairment in the sovereign creditworthiness translates in an increased perceived riskiness of default of the financial institution. So, whether assets are booked inside the trading or the market book makes no difference: a rational investor will go through the bank accounting conventions, assessing the bank's balance sheet evaluating financial assets at market value even if they are booked at amortized cost.

While the health of banks is directly affected by their government creditworthiness, sovereigns rely in turn on the absorbing capacity of the financial sector when issuing new debt. Banks absorb indeed a relevant portion of sovereign bond emissions and their distress could lead to complications during the new issuances. A deterioration in the public finances is thus connected with losses in the bank portfolios, which are reflected in the inability to cover significant amounts of new debt emission.

By the same reason, a shock arising from the distress of a relevant credit institution may have a negative effect on the demand and the liquidity of sovereign bonds issues. This phenomenon constitutes the inverse way in which the "sovereign exposure" channel manifest itself.

On the other hand, it is worth noting that a bank which faces difficulties could also adopt a "flight to quality" strategy, rebalancing its portfolio towards safer and more liquid assets (as sovereign bonds). Hence, it is not clear if the "sovereign exposure" channel is active also in the transmission of risks from banks to sovereigns.

The sovereign exposure channel become relevant when the financial sector is highly exposed towards its domestic government debt, the phenomenon is thus more pronounced when the "home bias" is marked. The home bias is the tendency for a subject to be over-invested in domestic financial assets, in the context of banks' sovereign holdings there are various reasons on the basis of the phenomenon.

Altavilla, Pagano and Simonelli (2016) offer a first interpretation. In their paper, the authors tried to explain why, in the aftermath of the European sovereign debt crisis, banks located in the vulnerable countries (Greece, Ireland, Italy, Portugal and Spain) significantly and rapidly increased their domestic sovereign exposures, in striking contrast with the behavior of banks located in the more stable European countries. They gave two possible explanations for the home bias registered in vulnerable countries: the moral suasion of monetary authorities and carry trade motivations.

First, Romans (1966) defines the moral suasion as "the attempt to coerce private economic activity via governmental exhortation in directions not already defined or dictated by existing statute law." In the context of sovereign debt holding moral suasion is related to the government pressure on credit institution to increase their domestic sovereign debt holdings. This behavior is likely to lead banks with a relevant public ownership to increase their exposure to domestic sovereigns. Moreover, banks which were subject to bailout tend to enlarge their domestic sovereign portfolio in the aftermath of their rescue. A high share of public ownership and a recent bailout increase indeed the moral suasion effect, giving more negotiating power to the public institutions.

Second, the carry trade motivation is related to the fact that weakly capitalized banks hold a large share of risky domestic sovereign debt with the aim to achieve a higher yield. As demonstrated by Crosignani (2017) banks with a low regulatory capital shifted their portfolio towards domestic sovereign bonds, linking in this way their future performances to that of their governments. In the aftermath of financial crisis weakly capitalized banks exploited the cheap liquidity offered by ECB by investing in risky high-yield sovereign debt, which absorbed a minimum fraction of supervisory capital. A similar explanation is offered by Livshits and Schoors (2009), which showed that banks in peripheral countries bet on risky domestic sovereign bonds because of the implied correlation between their risk of distress and their government's probability of default. These tendencies could thus explain the increase in bank domestic sovereign holdings in peripheral countries, along with the reduction in credit supply to privates (credit crunch) and a generalized weakness in the financial sectors.

Regardless of the health of countries where banks are located, there are other interesting aspects that lead banks to hold an amount of sovereign domestic debt larger than the optimal one. Some

of these reasons are stemming from the regulatory prudential framework in which the credit institutions operate.

The first regulatory incentive to hold domestic sovereign debt is related to the capital charges assessment connected to the credit risk evaluation. Stemming from the Basel III accords, the EU Regulation No 575/2013[2] states that banks, in the calculation of their RWA (Risk Weighted Assets) shall impose to their exposures a capital weight ranging from 0% to 150%. This is the so-called Standardized Approach and it constitutes the simplest methodology used by banks to calculate their capital requirements connected to their credit risk. The Standardized Approach prescribes the assignment of a bank's exposures to different classes based on the type of counterparty, the characteristics of the exposure and the manner in which the transaction is carried out. Each class thus defined is then related to different risk weights on the basis of the rating assigned by an independent rating agency. Alternatively, where an eligible credit rating issued by a recognized agency is not available, banks could base on the assessed counterparty's credit quality when assigning the proper risk weight.

To the purposes of this work, the focal point of the regulation is the treatment of the exposures against sovereigns. According to the preferential risk weight principle implied by the Standardized Approach, banks shall impose a 0% risk weight to their exposures to the central governments and central banks of Member States denominated and funded in the domestic currency. Thus, a 0% risk weight could be applied to the domestic sovereign debt holdings denominated in domestic currency.

The preferential risk weight could be applied also by banks which adopt the IRB approach (Internal Rate Base) in the calculation of their risk weighted assets. The Internal Rate Base approach is usually adopted by more sophisticated credit institutions and consists in the use of own internal rating models in the evaluation of the counterparty's creditworthiness. According to the CRD (Capital Requirement Directive) credit institutions that adopt the IRB approach could apply the standardized methodology to their domestic sovereign exposures, as long as these exposures are assigned a 0% Standardized risk weight.

It is worth noting, however, that being the euro area a monetary union the preferential risk weight principle does not lead to a home bias in a strict sense. The preferential treatment of the sovereign debt denominated in domestic currency is extended to most of the euro-denominated debt issued in the European Union. The European regulatory framework for the evaluation of credit risk capital requirements should thus produce incentives for banks to over-invest in Euro-denominated sovereign debt, not solely in domestic sovereign debt.

[2] Also known as CRR (Capital Requirement Regulation).

Connected to the evaluations of credit risk, banks are forced to respect binding capital requirements in order to operate, to better understand this aspect it is useful to introduce the concept of the stabilizing ROA (Return on Assets).

The stabilizing ROA is a theoretical measure corresponding to the required level of profitability that leaves unchanged the capital ratio of a bank from period to period. Supposing that a bank does not issue new shares to increase its capitalization level the periodic changes in its equity could only be due to its profit or losses in that period.

The stabilizing ROA formula[3] gives interesting clues on the aspects on which a bank could operate in order to maintain a stable (and adequate) level of capitalization.

$$ROAstab = \frac{\frac{K}{RWA} \cdot \frac{g}{1+g} \cdot w}{1-d}$$

Where $\frac{K}{RWA}$ corresponds to the level of the Capital Ratio (Supervisory capital divided by the level of risk weighted assets), $\frac{g}{1+g}$ corresponds to the asset growth rate from period to period, $(1-d)$ corresponds to the shareholders' payout ratio. In this context the term w corresponds to the level of riskiness of the assets and is given by the ratio between risk weighted assets and the amount of total assets $\frac{RWA}{TA}$.

As can be seen from the stabilizing ROA formula there are some fundamental relations that a bank needs to take into account: in a world where new capital issuances are not possible a bank that needs to maintain an adequate capital level (or needs to face an increase in its required level of capitalization) has limited options. Considering that it is not easy to increase the level of profitability leaving the other parameters unchanged a bank could undertake the following actions:

- Reducing the growth level of its assets, acting on the parameter $\frac{g}{1+g}$;
- Reducing the payout ratio to the shareholders, acting on the parameter d;
- Reducing the riskiness of their assets, acting on the parameter w.

Taking into account the current regulatory environment, in the aftermath of the financial crisis the last possibility seemed to be the most feasible. The ratio between risk weighted assets and the level of total assets (parameter w) could be softened by shifting a relevant part of the banking activities towards assets which can be assigned a lower risk weight. In this way it become easier to satisfy the binding supervisory capital requirements.

[3] I refer to Beccalli and Poli (2015).

For this reason, in the years following the financial crisis (and, more so, after the sovereign debt crisis) banks with a low capitalization level had great incentives to significantly increase their exposure in sovereign debt that enjoyed the preferential risk weight (equal to 0% of the nominal exposure).
This mechanism is still in place for all the banks which have troubles to respect the minimum capital requirements imposed by the regulatory authorities. In a period characterized by some degree of sovereign stress this incentive become stronger, as happened with the sovereign debt crisis. By expose themselves to risky sovereign debt banks could increase their profits[4] while reducing the risk level of their assets from a "regulatory" point of view.
To conclude, the recent regulatory attempts to increase the financial stability could have a collateral effect. The current supervisory capital regulation could be difficult to be respected, the increase in capital requirements asked for precautionary motives could constitute an additional stimulus to increase banks' sovereign holdings. Overall, this could turn out to exacerbate the potential magnitude of the "sovereign exposure" channel.

The regulatory incentives to hold sovereign debt are not limited to the risk weighted assets computed for credit risk management purposes: another important aspect which affects the behavior of credit institutions is related to the liquidity risk regulation.
According to the Bank of International Settlement definition liquidity risk is the "ability to fund increases in assets and meet obligations as they come due, without incurring unacceptable losses". The liquidity risk is thus typical of leveraged financial institution such as banks, which adopt a maturity transformation activity, funding themselves with short term debt and granting longer term loans.
Basel III regulation has established and introduced the LCR (Liquidity Coverage Ratio), a significant ratio that credit institutions need to respect[5]. The LCR doesn't impose binding capital requirements to be respected (as for the credit risk regulation) but requires to manage the composition of asset and liabilities in a sustainable manner.
The scope of the LCR is to ensure that a bank holds enough HQLA (High Quality Liquid Assets) in order to cover on an ongoing basis a significant stress scenario on the required cash outflows. In this framework the High-Quality Liquid Assets are defined as those financial assets that can be easily and immediately converted into cash without incurring in losses of value due to a lack of liquidity of the instrument.
In order for an instrument to be included into the eligible stock of High-Quality Liquid Assets it must respect some fundamental and market-related characteristics. In particular High-Quality

[4] Either from higher interest rates, or from changes in the market value of the sovereign debt in their balance sheets.
[5] Basel III has also introduced the NSFR (Net Stable Funding Ratio), a minimum requirement to promote incentives for banks to fund their activities with more stable sources of funding.

Liquid Assets should have a low risk and a low correlation with other risky financial assets, they should be traded on a developed and recognized exchange and their pricing formula must be certain and straightforward. In addition to that the market in which a potential High-Quality Liquid Asset is traded must be active and sizable, it should have a low volatility and should show a tendency to benefit from a flight to quality phenomenon. According to these features, the regulatory authority established that sovereign debt securities issued in domestic currency could be included in the "Level 1" category[6] of HQLA, the best classification in terms of liquidity. The necessity to cope with the current regulation on liquidity risk is thus another incentive to hold a significant amount of domestic sovereign debt.

In addition to this, there could be an additional stress transmission mechanism in case of sovereign stress. Sovereign paper is indeed frequently used as collateral in liquidity enhancing transactions (as, for example, repos). In the event of a shock on the price of the related government bonds larger haircuts on the transaction could be required, forcing the bank to encumber a higher amount of assets. Moreover, a sharp worsening in the creditworthiness of a sovereign could trigger a margin call for the transactions already collateralized with instruments issued by that government.

Related to the liquidity management, it is also worth mentioning the fact that government paper is granted preferential treatment when used as collateral in Central Bank refinancing operations. This constitutes a further stimulus for credit institutions to hold a significant amount of government bonds in their balance sheets.

2.1.2 Understanding the safety net channel

Until the introduction of the Bail-in regulation in Europe banks used to enjoy a set of government implicit and explicit guarantee arrangements which were designed to preserve the financial stability. Nowadays, granting state aids to financial institutions facing difficulties is less straightforward. The BRRD imposed stringent conditions and designed standard recovery and resolution procedures, which will be described in the third chapter.

Conversely, prior to the BRRD regulation a set of government backstops and guarantee was in place. The scope was to provide a safety net against the spread of panic and the possibility of bank runs with contagion effects among financial institutions. Within this scope, the typical banking system bailout program comprised the provision of explicit and implicit guarantees in the form of deposit guarantee schemes, explicit guarantees on non-deposit debt (bank bonds) and troubled assets purchase programs.

[6] According to the current regulation HQLA are divided in "Level 1" Assets (the category which comprises the most liquid assets), "Level 2A" and "Level 2B" assets (which are included in the stock of HQLA with a haircut). Level 2 assets can only comprise up to 40% of the overall stock of HQLA after these haircuts are applied.

With the exacerbation of the financial crisis bank bailouts and other related state aids constituted a huge burden in terms of fiscal costs. Governments from all over the world adopted massive fiscal interventions[7] in order to preserve and restore the financial stability and the trust in the financial system. Considering the European framework, the EU commission needed to approve € 3.89 trillion in state aid measures for guarantees to liabilities of financial institutions between October 2008 and 2014. This amount corresponds to 29.8% of EU GDP in 2013. Moreover, several public recapitalization measures were authorized, until 2013 € 448 billion were granted to European credit institutions. Overall, these measures contributed to the steady increase in the general government debt in the Euro Area.

The size of the banking sector constituted another source of instability: in many European countries the total banking assets were much higher with respect to the GDP of their host country. Even if, as shown by the ECB report on financial structures, the ratio of banking sector assets to GDP had been falling from 2008 to 2016, much of the national banking sectors still totalizes assets above 150% of their countries GDP. In this situation, a government guarantee to cover the losses arising from a generalized banking crisis could inevitably lead to a sovereign default. Indeed, the size of the state aid would be too high to be covered through taxation or public debt increases.

According to these views, while bailouts could translate in the alleviation of present distortions in the financial sector, they present drawbacks for a variety of reasons.

First, a large bailout is often translated into a steady increase of the sovereign risk. The worsening in the sovereign creditworthiness reduces the price of government paper and is in turn reflected into the activation of the "sovereign exposure" channel. In other words, a large government expenditure targeted to save a failing financial institution is immediately impaired by a reduction in the market value of the domestic debt in the bank's balance sheet.

Moreover, the increase in sovereign yields is translated into a shock for all the investors exposed towards that government. A large bailout brings thus to a dead-weight loss imposed both to the financial and the non-financial sector (including private investors), the more the country shows the features of the "home bias" phenomenon the more the collateral damage will hit the domestic economy.

Along with the "sovereign exposure" feedback effect, public bailouts present another problem. The large public expenditure connected to them needs to be partly financed with an increase in the taxation. Under normal circumstances higher taxes lead to a slowdown in the overall economic activity, with round effects on the bank profitability. This is the macroeconomic channel, the third path of propagation of the sovereign bank nexus. In the next paragraph I will present it with a deeper focus.

[7] All the following data are taken from the European Commission's State Aid Scoreboard.

On the other side, a worsening in the fiscal position of a government, by reducing its expenditure capacity, will impair the implicit value of the protection granted to the financial system. Without a credible public backstop, funding costs for banks are likely to increase. The deterioration of public finances could thus feed the safety net channel, hurting the financial stability.

As an additional element there's the need to consider the role played by banks with a significant public ownership, as German Landesbank. The peculiarity of these type of institution, which ties up banks and sovereigns even closer, strengthen this channel. The case of bank with public ownership could be considered as an extreme case of Sovereign-Bank Nexus, in which the relationship between sovereign and financial risk is even closer.

2.1.3 Understanding the macroeconomic channel

The contractionary effects on the overall economic activity manifest themselves both from negative shocks originating from an increase in bank credit risk and in case of a deterioration of the sovereign creditworthiness. The associated macroeconomic slowdown has in turn a second round of effects, with the potential of activating the other risk transmission channels.

In case of an increase in sovereign risk there could be the need for a fiscal consolidation, which could be reached through a higher taxation level or with a decrease in the government expenditure. A weaker government fiscal position is also typically associated with an increasing degree of political (and policy) uncertainty. Overall, the consequent economic downturn leads to an increase in the non-performing exposures in banks' balance sheets, impacting the financial stability. In addition, a higher level of sovereign yields negatively impacts the national economic activity, by causing higher interest rates on corporate bonds and on the loans issued by banks.

On the other side, the propagation mechanism is active also in case of shocks arising at a bank level. Along with a credit crunch phenomenon, banking crises will unavoidably lead to a downturn in the real economic activity, which is likely to decrease the government's tax revenues. An unhealthy credit system could also impair the smooth functioning of the monetary policy.

Moreover, an idiosyncratic crisis of a single bank could have a domino effect caused by the interconnectedness of the financial system. Banks are indeed highly exposed towards other credit institutions through loans, cross securities holdings and through their transactions in the interbank market.

Negative news about the credit system could also damage the trust of the investors and depositors. The spread of panic could trigger a bank run, inducing depositors to withdraw in mass as in a bad equilibrium à la Diamond and Dybvig (1983).
As an additional element of concern several studies[8] have shown that when a recession comes together with a banking crisis the associated economic downturn tends to last longer and to be tougher. The economic recovery subsequent to a banking crisis is thus likely to be slower.

To summarize, the macroeconomic channel is probably the most complex one, since it affects and is affected by a large number of factors. Consequently, it is not possible to independently assess the effects connected to the single propagation mechanisms thus defined.

The analysis conducted in this chapter shows that the Sovereign-Bank Nexus manifest its effects in a variety of ways, there are various relationships in place at the same time.
The behavior of the contemporaneous risk transmission mechanisms could be quite unpredictable, a small shock could translate in a self-reinforcing loop with disruptive effects on the financial sector and the public finances.
Addressing the problem is thus not straightforward, a variety of solutions has been proposed. The next chapter will analyze the regulatory attempts to cope with the various channels, describing in depth the Banking Recovery and Resolution Directive. This regulation, in particular with the Bail-in provision, should have a relevant effect on the safety net transmission channel.

[8] IMF (2009); Jordá, Schularick, and Taylor (2016); Abiad, Dell'Ariccia, and Li (2011).

3. Dealing with the Sovereign-Bank Nexus

As I argued in the previous chapter, the Sovereign-Bank nexus operates through various channels which interact each other, bank and sovereigns are thus linked with multiple complex relationships.

As a consequence, each measure intended to deal with the phenomenon needs to be designed and evaluated from a holistic point of view. While a specific regulation could successfully curtail the risk transmission through a single channel, it could also produce unintended negative consequences on the others. Consequently, to successfully slash the nexus the regulatory authorities must promote the resilience of the financial system, reducing the likelihood of a severe financial distress and the potency of the various risk transmission mechanisms in place.

This chapter investigates the various policies adopted by the regulatory authorities in order to deal with the Sovereign-Bank nexus, namely the creation of a Banking Union, the increase in the bank capital requirements (CRR/CRD IV) and the adoption of extraordinary monetary policies by the ECB. I will focus mainly on the implementation of the BRRD regulation and the Bail-in provision. I will also describe the proposal to create a European Safe Asset through the adoption of Sovereign Bond-Backed Securities.

3.1 The Banking Union and its pillars

One of the reasons why the Euro Area was severely affected by the financial crisis was related to the fact that different countries applied different standards when assessing their banks. In that situation problems related to the Sovereign-Bank Nexus in one country could easily spillover to other European countries, causing a generalized financial distress.

Consequently, the Banking Union[9] is deemed to provide a harmonized and consistent application of the EU banking rules in the participating countries[10], with the purpose to make the European banking system safer, more homogenous and more transparent. The centralization of powers is likely to restore confidence in the Euro, with a long-term view of a further economic and fiscal integration. The new framework has led to the shift of the responsibility for the banking policy from a national to a supranational level.

The Banking Union is based on the Single Rulebook, a set of harmonized prudential rules which constitutes a unified regulatory framework.

Among the others, the Single Rulebook comprises the Banking Recovery and Resolution Directive (BRRD), the Deposit Guarantee Scheme Directive (DSGD), the Capital Requirement Regulation (CRR) and the Capital Requirement Directive (CRD IV).

[9] The term "Banking Union" has not a legal or official definition, it generally refers to the shift of banking-sector policy instruments from a national to a centralized level.

[10] Participating countries are all the euro area countries and the non-euro countries who choose to participate by "opting-in".

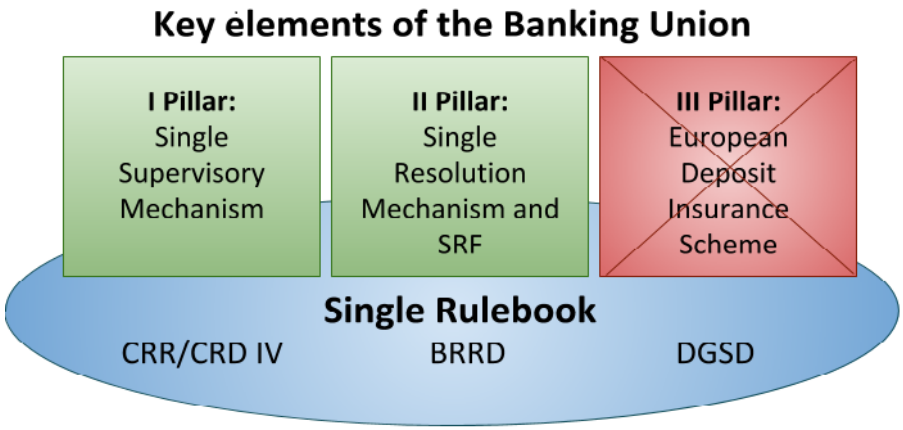

Figure 3.1, the three pillars of the European Banking Union.

All these measures influence the financial stability in Europe, with the potential to reduce the Sovereign-Bank Nexus. Establishing a harmonized legal framework across European countries is indeed likely to reduce financial vulnerability, mitigating the connection between banking and sovereign risk.

3.1.1 The Single Supervisory Mechanism

The Single Supervisory Mechanism is considered the first pillar of the Banking Union, it refers to the system of banking supervision in Europe and it comprises the ECB and the National Supervisory Authorities of the participating countries.

It has been approved in October 2013 and it is active since November 2014, nowadays the ECB is thus responsible of the direct supervision of Significant Institutions[11]. National Supervisory Authorities (NCAs) are still in charge of the supervision of the Less Significant Institutions, in close cooperation with the ECB.

The SSM provides a uniform approach to the banking supervision. It is thus aimed at increasing the trust in the European banking system, ensuring a consistent banking supervision among member states. By increasing the financial integration among countries, the SSM should promote the safety and soundness of the European banking system.

Even if the SSM mechanism is not designed to directly tackle the problem of the relationship between sovereign and banking risks it should increase the stability of the financial system, ensuring a level playing field through a sound supervision.

In addition to that, the European banking supervision was considered, according to Mario Draghi's words[12], as "…an essential precondition for the other pillars of banking

[11] As of 14 December 2018, the list of SI comprises 119 entities and it is available in the ECB website.
[12] Foreword on the European Central Bank ECB Annual Report on supervisory activities.

union". The SSM is thus deemed as the first step in the process of banking and financial integration among European member states.

3.1.2 The Single Resolution Mechanism, the BRRD and the Bail-in provision

The Single Resolution Mechanism constitutes the second pillar of the Banking Union, it establishes common rules and standards for banking resolution in Europe.

According to the SRM Regulation, fully operational since January 2016, the Single Resolution Board (SRB) is responsible to manage bank resolutions[13] and it can decide on the application of the various resolution tools and on the use of the Single Resolution Fund (SRF).

The final purpose of SRM is to ensure the efficient resolution (or the failure) of a credit institution, a bank insolvency should thus not translate anymore into large costs for the economy and for the taxpayers.

The SRM has been provided with a sort of financial arm, the Single Resolution Fund. The SRF is a centralized pool of financial resources, composed of contributions from credit institutions located in the countries participating in the Banking Union. The contribution fee paid by each credit institution is proportional to its size and the risks it has taken.

The scope of the SRF is to ensure the efficient application of resolution tools[14], it provides an insurance mechanism which should absorb idiosyncratic bank shocks. At the time of writing the SRF is still being gradually building up, by the end of 2023 it shall reach its target level, corresponding at least to 1% of the covered deposits held by all credit institutions within the Banking Union. As of July 2019, the Single Resolution fund measured around € 33 billion, with a cash injection of € 7.8 billion received during 2019[15].

The SRF should not be considered as a bailout fund, indeed it is a last resort measure which can be used solely to ensure the effective application of the tools within a resolution procedure.

The SRM Regulation is complementary to the Banking Recovery and Resolution Mechanism (BRRD) and it creates a uniform institutional framework for its application.

In order to better understand the rationale of the BRRD it is useful to consider that it was issued as a response to the global financial crisis. The crisis revealed indeed a set of problems related to the financial regulation: the difficulties for institutions to react to a distressed banking sector were essentially due to the insufficient tools available to them.

Developing a comprehensive banking recovery and resolution regime has thus become a priority, the regulatory efforts have led to the issuance of the 2010 Dodd-Frank Act in the US

[13] The SRB is responsible to manage the resolution of the Significant Institutions and the cross-border banks. The responsibility of the resolution for the less significant banks falls within the NRAs (National Resolution Authorities).
[14] I will explain the functioning of the four resolution tools in the following paragraphs.
[15] These data are available on the SRF website.

and the 2014 BRRD in the EU[16]. Both these measures are based on the "Key Attributes of Effective Resolution Regimes for Financial Institutions" established by the Financial Stability Board on October 2011.

The BRRD aims to provide a framework to manage bank failures effectively, without compromising the financial stability in the system and without relying on public funds. The minimization of the impact on the real economy is a further goal. The key objectives of the BRRD are explicitly defined as:

- Ensuring the continuity of the bank's critical functions;
- Avoiding significant adverse effects on the financial system;
- Minimizing the reliance on extraordinary public funds;
- Protecting insured depositors, clients' funds and assets.

It appears clear that these objectives are much broader than the ones followed by the traditional insolvency procedures, which are aimed at the protection of creditors and at the maximization of the value of the liquidation.

One important novelty introduced by the BRRD is the resolution plan (Art. 10-14 BRRD).

The resolution of a financial institution consists in its restructuring, at a stage prior to its liquidation, through a process managed by the independent resolution authorities. The implementation of a resolution plan should prevent the immediate closing of the financial institution, ensuring the continuity of its critical functions. The final scope is thus to restore the viability of all or part of that financial institution, while any part which cannot be made viable again is liquidated through the normal insolvency procedures.

The conditions required in order to activate the resolution process are established in Article 32 of the BRRD. Namely, the resolution shall start if the bank is FOLTF[17] (failing or likely to fail) and there are no other private sector measures which can restore the bank viability within a reasonable timeframe. In addition to that the "public interest" requirement must be respected[18], where this condition is not met the ordinary insolvency procedures are applied and the bank's distress is managed at a national level. It is worth noting that the insolvency procedures are not yet harmonized at a European level, so each national regulation establishes different schemes and objectives when dealing with a failing institution.

In the carrying out of the resolution process, the BRRD regulation provides to the resolution authorities a series of powers and measures, which are called "resolution tools".

[16] The BRRD is active since January 2015 while the Bail-in provision has been introduced in January 2016.

[17] A bank is deemed failing or likely to fail if at least one of the following conditions is met: the liabilities exceed the assets, the bank infringes the requirement for continuing authorization, the bank is unable to pay its debts when they fall due or if extraordinary public financial support is required. The FOLTF is knowingly vague, in order to give to the resolution authority the discretion to intervene early enough.

[18] According to SRB guidelines, the public interest requirement is met only if the "winding up of the bank under normal insolvency proceedings would not meet to the same extent the resolution objectives as defined in the BRRD".

There are 4 resolution tools, which can be used individually or in combination with other measures. I will provide an explanation for each tool focusing on the Bail-in provision, which is the most relevant for the scope of my empirical analysis.
The first three measures could be grouped under the category of the transfer tools, since all of them is based on the transfer to a third subject of part of the bank businesses, carried out in different technical ways.

Figure 3.2, the BRRD regulation established 4 resolution tools available to the resolution authority.

The sale of business tool (Art. 38-39 BRRD / Art 24. SRM) gives to the resolution authorities the power to sell the bank (or part of it) to a private buyer (or a group of buyers). The transfer could comprise every part of the institution under resolution: shares and other instruments, each type of marketable assets, rights and liabilities. An important feature is the fact that the transaction could be carried out also without the approval of the shareholders, the only limitation imposed is that it must be conducted on "commercial terms".

The bridge institution tool (Art. 40-41 BRRD / Art. 25 SRM) aims to maintain the continuation of the critical functions of the bank under resolution. This tool consists in the creation of a temporary bridge institution (bridge bank), controlled by the resolution authority, to which a set of assets, rights and liabilities are temporary transferred. Also in this case the transaction must be based on commercial terms. The bridge bank is thus a publicly owned company created

in order to take the necessary time (theoretically, up to 2 years) to find the best private sector solution in case of a complex bank resolution. The bridge bank is managed with the aim of continuing the bank critical functions in view of a subsequent sale in the market.

The last transfer tool is the asset separation tool (or bad bank tool, Art. 42 BRRD / Art. 26 SRM). In this case the transfer comprises impaired assets, rights and liabilities to a bad bank (a publicly owned asset management vehicle).
The scope of the AMV is to manage the liquidation of the failing bank, maximizing the value which could be retrieved from the transferred assets. Through the creation of a bad bank the activities could be gradually wound down or liquidated in a proper manner. The asset separation tool could also give to a distressed bank some relief by removing from its balance sheets part of the bad assets and the risks connected to them. A peculiarity of the asset separation tool is that it can be used only in combination with another tool.

The most permeating novelty introduced by the BRRD is however the Bail-in tool (Art. 43-55 BRRD), active since the beginning of 2016. This provision gives to the resolution authority the power to allocate the losses of a failing bank to their owners and creditors, minimizing the costs imposed to taxpayers.
There is thus a striking difference with respect to the previous framework: banks don't enjoy anymore the implicit safety guarantee given by public bailouts. Under the Bail-in provision losses are covered either converting part of the liabilities into common equity instruments or by writing down (or writing off) the principal amount of these instruments. Such liabilities could be used to absorb losses even if they were not originally designed to cover them outside of an insolvency procedure, as in the case of subordinated bonds.
The bail-in losses are imposed to capital instruments and liabilities according to a specific hierarchy, which should reflect the priority applicated in traditional insolvency proceedings. Shareholders are the subjects who are initially required to cover the losses, Common Equity Tier 1, Additional Tier 1 and Tier 2 are thus the first instruments to be written off.
If the capital instruments are not enough the subordinated creditors are the second set of subjects which are required to absorb the losses. Finally, the Bail-in cascade ends with the inclusion of senior unsecured liabilities, such as uncovered senior debt and uninsured deposits.
The Bail-in tool follows the penalty principle, the costs connected to a bank distress are shifted where they belong, they are thus sustained by bank's shareholders and creditors.
In principle, every liability could be bailed in, unless the BRRD regulation expressly excludes them. Among the excluded instruments the most relevant are:

- Covered deposits, deposits up to the amount covered by a Deposit Guarantee Scheme (DGS), currently corresponding to € 100,000;
- Employee remuneration, salaries and benefits (other than bonuses and variable remuneration);
- Liabilities to other financial institutions with an original maturity of less than seven days. This is a particularly important exclusion, considering the features of the interbank market;
- Liabilities to tax and social security authorities;
- Secured liabilities, up to the amount covered by the collateral value. If a collateral has a value lower than the liability secured, the difference could be used to absorb losses.

In order to better understand how the Bail-in works it is useful to consider an example. I refer to the Bail-in simulation carried out by A.C. Hüser et al. (2017). In particular, I consider a bank with a required CET1 ratio of 10% and no Additional Tier 1 and Tier 2 capital requirements. The shock considered is a 5% shock to total assets, equal to a loss of 5, illustrated in Figure 3.3.

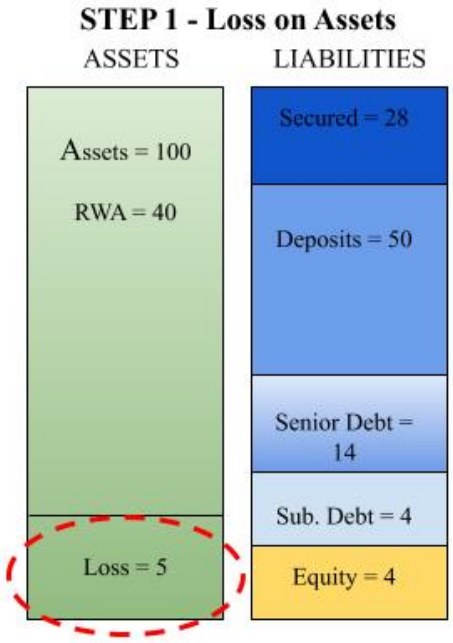

Figure 3.3, First step of a hypothetical Bail-in procedure: a bank with an equity equal to 4 has registered a loss equal to 5.

In order to cover the losses, following the Bail-in priority rule all equity and part of the subordinated debt must be written down. The loss of 5 will be thus covered through 4 of equity and 1 of subordinated debt. The theoretical situation after the coverage of losses is described in Figure 3.4.

As a third step, there's the need to recapitalize the bank in order to reach a capitalization of at least 10% of the Risk Weighted Assets amount. Following the loss absorption, the level of

subordinated debt is only 3. To reach a level of equity equal to 4 it is then necessary to convert all the subordinated debt and a little part (equal to 1) of the uncollateralized senior debt.
After the recapitalization the subordinated creditors will hold an amount of equity equal to 3, while they will be partially diluted (haircut) for the remaining amount of 1. The shareholders will be fully diluted while the senior creditors will be partially converted into shareholders.

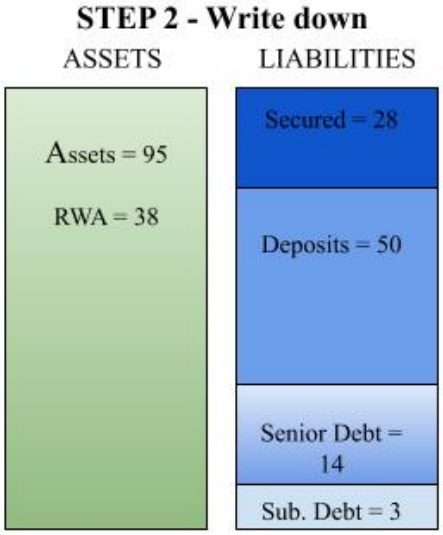

Figure 3.4, Second step of a hypothetical Bail-in procedure: equity and some subordinated debt are written off.

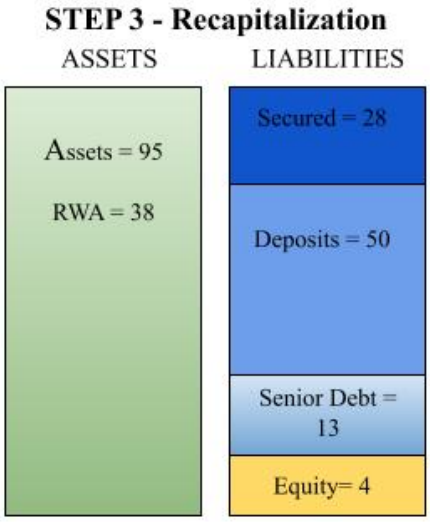

Figure 3.5, Last step of a hypothetical Bail-in procedure: recapitalization of the institution.

A further general condition which a loss absorption process needs to respect is the NCWO (No Creditor Worse Off) principle. The NCWO is a general key principle of the BRRD, addressed to the protection of creditors, which applies to all resolution cases. This requirement can become particularly binding in case of use of the Bail-in tool. Referring to the EBA definition the NCWO requires that "no creditor or shareholder shall incur greater losses than they would have incurred if the institution had been wound up under normal insolvency proceedings". Since each country has its own insolvency law, assessing the NCWO is not straightforward.
In order to ensure that every bank has a sufficient-loss absorbing capacity in terms of capital and liabilities (bail-inable instruments), the BRRD has introduced the MREL[19] concept (Art. 45 BRRD). This consists in a regulatory ratio[20] that requires credit institutions to proper manage their passive side of the balance sheet. The MREL requirement is in place to permit an orderly bank resolution with the implementation of an effective Bail-in procedure, avoiding contagion effect and the reliance on public funds.

[19] Minimum Requirement for own funds and Eligible Liabilities.
[20] The MREL is expressed as the ratio between the own funds plus the eligible bail-inable liabilities and the total own funds and liabilities of the credit institution. The BRRD doesn't require a harmonized minimum level but the requirement is set on a case by case basis by the resolution authority.

Overall, the Bail-in tool is a very powerful instrument in the hands of the Single Resolution Board. When considering the problem of the Sovereign-Bank Nexus this provision is likely to curtail the "safety net" channel, by ensuring that no exceptional public expenditure is required when dealing with a failing bank.

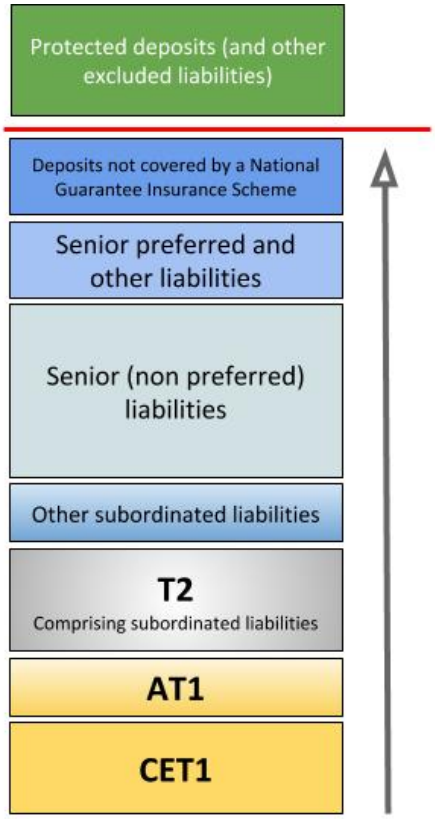

Figure 3.6, The hierarchy of Bail-inable instruments.

The BRRD regulation, however, doesn't completely exclude public aid when dealing with a distressed credit institution. Under the resolution procedure the BRRD establishes an internal loss-absorption threshold of 8% of liabilities (or 20% of Risk Weighted Assets), shareholders and creditors must bear losses up to that amount prior to the possibility to grant financial help from external sources. In this case, the SRF[21] may contribute for an amount up to 5% of the bank's liabilities.

Moreover, the BRRD prescribe the possibility to grant state aid in a strict sense under two circumstances. In either case, the use of taxpayers' money is limited through the full "burden sharing" principle, established in the 2013 Banking Communication on state aid[22]. This

[21] The SRF use do not constitute a state aid since the fund is financed by all the credit institutions in the Banking Union.
[22] The 2013 Banking Communication is an important part of the framework, since it establishes the condition to apply state aid measures to deal with distressed financial institutions. The state aid rules apply regardless of the procedure which is being followed (Resolution under BRRD, normal insolvency procedure or precautionary recapitalization).

principle prescribes that before any public intervention all other internal capital-generating measures must be achieved, with the absorption of losses up to the subordinated-debt level.

As a first circumstance, if the resolution procedure is carried to solve a systemic crisis, public support could be granted in the form of government stabilization tools[23] (funding guarantees, recapitalizations or asset relief measures). This is a last resort intervention aimed to preserve financial stability. The adoption of these measures is permitted only to prevent serious disturbances in the economy. The state aid granted must be limited to the minimum necessary amount, in order to minimize the possible competitive distortion between banks.

The BRRD regulation prescribes another circumstance under which state aid could be granted, this is the case of the precautionary public recapitalization of a solvent bank (Art. 32 BRRD). According to the World Bank BRRD Guidebook, a precautionary public recapitalization is "the provision of temporary public financial support to an otherwise solvent bank to cover the shortfall identified under the adverse scenario of a stress test in order to remedy a serious disturbance in the economy and preserve financial stability." This type of state aid could be granted without triggering a resolution process. Also in this case the public expenditure must be limited to the minimum necessary, in order to circumvent any distortion in the internal market and to avoid negative effects on public finances. The precautionary public support transaction can take various forms, such as a guarantee to liquidity facilities provided by central banks (ELA[24]), a guarantee on newly issued liabilities or measures involving capital instruments. The possibility to grant state aid under the precautionary recapitalization option is available only to banks which are deemed solvent (not FOLTF), the State support shall be temporary and shall not be used to offset losses which the institution has incurred or will incur in the future. According to the BRRD rules a bank's restructuring plan must also be submitted and approved prior to the implementation of any precautionary state aid measure. It is important to stress the fact that the precautionary recapitalization is an exceptional measure and its implementation is conditional on the approval of the EU commission.

In addition to the BRRD provisions, the national insolvency procedures could prescribe the possibility to grant additional state aid measures. However, these prescriptions must be compliant with the above-mentioned "burden sharing" principle.

[23] Art. 56-58 BRRD.

[24] Emergency Liquidity Assistance.

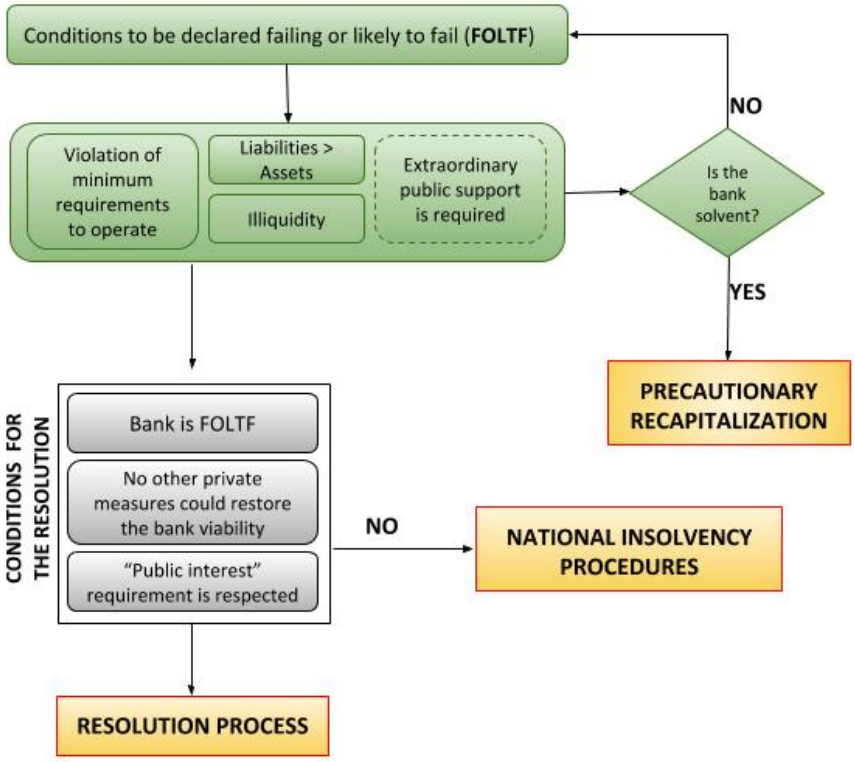

Figure 3.7, A conceptual map to deal with the distress of a financial institution.

The BRRD is a comprehensive directive, which regulates a large set of measures and instruments to deal with the difficulties which could be faced by credit institutions. Accordingly, the recovery plan (Art. 5-9 BRRD) and the Early Intervention Measures (Art. 27-30 BRRD) are regulated by the BRRD. While discussing in detail these measures is outside the scope of my research, it should be noticed that both of them are under the responsibility of the supervisory authority. Consequently, the BRRD draws a clear line of responsibility between the supervisory and the resolution authorities. In particular, the resolution authority takes over only if the bank is facing a fierce financial distress and its failure seems inevitable (FOLTF).

Overall, the BRRD constitutes a very complex framework. A bank distress could fall within different cases, from the winding up of the institution through the national insolvency procedures to the resolution carried out by supranational authorities, passing for the various early intervention possibilities.

As pointed out by Troeger (2017), the directive establishes a multitude of exceptions, counter-exceptions and restrictions, this empowers the competent authorities with a high degree of discretion. Consequently, the proper functioning of the crisis management process depends on the close cooperation between the various subjects involved, with the problem of information sharing across jurisdictions.

These ambiguities could lead to unpredictable outcomes, which could impair the effectiveness of the whole regulation. Every situation of financial distress is indeed managed on an *ad-hoc* basis, leaving room for political pressures by the national authorities in order to reach their most desired outcome. There is thus a regulatory trade-off, the need to cope with a variety of banking crises in different context requires a high level of flexibility, the related discretionality allows the national political authorities to exercise their moral suasion powers.
The various regulatory uncertainties related to the BRRD could also undermine the assessment of risks involved in the bank capital investments, impairing the correct market pricing of the various instruments issued by the banks.

A further critical issue relates to demand side of the capital instruments subject to Bail-in, a sound banking policy should require the monitoring of the types of subjects who hold the bail-inable assets.
An investor who holds these kinds of instruments should indeed be aware of the risks connected to them, she should be financially literate and should be able to bear the losses which can arise from the possible dilution of their holdings.
Unsophisticated investors, such as households, usually invests a large fraction of their wealth in few instruments. If many retail investors choose to hold a large fraction of bail-inable instruments, a Bail-in procedure could spark negative trust, social and psychological consequences. The fear for a high political price could induce the governments to try to undertake bailouts, granting state aids through pressures on the resolution authorities, impairing in this way the BRRD expected effectiveness.
Moreover, a sophisticated investor has the skill to correctly price the risk which has taken. Indeed, if a large part of the bank capital is hold by unsophisticated subjects the pricing mechanism could not work properly.
In addition to that, Institutional investors in bail-inable instruments should not belong to the banking sector. Cross-holdings in the banking industry could trigger a contagion effect that could lead to a systemic crisis.
At the time of writing there are not restrictions, set by prudential regulation, which effectively prohibits to credit institutions the sale of their bail-inable instruments to unaware retail investors. The only limitations in place are set by the MIFID II regulation[25], which has recently introduced multiple new provisions with the scope to strengthen the protection of retail investors. The problem of the retail holdings of bail-inable instrument is thus linked with the various aspects of consumers' protection. The MIFID directive shall ensure that financial instruments are distributed to compatible clients according to a suitability test. Moreover, with

[25] Markets in financial instrument directive (2014/65/EU), valid since January 2018.

respect to the outstanding bail-inable instruments, MIFID II requires institutions to provide to the holders complete and updated information of the potential treatment of their investments in case of resolution or insolvency.

Despite these efforts, the retail holdings of bail-inable instruments still constitute a large fraction of the total banking sector issuances, especially in some countries. As of Q3 2017, according to the elaborations by EBA and ESMA[26], banking debt securities held by European retail clients constitutes € 262.4 billion, 12.7% of the total outstanding nominal amount.

Considering the Country of issuance, debt held by European retail clients issued from Italian banks constitutes a large fraction of the total senior and subordinated outstanding debt, summing up to a nominal amount of € 132.3 billion. Measured as a fraction, the retail holdings consist in 36.9% of the total outstanding debt, this is a remarkable amount corresponding to 3.4% of the Italian banking sector total assets. Considering solely Italian subordinated debt, retail holdings held by European investors sum up to around € 20 billions. Italy represent a unique case among the biggest European countries, the only comparable figures are found for Austria, where retail investors constitutes 35.8% of the banking subordinated and senior debt issuance.

As for the other big European countries, the most relevant holdings of retail debt are found for the German and French banking sectors, with € 49.4 billion and € 31.7 billion respectively.

The retail holdings of bail-inable instruments have the potential to cause huge negative consequences, especially in the case of institutions closely rooted in a region, where concentrated losses[27] imposed on retail holders and the other socioeconomic consequences connected to a bank distress sum up. This happened, for example, in the cases of the resolution of the 4 regional banks in Italy in November 2015[28]. According to the Bank of Italy figures the losses imposed to shareholders and subordinated creditors amounted to € 870 million, many of them have suffered the loss of much of their savings.

According to these figures, imposing some degree of holding restriction could increase the effectiveness of the BRRD. A comprehensive intervention, by minimizing the distortionary effects associated to the Bail-in tool application, could indeed improve the credibility of the whole directive on the markets.

An additional element which could constitute a weakness of the new comprehensive resolution framework is connected to the size of the Single Resolution Fund. The fund has indeed a limited

[26] Data taken from the "Statement of the EBA and ESMA on the treatment of retail holdings of debt financial instruments subject to the Bank Recovery and Resolution Directive".

[27] It is important to consider the fact that the distribution of retail holdings among the investors is not uniform and some savers could be significantly exposed towards an institution.

[28] The four banks were Cassa di Risparmio di Ferrara, Banca Marche, Banca Popolare dell'Etruria and Cassa di Risparmio di Chieti. Actually, the BRRD was implemented with a legislative decree (D.lgs. 180/2015) ratified one week before the resolution of these institutions.

capacity, which prevents it from effectively cover the possible costs related to a systemic crisis. While the fund is suitable to face idiosyncratic shocks (small banking crises) a large financial distress (as happened in 2008) could require much more resources to be managed. This could be a major concern since, as argued by White and Yorulmazer (2014), bank crises do not uniformly distribute over time but tend to happen together in the same period.
Additionally, the overall credibility of the SRF could be hindered by the fact that it doesn't enjoy a public backstop system. This constitutes a great difference with respect to the US financial system, where the FDIC (Federal Deposit Insurance Corporation) is fully covered by the backstop of the Treasury support.
To face this flaw, the solution adopted by the European authorities is to require banks to build a suitable set of liabilities, ensuring that they could be solved without being backed by the use of public (or other institutional) funds. MREL and TLAC[29] (Total Loss Absorbing Capacity) are thus the two minimum requirements which should ensure the effective application of Bail-in.

Regardless of the various weaknesses of the new resolution framework, the second pillar of the Banking Union is the most important solution which has been adopted in order to solve the Sovereign-Bank Nexus problem. In the next chapter I carry out an empirical analysis to determine whether the implementation of the BRRD, in particular with the Bail-in provision, effectively contributed to the alleviation of the nexus.

3.1.3 The European Deposit Insurance Scheme

The last objective of the Banking Union is to promote a uniform insurance cover for retail depositors, so as to avoid the possibility of a bank run. In case of a bank distress a mass withdrawal of deposits could indeed lead to additional financial instability problems, an effective deposit guarantee constitutes a backstop to this risk.
Following this reasoning, in November 2015 the European Commission proposed to set up a European Deposit Insurance Scheme (EDIS) for banks' deposits inside the Euro Area. In the intention of the regulator this should be the third pillar of the Banking Union, being a fundamental step towards the process of European financial integration.
At the time of writing the EDIS has not yet been approved, since there are various national interests in place it will be difficult to reach an agreement. The core countries are indeed reluctant to pool their risks together with countries with a weaker and riskier financial sector,

[29] While the MREL is regulated under the BRRD (Art. 45) the TLAC has been established by the FSB on November 2015. It should ensure the improvement of the loss absorbing capacity in the G-SIBs in case of resolution. Its scope is to face the "too big to fail" (and "too big to be saved") problem. Accordingly, MREL must be respected by all banks located in the participating countries while TLAC is binding only for G-SIBs.

being the creation of a uniform deposit insurance mechanism prone to the cross-subsidization problem.

Currently, deposit guarantee schemes are organized at a national level, with the DGSD[30] setting minimum standards to be respected. According to the EU rules every national deposit guarantee scheme should cover € 100,000 per depositor[31] and must be funded entirely by banks, without relying on public money. The DGSD tries to ensure a minimum level of harmonized protection for depositors, issuing also a mandatory list of the types of protected deposits.

However, being the various insurance schemes confined at their national levels, their limited capacity could make them vulnerable to large scale shocks. In the case of failure of a systemic credit institution a national guarantee scheme could not be enough to cover all depositors' losses. Consequently, the shortfall must be funded by relying on public funds, with the potential to ruin the fiscal position of that country. Accordingly, the level of confidence of a bank's depositor could depend on the bank's location. This could constitute a further element linking a banking sector to its sovereign, worsening the Sovereign-Bank Nexus.

Any divergence between national deposit guarantee schemes, substantial or perceived, could be an obstacle to the European financial integration process, since it exacerbates the market fragmentation across countries.

A European Deposit Insurance Scheme would address these problems, by promoting a stronger and more consistent protection of depositors. A centralized deposit insurance framework provides the full protection of depositors, regardless of where they held their money inside the Banking Union. Thanks to the pooling of risks and a larger set of financial resources the EDIS would be suitable to handle potential systemic shocks, which would otherwise exceed the capacity of the single national schemes and consequently require the use of public money. Overall, the financial system would be more resilient to large shocks. EDIS would help to minimize the level of deposit withdrawn in case of adverse shocks, leading to a sharp reduction in the likelihood of liquidity problems.

The proposal by the European Commission, published in November 2015, entailed the introduction of the European deposit scheme through a process lasting around 8 years and composed by various stages. The target size was identified at 0.8% of the total covered deposits inside the Euro area[32]. Carmassi et al. (2018) showed that a similar amount would be enough to cover losses on covered deposits related to events even more serious than the 2008 financial crisis.

[30] Deposit Guarantee Scheme Directive, adopted in 2014.

[31] The DGSD protects depositors, not deposits. This means that two subjects who have a joint account are protected for an amount of € 100,000 each. Similarly, a subject who holds more than one account will enjoy a protection up to that amount.

[32] According to the EU Commission factsheet, based on data from 2011, this amount corresponded to € 43 billions. The target level is proposed to be dynamic; this means that the amount of the fund increases proportionally to the growth of the banking sector.

To promote a fair insurance mechanism, the banks' contributions to the insurance fund would be proportional to the risk taken by each bank with respect to the other credit institutions inside the Banking Union.
After the European Deposit Insurance Scheme will be fully operational, reaching its target level, the EU commission proposal states that the single national funds will continue to stay in place. They will act as a contact point between depositors and banks, with the responsibility to manage the pay-out processes. Moreover, the national insurance funds will be entitled to collect from banks additional resources to be used as a further national insurance layer.
To summarize, a hypothetical introduction of the European Deposit Insurance Scheme could reduce banks' dependence on public funds in case of their failure. A centralized scheme could have the potential to reduce the Sovereign-Bank Nexus and could promote a more integrated and harmonized financial sector.

3.2 Raising Banks' Equity: Basel III and CRR/CRD IV

Along with the institution of the Banking Union, the post-financial crisis regulation tried to increase the European financial stability through a set of other measures. From the Basel III agreements, subscribed in 2010, a new set of prudential capital requirements has been established for credit institutions. The Basel agreements have been implemented in June 2013, with the CRR and CRD IV[33]. Even if these measures could be considered part of the Banking Union framework, I will discuss their consequences on an individual basis.
In the previous chapter I have enlightened the fact that the new prudential framework is likely to increase the banks' government debt holdings, strengthening the "sovereign exposure" propagation channel of the Sovereign-Bank nexus. In particular, the introduction of new requirements on liquidity risk management (LCR) and the maintenance of the preferential risk weight treatment for sovereign exposures in the evaluation of Risk Weighted Assets constitutes an incentive for banks to increase their exposures towards domestic governments.
In contrast, the CRD IV also introduced some novelties which are likely to make financial institutions more resilient against adverse shocks, reducing the possibility of their distress.
In particular, Basel III requires banks to hold a higher quality supervisory capital, by imposing a strict requirement on the Common Equity Tier 1 ratio (4.5% of RWA), while the total capital[34] should be at least equal to 8% of RWA. Another novelty is related to the capital buffers, composed by additional capital requirements that banks need to satisfy using their Common Equity. The additional capital buffers could be considered as macro-prudential tools aimed to

[33] Capital Requirement Regulation and Capital Requirement Directive IV.
[34] Common Equity Tier 1 + Additional Tier 1 + Tier 2.

reduce the systemic risk in the financial system by providing additional flexibility to the supervisory authorities.

Along with the capital requirements established by the Basel framework, the supervisory authorities are empowered to impose to every bank, on a single basis, to respect additional requirements on their capital holdings. Under the SREP (Supervisory Review and Evaluation Process), the Central Bank is indeed responsible to perform, on an annual basis, an analysis of every bank's risk profile. The evaluation consists in assessing the appropriateness of the capital and the organizational arrangements of a credit institution, taking into consideration the risks it has taken. If the analysis reveals deficiencies, the Central Bank is entitled to take remedial actions. The SREP provides to the Central Bank a high level of discretion: following a complete and informed assessment of the credit institution, the supervisory capital requirements could be increased on an *ad hoc* basis. These capital adds-on are purely confined to a micro-prudential perspective, addressing problems related to the single bank. This additional prudential layer ensures a more efficient banking supervision, it prevents foreseeable crisis by permitting the adoption of relevant measures in a timely manner.

Further, CRD IV introduced the Tier 1 Leverage Ratio, which limits the financial leverage of credit institutions by imposing the Core capital to be at least equal to 3% of total consolidated assets. This constitutes a first regulatory attempt to promote a sustainable growth in bank balance sheets through a simple non-risk-weighted measure.

The financial crisis has indeed highlighted the weaknesses of risk-sensitive bank capital ratios, especially where banks adopt Internal methods to estimate their level of Risk Weighted Assets. The development of internal models for the evaluation of credit, market and operative risks requires huge resources to a bank, with an investment that can reach the order of hundreds of millions of Euros. It is clear that the management decides to bear these costs because they could be more than recovered through a consistent reduction in the connected capital requirements. The level of RWA evaluated through an internal model is indeed consistently lower with respect to the amount connected to the Standardized approach. While the regulatory scope for the adoption of an Internal model is to capture the risks more effectively than the standard model, the financial crisis has demonstrated that credit institutions tailored their algorithms in order to minimize their capital requirements. In this framework the Leverage Ratio constitute a backstop against a potential source of instability for the financial system. This requirement represents indeed a clear, mandatory and objective limitation which each financial institution needs to respect.

Moreover, representing a counter-cyclical measure the Leverage Ratio should act as a stabilizer in the financial industry. The Leverage is indeed a tight constraint during periods of boom,

while it became softer in case of economic downturns. Conversely, one of the main limitations of the risk-sensitive capital ratios is that they are heavily procyclical: during a period of economic growth the risks connected to the assets in a bank balance sheet are considered lower, with a consequent reduction in the level of RWA. This will give to credit institutions the possibility to enlarge their balance sheets without increasing their supervisory capital. Banks will have the possibility to expand their credit provisions, leading to the risk of an overheating of the overall economic activity. In reverse, in case of economic downturn the level of RWA increases and the risk-sensitive capital requirement becomes binding. Banks could be forced to shrink their outstanding assets and the connected credit crunch phenomenon will drive a further worsening of the real economic activity.
To minimize this problem, among the above-mentioned additional capital requirements imposed by the Basel III regulation the countercyclical capital buffer has been introduced.

Overall, regardless of the discussed weaknesses, the CRR/CRD IV should increase a bank resilience to adverse shocks by imposing additional limits on its risk-taking capacity. The capital requirements imposed to banks are tighter and credit institutions are obliged to hold a larger share of high-quality capital. Moreover, the combination of macro-prudential and micro-prudential regulations is likely to prevent systemic crisis, overcoming the problems connected to the Basel II regulatory framework.
With regard to the Sovereign-Bank Nexus, a triggering event stemming from a distress in a credit institution should be less likely. The downside is related to the possible increase in the magnitude of the "Sovereign exposure" channel. However, since this linkage could be curtailed through other types of measures, the new prudential framework should have an overall positive effect on the Sovereign-Bank Nexus.

3.3 Creating a European Safe asset: SBBS, Sovereign Bond-Backed Securities

Once governments worsened their fiscal positions, investors started to perceive sovereign debt not to be risk-free. The absence of risk-sharing measures across European countries has led to an increased risk aversion against government's securities issued by the peripheral countries. These concerns increased their sovereign yields, causing a further worsening of their fiscal balances.
Together with that, the fact that there is not a widely available European risk-free asset constitutes the base of the "Sovereign-Exposure" Channel. This is the reason why Brunnermeier et al. (2016) proposed the creation of the ESBies (European Safe Bonds), a complex asset which could be created through a procedure of financial engineering, securitizing a set of European government bonds.

In the scheme proposed by the authors a central supranational vehicle, like the ESM (European Stability Mechanism), should buy sovereign debt held by banks in the Euro area in exchange for a newly issued asset backed security. These issuances should then be splitted in a senior tranche, protected against default (around 70% of the total portfolio) and a junior tranche (for the remaining 30%).

This procedure should thus permit the creation of a Synthetic Eurobond[35], with its senior tranche constituting a completely risk-free asset. According to the authors' calculations, given historical data and adopting conservative assumptions about default correlation, the default of ESBies senior tranche is expected to take place once every 600 years. This would permit the securities to be rated AAA, with a yield comparable to the German Bund interest rate. The junior tranche is expected to be considered an investment grade instrument, yielding around 6% in standard times. Institutional investors, mutual funds and hedge funds should be willing to invest in this kind of instrument.

The suggestion by Brunnermeier et al. involves the creation of a market measuring around 60% of the Eurozone GDP. The European Debt Agency[36] would be responsible for buying on the secondary market around € 5.5 trillion of sovereign securities, the weights of every country debt in these transactions would be given by their contribution to the European GDP.

Reflecting this scheme, in May 2018 the EU Commission presented a legislative proposal to develop a market for SBBS (Sovereign Bond-backed Securities), endorsed in April 2019 by the European Parliament. According to the European Commission's definition Sovereign Bond-backed Securities "are securities backed by a diversified portfolio of euro area central government bonds".

The objective of the proposal is to eliminate the regulatory obstacles which prevent SBBS from spreading, SBBS should indeed be granted the same regulatory treatment as the other euro-area domestic sovereign bonds, such as preferential risk weight in the capital requirement evaluation. By building a level-playing field, these novelties will enhance the liquidity and the attractiveness of the SBBS market, creating the preconditions for an effective adoption of this measure.

In the intentions of the Commission SBBS are likely to bring some advantages, they should definitively address the Sovereign-Bank Nexus problem by curtailing the "Sovereign Exposure" channel. Credit institutions would indeed be able to effectively diversify their sovereign holdings, reducing enormously the exposure towards their domestic governments.

[35] Eurobond were proposed on 23 November 2011 in a Green paper by the European Commission. The proposal contained three approaches: full Eurobonds with joint liability, partial Eurobonds with joint liability and partial Eurobonds without joint guarantees. However, since they are prone to the typical problems of free riding and moral hazard the Eurobond introduction process was never carried out.

[36] The subject proposed to be responsible of the securitization process.

Moreover, the acquisition of the outstanding government debt by the supranational vehicle will wipe out much of the existing excess exposures towards domestic governments from banks' balance sheets. This will help banks to become immune to the risk of default of their sovereigns. By splitting and trenching a pool of sovereign debt from different countries the procedure should generate a large amount of a homogenous safe asset. There is the potential to create a market which could reach half of the size of the US Treasury outstanding amount.
By enhancing the sharing of risks across investors and across borders, a developed SBBS market brings also the advantage to optimize the asset allocation process. In case of a new stress situation on the sovereign market the related increase in sovereign yields is likely to be minimized, much of the debt would be indeed held by the supranational vehicle until its maturity. The risk of sharp yield increases, triggered by fire sales on the secondary market, would be thus partly avoided.
Stemming from the securitization process, the key feature of SBBS is the fact that they constitute a way to create a standardized safe asset without relying on the mutualization of risks between EU countries. Since there is not a joint liability mechanism, each government remain responsible for the repayment of its debt. In case of default of one participating country, the junior tranche holders will bear the losses. The moral hazard problem should thus be avoided.
Overall, according to their proponents, EBSies (or SBBS) would maintain all the advantages of Eurobonds without bearing the political constraints connected to them. Since the process simply consists in pooling and tranching European government bonds, the approval of SBBS proposal has not encountered obstacles from the "fiscally responsible" European core countries. Moreover, in order to create the new market, there will be no need to change the European treaties, every government will indeed remain responsible for the implementation of its fiscal policy.

There are some elements, however, which could hinder the success of the SBBS. The first criticality comes from their key feature, since there's not a risk sharing mechanism between countries the probability of default of each sovereign bond will be reflected in the price of the SBBS. The yield curve of SBBS will thus depend on the various governments' fiscal positions, a worsening in the creditworthiness of one relevant country will have a non-negligible effect on the price of the securitized assets.
Moreover, in order to issue the safest possible instrument, the European Debt Agency should have to invest heavily in German Bunds, creating a feature which is not optimal for most indebted countries. In this regard, it is useful to build a hypothetical structure of the initial sovereign debt acquisition, based on the proposal to acquire bonds proportional to the country contribution to Eurozone's GDP. Rounding the total value of the SBBS issue to € 6 trillion

there would be sharp differences in the fraction of each country's total debt absorbed. Using data from 2016, such transaction would pertain € 1690 billions of German sovereign debt, corresponding to roughly 80% of the total outstanding German debt. As for the Italian debt, the share acquired by the supranational vehicle would be equal to 45% of the outstanding amount, with a remaining fraction of € 1227 billion that would not be transferred to the new subject. These figures are similar for the other peripheral countries, the absorbed amount is equal to 39% for Greece, 44% for Portugal, 54% for Ireland and 58% for Spain. More generally, the share of debt absorbed is quite heterogeneous among countries.

Assuming that SBBS will be successfully introduced in the future, the new market will probably absorb much of the bank's demand for "sovereign debt like" securities. While this would undoubtedly have its advantages in terms of a curtailing in the Sovereign-Bank Nexus, the peripheral countries would face difficulties when placing the part of their new debt emission which is excluded from the securitization process. Accordingly, peripheral governments would be forced to offer higher yields when refinancing their expiring debt, with the potential to trigger disruptive effects on public finances.

The proportional methodology followed in the engineering of SBBS has another weakness. Some European countries have indeed a debt to GDP ratio which is heavily lower with respect to the average. Following the same procedure as before, the evaluations show that the debt of these countries would be almost completely absorbed by the first securitization procedure. The supranational vehicle would indeed absorb, for example, 100% of the Latvian public debt, 98% for Luxembourg and 94 % for Slovakia. Since these instruments would almost completely disappear from the secondary market a hypothetical new issue of SBBS could not rely anymore on the public debt of these countries. Consequently, there would be the need to create a different type of SBBS, backed by a tighter pool of sovereign bonds. This would be a source of complexity in a market in which the need for simplicity and clarity is a necessary feature. To avoid this problem, the amount of SBBS issuances should thus be constrained at a level which reflects the debt of the virtuous, less indebted countries.

A further element of concern is related to the unintended consequences stemming from the introduction of these instruments. In the intentions of the proponents, the safe senior tranches of the SBBS emissions are going to be held by banks, while other suitable subjects (such as investment funds) would invest in the riskier junior tranches. In this framework, SBBS would be an effective method to diversify risks and enhance peripheral banks' creditworthiness. However, this interpretation doesn't take into account the different needs of weaker banks. Riskier institutions need indeed to cover a higher level of funding costs, they could be consequently forced to invest a significant part of their activities into the riskier junior tranches.

This would lead to an inefficient capital allocation, with a further segmentation of risks between safe banks (and core countries) and riskier banks (and peripheral countries). The sovereign portfolio held by banks located in peripheral countries could end up being riskier than in the current situation.

While SBBS would constitute a large stock of a Euro-denominated safe and liquid asset under normal circumstances, it is questionable whether these instruments will remain reliable in case of a new harsh financial crisis. Even if from the calculation of the ESBies proposers the senior tranches should be always repaid, De Grauwe and Yuemei (2018) argued that these instruments could not survive to a systemic crisis.

First, a large securitization process will shrink the national sovereign bond markets, causing an increase of the volatility of sovereign yields during stress periods. Consequently, the risk of panic-driven crisis could end up being higher.

Secondly, during stress periods yields in high risk assets (such a peripheral sovereign bonds) become highly correlated, while yields on safe asset (such a core sovereign bonds) become negatively correlated with respect to the riskier ones. An increase in market uncertainty is thus reflected in a surge of peripheral countries' yields and a reduction for the core countries ones. Accordingly, investors will perceive the SBBS senior tranche, composed by a part of peripheral sovereign bonds, as being riskier than the underlying safer core sovereign bonds. Investors will be thus likely to shift from the entire securitized products to their safe "components", such as German Bunds.

Other arguments against the fact to consider SBBS as being completely risk-free products comes from the findings of Caballero et al. (2017), who argue that safe assets need to be "simple in complex times". Instability times are not only characterized from a "flight to quality" phenomenon, but also from a "flight to simplicity" tendency. Undoubtedly, simplicity is not a feature enjoyed by SBBS. Another clue comes considering the historical analogy of CDOs (Collateralized Debt Obligations), a case of financially engineered products which were deemed efficient in enhancing the overall financial stability and were argued to contribute to the diversification of risks.

Finally, there's the need to consider that the introduction of SBBS would also entail changes in the incentive to default of single countries, in the case whether the junior tranches are completely held by foreign institutions the choice not to repay the sovereign debt would not hit the domestic banking sector. Consequently, sovereigns could decide to default on their debt more frequently.

Because of all these contradictory elements it is not possible to state whether the introduction of European Safe Bonds would constitute a further step towards the financial integration process or it would end up being a distortionary element. The above-mentioned potential disruptive consequences deter policymakers to pursue this revolution, the possible unintended collateral effects related to such a drastic novelty are not counterbalanced by clear and shared advantages for the European financial system. The only way to create a SBBS in a sustainable manner is through a step-by-step process, with a series of small acquisitions of sovereign debt on the secondary market. This would give the regulatory authorities the opportunity to test the effective functioning of the new framework prior to its complete adoption. In such a case, the SBBS market should be able to survive to the "acid test" of a sovereign stress period, showing resilience and reliability features.

Alternatively, the scope to create a broad European safe asset, which could be held by banks in order to serve as a collateral and as a liquidity reserve, should be pursue by other means. Governments must be always able to credibly commit to the full repayment of their debts, once investors rely on sovereigns' creditworthiness the risk to trigger a stress situation on bond yields is considerably reduced. In a situation in which risk-sharing mechanisms are not in place, the only way to maximize the level of financial integration across European countries is to minimize the level of risks connected to every country, acting towards the sustainability of public finances.

On the other side, the need for a diversification in the sovereign portfolios held by banks is another obstacle to a stable financial system. As I will argue in the last chapter, in order to act on the "Sovereign Exposure" channel, the most feasible solution seems to be the introduction of concentration charges on banks' sovereign exposures.

3.4 Emergency Measures by ECB: LTRO and OMT

At the peak of the sovereign debt crisis all the channels of the Sovereign-Bank Nexus were under stress, these linkages were threatening the financial stability and were hindering an effective functioning of the sovereign debt market. The increase in solvency risk of peripheral countries was also connected to a run on short-term funding of their banking systems.

In order to provide some relief to the financial system the ECB adopted a series of unconventional policies, acting both as a Lender of Last Resort (LoLR) and as a Buyer of Last Resort (BoLR). It is interesting to assess whether these measures were effective in restoring a sound sovereign debt market, helping banks in recovering their short-term funding and reducing the Sovereign-Bank stress linkages. For these evaluations I refer to the paper by Acharya, Pierret and Steffen (2016).

The first extraordinary measure was the LTRO (Long-Term Refinancing Operation), adopted in December 2011. With the LTRO ECB started to inject liquidity in the financial system, acting as a LoLR. The measure consisted in the provision of funding liquidity to credit institutions in exchange to eligible collaterals. In this period, ECB granted € 489 billion to 523 banks through 3-years loans. On February 2012 ECB carried out the second LTRO allotment, providing additional € 530 billion to 800 credit institutions.

According to the authors' evaluations the LoLR measures didn't help to tackle the problem of the linkages between sovereigns and banks in the peripheral countries. Given their incentives to "gamble for resurrection" as in Crosignani (2017), peripheral banks used the liquidity obtained from the ECB to further increase their exposure towards domestic debt[37]. Conversely, the banking systems of core countries, being less fragile, didn't have any incentive to increase their exposures towards riskier sovereign bonds.

A collateral effect of LTROs allotments was thus to further tying up the peripheral banking sector to their sovereigns, with an increase in the magnitude of the "sovereign exposure" channel. Moreover, the fact that a relevant part of the available banking resources was devoted to the investment in sovereign debt contributed to a further crowding-out of the real economic sector. The associated credit crunch contributed to an exacerbation of the macroeconomic channel.

Accordingly, LTROs were not successful in addressing the linkages between sovereigns and banks. Moreover, the concentration of sovereign risk in the portfolio of peripheral banks contributed to a further fragmentation and segregation of risks in the Euro area, worsening the financial instability situation.

Subsequently, ECB decided to assume the role of BoLR (Buyer of Last Resort) through the OMT (Outright Monetary Transactions) measure. The OMT was preceded by Mario Draghi's "Whatever it takes" speech in July 2012. On 2nd August the ECB announced that it would have purchased an unlimited amount of sovereign debt on the secondary market in case of need. These transactions would involve sovereign debt with maturity from one to three years and would be available conditionally to the meeting of a set of requirements.

In practice an OMT was never undertaken, its announcement was enough to effectively reduce the redenomination risk connected to the possibility for peripheral countries to leave the Euro area. Consequently, demand for peripheral sovereign debt from foreign investors started to grow, as in Krishnamurthy et al. (2014). This has led the core banking system to increase its exposure towards peripheral sovereign debt, leading in turn to a better diversification of risks among countries and to an overall reduction in the sovereign debt fragmentation.

[37] After the two LTRO allotments, Italian and Spanish banks increased their domestic sovereign holdings by € 49 billion, reaching a domestic share of sovereign portfolio of 83%.

Thus, the OMT announcement has led to an increase in the price of peripheral sovereign bonds and to a mitigation in the risk transmission linkages between domestic banks and governments. Since there was no need to pursue any Outright Monetary Transaction the mechanism acted as a zero-cost insurance. The credibility of ECB restored the confidence in riskier sovereign bonds by significantly reducing the probability of happening of a worst-case scenario[38] shock.

Lastly, the fact that the liquidity provided by ECB with the LTROs was used by banks for unintended purposes led to the arrangement of TLTROs (Targeted Long-Term Refinancing Operations). Between September 2014 and March 2017[39] the ECB has conducted 12 liquidity issuances to credit institutions. Banks were obliged to use those funds to finance the real economic activity through the provision of credit to non-financial corporations and households (excluding the supply of mortgages). These measures are an important enhancement of the "standard" LTROs transactions, which have shown the above-mentioned unexpected destabilizing effects.

While the Targeted LTROs issuances didn't directly affect the "Sovereign Exposure" channel, they have helped banks to return to a sustainable development path. Accordingly, the banking book increased its relevance in the banks' balance sheet, while the trading book (and the fraction of sovereign debt held in the banking book) became a less significant fraction of banking activities.

3.5 ESM, European Stability Mechanism

One of the main fragilities of the European Monetary Union lies in the fact that the sovereign debt of member countries is issued in a sort of "foreign" currency. This hinders the capacity of governments to credibly commit to always repay their debt, European countries are indeed intrinsically prone to liquidity crises and contagion effects.

This is the reason why the ESM (European Stability Mechanism) was designed, replacing the temporary EFSF (European Financial Stability Facility)[40], implemented as an emergency measure in response to the sovereign debt crisis.

The scope of the ESM is to provide financial assistance to euro area countries which are experiencing financial difficulties. The ESM is thus aimed to preserve the financial stability in the euro area, acting as a backstop against the risk that a country is not able to repay its debt.

[38] Using the words of Benoît Cœuré (Member of the Executive Board of the ECB) during a speech in Berlin in September 2013, "OMTs are an insurance device against redenomination risk, in the sense of reducing the probability attached to worst-case scenarios."

[39] In March 2019 ECB's Governing council announced a third TLTRO operation, to be implemented through quarterly operations from September 2019 to March 2021.

[40] Currently, the ESFS is still active in order to receive the repayments to the loans granted to the beneficiary countries (Ireland, Portugal and Greece) and repay the bonds issued in order to raise funds to finance its operations. However, any future financial assistance will be provided by the ESM.

Consequently, the magnitude of risk transmission mechanisms from sovereigns to banks should be reduced.

The ESM is based on the contribution of its 19 participating countries, it has a total subscribed capital of € 702 billion[41], of which € 80 billion is paid-in capital. The remaining part (€ 622 billion) is in the form of committed callable capital.

The financial assistance granted to Member countries is financed through the emission of bonds on the capital markets, in order for these instruments to maintain a AAA credit rating the total lending capacity is capped at € 500 billion. The bonds issued by the ESM are currently recognized as Extremely High-Quality Liquid Assets and are included in the ECB's list of eligible assets.

There are two weaknesses related to the ESM backstop mechanism.

First, the ESM acts with a limited amount of resources, at the time of writing the residual lending capacity is around € 410 billion (82% of the original available amount). This figure could not be enough to deal with a systemic sovereign stress situation. ESM will not have the necessary credibility to act as a backstop against the risk of a contagion among countries. Moreover, the financing structure of the ESM makes the institution heavily reliant to the health of capital markets. Since the need for support for a country is likely to happen in a situation of stress, ESM should face more difficulties in access to its funding sources in such period. This scenario could require individual countries to pay additional capital contributions, since there's not a stepping-out mechanism the country which has to receive the financial support will have to pay its capital contribution quote in order to access the loan.

Second, the governance structure is not suitable for crisis management processes, as enlightened in De Grauwe (2011). The decisional process grants a voting right proportional to the capital contribution, consequently Germany holds around 27% of the voting weight, while France and Italy count around 20.3% and 17.9% respectively.

Every decision under an ordinary procedure must be taken by mutual agreement of the countries participating in the meeting, every country has *de facto* a veto power. The risk is that every proposed measure will be questioned by local political concerns. Moreover, in order for a voting procedure to be valid ⅔ of the member countries (and ⅔ of the voting rights) must be present at the meeting, this empowers a hypothetical group of 6 small countries to block any decisional process.

European Commission and ECB could partially overcome this impasse by declaring that a lack of intervention by ESM would threaten the economic and financial stability of the euro area. In this case an emergency procedure is activated, requiring an 85% majority of votes cast. This

[41] All the data are retrieved from the ESM website.

means that regardless the voting procedure Germany, France and Italy could individually block any decision.

Overall, the European Stability Measure is a necessary backstop against the possible onset of contagion effects among European countries. Since its adoption the Monetary Union has an additional instrument to tackle financial stability problems. This constitutes a further supranational layer to bear shocks at a country level. By reducing the probability of sovereign defaults, the ESM has partly led to some relief on the Sovereign-Bank Nexus. However, in order to properly work as an effective insurance scheme its functioning should be improved, since its deficiencies constitute a threat to its credibility.

In this chapter I described a list of measures, implemented or advocated, which are likely to give some relief to the Sovereign-Bank Nexus. As a next step, in the next chapter I will perform an empirical analysis in order to demonstrate that the implementation of the Bail-in provision was effective in the curtailing of the “safety net” channel.

4. Empirical Analysis

In this section I will provide some empirical evidence in favor of the time evolution of the Sovereign-Bank Nexus. The analysis will explain how the loop has evolved after the introduction of the BRRD regulation and with the Bail-in tool. The scope of this chapter is to determine if the Bail-in provision was able to curtail the risk transmission mechanism in place between Sovereigns and banks.

In order to analyze these aspects, I replicated the model followed by Acharya et al. (2014).

This approach describes the credit risk of banks and sovereigns using 5 years CDS mid spreads[42], where every bank is matched with its corresponding Country. Credit default swaps are the most suitable instrument in order to measure the perceived credit risk, both for the sovereign and the banking sector. The CDS used for describing credit risk are the ones that offer the protection against subordinated bonds, I made this choice since this type of instrument is the one which should be more affected by the introduction of the Bail-in provision. As an additional control, I conducted again the whole analysis using the CDS covering bank's senior debt: the results obtained are comparable to the ones arising using data on subordinated CDS.

The following empirical analysis is entirely performed using the statistical software Stata.

4.1 Data and Summary Statistics

All the data used for the empirical analysis are retrieved from Thomson Reuters DataStream, unless otherwise specified.

Since the analysis is focused in assessing the effectiveness of the BRRD regulation, the Countries included in the sample are those that have adopted it. In order for a bank to be included in the analysis it must have publicly traded CDS and equity throughout all the sample period, which goes from November 2008 to May 2019.

According to these definitions, 22 banks established in 12 Countries are identified.

Data are retrieved at a daily level: while this allows the dataset to be large, a daily frequency expose the data to noise and measurement errors due to the possible lack of liquidity in the different markets. According to this view the estimates obtained could be biased downwards. To rule out this problem a robustness check will require the analysis to be performed also at a weekly level.

In the coming analysis the Countries and their corresponding banks will be clustered in 3 groups:

[42] The CDS spread refers to the price of the protection contract and it is expressed in basis point. For example, if a 5Y CDS is traded at 325 basis point, the protection buyer needs to pay a sum equal to 3.25% of the nominal value of the insured amount in order to be protected against the entity's default in the next 5 years. The mid spread is the midpoint between the bid and the ask price for CDS protection.

- Giips (peripheral) Countries: comprising Italy, Spain, Portugal and Ireland[43];
- Non Giips (core) Countries: comprising Germany, France, Belgium, Netherlands and Austria;
- Non-Euro Countries: comprising those Countries in the banking union which have adopted the BRRD regulation but are not in the Euro Area, namely UK, Denmark and Sweden.

NON-GIIPS COUNTRIES	
BANK	***COUNTRY***
Erste Group	Austria
KBC	Belgium
BNP Paripas *Crédit Agricole* *Société Générale*	France
Commerzbank *Deutsche Bank*	Germany
ING Groep	Netherlands

GIIPS COUNTRIES	
BANK	***COUNTRY***
Bank of Ireland	Ireland
Monte dei Paschi *Banca Intesa* *Unicredit* *Mediobanca* *Unione di Banche*	Italy
Banco Comercial	Portugal
BBVa	Spain

NON-EURO COUNTRIES	
BANK	***COUNTRY***
Svenska Hand. *Swedbank*	Sweden
Danske Bank	Denmark
Barclays *Lloyds*	United Kingdom

Table 4.1: the list of banks included in the dataset and their corresponding countries.

With the aim to seize the evolution of the Sovereign-Bank Nexus across the sample, I identified 4 time periods:

1. From November 2008 to April 2011: the analysis begins after the birth of the nexus. As Acharya et al. showed, the Sovereign-Bank loop was a phenomenon established in the aftermath of the financial crisis contagion. Prior to the 2008 financial turmoil there was indeed no sign of the loop and the sovereign debt was perceived to be risk free;
2. From May 2011 to December 2014: this period begins with the onset of the European sovereign debt crisis in the peripheral (Giips) countries;
3. From January to December 2015: this period corresponds to the implementation of the "incomplete" BRRD. The directive was indeed initially adopted without the Bail-in provision;
4. From January 2016 to May 2019: the last period considered begins after the implementation of the Bail-in scheme.

[43] Greece is not considered in the analysis since data on Sovereign CDS have not been available for much of the period considered. Moreover, Greece represent the typical outlier in this kind of analysis.

4.2 Preliminary evidences

In advance of modelling the feedback loop, I present some preliminary evidence offered by the dataset.

Period 1, from November 2009 to April 2011

	N	Mean	Std.dev	p1	p99
Giips					
CDS Banks	4839	350.33	313.63	87.87	1787.34
CDS Sov		150.7	95.63	47	541.1
Non-Giips					
CDS Banks	3954	207.05	91.09	90.42	513.25
CDS Sov		52.28	27.71	15.01	147
Non-Euro					
CDS Banks	2557	206.74	104.47	77.91	550.8
CDS Sov		57.93	31.32	20.08	155

Period 2, from May 2011 to December 2014

	N	Mean	Std.dev	p1	p99
Giips					
CDS Banks	7842	605.71	475.77	101.71	2964.15
CDS Sov		260.31	204.96	43.15	1111.64
Non-Giips					
CDS Banks	7063	313.47	172.36	82.52	812.17
CDS Sov		53.18	46.39	9.67	240.53
Non-Euro					
CDS Banks	4063	251.26	145.46	72.11	671.47
CDS Sov		38.92	26.94	8.24	122.17

Period 3, from January to December 2015

	N	Mean	Std.dev	p1	p99
Giips					
CDS Banks	2146	212.43	89.7	95.38	519.62
CDS Sov		86.65	27.1	33.8	161.31
Non-Giips					
CDS Banks	1569	129.99	51.38	73.48	273.54
CDS Sov		18.76	8.96	6.66	35.84
Non-Euro					
CDS Banks	939	90.41	12.45	66.01	122.45
CDS Sov		14.54	4.73	8.63	22.82

Period 4, from January 2016 to May 2019

	N	Mean	Std.dev	p1	p99
Giips					
CDS Banks	6863	281.95	195.06	77.78	851.93
CDS Sov		81.34	44.61	18.67	229.27
Non-Giips					
CDS Banks	4846	120.24	61.18	41.37	313.89
CDS Sov		13.75	7.01	5.18	35.51
Non-Euro					
CDS Banks	3070	87.1	38.66	39.28	198.89
CDS Sov		17.77	9.25	6.29	39.38

Table 4.2: the table shows, for every time period and group of Countries considered, the number of observations (N), the mean of the observed values (Mean), the standard deviations (Std.dev) and the 1st and 99th percentiles (p1 and p99).

It is useful to begin the empirical analysis looking at the summary statistics regarding banks and sovereigns CDS. In order to grasp all the features of the data Table 4.2 summarizes the sample, sorting it by period and group of country. As expected, in every period the highest average values for both sovereign and bank CDS are the ones registered in Giips countries.
Moreover, for every group the second period is the one characterized by the highest values in bank CDS, this time phase corresponds also to the highest recorded volatilities. This could be easily explained considering the fact that the second time period represents the worsening of the Sovereign debt crisis.
In the last period there has been an increase in the average bank CDS in Giips Countries, while the other groups have experienced a slight decrease in these values. The Bail-in tool implementation is thus associated to a different reaction among the various groups of countries.

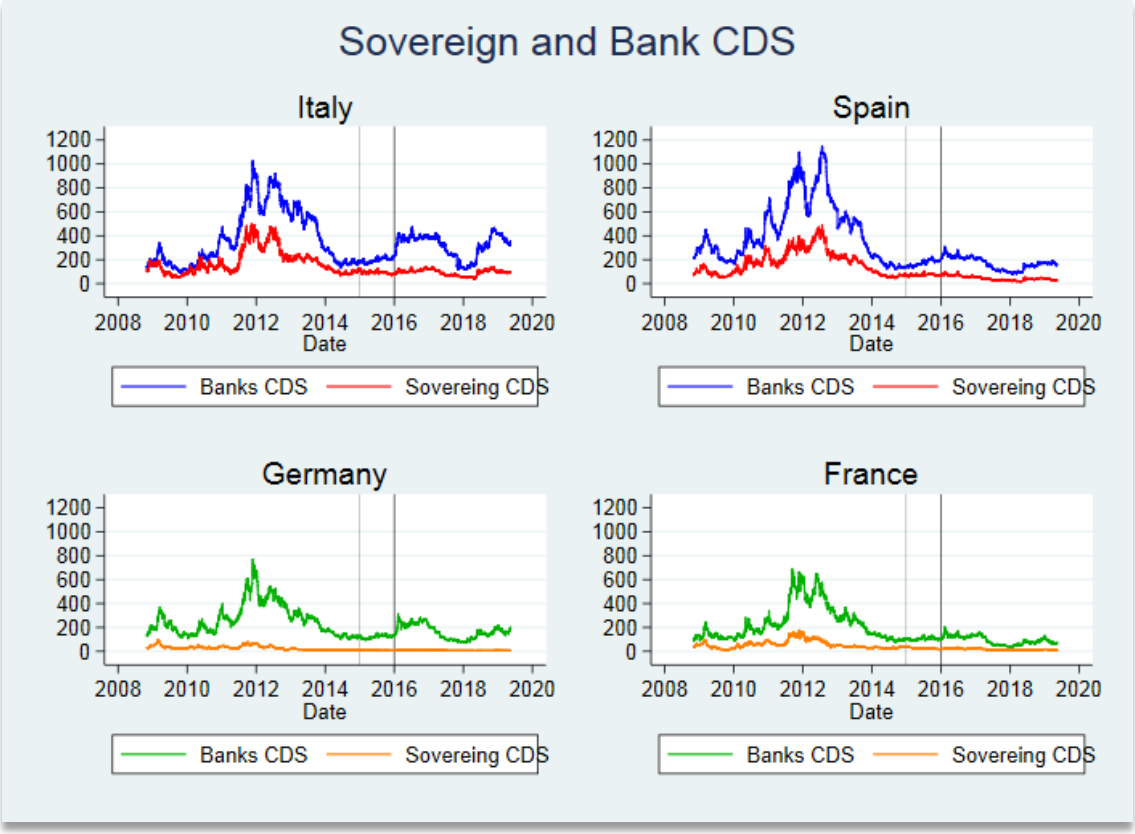

Figure 4.1, CDS mid spread level for Sovereign and Banks. For every Country, the banking sector's CDS level is represented by the average CDS value of the National banks in the sample.

Figure 4.1 shows the evolution of sovereign and bank CDS spread for the most important countries in the sample. In order to represent the banking sector CDS level for a country, the simple average of the individual banks CDS rooted in that country is computed.
Figure 4.2 shows instead the average CDS level considering Giips and Non-Giips Countries.
In these graphs the difference between core and peripheral countries is relevant, with the latter exhibiting a tremendously higher credit risk in both sovereign and banking sectors. It is also

worth noting that for Giips countries sovereign and bank CDS seems to be more closely tied up, while in core countries the relationship that links banks and sovereigns appears less severe.

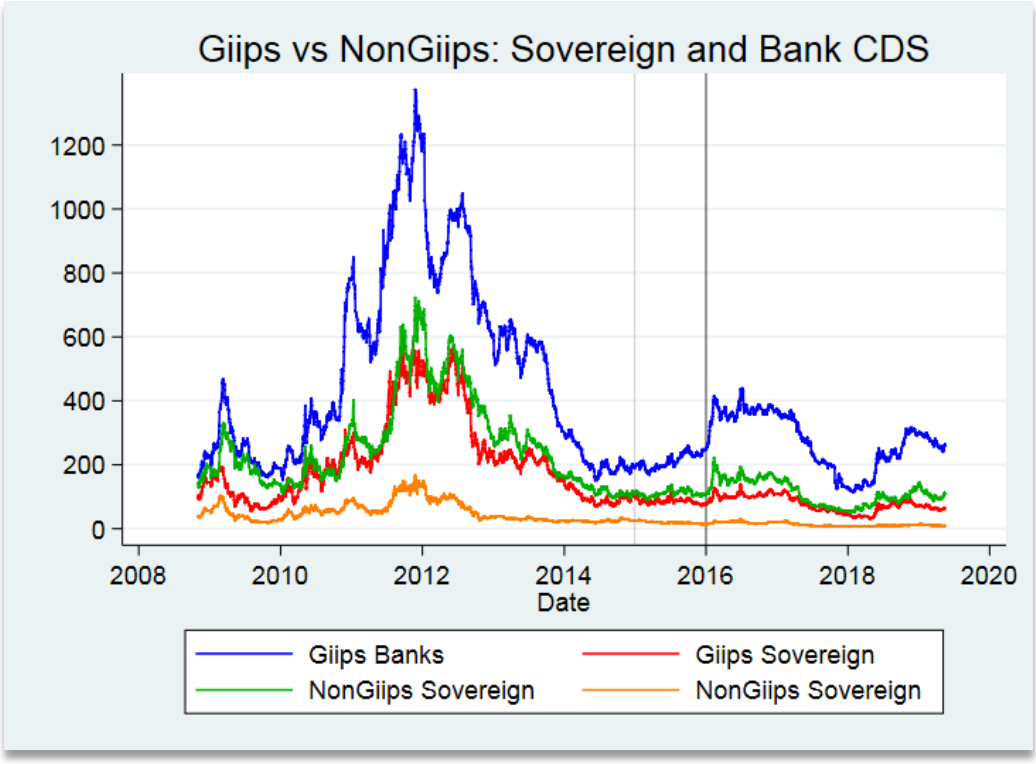

Figure 4.2, CDS mid spread level for Sovereign and Banks. For every group of countries, the banking sector's CDS level is represented by the average CDS value of the banks belonging to that group.

Moving a step further, the correlation between changes in banking and sovereign risk could be examined. First, relative daily changes in the sovereign and banking sector CDS are computed for every country. As a second step, the correlation between the daily changes is evaluated for each period.

The results of these evaluations are reported in the Figures 4.3, 4.4, 4.5 and 4.6.

Again, there are striking differences in the extent of the co-movement between different groups of countries: as easily predictable Giips countries are those facing the tougher situation. In Italy, in the periods prior to the BRRD implementation the correlation level exceeds the remarkable level of 0.6. It seems however that after the implementation of the Bail-in mechanism (Period 4) the correlation is slightly reduced in Giips countries, especially in Portugal.

As for the other countries, the BRRD implementation in the third period coincides with a sharp reduction in the estimated correlations in Germany and Belgium, as can be seen in Figure 4.4.

Looking at figure 4.5, UK represents a particular case. In the aftermath of the 2008 financial crisis its sovereign and banking credit risk were strictly connected, while in the other periods the pattern is completely changed and the correlation almost disappears. A possible explanation could be given considering the fact that the great financial crisis had a tremendous impact on the British economy. In UK the government was indeed forced to spend a lot of resources in

order to save its financial system, the uncertainties of that period could be the cause of that outstanding correlation level.

Overall, as a first rough conclusion, the Bail-in introduction coincides with a period of lower correlation between sovereigns and banks CDS. Anyway, the simple graphical evidence is not enough to affirm that the Bail-in was effective in the reduction of the feedback loop. There could be indeed various underlying common factors which drive these co-movements.

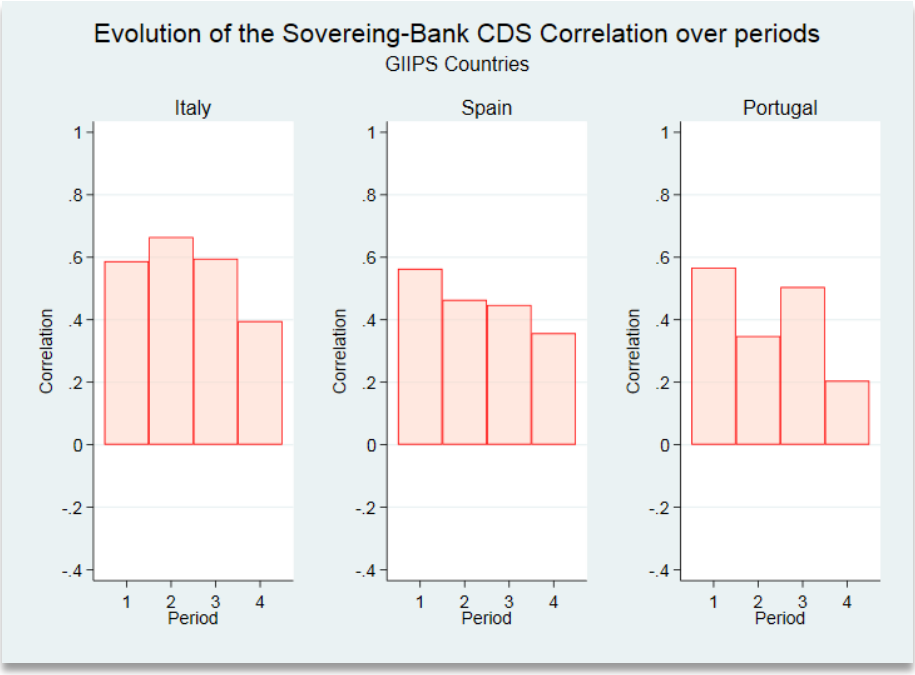

Figure 4.3, The figure show, for every time period, the correlation between sovereign and banking sector CDS spread for the Giips countries.

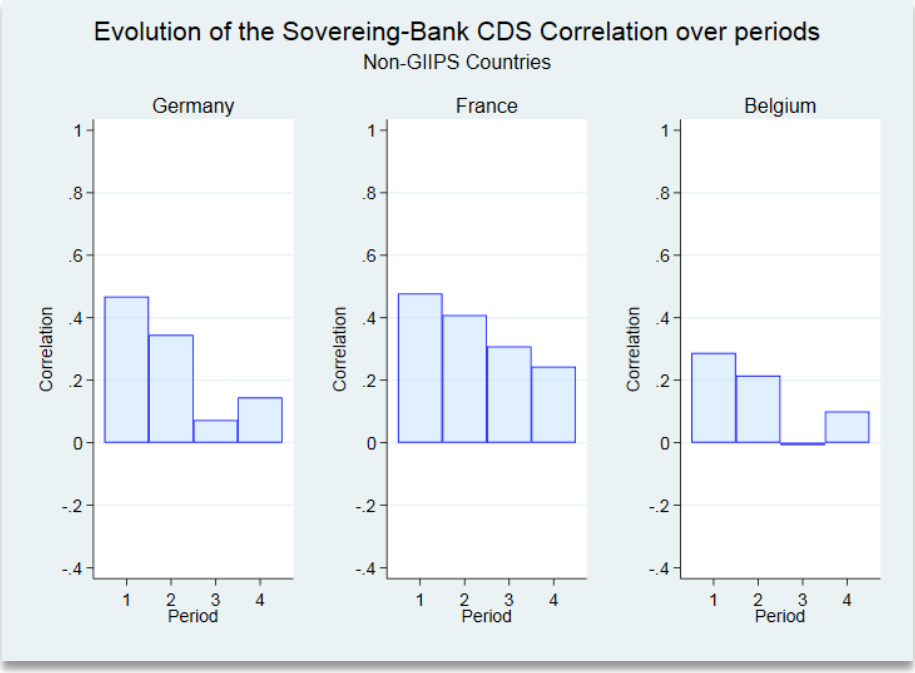

Figure 4.4, The figure show, for every time period, the correlation between sovereign and banking sector CDS spread for the Non-Giips countries.

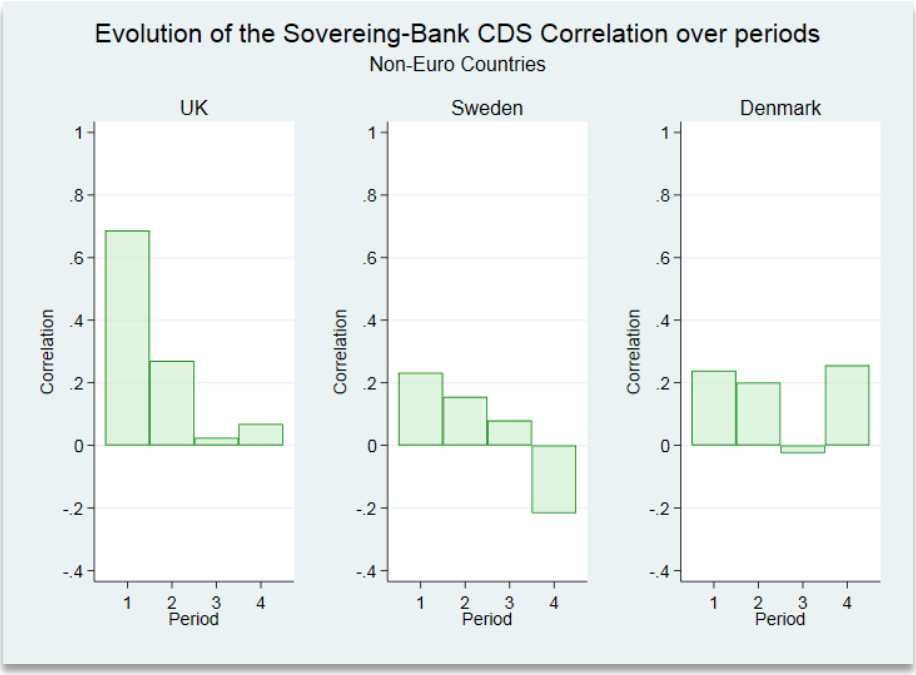

Figure 4.5, The figure show, for every time period, the correlation between sovereign and banking sector CDS spread for the Non-Euro countries.

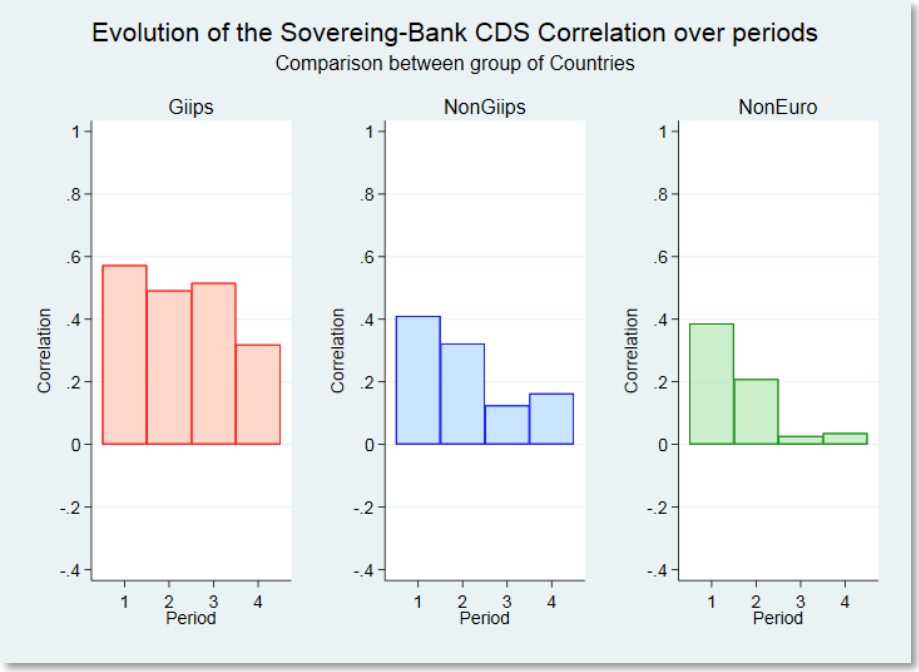

Figure 4.6, A comparison of the evolution of the correlation between sovereign and banking sector CDS, considering the different groups of Countries.

I carried out a similar analysis evaluating the correlations between bank and sovereign credit risk using a rolling time window of 90 days. The analysis starts from the 90th available observation and evaluates the correlation between the daily changes in bank and sovereign CDS for the previous 90 trading days. Then, for every following observation the sample is rolled over and the correlation for the previous 90 days is evaluated again. This procedure enables to have a clearer measure of the evolution in the co-movement between CDS changes over time.

Figure 4.7 shows the evolution of the rolling correlation for Italy, after the Bail-in introduction a relevant reduction in the co-movement can be appreciated. The correlation rises again starting from 2018, this phenomenon is probably arising from the stress on sovereign yields registered after the settlement of the first Conte government.

Looking at Figure 4.8, the level of the correlation for Giips countries is generally higher than that of the core ones, especially in the years between the onset of the sovereign debt crisis and the introduction of the Bail-in. After January 2016 the time series appear to be closer.

Surprisingly, the introduction of the BRRD and the Bail-in coincide with an increase in the co-movement between sovereign and debt CDS changes in the core countries, but this could be explained by changes in other confounding factors.

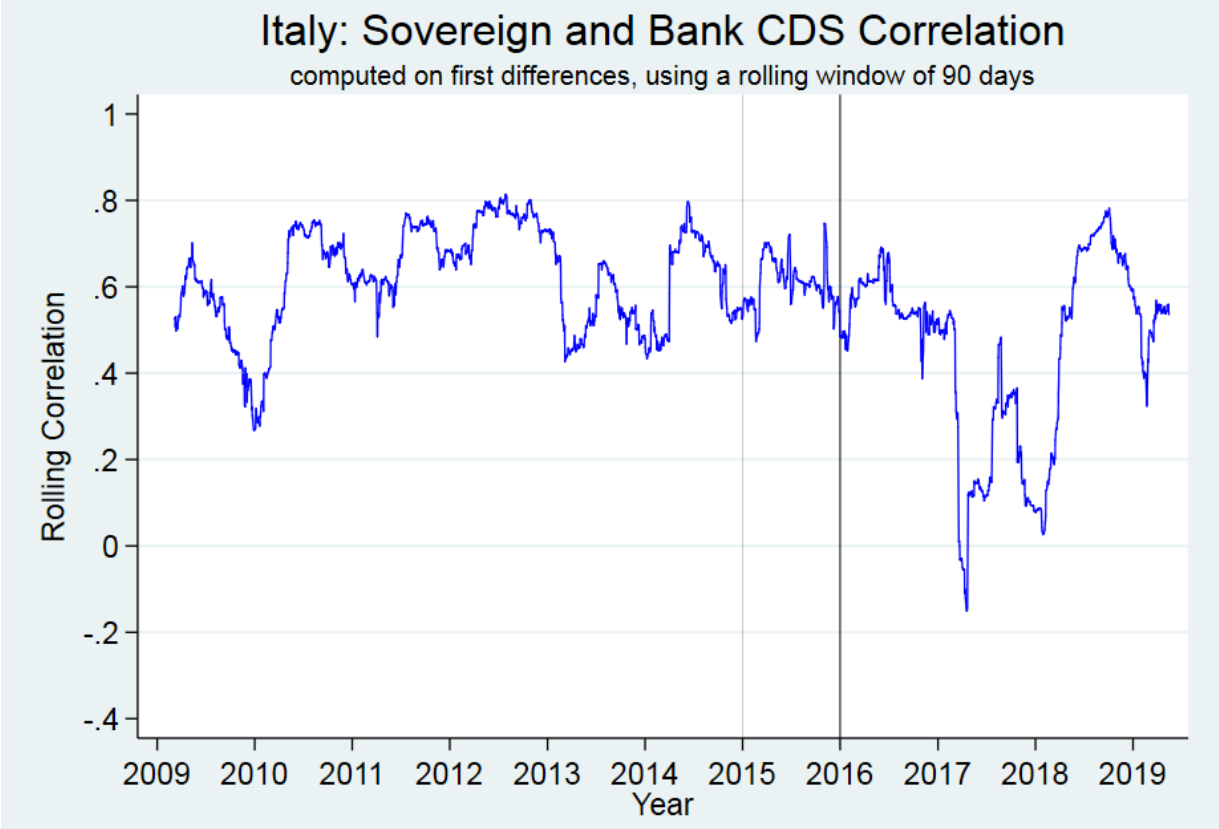

Figure 4.7: Rolling correlation between Italian sovereign debt CDS and its banking sector CDS. The graph plots, for every time period considered, the correlation for the previous 90 trading days. The thin vertical line corresponds to the BRRD regulation, the thicker one represents the Bail-in introduction.

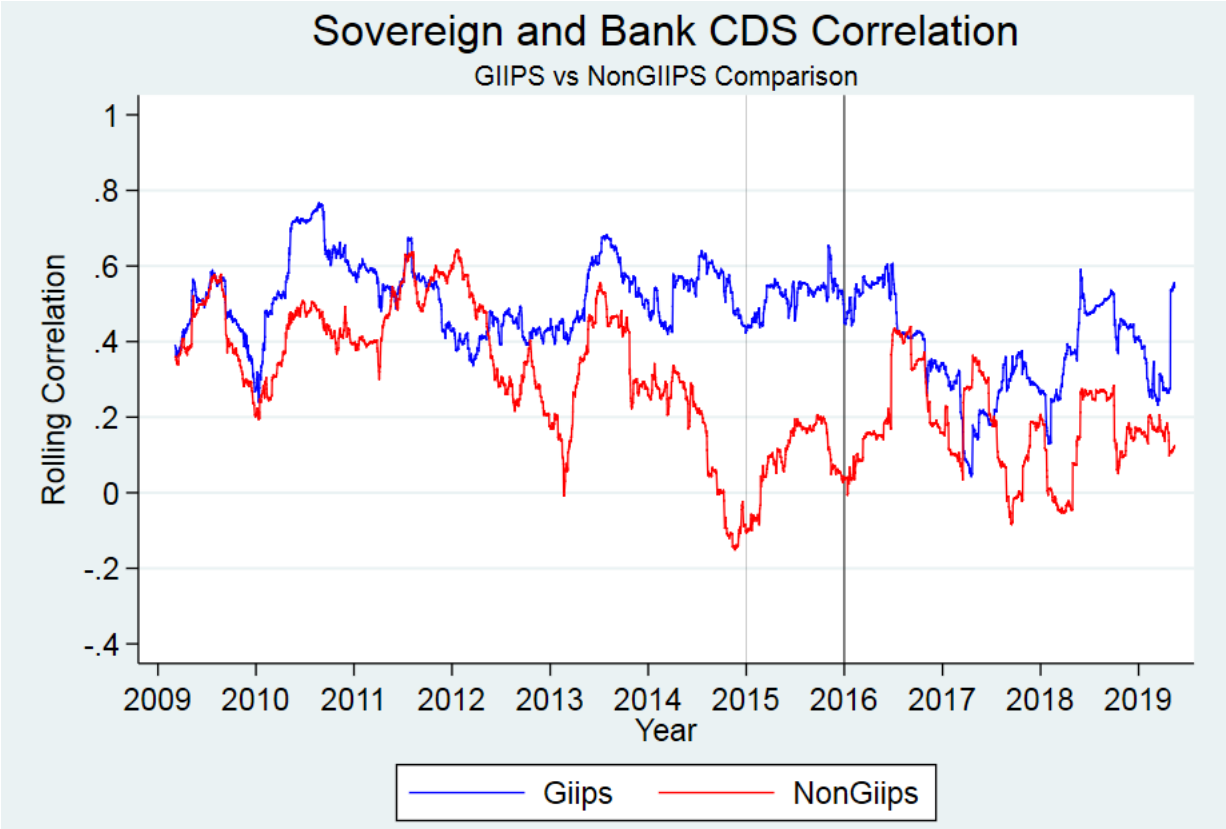

Figure 4.8, Comparison of the rolling correlations between Giips/NonGiips and its banking sector CDS. The graph plots, for every time period considered, the correlation for the previous 90 trading days. The thin vertical line corresponds to the BRRD regulation, the thicker one represents the Bail-in introduction.

4.3 The feedback loop assessment

The aim of the empirical analysis is to assess the evolution of the two-way feedback loop before and after the introduction of the Bail-in tool. According to the theory, following the implementation of the Bail-in a reduction in the co-movement between sovereign and bank CDS is expected. The Bail-in provision is likely to significantly curtail the risk transmission connected to the "safety net" channel, identified in the previous chapter.

4.3.1 Identification strategy

The key challenge in measuring this phenomenon lies in the fact that there may be other unobserved factors affecting both sovereign and bank credit risk. It is then necessary to consider all the factors that could explain the co-movement between bank and sovereign CDS which are not driving elements of the underlying feedback loop.

For instance, as Acharya explains "sovereign credit risk reflects changes in expectations about macroeconomic fundamentals, such as employment, economic growth, and productivity. These fundamentals have also a direct effect on the value of bank assets such as mortgages or bank loans. Hence, changes in macroeconomic conditions may generate a correlation between sovereign and bank credit risk even in the absence of a direct feedback mechanism."

More generally every macroeconomic factor with a simultaneous positive effect both on bank and sovereign risk should produce a positive distortion in the estimation, while a phenomenon with a divergent effect on the two variables should led to a negative bias.

Following the methodology proposed by the author I address this endogeneity issue including two set of controls[44] .

First, weekly time effects[45] are taken into account in the ensuing regressions. They should capture and explain all changes in market fundamentals affecting both banking and sovereign credit risk. In this way all the macroeconomic changes that have a common effect on the financial sector and on the sovereign should be captured.

Second, a variable representing the foreign credit risk exposure of every country's financial sector is included: controlling for this index is necessary since changes in the bank credit risk could be driven by changes in the foreign exposures recorded in their balance sheets. The "sovereign exposure" channel described in the second chapter is indeed partially active also in the transmission of risk across countries.

I built the banking sector foreign exposure index as the weighted average of the sovereign CDS rates of the other countries included in the sample[46]. In order to compute the weights, I followed a two-step approach: as a first step I retrieved, from the Bank for International Settlement warehouse, data on the foreign exposure of every country's financial sector. This allowed me to obtain a quarterly measure of the total claims of every country's banking sector versus each counterparty country. As a second step, I scaled the total foreign exposures of each country's banking sector for the size of the country's financial sector, since a larger credit sector should be proportionally more resilient to a similar absolute shock. I recovered this information from the European Central Bank Statistics website[47].

Finally, I multiplied the weights thus obtained for the other countries' sovereign CDS rates. The index will then reflect changes in:

- The level of absolute foreign credit exposures;
- The perceived riskiness of the foreign sovereign debt;
- The size of the domestic financial sector.

This procedure should allow to have a realistic measure of the sensitivity of every country's banking sector to its foreign sovereign risk exposure.

---

[44] Note that the Acharya model also includes a third set of controls consisting in bank fixed effects. However, from the analysis carried out, the fixed effect approach turned out to be pointless: the model in this dissertation will then be based on a pooled OLS estimation technique.

[45] Acharya adopted daily time effects in his model. However, for computational efficiency reasons I preferred to implement weekly time effects.

[46] For simplicity sake the countries which are not a part of this study are excluded. Moreover, data for the foreign exposures of the Danish financial sector are not available.

[47] As a proxy of the country's financial sector size the total assets reported by the MFI (excluding ESCB) are used. These data are available at a monthly frequency, but I consider only quarterly changes. The request form for the data is available at http://sdw.ecb.europa.eu/browse.do?node=1491

The same approach is followed to build a measure of the sensitivity with regards to the sovereign risk against Greece: I assessed this index individually since it is of particular interest for the analysis. The exposure versus the Hellenic sovereign bonds was indeed one of the main concerns for the core economies after the onset of the 2011 sovereign debt crisis.
As additional controls a CDS market index (iTraxx) and a measure of the aggregate market volatility (VDAX) are included.
The iTraxx Europe index, according to the Markit definition, is composed by "125 of the most liquid European entities with investment grade credit ratings". This variable should capture common movements between bank and sovereign CDS given by trends in the CDS market.
The VDAX is instead an index that measures changes in the aggregate volatility, a driving factor in the credit risk pricing. Periods of higher volatility in the markets are associated with a higher level of uncertainty, this should lead to a higher perceived credit risk: a positive relationship is thus possible.
Lastly, since there could be other country-specific factors that affect both sovereign and bank credit risk, I included a control for bank fundamentals. I implemented this measure using data on bank's equity price. This part of the identification strategy relies on a specific peculiarity of bank bailouts: most of them was directed to cushion debtholders rather than equity. According to this feature, a shock arising at a sovereign level should have a disproportionate effect on the price of debt relative to equity, in striking contrast with the other shocks arising from changes in banking assets or fundamentals. Accordingly, in the absence of a direct sovereign-bank credit channel, by controlling for banks' own equity return it will be possible to capture all the effects on bank debt values of any country-level shock. Thus, changes in sovereign CDS will explain changes in bank debt values only in the presence of a direct risk transmission channel.
These assumptions are based on the contingent claim analysis model developed by Robert Merton in 1974. Merton's model theorizes that potential changes in the asset value of a company first affect shareholders, while bondholders are impacted only if the value of assets become lower than the bank's total liabilities.
With this set of controls in place the OLS estimation should be able to assess a measure of the two-way feedback loop between bank and sovereign CDS, eliminating all the possible unobserved confounding factors.

4.3.2 The evolution of the Sovereign-Bank Nexus over time

From this section, I will not consider observations with missing bank or sovereign CDS data. In order to avoid stale data, observations consisting of two consecutives zero changes in bank or sovereign CDS are also dropped from the sample. The database consists then in an unbalanced panel data with 49.753 observations.

Finally, I will use the following pooled OLS specification:

$$\Delta \log(BankCDS_{ijt}) = \beta \Delta \log(\ SovereignCDS_{jt}) + \ \sigma_t + \zeta \Delta Equity_{ijt} + \ \gamma \Delta X_{ijt} + \ \varepsilon_{ijt}$$

The coefficient of interest is β, this parameter should capture the magnitude of the relationship between changes in sovereign and bank CDS rates. The parameter β is then a measure of the strength of the Sovereign-Bank Nexus

The analysis is conducted relying on daily log changes in bank and sovereign CDS, this strategy is adopted in order to reduce the impact of outlier values. The same holds true for changes in the foreign exposure index. For the other variables relative linear changes are instead considered.

In the above OLS specification the term $\gamma \Delta X$ comprises all the other control variables, namely the logarithmic changes in the foreign and the Greek exposures, the iTraxx and the VDAX indexes. The term σ_t represent the time effects, which in my specification are weekly.

As in the previous analysis, the data sample is divided in 4 periods. Initially the regression is performed considering the full set of countries. Table 4.3 shows the results.

Table 4.3 'All Countries: standard OLS regression'
The specification includes weekly time effects.

	Δlog (CDS Bank)			
	Period 1 Nov '08 – Apr '11	Period 2 May '11 – Dec '14	Period 3 Jan '15 – Dec '15	Period 4 Jan '16 – May '19
Δlog (CDSsov)	0.0718***	0.0184***	0.0221***	-0.00108
	(0.00898)	(0.00273)	(0.00361)	(0.00607)
Δlog (ForSov)	0.0583***	0.0600***	0.0135***	0.000264
	(0.00989)	(0.00918)	(0.00350)	(0.000186)
ΔEquity	-0.0160***	-0.0104***	-0.0110*	-0.00633
	(0.00289)	(0.00250)	(0.00483)	(0.0162)
ΔVDAX	-0.00461	0.000820	-0.00369	0.00551*
	(0.00237)	(0.00121)	(0.00252)	(0.00217)
ΔiTraxx	0.0840***	0.0690***	0.0873***	0.0887***
	(0.00440)	(0.00260)	(0.00536)	(0.00878)
N	10915	17255	4463	13845
R^2	0.408	0.390	0.338	0.201

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Taking into consideration the whole set of Countries, the first period shows a remarkable feedback loop effect. In this phase a 10% increase in the sovereign CDS translates into a 0.72% increase in bank CDS, the estimation is nearly identical to the one assessed by Acharya et al. in their empirical work.
In the second and the third period there is a relevant reduction in the phenomenon, which however is still highly statistically significant: in both periods a 10% increase in sovereign CDS is associated with roughly a 0.2% increase in bank CDS. The decline in the Sovereign-Bank Nexus could be explained as an effect of the unconventional policies followed by ECB in order to alleviate the financial stress in Europe, namely the LTRO (Long Term Refinancing Operations) and OMT (Outright Monetary Transaction program). In this phase, also the implementation of the SSM (Single Supervisory Measure) could have helped to give some relief to the financial sectors.
Another relevant aspect in these results is the striking reduction in the transmission of the sovereign and financial risk across countries. Indeed, while in period 1 and 2 the exposure to foreign countries was a sizable factor in the pricing of the banking credit risk, this feature started to disappear from the beginning of 2015.
Considering the post Bail-in period, it appears clear how the Sovereign-Bank Nexus vanished: indeed, the relationship between sovereign and bank CDS in the last column is not significant. So, as a first conclusion, the introduction of the Bail-in clause was able to significantly cease the transmission of risk between sovereign and the banking sector.

As a further step, I separately consider the different groups of countries previously identified. The various groups of countries could be indeed characterized by striking differences in the features of the risk transmission channels: it can be shown that these disparities are not due to countries fixed effects. Running the regressions including either bank, country or group of countries fixed effects doesn't indeed impact the estimations: the differences across countries fundamentals are instead reflected into the magnitude of the co-movement between sovereign and bank risks.
As a first step, I estimated again the same OLS specification considering only Giips countries, this exercise leads to the results summarized in Table 4.4. Unsurprisingly, the estimation leads to substantially larger results. In particular, starting from the second period (which corresponds to the financial turmoil phase) the Sovereign-Bank Nexus shows a much critical outcome: in this time span a 10% increase in sovereign CDS corresponds to a 2.4% growth in bank CDS.
During the sovereign debt crisis, the relationship between financial and credit risk has reached a massive level, in this phase the growing threat of a sovereign default in peripheral Euro

countries resulted in a sharp growth of the sovereign CDS level. This has led in turn to concerns regarding other banking crisis and has fed the worsening of the feedback loop.

As can be seen from the third column, this pattern is roughly the same also in the third period. This proves that the introduction of the BRRD without the bail-in provision was not enough to stop the multiple risk transmission mechanisms in place between sovereign and banks. Moreover, these results suggest that the different measures discussed in the previous chapter (SSM, ESM, LTRO) were not effective in reducing the Sovereign-Bank nexus in the peripheral countries.

Table 4.4: 'Giips Countries: standard OLS regression'
The specification includes weekly time effects

	Δlog (CDS Bank)			
	Period 1 Nov '08 – Apr '11	Period 2 May '11 – Dec '14	Period 3 Jan '15 – Dec '15	Period 4 Jan '16 – May '19
Δlog (CDSsov)	0.0923***	0.242***	0.206***	0.0638*
	(0.0198)	(0.0178)	(0.0336)	(0.0290)
Δlog (ForSov)	0.0313**	0.0280	-0.00475	0.000170
	(0.0113)	(0.0147)	(0.00408)	(0.000141)
ΔEquity	-0.00714	-0.000118	0.00453	-0.0184**
	(0.00455)	(0.00505)	(0.00540)	(0.00657)
ΔVDAX	0.000681	0.00170	-0.00439	0.00882**
	(0.00408)	(0.00204)	(0.00340)	(0.00326)
ΔiTraxx	0.0756***	0.0307***	0.0570***	0.0420**
	(0.00729)	(0.00399)	(0.0105)	(0.0129)
N	4233	6193	1887	5851
R^2	0.375	0.328	0.286	0.248

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

A relief in the feedback loop can be appreciated considering the introduction of the Bail-in tool. Specifically, as shown in the fourth column, while there is still an economically sizable Sovereign-Bank Nexus the estimation loses much of its statistical significance.

Other remarkable results could be grasped from this specification. In particular, there are not relevant signs of financial risk transmission across countries. For Giips countries the foreign credit risk transmission mechanism was not the main concern: as it will be demonstrated in Table 4.5, this effect is instead predicted to be a relevant pattern for core European countries. The explanation is easily provided: the risk of both core and the peripheral credit institutions was priced considering mainly the fear of losses due to low quality sovereign debt holdings. Indeed, while the banks located in the peripheral countries were fully exposed to their domestic sovereign holdings, the Non-Giips banking sector was related to the peripheral countries'

creditworthiness towards the "sovereign exposure" channel. The main concern for the peripheral banks was instead related to the domestic debt, this fact could explain why in Table 4.4 the Δlog (ForSov) coefficient is not significant.

Table 4.5 provides evidences in favor of this explanation, here the OLS estimation is appraised considering the core European countries.

Table 4.5: 'Non Giips Countries'
The specification includes weekly time effects

	Δlog (CDS Bank)			
	Period 1 Nov '08 – Apr '11	Period 2 May '11 – Dec '14	Period 3 Jan '15 – Dec '15	Period 4 Jan '16 – May '19
Δlog (CDSsov)	0.0634***	0.00617	0.0221**	0.0244***
	(0.0122)	(0.00384)	(0.00678)	(0.00549)
Δlog (ForSov)	0.111***	0.0727***	0.0355***	-0.000399
	(0.0193)	(0.0103)	(0.00841)	(0.000509)
ΔEquity	-0.0205***	-0.0100***	-0.0310**	-0.0483***
	(0.00454)	(0.00281)	(0.0104)	(0.00886)
ΔiTraxx	0.0865***	0.0805***	0.0887***	0.105***
	(0.00784)	(0.00351)	(0.00915)	(0.00730)
N	3952	7063	1569	4596
R^2	0.472	0.485	0.405	0.343

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The estimates show how, from the beginning of the sovereign debt crisis in mid-2011, investors stopped to take care at the relationship between domestic sovereign and bank credit risk in core European countries. The attention was instead focused on the credit risk transmission from the peripheral countries and the potential losses connected with the holdings of foreign instruments. In addition, conversely to what happened with Giips countries, Bail-in has not led to a loosening in the Sovereign-Bank Nexus: from the introduction of BRRD in January 2015 the relationship between sovereign and bank CDS is stable and highly statistically significant, although very modest in magnitude. A 10% increase in sovereign CDS leads to a 0.24% increase in banking CDS in the post Bail-in period.

Table 4.5 permits to grasp another interesting pattern in the risk transmission channel. After the Bail-in introduction, idiosyncratic shocks on bank equity are reflected into a sizable effect on banking credit risk. Thus, a negative daily return on equity translates into an increase in bank CDS, the rationale behind this pattern lies in the fact that in the last period debtholders are no longer protected against fluctuations in the value of the banks' assets. Without a government guarantee on bonds the credit risk pricing has become more sensitive to changes in the bank fundamentals. The same feature, although with a smaller extent, could be grasped from Table

4.4. Consequently, an increase in the sensitivity of bank CDS to the credit institutions' fundamentals is a common pattern between countries, this could be seen as a positive collateral effect carried by the introduction of the Bail-in provision. Since investors started to consider more carefully banks' fundamentals the banking risk pricing mechanism has indeed become more efficient.

Repeating the analysis for the countries outside of the Euro Area (namely UK, Sweden and Denmark) leads to results that resembles the ones obtained for core EU countries. Accordingly, as a further conclusion, I could state that the Sovereign-Bank Nexus in the safe European countries[48] has decreased in importance since the onset of the sovereign debt crisis in Summer 2011. Conversely, the concerns regarding the creditworthiness of peripheral countries debt has led to a strict risk transmission mechanism between sovereign and bank for those countries in that period. The introduction of the Bail-in provision, truncating one stress transmission channel, considerably contributed to a reduction in the co-movement between bank and sovereign CDS in Giips countries.

4.3.3 A Robustness check: Analysis with weekly observations

The fact that the data could suffer from measurement errors due to the potential lack of liquidity in the CDS market could lead the former estimates to be biased downwards.

Problems due to a lack of liquidity in the market should be reflected in a widening of the bid-ask spread. Since the measure considered in the analysis is the CDS mid spread this should not be a serious concern. Indeed, the midpoint between bid and ask prices should remain the same, this kind of data should not be impaired by changes in liquidity conditions. Nevertheless, asymmetric shocks on one side of the market, having an influence on the mid value between the bid and the ask price, can't be excluded a priori.

One way to overcome this potential problem is to use weekly observations. In order to reach the maximum level of consistency, I collapsed the daily observations of the daily dataset into their weekly average values. The new panel data is composed by 11.156 observations.

I repeated the weekly analysis maintaining the same OLS specification, the results for Giips countries are depicted in Table 4.6. As expected, the evolution pattern of the Sovereign-Bank Nexus in the various periods resembles the one obtained using daily data. The estimates obtained are somewhat larger with respect to the results deriving from the daily-data analysis, confirming the view that CDS markets are affected by liquidity shortages. At a weekly level the regression assumes also a higher descriptive power, with an adjusted R-squared ratio higher than 0.6 in every period.

[48] Either corresponding to the core EU countries or non-EU ones.

Focusing on the results, the feedback loop in Giips countries reached again an enormous level at the peak of the sovereign debt crisis. The Sovereign-Bank Nexus has maintained its magnitude also after the adoption of the BRRD regulation in 2015.

The most important result is the one regarding the post Bail-in phase. Remarkably, estimating the coefficients at a weekly level brings the risk transmission channel between sovereign and banks to be statistically insignificant: this result empowers the view that the Bail-in provision has curtailed the diabolic loop in the peripheral EU countries.

Table 4.6: 'Giips Countries, analysis using weekly data'
The specification includes weekly time effects

	Δlog (CDS Bank)			
	Period 1 Nov '08 – Apr '11	Period 2 May '11 – Dec '14	Period 3 Jan '15 – Dec '15	Period 4 Jan '16 – May '19
Δlog (CDSsov)	0.118**	0.295***	0.304***	0.0677
	(0.0454)	(0.0324)	(0.0747)	(0.0475)
Δlog (ForSov)	-0.0106	0.0245	0.00162	0.00507*
	(0.0214)	(0.0139)	(0.00662)	(0.00227)
ΔEquity	-0.0120	-0.00620	-0.0115	-0.0591***
	(0.00658)	(0.00662)	(0.0150)	(0.0155)
ΔVDAX	-0.0495	0.00805	-0.0469	-0.0159
	(0.0429)	(0.0153)	(0.0294)	(0.0236)
ΔiTraxx	0.121*	0.176***	0.297	0.00590
	(0.0578)	(0.0485)	(0.167)	(0.0801)
N	972	1269	407	1218
R^2	0.697	0.674	0.635	0.623

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Idiosyncratic shocks on bank equity are again translated into sizable and statistically significant changes in bank CDS only after the introduction of Bail-in, proving again that there has been an improvement in the efficiency of the credit risk pricing.

The results obtained through the analysis using data at a weekly level thus confirms the ones obtained with daily observations.

4.3.4 A Robustness check: Quantile regression analysis

One additional concern is related to the fact that the structure of the data could endanger the results obtained up to this moment. Stata offers a wide range of tools to analyze the features of a dataset, in particular it is important to understand how the residual values are distributed. First of all, from the White test the null hypothesis of homoscedasticity is strongly rejected. The way to deal with the issue of heteroscedasticity is to include robust standard errors, relaxing the

assumption that they are identically distribute. I conducted all the empirical analysis adopting this solution.

Another obstacle is given by the fact that financial time series are usually characterized by the presence of outlier values, a robustness exercise should consider the fact that few extreme values could influence the whole outcome of the analysis. In order to rule out this possibility a more advanced statistical method comes into help: the quantile regression technique is a more robust approach against outlier values with respect to the classical Ordinary Least Square method. Whereas this latter technique consists in estimating the conditional mean of the dependent variable reacting to the independent ones, the quantile regression method is addressed to assess the value of given conditional quantiles of the response variable. Consequently, a further advantage of the quantile regression analysis is that it enables to simultaneously evaluate the reaction of the response variable at different quantile levels. It is then possible to estimate the behavior of the Sovereign-Bank Nexus along the entire distribution of the changes in bank CDS.

As a first step I conducted a simultaneous quantile regression[49] considering the full sample of countries in the different time periods. I estimated a set of 7 different quantiles, specifically the 5^{th}, 10^{th}, 25^{th}, 50^{th}, 75^{th}, 90^{th}, and 95^{th}. Table 4.7 lists the result.

In the first period, the estimation for the median percentile resembles the OLS estimation for the mean of the response variable, a 10% percent change in the sovereign CDS corresponds indeed to a 0.66% change in bank CDS. Extreme values for bank CDS changes are associated with a larger feedback loop, this effect is sharper for the highest percentiles: at the 95^{th} quantile the coefficient of interest is almost doubled compared to the median regression.

A similar behavior is associated to changes in equity: a change in a bank's equity price has a higher effect on credit risk when considering extreme changes in bank CDS.

In the second period of the quantile regression the Sovereign-Bank Nexus evaluated on the full sample has almost disappeared, while the feedback effect is again more pronounced in response to the highest increases in bank CDS. This pattern is quite similar for the results estimated in the period after the BRRD implementation in the third column. The last column, referring to the Bail-in implementation period, confirms the view that the Sovereign-Bank Nexus has not been much affected by the Bail-in provision when considering the whole set of countries.

[49] The simultaneous quantile regression consists in the contemporaneous estimation at the various quantile levels.

Table 4.7: 'Comparison of quantiles between periods, all the Countries'
The specification includes weekly time effects

Δlog (CDS Bank)				
	Period 1 Nov '08 – Apr '11	Period 2 May '11 – Dec '14	Period 3 Jan '15 – Dec '15	Period 4 Jan '16 – May '19
		5th quantile		
Δlog (CDSsov)	0.0829***	0.0283***	0.0258	0.00385
	(0.0131)	(0.00827)	(0.0133)	(0.0153)
ΔEquity	-0.0197***	-0.0276***	-0.0198	-0.0332***
	(0.00482)	(0.00585)	(0.0173)	(0.00702)
		10th quantile		
Δlog (CDSsov)	0.0660***	0.0230***	0.0158***	0.0104
	(0.0143)	(0.00431)	(0.00456)	(0.00674)
ΔEquity	-0.0221***	-0.0235***	-0.0162*	-0.0218***
	(0.00479)	(0.00404)	(0.00789)	(0.00460)
		25th quantile		
Δlog (CDSsov)	0.0510***	0.0120***	0.0134***	0.00948**
	(0.00842)	(0.00212)	(0.00386)	(0.00328)
ΔEquity	-0.0147***	-0.0137***	-0.0176***	-0.0185***
	(0.00308)	(0.00203)	(0.00398)	(0.00155)
		Median quantile		
Δlog (CDSsov)	0.0660***	0.00841***	0.0119**	0.0118***
	(0.00792)	(0.00184)	(0.00383)	(0.00245)
ΔEquity	-0.00961***	-0.00901***	-0.0157***	-0.0118***
	(0.00135)	(0.000996)	(0.00418)	(0.00222)
		75th quantile		
Δlog (CDSsov)	0.0836***	0.0132***	0.0213***	0.0204***
	(0.00880)	(0.00254)	(0.00409)	(0.00201)
ΔEquity	-0.0129***	-0.00997***	-0.0138*	-0.0179***
	(0.00190)	(0.00177)	(0.00600)	(0.00284)
90th quantile				
Δlog (CDSsov)	0.0953***	0.0238***	0.0388***	0.0363***
	(0.0121)	(0.00174)	(0.00551)	(0.00338)
ΔEquity	-0.0148***	-0.0121***	-0.00102	-0.0258***
	(0.00321)	(0.00279)	(0.00898)	(0.00504)
		95th quantile		
Δlog (CDSsov)	0.115***	0.0343***	0.0494***	0.0410***
	(0.0245)	(0.00285)	(0.00798)	(0.00913)
ΔEquity	-0.0208***	-0.0113***	-0.00646	-0.0413***
	(0.00501)	(0.00329)	(0.0190)	(0.00753)
N	10309	16497	4209	13064

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

It could also be useful to plot the estimated levels of the feedback loop at all the quantiles of the response variable. In the following figure I consider the entire distribution of changes in bank CDS. The evaluations are bounded at the 5th and 95th quantiles, I excluded extreme percentiles since for these values the estimations are not reliable.

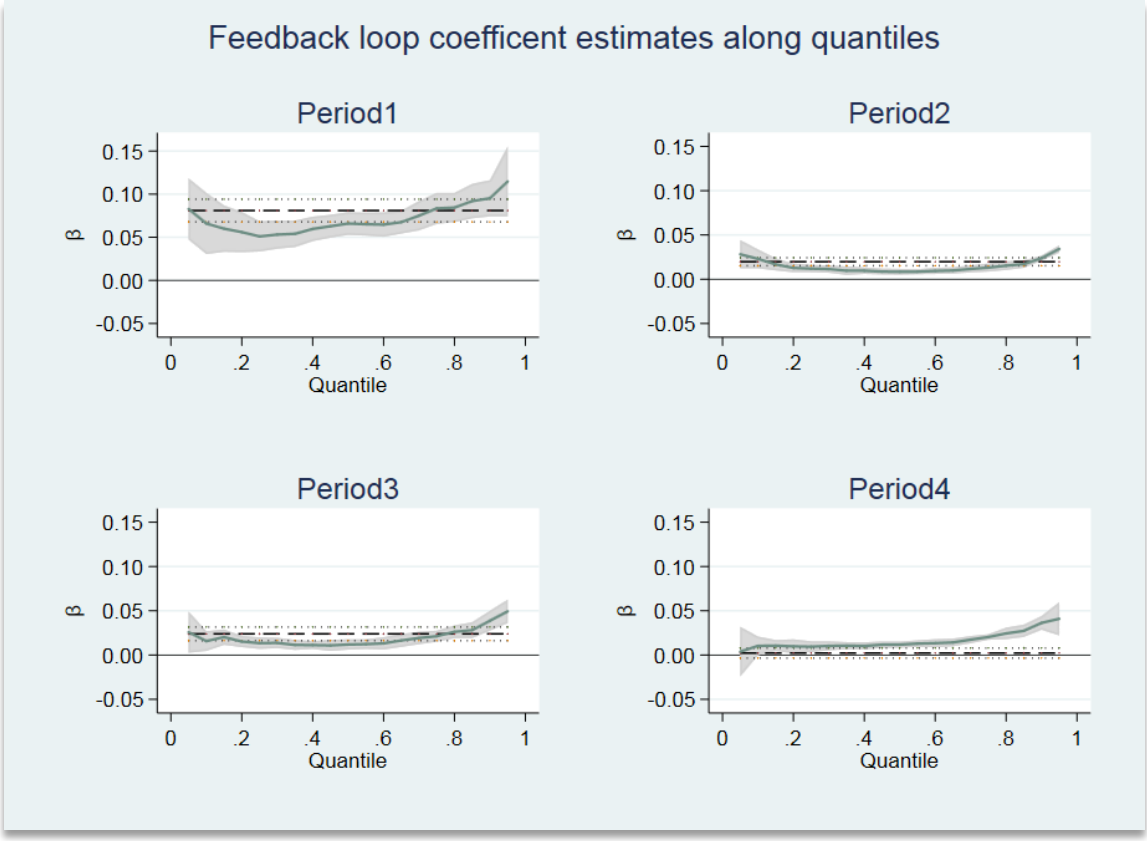

Figure 4.9, For every period, the green line represents the magnitude of the Sovereign-Bank Nexus (coefficient Beta), estimated through the quantile regression technique at every quantile of the response variable (Δlog (CDS Bank)). The grey area is the corresponding confidence level. The black dotted line shows the corresponding OLS estimation, with its confidence level (represented by the grey dotted line). The sample considered is the whole distribution

As a further step I evaluated the quantile regression for the Giips countries, the time evolution of the feedback loop is similar to the one predicted with the OLS estimation, although the results are less striking.

The Bail-in provision has contributed to give some relief to the risk transmission channels between bank and sovereigns in peripheral countries, causing a reduction in the phenomenon of the Sovereign-Bank Nexus. However, for every quantile assessed the feedback loop estimations are still economically and statistically significant.

The post Bail-in feedback loop is particularly sizable for the highest quantile: at this point a 10% increase in sovereign CDS is translated into a growth of roughly 1.5% into bank CDS. In this case the boundaries of the assessment are the 10th and 90th percentiles, the reduction of the evaluation area is necessary since the sample is smaller and less observations are available.

Indeed, in order for the quantile regression technique to be consistent at all the percentiles, a much higher number of observations with respect to the standard OLS estimation is required. To conclude, the results previously obtained are only partially confirmed: the Bail-in clause was indeed able to curtail part of the risk transmission channels between sovereign and banks, but it seems that risk spillover effects are still active. In particular, while the "safety net" channel is likely to be slashed, it seems that the other risk transmission mechanisms are still in place. Table 4.8 and Figure 4.10 show the evidences for the quantile analysis of Giips Countries.

Table 4.8: 'Comparison of GIIPS quantiles between periods'
The specification includes weekly time effects

Δlog (CDS Bank)				
	Period 1 Nov '08 – Apr '11	Period 2 May '11 – Dec '14	Period 3 Jan '15 – Dec '15	Period 4 Jan '16 – May '19
		10th quantile		
Δlog (CDSsov)	0.111***	0.240***	0.144***	0.0676*
	(0.0310)	(0.0270)	(0.0305)	(0.0296)
ΔEquity	-0.0208**	-0.00914	0.00688	-0.0256***
	(0.00720)	(0.00638)	(0.00862)	(0.00668)
		25th quantile		
Δlog (CDSsov)	0.113***	0.195***	0.132***	0.0771***
	(0.0214)	(0.0156)	(0.0203)	(0.0217)
ΔEquity	-0.0117*	-0.00827***	-0.00267	-0.0105**
	(0.00474)	(0.00220)	(0.00554)	(0.00326)
		Median quantile		
Δlog (CDSsov)	0.104***	0.176***	0.125***	0.0904***
	(0.0182)	(0.0109)	(0.0202)	(0.0158)
ΔEquity	-0.00676*	-0.00183	-0.00120	-0.00490**
	(0.00287)	(0.00110)	(0.00232)	(0.00175)
		75th quantile		
Δlog (CDSsov)	0.114***	0.186***	0.162***	0.123***
	(0.0174)	(0.0142)	(0.0217)	(0.0169)
ΔEquity	-0.00535	-0.00519**	-0.00124	-0.00217
	(0.00337)	(0.00161)	(0.00532)	(0.00342)
		90th quantile		
Δlog (CDSsov)	0.118***	0.221***	0.234***	0.147***
	(0.0270)	(0.0186)	(0.0401)	(0.0325)
ΔEquity	-0.0126	-0.00520	0.00390	-0.00878
	(0.00815)	(0.00391)	(0.0102)	(0.00530)
N	4233	6193	1887	5851

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

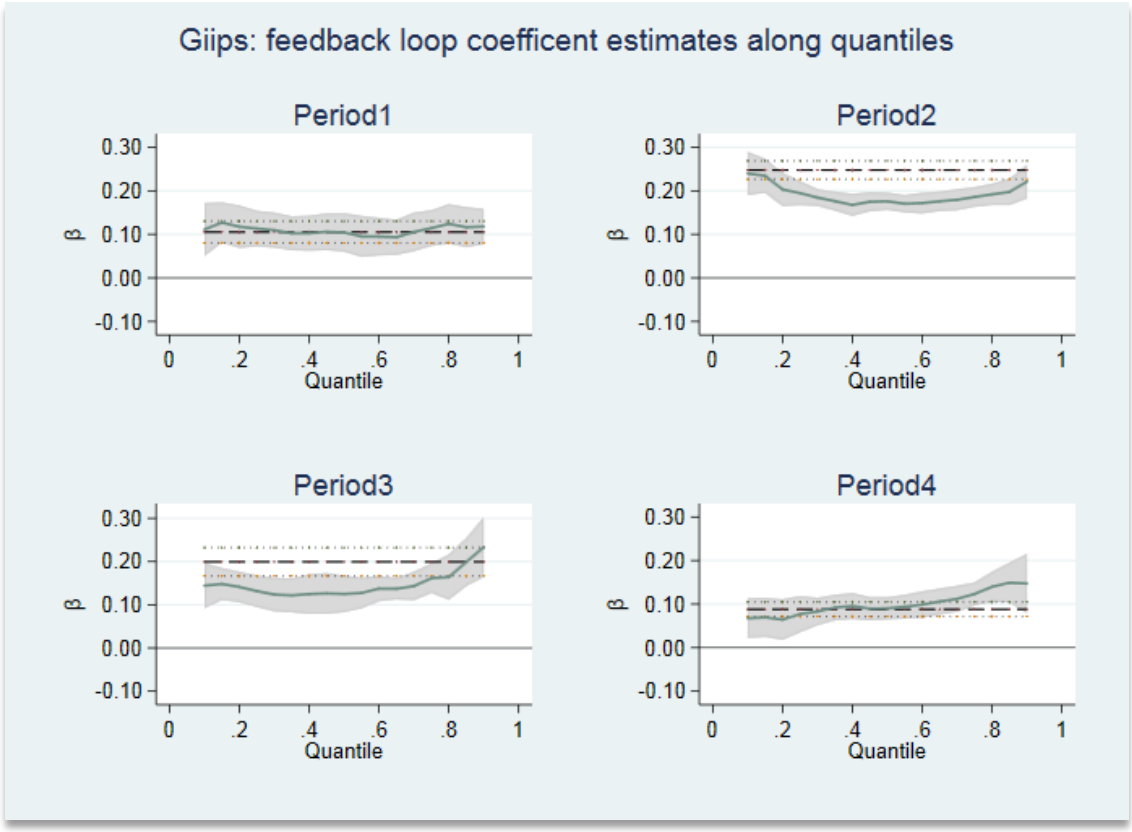

Figure 4.10, For every period, the green line represents the magnitude of the Sovereign-Bank Nexus (coefficient Beta), estimated through the quantile regression technique at every quantile of the response variable (Δlog (CDS Bank)). The grey area is the corresponding confidence level. The black dotted line shows the corresponding OLS estimation, with its confidence level (represented by the grey dotted line). The estimations consider the Giips Countries only (Italy, Spain, Portugal, Ireland).

4.3.5 A counterfactual: the special case of Italy

I have demonstrated that the Bail-in clause was able to significantly reduce the two-way feedback loop in a situation in which this perverse mechanism was in place in a sizable manner. While in safe and stable countries the introduction of this provision didn't produced an appreciable result the risk transmission has been remarkably reduced in the less safe peripheral euro countries.

In order to grasp another fundamental aspect of the analysis it is useful to further divide the dataset between the various Giips countries, namely Italy, Spain, Ireland and Portugal. As tables 4.9 and 4.10 show the comparison of the time evolution of the Sovereign-Bank Nexus between Italy and the other Giips countries permits to obtain contrasting results.

Considering Spain, Ireland and Portugal the results appear to be indisputable: the feedback loop has been in place with a considerable effect until the introduction of the Bail-in. Afterwards, there was no more sign of this phenomenon: since the estimate loses all of its significance it could be concluded that the Bail-in provision was able to curtail the Sovereign-Bank Nexus in these countries.

Table 4.9: 'Giips Countries, Italy excluded. Standard OLS Regression'
The specification includes weekly time effects

	Δlog (CDS Bank)			
	Period 1 Nov '08 – Apr '11	Period 2 May '11 – Dec '14	Period 3 Jan '15 – Dec '15	Period 4 Jan '16 – May '19
Δlog (CDSsov)	0.123***	0.190***	0.191***	0.0164
	(0.0216)	(0.0202)	(0.0270)	(0.0227)
Δlog (ForSov)	0.0105	0.00504	-0.0125**	0.0000991
	(0.0126)	(0.00598)	(0.00474)	(0.0000952)
ΔEquity	-0.00525	-0.00297	0.00713	-0.0214**
	(0.00491)	(0.00548)	(0.00605)	(0.00765)
N	2344	3642	983	3027
R^2	0.374	0.206	0.252	0.169

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

In contrast, Italy represents a sort of exception across Giips countries. The evolution of the Sovereign-Bank Nexus in Italy is indeed considerably different with respect to the other peripheral countries.

Table 4.10: 'Italy. Standard OLS Regression'
The specification includes weekly time effects

	Δlog (CDS Bank)			
	Period 1 Nov '08 – Apr '11	Period 2 May '11 – Dec '14	Period 3 Jan '15 – Dec '15	Period 4 Jan '16 – May '19
Δlog (CDSsov)	0.0451	0.267***	0.163*	0.354***
	(0.0334)	(0.0328)	(0.0685)	(0.0466)
Δlog (ForSov)	0.0604***	0.0489	0.0248**	0.00120
	(0.0172)	(0.0273)	(0.00845)	(0.00289)
ΔEquity	-0.0167	0.00846	-0.00717	0.00316
	(0.0114)	(0.00755)	(0.0122)	(0.00842)
N	1889	2551	904	2824
R^2	0.413	0.526	0.364	0.429

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

After the onset of the 2008 financial turmoil no sign of the feedback loop was in place in Italy, this could be explained considering the fact that the great financial crisis didn't have a severe effect on the Italian banking sector. Consequently, there was no need for the Italian government to spend public money into bank recapitalizations and backstops.

The situation dramatically changed with the worsening of the sovereign debt crisis in the summer of 2011: in this period the concerns around the solvency of the Italian public debt triggered an upsurge in the Sovereign-Bank Nexus. Banks suffered towering losses in their holdings of domestic sovereign debt and this in turn has led to a sharp contraction in their

activity. The explosion of the problem of NPL (Non-Performing Loans) contributed to this nosedive, leading to a further weakening of the financial sector. With all these ingredients settled, a very strong two-way feedback loop can be identified in the second period of the analysis. In the second column a 10% increase in sovereign CDS leads to a 2.7% grow in bank CDS.

In the third period, following the implementation of the BRRD, the feedback loop is somehow reduced in Italy, moreover the estimate is significant only with a 10% level of confidence.

Unexpectedly, after the introduction of Bail-in the Sovereign-Bank Nexus improves its strength, reaching an exorbitant level: a 10% increase in sovereign CDS brings a 3.5% increase in bank CDS. Since the elimination of one risk transmission channel should have reduced the risk of spillover effects this pattern calls for an explanation, the estimation shows indeed a fierce exacerbation of the phenomenon.

The rationale behind the onset of this strict co-movement could lie behind some triggering events. In order to understand if the happening of a particular circumstance has caused the feedback loop to improve its power, 3 sparking occurrences are considered.

First, the worsening of the feedback loop in the last period could be the outcome of the Monte dei Paschi bank crisis. In the aftermath of the December 2016 Referendum, Italy has indeed undergone a period of political uncertainty, caused by the resignations of the Prime Minister Matteo Renzi. Alongside, in the same period MPS entered in a negative spiral and the government was forced to activate the precautionary recapitalization procedure. According to the BRRD, if a systemic important bank suffers from a shortfall of capital after failing a stress test (as it happened in the July 2016 EBA exercise) this kind of state aid is allowed. The rescue package of MPS costed to the newly established Italian government roughly €20 billion, a massive amount of money. It then could be the case that this event caused the Sovereign-Bank Nexus to worsen dramatically.

In order to check this hypothesis, I adopt again the standard OLS specification of the model. I evaluate the Sovereign-Bank Nexus before and after the triggering event. I identified the discontinuity at 22nd December 2016, when the government passed the decree taking MPS public. As a counterproof, I separately assess the feedback loop for the other Giips countries in the same time windows.

As shown in Tables 4.11 and 4.12, in the period following the MPS public recapitalization the feedback loop has increased its magnitude in Italy. Conversely, for the other countries the Bail-in has been effective for the reduction of the co-movement in both the sub-periods, confirming the previous conclusions.

Table 4.11: 'Italy, before and after MPS case'

Δlog (CDS Bank)		
	Before MPS Case	After MPS Case
Δlog (CDSsov)	0.251**	0.381***
	(0.0932)	(0.0479)
N	946	1878
R^2	0.378	0.474

Table 4.12: 'Other GIIPS, before and after MPS case'

Δlog (CDS Bank)		
	Before MPS Case	After MPS Case
Δlog (CDSsov)	0.0634	0.0146
	(0.0481)	(0.0201)
N	979	2048
R^2	0.247	0.148

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

As a second trigger event, I considered the crises of Veneto Banca and Banca Popolare di Vicenza. These cooperative banks, deep-rooted in the North-East of Italy, suffered from huge losses due to management inefficiencies and the eruption of the NPL problem. On 23rd June 2017 ECB deemed VB and BPVi failing or likely to fail for lack of capital. According to the BRRD regulation, the Single Resolution Board concluded that the conditions for starting a resolution procedure were not met due to the lack of the public interest requirement.

As a consequence, the two banks had been liquidated following the Italian ordinary insolvency procedures. Intesa SanPaolo acquired part of them for a symbolic value of €1 and the Italian government ended up controlling entirely a "bad bank" composed by the residual assets. In addition to that, the government also granted up to € 6.4 billion of the assets acquired by Intesa SanPaolo through this operation. These events have caused a huge impact on the economic activities in the region of Veneto, leading moreover to great uncertainties around the effectiveness of the resolution procedures established in BRRD. Thus, the reference date is now fixed at 23rd June 2017.

Table 4.12 shows that the difference between the two periods is now more prominent, while in the pre-crisis period the assessed level of the Sovereign-Bank Nexus was 0.244 (with a 5% significance level) the post ECB intervention period sees an astounding increase in the loop, which reached the level of 0.413. This means that, after the liquidation of the cooperative banks, almost half of the increase in the sovereign CDS is reflected into an increase of bank CDS.

Again, the results for the other Giips countries show the complete absence of a Sovereign-Bank Nexus phenomenon in both periods.

Table 4.13: 'Italy, before and after VB and BPVi cases'

Δlog (CDS Bank)		
	Before VB case	After VB case
Δlog (CDSsov)	0.244**	0.413***
	(0.0846)	(0.0497)
N	1464	1360
R^2	0.369	0.498

Table 4.14: 'Other Giips, before and after VB and BPVi cases'

Δlog (CDS Bank)		
	Before VB case	After VB case
Δlog (CDSsov)	0.0184	0.0171
	(0.0383)	(0.0210)
N	1483	1544
R^2	0.174	0.184

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

There's however another fact that could be the cause of the tremendous increase in the Sovereign-Bank Nexus in Italy. On 1st June 2018 the new Italian populist government has seated, the reaction of the market has led to a sharp increase in the sovereign bond yields, shifting consequently this stress to the banks' balance sheet. To consider the possibility that the rise in the Sovereign-Bank Nexus could be driven by this trigger event the date taken as reference is the 23rd May 2018, when the premier Giuseppe Conte received the task to form the new government for the first time.

As Table 4.14 shows, the estimated feedback loop effect for the period before the settlement of the new populist government is the same as the one regarding the period before the VB and BPVi crisis. This result suggests that probably the trigger event for the growth in sovereign-debt co-movement is the settlement of the Conte government.

Table 4.15: 'Italy, before and after the government settlement'

Δlog (CDS Bank)		
	Before NewGov	After NewGov
Δlog (CDSsov)	0.244***	0.471***
	(0.0589)	(0.0535)
N	2161	663
R^2	0.376	0.646

Table 4.16: 'Other Giips, before and after the government settlement'

Δlog (CDS Bank)		
	Before NewGov	After NewGov
Δlog (CDSsov)	0.0640**	0.0224
	(0.0235)	(0.0165)
N	2292	735
R^2	0.183	0.322

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The extraordinary increase in the Sovereign-Bank Nexus in the aftermath of the new government creation could be explained, first of all, by the quick increase in the sovereign debt yields. The associated reduction in the value of the sovereign bond has indeed caused relevant losses to the Italian banks, with a consequent increase in the bank CDS levels. The increase in the feedback loop recorded in this period could indeed be read as a consequence of the resurgence of the "Sovereign Exposure" risk transmission channel.
However, also in the period preceding the stress on sovereign yields a relevant feedback loop effect was in place. From the proposed analysis it can be pointed out that the Bail-in provision was not able to curtail the Sovereign-Bank Nexus in Italy, the reasons behind this could be various.

A possible way to understand the lack of success of the Bail-in in Italy relies on the fundamental features of this country. Italy is characterized by a huge amount of public debt compared to the GDP, with a debt/GDP ratio of 131.2% registered in 2017. In addition to that, the country has faced a substantial economic stagnation in the last years. In contrast Spain, Portugal and Ireland have enjoyed a substantial GDP growth from 2014 on.
Alongside the macroeconomic problems that affect the Italian economy also its banking sector is not thriving: the main concern is related to the huge amounts of NPL and "bad loans" persisting in banks' balance sheets. Another source of worry lies in the poor profitability of the whole banking system.
A further possible explanation that could be given to the persistency of the Sovereign-Bank Nexus in Italy calls into question the lack of credibility of the institutions. In the last years, the various Italian political leaders tried to gain consent with a series of controversial announcements regarding the banking industry and its regulation. These announcements translated into the implementation of the FIR (Fondo Indennizzo Risparmiatori), a government scheme to reimburse shareholders and bondholders of failed credit institutions, active from August 2019. The fund, amounting to € 1.575 billion, is aimed to reimburse the retail savers to whom instruments of the 11 banks failed in Italy between November 2015 and January 2018 were "mis-selled". The amount reimbursed corresponds to 95% of the instrument's nominal

value for bondholders and to 30% for shareholders. All the investors with financial assets up to € 100.000 or with an annual income up to € 35.000 could directly require the reimbursement, according to the estimations conducted by the MEF this group corresponds to 90% of the total retail investors. The others retail savers will need to demonstrate, through a simple procedure, that they were effectively victims of mis-selling. The institution of this fund clearly collides with the *ratio* of the Bail-in provision, turning out to damage the credibility of the entire European banking resolution framework. While this approach could be justified by the spread mis-selling of banking financial instruments, using the words of Markus Ferber[50] "…such a decision would set a very bad precedent as bondholders and shareholders could reasonably assume that this would not be a one-off decision…". Public finances and banking liabilities could thus turn out to be linked again through the reimbursement of the instruments which were "bailed-in" during a resolution procedure.

Along with this, the fact that BRRD regulation leaves room for discretionality leads to further uncertainties about the future effective implementation of the Bail-in provision.

To conclude, while the Bail-in provision significantly helped to shorten the safety net channel, the Sovereign-Bank Nexus needs to be handled implementing additional measures.

The fact that my calculations highlighted a sharp worsening of the feedback loop in response to the 2018 Italian sovereign yields shock could be seen as a "wake up call". The risk transmission channels still in place have indeed the potential to trigger harsh reactions in the financial markets. Pursuing the path of financial integration across European countries and limiting the banks' holding of sovereign debt should thus be a priority for authorities.

The following chapter briefly describes a proposal which should effectively act towards the lessening of the Sovereign Exposure channel.

[50] German lawmaker, former leader of the conservative group in EU parliament's economic committee. The extract could be found in an article published by Reuters on April 9, 2019.

5. Sovereign Concentration Charges Regulation

The Bail-in provision, discussed in the previous chapter, had a great impact in curtailing the Sovereign-Bank Nexus. However, to definitively break the vicious loop linking sovereigns and banks another problem needs to be handled. The fact that many euro-area banks are still highly exposed towards their domestic sovereign leads indeed to potential disruptive effects.

The home-bias problem could be hidden in the European banks' balance sheets without showing alarming effects in stable times. However, in case of increasing sovereign stress the risk transmission between banks and their sovereign could show an enormous upsurge, as happened with the 2011 sovereign debt crisis. The calculations of the previous chapter demonstrate that the Sovereign Exposure channel is still active in the Euro Area. Indeed, the stress on Italian sovereign yields started from May 2018 has been immediately followed by a severe increase in the co-movement between sovereign and banking credit risk.

Reducing the incentives to hold a large share of domestic sovereign debt should thus be a priority to tackle the residual linkages of the feedback loop. In this chapter I summarize the proposal to introduce a Sovereign Concentration Charges Regulation (SCCR), referring to the work of Véron (2017)[51].

The Sovereign Concentration Charges Regulation refers to possible additional capital requirements imposed to the banks located in the Euro Area. These capital requirements are imposed if a bank is exposed towards sovereign debt issued in another Euro Area country (including the domestic one) above a certain threshold. Consequently, sovereign exposures would maintain their 0% capital risk weight if they are below a certain exemption threshold, otherwise they would entail a proportionally increasing positive risk weight. The author identified the optimal threshold at a level equal to 33% of the bank's Tier 1 Capital, above that level the sovereign exposures could be charged of a concentration capital requirement that goes from 15% to 500% of their nominal amount.

Bucket	**1**	**2**	**3**	**4**	**5**	**6**	**7**
$\frac{\textbf{Sovereign Eposure}}{\textbf{Tier 1 Capital}}$	< 33%	33% -50%	50% - 100%	100% - 200%	200% - 300%	300% - 500%	> 500%
Sovereign Concentration Charge	-	15%	30%	50%	100%	200%	300%

Table 5.1, The proposed concentration charges on concentrated sovereign exposures. The related charges are evaluated at buckets: this means that holdings up to 33% of Tier 1 Capital are not charged of any weight, while if sovereign holdings exceed this threshold the exceeding part is charged a weight equal to the 2nd bucket. Similarly, holdings exceeding the second threshold (50%) are proportionally charged of the 3rd bucket weight for the exceeding part.

[51] This paper has been published by the European Parliament, which is considering the feasibility of introducing a Sovereign Concentration Charges regulation.

By imposing concentration charges for concentrated sovereign exposures banks will have an incentive to diversify their Euro-denominated sovereign holdings without being charged with an additional burden for credit risk. In this way the home-bias problem would be addressed and the sovereign debt issued by the various Euro Area countries would be more evenly distributed across countries. The introduction of SCCR would then be an important antidote against the financial fragmentation in the Euro Area. Diversify sovereign holdings across the Euro Area countries should be the optimal behavior for credit institutions. Banks have indeed the possibility to reduce their dependence on a single country's creditworthiness without incurring in an additional currency risk.

The proposal to implement concentration charges instead of adopting simple risk weights on sovereign exposures represent an optimal solution for a variety of reasons. First of all, the introduction of positive capital weights on sovereign holdings regardless of their concentration would entail distortionary effects.
Another problem would be related to the magnitude of the risk weight to be imposed on every sovereign issue. This would hold regardless of the methodology adopted for the determination of the risk weight. The credit risk assessment is indeed not a straightforward procedure. Moreover, correctly estimating the creditworthiness of a sovereign is much more difficult with respect to another subject.
The solution to adopt a Standardized Approach solution would leave the assessment decision to rating agencies or other public entities. Giving so much power to these subjects would involve controversies related to their governance, independence, supervision and accountability.
Alternatively, another solution could be to derive the proper risk weight from market signals, but this would entail the potential for market manipulation.
Finally, the IRB approach would clearly not be suitable, since banks would have room for self-serving behavior.
Through SCCR, conversely, the choice of the concentration charge to be implemented would be established a priori, in a clear and objective way, as showed in Table 5.1. The concentration charge imposed on sovereign holdings would not depend on the sovereign's creditworthiness, the problem of the correct assessment of the risk weight would thus not be in place.

An additional downside of imposing positive risk weight on sovereign exposures would be the fact that this prudential framework entails a strong procyclical effect. In case of a sovereign debt distress, an increment in the risk weight of the related securities would trigger a fire sale

reaction, leading to a major threat for that sovereign's creditworthiness. In contrast, concentration charges, being fixed, should not involve a pro-cyclical market reaction.
The adoption of positive sovereign risk weights at a European level, without an international simultaneous adoption across countries as in the case of Basel agreements, would also bring cross-border competitive distortions. The Euro Area banks would be subject to higher capital requirements with respect to the other financial institutions. The competitiveness of the EU banking industry would be endangered.
Conversely, if a bank behaves as prescribed by the hypothetical SCC regulation, maintaining their sovereign exposures below the exemption threshold, there would be no additional capital requirements. In this way, the international competitiveness of the Euro Area bank would be preserved.

Lastly, the home-bias problem would not be addressed through the introduction of risk weights on sovereign holdings. While positive risk weights would probably restrict the banks' sovereign portfolios, there would be no incentives for them to diversify away their holdings from their domestic countries. In contrast, concentration charges would introduce the incentive for banks not to over-invest in a single Euro Area sovereign debt and to build their sovereign portfolios in a sustainable manner.

In the intention of the author, the implementation of a regulation on Sovereign Concentration Charges should be pursued along with the introduction of a fully integrated European Deposit Insurance Scheme. The two measures have indeed a set of interdependencies and their joint application would be a crucial step towards the creation of a comprehensive European Banking Union. While the concentration charges regulation would defuse the Sovereign Exposure channel, the European Deposit Insurance Scheme creation would help to fully mutualize risks across the European Union.
Finally, it is important to notice that SCCR would be suitable to face the introduction of a European safe bond, as the above-discussed Sovereign Bond Backed Securities. In order to be successfully implemented, the SBBS should be exempted from concentration charges or, alternatively, their lower risk profile should be recognized by imposing a higher exemption threshold with respect to the "traditional" sovereign exposures.

Conclusions

Since the aftermath of the 2008 financial crisis, one of the main goals of the regulatory authorities has been the reduction of the interconnections between the public finances and the credit system. In my thesis I discuss in depth the various policies which have been implemented in the last decade, describing the effects that they are likely to produce on the Sovereign-Bank Nexus.

First, the SSM (Single Supervisory Mechanism) has harmonized at a European level the activity of banking supervision. The assessment of banks could thus be carried out in a more consistent manner, the SSM has impacted on the Sovereign-Bank Nexus reducing the likelihood of unexpected banking crises.

Similarly, Basel III agreements enhanced the prudential regulation, leading to the adoption of CRR/CRD IV. These new provisions significantly increased the capital requirements that credit institutions need to respect in order to operate. This has enhanced the banks' loss absorption capacity. The financial system is thus more resilient against negative shocks. On the other hand, some provisions of the CRR/CRD IV incentivize banks to enlarge their exposure towards domestic sovereign debt. This aspect could end up feeding the "sovereign exposure" channel, leading to a potential sharp increase in the magnitude of the Sovereign-Bank Nexus in case of stress on sovereign yields.

In order to curtail the "sovereign exposure" channel the introduction of a European Safe Bonds has been recommended by many scholars. In my thesis I discuss the proposal to introduce SBBS (Sovereign Bond-Backed Securities). The European Commission implemented this idea by formulating a scheme for the introduction of ESBies (European Safe Bonds). While these instruments could bring to a sharp reduction in the Sovereign-Bank Nexus, some potential distortionary effects are stopping the creation of the new market.

Focusing on the safety net channel, through my empirical analysis I demonstrated that the Bail-in provision was able to significantly curtail the risk transmission arising from the presence of government guarantees on banking liabilities. In particular, I referred to the methodology adopted by Acharya (2014), assessing the co-movement between the logarithmic daily changes of 5-year banking CDS and the corresponding sovereign CDS.

My estimations confirm the view that the Bail-in significantly reduced the risk transmission in place between sovereigns and banks in Giips countries. Considering the core European countries, my calculations show that the Sovereign-Bank Nexus has a negligible effect, albeit significant.

As an additional positive effect, the Bail-in provision has enhanced the credit risk pricing mechanism in the banking sector. Indeed, my estimations show that changes in the equity price of a bank are significantly reflected in a change in the bank CDS solely after the Bail-in implementation.

Overall, however, the BRRD framework shows some criticalities that could impair its effectiveness. The possibility to grant financial assistance to credit institutions through state aid has not been completely excluded. The BRRD gives indeed to the competent authorities a lot of discretion around the proper management of a credit institution's distress. While this is a necessary feature, the high level of flexibility leaves room for uncertainties and enables the national political interests to negotiate their preferred outcomes. A clear and objective crisis management practice has not yet been established, a future goal for the regulatory authorities should thus be the successful and effective application of the BRRD rules.

Moreover, it is not clear how the financial system could react to a systemic shock in the new resolution framework.

The case of Italy is worth of a special mention, my empirical analysis registered a sharp increase in the Sovereign-Bank Nexus after the implementation of the Bail-in tool. This tendency could have several explanations. First, the particular features of the country (high GDP/ratio) and of the credit system (high level of NPL and low profitability) could be called into question. Second, the increase in the feedback loop could be seen as a consequence of the lack of credibility of the political establishment. Third, part of the exacerbation of the risk transmission could be attributed to the shock on sovereign yields registered after the 2018 general election.

To definitively slash the Sovereign-Bank Nexus further steps are required. The fact that in many countries the credit industry is still heavily exposed towards its sovereign debt represent a serious threat to the financial stability. These large holdings could bring to a fierce feedback loop effect in case of new shocks on sovereign yields. To eliminate this risk, the regulatory authorities should intervene by implementing a new prudential provision. In particular, Véron (2017) proposes the implementation of a regulation on Sovereign Concentration Charges. By incentivizing banks to diversify their sovereign holdings, the transmission of risks through the "sovereign exposure" channel would be seriously impaired.

Along with the Sovereign Concentration Charges, to definitively slash the residual linkages active in the Sovereign-Bank Nexus, it should be necessary to complete the Banking Union with the implementation of its third pillar. Without an EDIS (European Deposit Insurance Scheme), in case of a large banking distress, governments could be called to intervene to cover the lack of their national insurance deposit schemes. A centralized deposit insurance mechanism

would address these concerns, providing a credible protection to depositors regardless of the country in which their bank is located.

Finally, it is not sure whether the interconnections inherent in the macroeconomic channel could be managed. On one hand the process of financial integration and harmonization could bring the credit system to diversify their activities across the European Union. Conversely, many banks, especially the smaller ones, are strictly rooted in their region and their health is closely connected to the vitality of the economic activity in their area. My interpretation is that the process of consolidation of financial institutions in place in the last decade will continue, bringing to the development of supranational banking conglomerates which should not more depend on the state of a single economy. Consequently, a sound and safe Banking Union would be necessary to cope with the many "too big to fail" credit institutions which are likely to operate in the financial industry in the next decades.

To conclude, I propose some future research suggestions. The empirical analysis conducted in my thesis could be repeated considering other non-European countries, such as USA. The illustrated Sovereign-Bank Nexus is a typical feature of a monetary union. It could be possible, however, that after the massive bailouts undertaken during the financial crisis, some transmission of risk was active in USA. Useful features of the phenomenon could be then grasped by comparing the time evolution of the Sovereign-Bank Nexus in USA with the results obtained in this work.

Furthermore, my analysis could be improved by developing more advanced econometric techniques. By implementing an impulse-response model, the transmission of risks stemming from shocks at a bank level could be separately assessed.

Lastly, my results should be periodically updated in order to catch the reactions arising from relevant events, such as new regulatory improvements or the carrying out of a controversial resolution procedure. In this sense, the possible collateral effects stemming from the implementation of the Italian FIR[52] should be evaluated in the next months.

[52] I discussed about the FIR (Fondo Indennizzo Risparmiatori) in the third chatper. Briefly, it is a government scheme to reimburse retail shareholders and bondholders of the 11 recently failed Italian credit institutions. The FIR consists of a fund amounting to € 1.575 billion.

BIBLIOGRAPHY

Abiad, A., Dell'Ariccia, G., and Li, B. (2011). "Creditless Recoveries." IMF Working Paper 11/58, International Monetary Fund, Washington, DC.

Alogoskoufis, S., Lanfield, S. (2018), "Regulating the Doom Loop". Working Paper, No 74, European Systemic Risk Board

Acharya, V., Drechsler, I., and Schnabl, P. (2014), "A Pyrrhic Victory? Bank Bailouts and Sovereign Credit Risk", The Journal of Finance, Vol. LXIX, No. 6

Acharya, V., Pierret, D., and Steffen, S. (2016), "Lender of Last Resort vs. Buyer of Last Resort: The impact of the European Central Bank actions on the bank-sovereign nexus", ZEW Discussion Papers, No 16-019

Altavilla, C., Pagano, M., and Simonelli, S. (2016), "Bank exposures and sovereign stress transmission". Working Paper, No 11, European Systemic Risk Board

Angelini, P., Grande, G., Panetta, F. (2014), "The negative feedback loop between banks and sovereigns". Occasional Papers No 213, Questioni di Economia e Finanza, Banca d'Italia

Arnal-Martínez, J., Moreno, A. (2018), "The Sovereign-Bank Feedback Loop: Did European Policies Alleviate It?"

Battistini, N., Pagano, M., and Simonelli, S. (2014), "Systemic Risk, Sovereign Yields and Bank Exposures in the Euro Crisis", Economic Policy, Vol. 29, Issue 78: 203-251

Beccalli, E., Poli, F. (2015), "Bank Risk, Governance and Regulation", Springer

Brunnermeier, M.K., Langfield, S., Pagano, M., Reis, R., Van Nieuwerburgh, S., Vayanos, D. (2016), "ESBies: Safety in the tranches", Working Paper Series No 21, European Systemic Risk Board

Caballero, R. J., Farhi, E., Gourinchas, P. (2017), "The Safe Assets Shortage Conundrum", Journal of Economic Perspectives, Vol 31, No 3: 29-46

Carmassi, J., Dobkowitz, S., Evrard, E., Parisi, L., Silva, A., Wedow, M., (2018), "Completing the Banking Union with a European Deposit Insurance Scheme: who is afraid of cross-subsidisation?", Occasional Paper Series No 208, European Central Bank

Cooper, R., Nikolov, K. (2017), "Government Debt and Banking Fragility: The Spreading of Strategic Uncertainty", NBER Working Paper Series, No 19278

Crosignani, M. (2017), "Why are banks not recapitalized during Crises?" Working paper, No 57, European Systemic Risk Board

De Grauwe, P., Yuemei, J. (2017), "How safe is a safe asset?", Policy Insight No 8, CEPS (Centre for European Policy Studies)

De Grauwe, P. (2011), "The European Central Bank: Lender of Last Resort in the Government Bond Markets?", CESifo Economic Studies, Vol. 59: 520-535

Dell'Ariccia, G., Ferreira, C., Jenkinson, N., Laeven, L., Martin, A., Minoiu, C., Popov, A. (2018), "Managing the sovereign-bank nexus", Working Paper Series No 2177, European Central Bank

Diamond, D.W., Dybvig, P.H. (1983), "Bank Runs, Deposit Insurance and Liquidity", The Journal of Political Economy, Vol 91, No. 3: 401-419

Erce, A. (2015), "Bank and sovereign risk feedback loops". Working Paper Series No 1, European Stability Mechanism

Fahri, E., Tirole, J. (2016), "Deadly Embrace: Sovereign and Financial Balance Sheets Doom Loops", NBER Working Paper Series, No 21843

Galliani, C., Zedda, S. (2015), "Will the Bail-in Break the Vicious Circle Between Banks and their Sovereign?", Computational Economics, Vol. 45, issue 4, 597-614

Hüser, A.C., Halaj, G., Kok, K., Perales, C., van der Kraaij, A. (2017), "The systemic implications of bail-in: a multi-layered network approach". Working Paper Series, No 2010, European Central Bank

International Monetary Fund (IMF). (2009), "From Recession to Recovery: How Soon and How Strong?" In World Economic Outlook, 103-38.

Jordà, O., Schularick, M., and Taylor, A. (2016), "Sovereigns versus Banks: Credit, Crises, and Consequences." Journal of the European Economic Association 14(1): 45–79.

Krishnamurthy, A., Nagel, S., Vissing-Jorgensen, A. (2014), "ECB Policies Involving Government Bond Purchases: Impact and Channels", Working Paper No. 23985, NBER (the National Bureau of Economic Research)

Leonello, A. (2017), "Government guarantees and the two-way feedback between banking and sovereign debt crises". Working Paper Series, No 2067, European Central Bank

Livshits, I., and K. Schoors. (2009). "Sovereign Default and Banking". Unpublished, University of Western Ontario.

Merton, R. (1974). "On the Pricing of Corporate Debt: The Risk Structure of Interest Rates", The Journal of Finance, Volume 29, Issue 2: 449-470

Romans, J.T. (1966), "Moral Suasion as an Instrument of Economic Policy". The American Economic Review, No 56 (5): 1220-1226

Troeger, T.H. (2017), "Too Complex to Work: A Critical Assessment of the Bail-in Tool Under the European Bank Recovery and Resolution Regime". Journal of Financial Regulation, Vol. 4, Issue 1.

Véron, N., (2017), "Sovereign Concentration Charges, A New Regime for Banks' Sovereign Exposures", European Parliament, Economic Policy Support Unit

White P., Yorulmazer, T. (2014), "Bank Resolution Concepts, Trade-offs, and Changes in Practices", Economic Policy Review, Vol. 20, No 2

SITOGRAPHY

https://www.bis.org/ *Bank for International Settlement website*

https://www.bankingsupervision.europa.eu/ *ECB Supervisor website*

https://bruegel.org/ *Bruegel Think Tank website*

https://www.ebf.eu/ *European Banking Federation website*

https://ec.europa.eu/ *European Commission website*

https://www.ecb.europa.eu/ *ECB website*

http://sdw.ecb.europa.eu/ *ECB statistical data warehouse*

https://www.esm.europa.eu/ *European Stability Mechanism website*

https://www.esma.europea .eu/ *EU Security and Market Authority website*

http://www.mef.gov.it/index.html *MEF website*

https://ihsmarkit.com/index.html *IHS Markit website*

https://www.reuters.com/ *Reuters website*