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**"THE BANKING UNION AND THE LINK BETWEEN BANKS AND**  
**SOVEREIGN CREDIT RISKS"**

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## Introduction

The events of the recent financial crisis gave reasons to be more and more concerned about sovereign and banks credit risks. In fact, the situation of several countries and banking sectors worsened significantly in the last few years.

Several States had to deal with severe distress in their financial markets and had to carry out significant bailouts to rescue their local banks. Therefore, during the crisis, banks and sovereign credit risks suffered significant increases.

Moreover, these two risks showed to be linked together in such a way that a worsening in sovereign credit risk was mirrored by an equivalent worsening in banks credit risk. The sovereigns, in fact, by carrying out the bailouts, took over the risk of the rescued banks. Through this risk shifting the credit risk of sovereign started to be linked to those of banks.

Thus, many authors, focusing on the link between sovereign and banks credit risks, identify the bailouts as the trigger factor of this link. Acharya et al. (2014), in particular, identify three important phases in the link: an initial phase before the bailouts where the two risks are not linked; a period just after the bailouts in which the link starts and the sovereign takes over banks risk; a period after the bailouts in which the two risks co-move and a vicious cycle starts between sovereign and banks credit risks.

Breaking the vicious link between sovereign and banks credit risks provided the impetus for the creation of the Banking Union. This goal should be achieved through the establishment of a common supervision supported by a common resolution and a common deposits insurance throughout Europe.

We analyze data on sovereign and banks CDS to show that the link between sovereign and banks credit risks is present also between Italian sovereign and Italian banks credit risks. We show that in the case of Italy the bailout is not the trigger factor of the link. Moreover, we show that the Banking Union has positive effects on the link, by weakening it, in the long run. In order to present our analysis, the work is structured as follows: the first chapter introduces the concept of credit risk, in particular it focuses on sovereign and banks credit risks. The second chapter focuses on the link between sovereign credit risk and banks credit risk. The third chapter focuses on the Banking Union. The fourth Chapter presents the model on which the empirical analysis is built on. The fifth chapter presents the empirical analysis and its results.





# Chapter 1

## The credit risk

Banks and States faced several difficulties during the crisis. These difficulties were mirrored by a sharp increase in the credit risk of both European banks and sovereigns since 2008.

The crisis started as a banking crisis, with several failures of banks. These lead to important losses in trust among banks and investors. Thus, banks faced a higher risk of being unable to meet their credit obligations. The banking crisis soon developed in a sovereign debt crisis. This was due, among other factors, to the several rescue packages that the sovereign enacted to reach stability in the financial sector. While this assistance to banks reduced the problems of the financial sector, it increased public debt and government liabilities, raising concerns about the fiscal sustainability of some countries.

Since credit risk has become an important issue of this period, the aim of this chapter is to give an overview on this risk. We first give a general definition and then focus on bank and sovereign credit risks.

### 1.1 Definition of credit risk<sup>1</sup>

*Credit risk, also known as default risk, is the risk that companies or individuals will be unable to make the required payments on their debt obligations.* Thus, it is the risk that one who borrows money is unable to pay them back. Credit risk is determined by the probability of default of the borrower. The higher is the probability that the individual, or company, is unable to pay back the money (the event default), the higher is the credit risk.

In the case of bonds, credit risk is the risk that the bond issuer will not be able to make the required coupon and principal payments. The interest rates of bonds are a signal of the level of credit risk. The higher the interest rate the higher the credit risk of the issuer.

Moreover, credit risk affects credit ratings. There are several credit agencies like Moody's and Standard & Poor's which research and analyze bond offerings in an effort to measure the issuer's risk. The results of their work are credit ratings that investors can track and compare with other issuers. Usually the lower the rating the higher the probability of default of the issuer and so the higher the credit risk<sup>2</sup>.

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<sup>1</sup> Part of the contents presented in this paragraph are taken from <https://www.youtube.com/watch?v=DVe3TMUDSDw>.

<sup>2</sup> For example Standard & Poor's ratings vary from AAA (the most secure) to D, which means the issuer is already in default. Moody's ratings go from Aaa to C. Only bonds rated BBB or better are considered "investment grade." Anything below BBB- or Baa3 is considered "junk." Usually treasury bonds have the highest ratings.

Many factors can influence an issuer's credit risk and in varying degrees. These factors influence the level of credit risk by affecting the probability of default.

Among all, we can identify:

- **Financial strength of the bond issuer.** The stronger is the financial position of the issuer the lower is the credit risk. The financial strength of the issuer is determined first by the ratio between assets and liabilities and, secondly, by the capital structure of the issuing company.
- **Ability to generate cash flows in the future.** The future cash flows are important to cover the future principal and interest payments to the lender. Therefore the higher the ability to create future cash flow the lower the credit risk, since the probability of default remains low.
- **Possibility of increased expenses.** If the costs increase faster than the revenues the probability of default increases, raising the credit risk of the issuer.
- The credit risk associated with foreign bonds also includes the home country's sociopolitical situation and the stability and regulatory activity of its government.

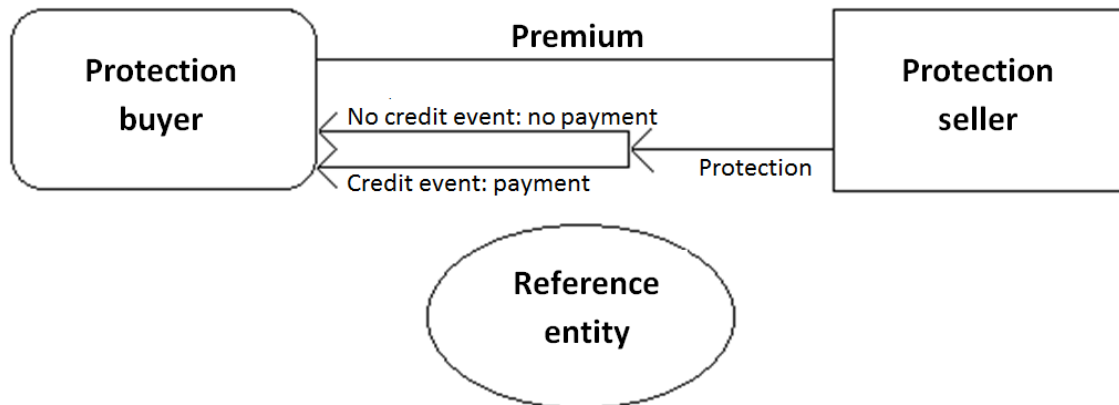
### 1.1.1 Credit Default Swaps (CDS): A measure of credit risk

Credit Default Swaps (CDS) are contracts where a buyer makes a payment to a seller in return for a promise that the seller will compensate the buyer if a specified credit event occurs (Kriz et al. 2015). The international Swaps and Derivative Association (ISDA) gives the definition of three types of credit event:

- Failure to pay principal or coupon when they are due: hence, already the failure to pay a coupon might represent a credit event, albeit most likely one with a high recovery (i.e. 'technical default').
- Restructuring: The range of admissible events depends on the currency and the precise terms which materialize.
- Repudiation / moratorium (Fontana et al. 2010).

In essence, a CDS is a credit derivative contract between two parties. The buyer, often referred to as the "protection buyer," makes periodic (usually quarterly) payments (called the premium or "spread") to the seller (or "protection seller") and receives in return the promise of a payoff if an underlying financial instrument defaults or experiences a similar credit event (Kriz et al. 2015). It can be seen as an insurance against the risk of default of the underlying financial instrument. The structure of a CDS is shown in Figure 1.

**Figure 1: Rights and obligations under a CDS contract**



Source: Author's own elaboration built on Kriz et al. (2015).

The “spread” of a CDS is the amount (the premium) that the protection buyer must pay to the protection seller over the length of the CDS contract, usually quoted as a percentage of the notional amount. For instance, if the CDS spread of an AAA municipal government is 30 basis points, or 0.3%, then an investor buying \$1 million worth of AAA municipal bonds must pay the seller \$3,000 per year. These payments are usually made on a quarterly basis and continue until either the CDS contract expires or a credit event occurs. A CDS associated with a higher spread is considered more likely to default by the market, since a higher fee is charged to protect against such an event (Kriz et al. 2015). Thus, when default risk increases and therefore also credit risk increases, CDS spreads increase. Therefore market participants consider CDS spreads indicators of the likelihood of default or the riskiness of the underlying debt asset. For these reasons CDS are considered as a measure of credit risk.

## **1.2 Bank credit risk**

*Bank credit risk is the risk that a bank fails. A bank failure occurs when a bank is unable to meet its obligations to its depositors or other creditors because it has become insolvent or too illiquid to meet its liabilities.* In this sense, bank credit risk incorporates both liquidity and insolvency risks of a bank. Both risks are strictly connected with the issue of maturity transformation, one of the primary functions of the financial system. In most cases, banks finance their investments in loans or bonds by issuing liabilities whose average maturity is shorter than that of those same investments. The fundamental role of banks in facilitating the maturity transformation of short-term deposits into long-term loans makes banks vulnerable to liquidity risk. This consists in the risk that demands for repayment outstrip the capacity to

raise new liabilities or liquefy assets<sup>3</sup>. Thus, a liquidity crisis occurs when a bank is unable to cover the demand for repayment of its depositor by using its funds or by selling asset without losing too much on their sell prices. If a liquidity crisis is not well managed a bank runs into an insolvency crisis. The market value of its assets declines to a value that is less than the market value of its liabilities. Thus, the bank is no longer able to cover its liabilities, to meet its obligation and goes into insolvency. At this point, to avoid bankruptcy, the bank is bailed out by the sovereign, or, as the new European Union regulation envisages, the costs of insolvency are borne by its shareholders, subordinated bondholders and the bondholders up to 8% of assets (the new bail in tool).

The failure of a bank is generally considered more relevant than the failure of other types of business firms because of the interconnectedness and fragility of banking institutions. It is often feared that the effects of the failure of one bank can quickly spread throughout the economy and possibly cause the failure of other banks. These contagion effects can result in a systemic failure of banks that creates several problems to the real economy as can be seen from the recent global financial crisis.

During the recent crisis banks faced several problems in term of liquidity and solvency which lead to a sharp increase in their credit risk.

The crisis started in the US with the subprime meltdown. The American financial institution in the pre-crisis period made a lot of loans thanks the new securitization technics<sup>4</sup>. The major part of such new securities were strictly connected to the real estate (this is the case of the Residential Mortgage Backed Securities, RMBS). For this reason when the real estate bubble burst, a lot of people were unable to repay their debts. Many banks, consequently, suffered a lot of losses due to the missed payments of the loans and experienced an increase in their credit risk. The credibility of banks started to weaken because of the growing concerns about the decreasing creditworthiness of their counterparts. Banks that were strictly connected, no longer trusted in each other. As a result, the interbank market virtually closed and risk premiums on interbank loans soared. Banks faced a serious liquidity problem, as they experienced major difficulties to rollover their short-term debt (European Commission, 2009). With the rise of interbank loans rates it has become more difficult for banks to raise funds for its activities. Many banks started to be unable to meet their obligations with depositors and

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<sup>3</sup> Notes taken from the material of the course “Banking: Financial and Risk Management”, University of Padua, A.Y. 2014 - 2015.

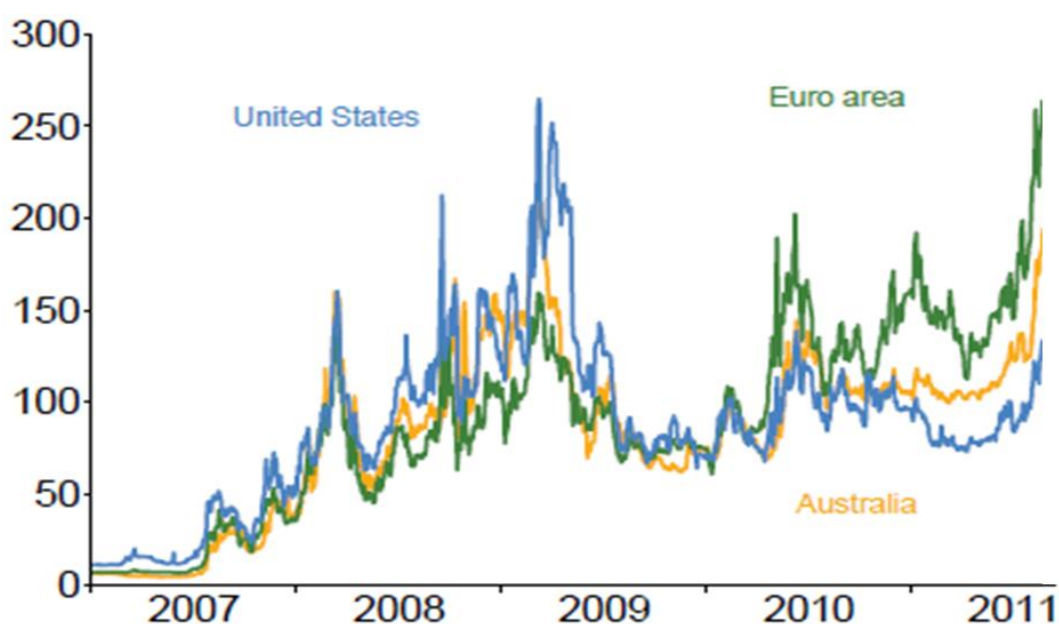
<sup>4</sup> Securitization: the bank pools together all its loans and sells it to another entity, the special purpose vehicle (SPV). In exchange the bank gets money to make new loans. The SPV, to get the money to pay the bank, issues new instrument with the pool of loans given by the bank. These new securities are the product of the securitization process, usually called Asset Backed Securities (ABS). The SPV divides the pool of loans in different tranches accordingly to the probability of repayment. The result is a set of new securities with different ratings.

other creditors, entering in this way in a liquidity crisis. This additionally raises the credit risk of banks.

Hence, during the crisis banks faced a lot of difficulties that were translated in higher levels of credit risk. To face all these difficulties banks were forced to restrain credit, increase the rates on their lending activities, reduce liabilities and so on. Furthermore, also the intervention of the European Central Bank was needed. The ECB introduced several unconventional policy measures, in order to help banks to restore their position.

As a result of the increasing credit risk, also banks CDS spreads rose significantly during the crisis. Effectively, investor asked for higher risk premiums worried about the troubles that banks were facing.

**Figure 2: Banks CDS spreads (2007/2011)**



The figure shows the CDS spreads of the major banks of US, Europe and Australia from 2007 to 2011. The CDS spreads are expressed in basis points. High CDS spreads mirror high credit risk.

Source: <http://www.macrobusiness.com.au/2011/09/the-rbnz-throws-cold-water-on-the-rba/bank-cds-spreads/>.

Figure 2 gives an overview on the CDS spreads of the major banks in US, Europe and Australia during the crisis. As can be seen, the CDS spreads follow the same pattern in all the three areas showing the global diffusion of the crisis. The spreads level started to increase in the middle of 2007 when the liquidity cost started to rise and the interbank market showed the first signs of collapse. Higher cost of liquidity increased the liquidity risk of banks which was translated into higher credit risk mirrored in higher level of CDS spreads. Furthermore, it can be seen that the spread level remained high for the entire period of the crisis. This high levels were translated into high levels of credit risk.

### 1.3 Sovereign credit risk

*Sovereign credit risk is the risk of a government becoming unwilling or unable to meet its loan obligations.* Hence, the credit risk of a sovereign is strictly connected with the level of public debt. The higher the level of debt the more are the concerns about the ability of the sovereign to pay back its debt. The higher is the probability that the sovereign is unable to repay its debt the higher is the sovereign credit risk.

Many are the causes of the rise of sovereign credit risk. Among all, the more relevant are:

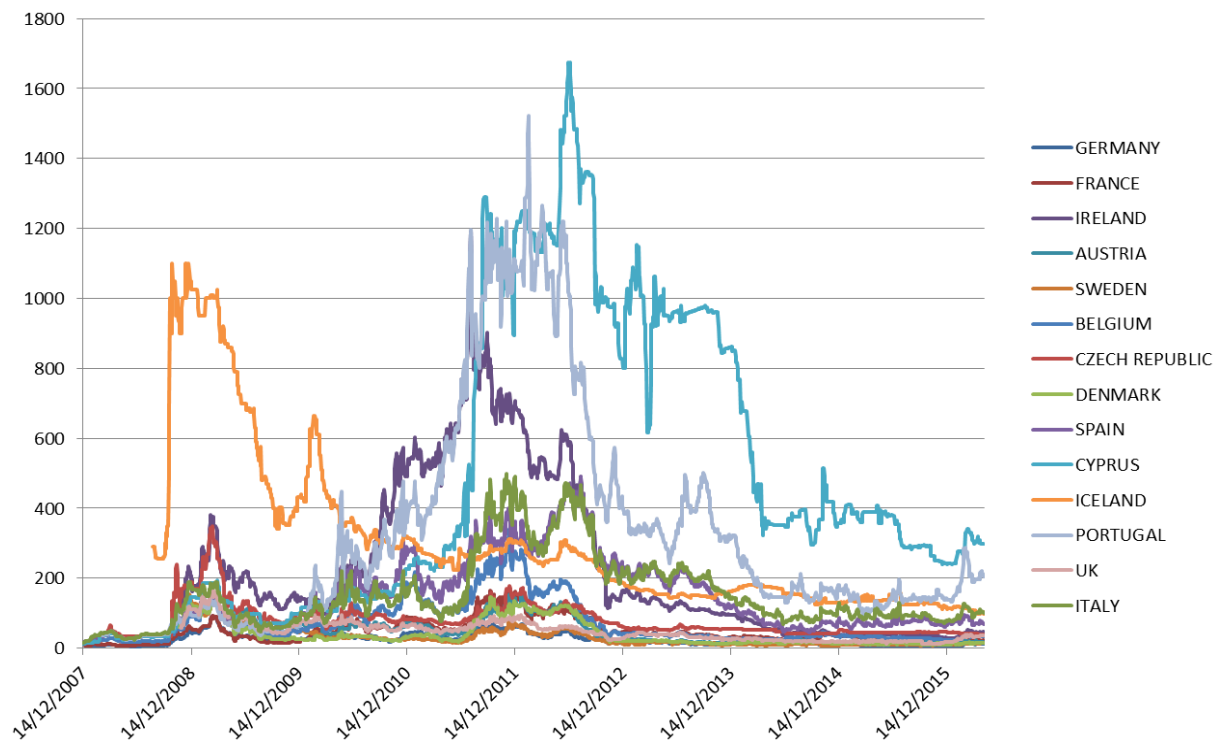
- **Weak actual and potential growth.** Collapsing economic activity sharply reduces tax revenues. Moreover, a rising unemployment, consequence of a weak economic growth, leads to increasingly large state benefit payments. To support the economy most governments also offer stimulus packages and reduce taxes (Sgherri et al. 2009). All these facts increase the level of debt and, thus, the sovereign credit risk rises.
- **Competitive weakness.** This can be a result of a low economic growth. Moreover, it is the strongest signal of the scarcer performance of some countries to export its product abroad.
- **Liquidation of banks and sovereigns.** In case of financial distress, most governments intervene in order to restore financial markets stability. Sovereigns usually commit large resources to guarantee, recapitalize, and resolve financial institutions, as well as support certain asset markets (Sgherri et al. 2009). The same happens if there is a country that needs to be bailed out. All these actions impact on public debt, raising therefore sovereign credit risk.
- **Large pre-existing debt-to-GDP ratios.** High levels of debt-to-GDP ratio imply a high number of obligations that has to be met. In addition, if a crisis starts and the GDP growth begins to decline, the government has to intervene with a number of aids to the economy. This has a negative impact on the already high debt making it difficult for the government to repay its debt. Thus, the credit risk of the sovereign rises.
- **Considerable liability stocks.** The more are the liabilities of a sovereign the higher is the number of obligations to be met. Moreover, the higher is the number of obligations to be met the greater is the difficulty to meet these. Therefore the credit risk rises.

During the recent financial crisis many countries suffered a sovereign debt crisis in addition to the banking crisis. Thus, they faced an increasing sovereign credit risk. Greece, Cyprus, Ireland are examples of countries that faced very high sovereign credit risk.

Different are the reason that lead to the sovereign debt crisis in Europe. Some countries, like Greece, had unsustainable high levels of public debt. Other countries, like Ireland and Spain,

had to bail out financial institutions. Moreover, other countries like Italy, in addition to high levels of public debt, lost political credibility. The development of the sovereign credit risk of European countries can be seen by looking at the levels of sovereign CDS spreads. These are shown in figure 3.

**Figure 3: Sovereign CDS spreads (2007/2016)**



The figure shows sovereign CDS spreads from 2007 to 2016. The CDS spread values are expressed in basis points. High levels of spread mean high sovereign credit risk for the considered country. Greece is dropped for reason of unit of measure. Greece has very high levels of CDS spreads and this does not permit to understand the trend of the other countries CDS spreads.

Source: Datastream. Authors own evaluation.

As can be seen in figure 3, the increase of CDS spreads started at the end of 2008 when many countries had to bail out their local banks.

The country facing the highest increase in sovereign credit risk at the end of 2008 was Iceland. This country in fact, had to rescue from failure three of its major banks in late 2008. Other countries that showed a peak in sovereign credit risk in late 2008 were Ireland (which also bailed out national banks at the end of September 2008) and Czech Republic. They faced an increase in risk at the beginning of the period and then recovered slowly.

The other European countries followed an almost opposite pattern. They started with relative low values and then showed an important rise in sovereign credit risk in the period between 2010 and 2011.



Cyprus, Portugal, Spain and Italy show the highest level of sovereign credit risk. Among all the reason for such an increase there was the risk of default of Greece (which is dropped in the figure for reasons of unit of measure).

To conclude, the bad economic condition, due to the crisis, made the public debt growing because of the reduction of taxes revenues and the large expenditure for stimulus packages. Moreover, the difficult situation of many banks made essential the intervention of the State. Thus, the stabilization of the financial markets with several bailouts increased the public debt which was already high, putting the European countries in a weaker position. This caused the huge increase of the sovereign credit risk in the euro area.

## Chapter 2

### The link between bank and sovereign credit risks

As highlighted in the previous chapter, banks and sovereigns credit risks became important features of the recent global financial crisis. Moreover, these two risks showed to be bound and this was one of the causes that further aggravated the financial crisis. In the majority of cases, this link started to be evident after the bailouts of financial institutions enacted by the governments. Thus, the several bailouts, occurred during the crisis, can be considered as the trigger factor that generates the link between banks and sovereign credit risks.

Accordingly to Acharya et al. (2014), three phases can be identified in the relationship between credit risk of banks and credit risk of sovereigns: a pre-bailout phase in which there is no link between the two risks; a bailout phase, in which the two credit risks start to be linked; finally, a post-bailout phase, characterized by a feedback loop, in which the two risks move together.

The chapter presents the three phases of the relationship between banks credit risk and sovereign credit risk. Furthermore, it focuses on the reasons that lead to it and those which exacerbate it.

#### 2.1 The first phase: the pre-bailout phase

The first phase covers the pre-crisis period. It is characterized by the absence of a relationship between banks and sovereign credit risks. The two risks move independently showing different patterns of behavior.

Prior to the financial crisis of 2007 to 2008, there was essentially no sign of sovereign credit risk in the majority of developed economies, and the prevailing view was unlikely to be a concern for these economies in the near future (Acharya et al. 2014). Thus, this first period was characterized by a significant increase in the credit risk of the financial sectors while almost no change in sovereign credit risk.

Evidence of this first phase can be obtained from the changes in banks and sovereigns CDS spreads during this period.

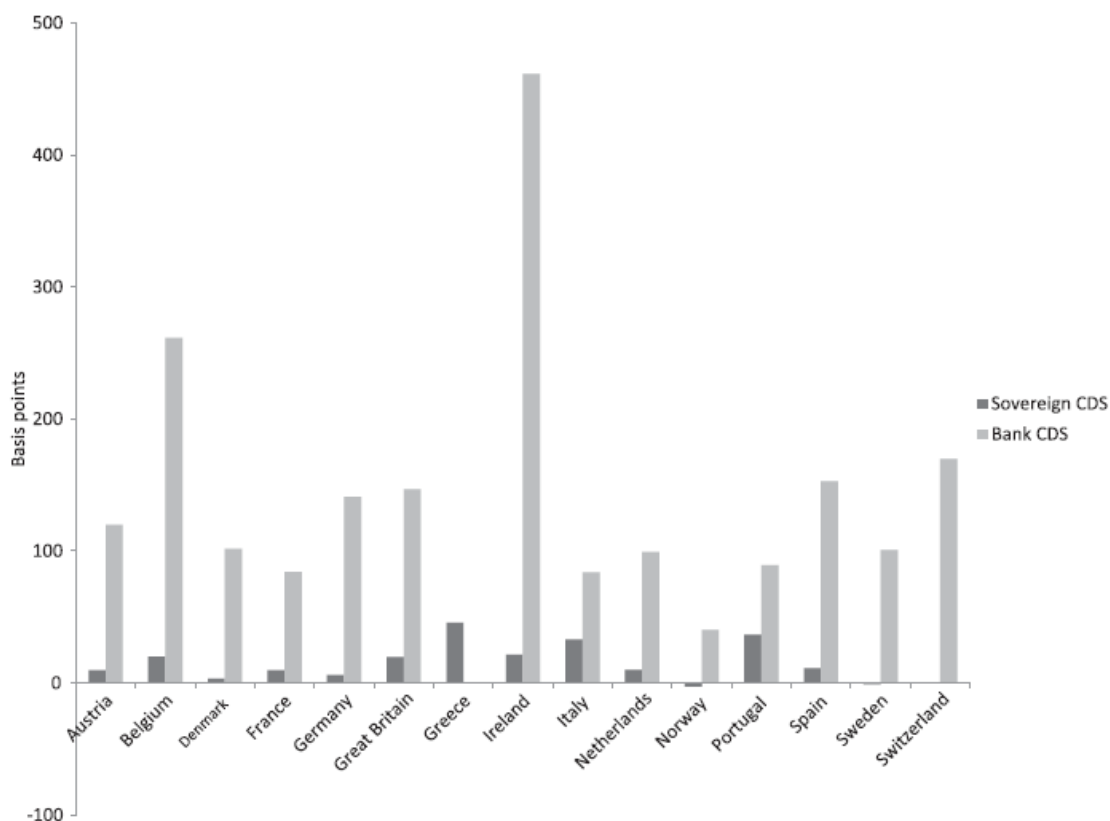
Figure 4<sup>5</sup> shows the changes in banks and sovereign CDS spreads for the Eurozone countries

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<sup>5</sup> Figure 4 is taken from Acharya et al. (2014). The authors consider as pre-bailout phase the interval from 01/01/2007 to 25/09/2008 since they take as starting point of their case study Ireland. The Irish government announced the bailout of six of the Irish major banks on 30 September 2008. For these reasons they established these limits for the first phase. Although, after Ireland other countries bailed out their major banks. Thus, the pre-bailout phase can be consider significant also for all the other European countries.

in the pre-bailout phase. As can be seen, banks CDS spreads show a very different behavior with respect to sovereigns CDS spreads. In fact, the pre-bailout period is characterized by a significant increase in banks CDS spreads while almost no change in sovereign CDS spreads for the majority of the European countries. This confirms the absence of a link between banks credit risk and sovereigns credit risk during the pre-bailout phase.

**Figure 4: Changes in banks and sovereigns CDS spreads in the pre-bailout phase**



The figure shows the changes in sovereigns and average banks CDS spreads of the Eurozone countries in the pre-bailout phase. The pre-bailout phase goes from 01/01/2007 to 25/09/2008. The banks CDS spreads are computed as the equal-weighted average of banks CDS spreads for banks headquartered in that country. CDS spreads are expressed in basis points. Source: Acharya et al. (2014).

The country that shows the greatest difference in the changes in CDS spread is Ireland. The CDS spreads of Irish banks show a huge increase in this first phase while almost no change in the sovereign spreads. Thus, again this example shows that in the pre-bailout phase, for the majority of the European countries, the credit risks of banks and sovereign are not linked.

## 2.2 The second phase: the bailout phase

The second phase focuses on the event of bailout of a financial institution by the government and its effects on the economy. After the bailouts, in fact, sovereign credit risk and banks credit risk start to be linked.

In the case of a financial distress the sovereign intervenes in order to restore financial stability.

It has to bailout the distressed financial institution in order to prevent it from bankruptcy<sup>6</sup>. The sovereign can finance the bailout through taxation or through the issuance of new public debt. In the case that the bailout is large and the economy is already hit by a financial crisis, the sovereign cannot increase the burden of taxation so it has to issue new debt. This in turn increases its credit risk since the amount of debt that has to be repaid is sharply increased. Consistently with this, the second phase is mainly characterized by a huge increase in the credit risk of sovereigns and a corresponding decrease in the credit risk of banks. This is due to the fact that the bailouts alleviate the financial sector distress. However, they increase the level of public debt and consequently the credit risk of sovereigns.

Moreover, by rescuing a bank the sovereign takes off its risk. Hence, the increase in sovereign credit risk and the immediate reduction in bank credit risk represents a risk shifting from banks to the sovereign. With the risk shifting banks and sovereign credit risks start to be liked together.

Since the risk shifting is due to the bailouts, these can be considered as the trigger factor that generates the relationship between bank and sovereign credit risks.

Evidence of this can be found in the events of the recent financial crisis. The bailouts consisted of asset purchase programs, debt guarantees, equity injections, or some combination thereof (Acharya et al., 2014). The costs of these programs were substantial, at an estimated 54% of GDP in the United Kingdom, 28% of GDP in Germany, 9% and 12% of GDP in Spain and Portugal, respectively, roughly 30% of GDP in Austria and the Netherlands and 22% of GDP in the United States<sup>7</sup>. In order to cover these huge costs, sovereigns were forced to issue new debt and consequently to sacrifice their creditworthiness. As a consequence, the credit risk of sovereigns raised significantly. On the other hand, the credit risk of banks decreased substantially since bailouts were beneficial to the financial markets.

Additional demonstration of what said can be found by looking at the CDS spreads of banks and sovereigns in this period.

Figure 5<sup>8</sup> shows the changes in the CDS spreads of banks and sovereigns for the Eurozone countries during the bailout phase. As can be seen, banks CDS spreads decrease significantly

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<sup>6</sup> As stated by Veronesi et al. (2010), the government intervenes in case of market failure. In particular, the government intervenes in case of bank runs or excessive leverage that leads to inefficient underinvestment (debt overhang problem (Myers, 1977)).

<sup>7</sup> Data taken from König et al. (2014).

<sup>8</sup> Figure 5 is taken from Acharya et al. (2014). The authors consider as bailout phase the period from 22/10/2008 to 30/06/2008. This period covers the bailouts started with the Irish one and ending with the bailout set up by the Swedish government.

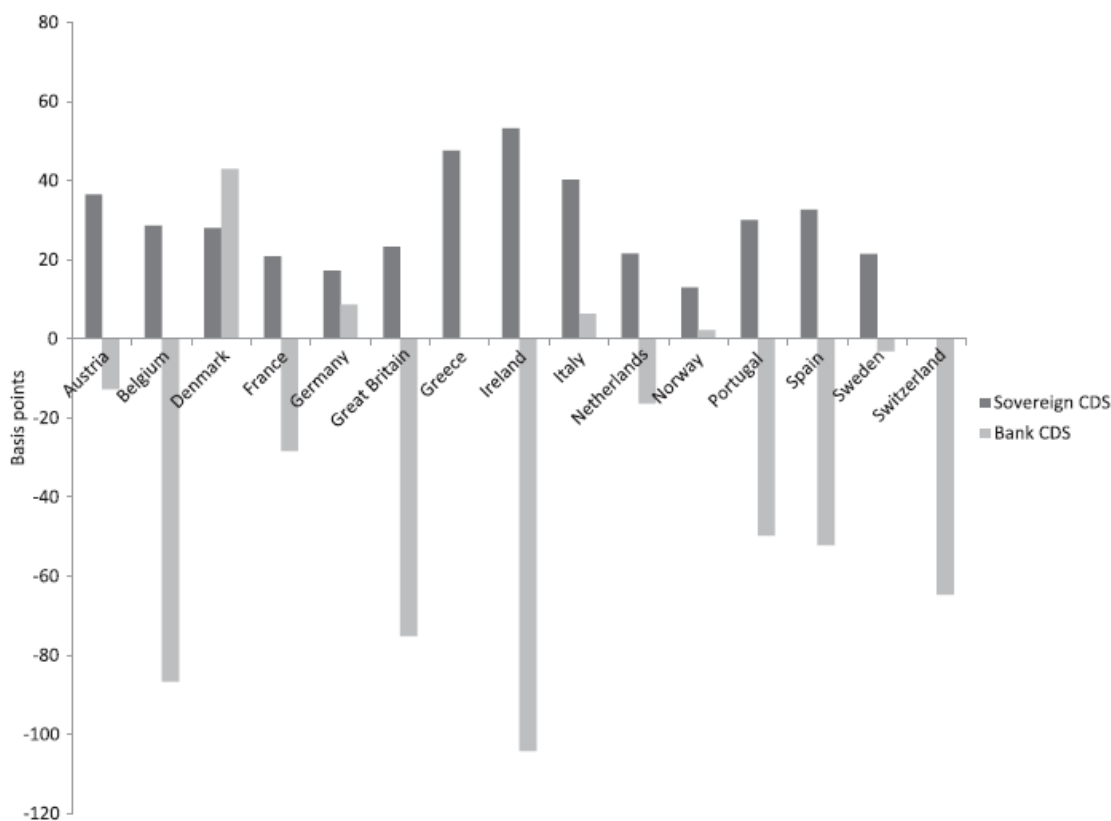
in this period. The important rescue packages of the governments, in fact, reduce banks credit risk. Consistently with what said before, sovereigns CDS spreads rise significantly.

Moreover, also the risk shifting between banks and sovereigns can be identified: a positive change in sovereigns CDS spreads is mirrored by a negative change in banks CDS spreads.

The country with the greatest changes in CDS spreads is Ireland. This is consistent with what said since the Irish government bailed out six of its major national banks at the end of September 2008. Other countries that show important changes in CDS spreads are Belgium, Spain and Portugal. Different is the case of Italy. In fact, banks and sovereign CDS changes move in the same direction. This can be due to the fact that Italy did not carry out bailouts in this period.

Thus, the link between sovereign and banks credit risks starts to be evident after the bailouts for the majority of the European countries. Therefore, as many studies recognize, the bailout of a financial institution by the sovereign is the major trigger factor of the link between banks credit risk and sovereign credit risk.

**Figure 5: Changes in banks and sovereigns CDS spreads in the bailout phase**



The figure shows the changes in average banks and sovereigns CDS spreads for the Eurozone countries in the bailout phase. The bailout phase goes from 26/09/2008 to 21/10/2008. The banks CDS spreads are computed as the equal-weighted average of banks CDS spreads for banks headquartered in that country. CDS spreads are expressed in basis points.

Source: Acharya et al. (2014).

Another collateral effect of the bailouts is the increase in the sensitivity of sovereign credit risk to the crisis events.

As stated by Ejsing et al. (2011) in fact, the risk transfer from the financial sector to the government has also a dynamic dimension. Actually, sovereigns and banks credit risks depend on the events of the crisis. The financial sector and the public sector are increasingly distressed by the aggravation of the macroeconomic situation, that consists for example in reduced profit expectations or decreasing tax revenues and increasing fiscal deficit. Moreover, an additional driving force affecting credit risk is investors' risk aversion. Since investors' risk aversion is likely to be countercyclical, it increases both banks and sovereign credit risks with the worsening of the macroeconomic situation. The magnitude at which the events of the crisis affect the two credit risks depends on their sensitivity to these crucial events. Ejsing et al. (2011) demonstrates that after the bailouts banks sensitivity to further aggravations of the crisis is reduced whereas sovereign sensitivity increases significantly. The data in Ejsing et al. (2011) show that with the introduction of rescue packages, the sovereigns sensitivity nearly quintupled and stayed around this level until mid-March 2009 (Ejsing et al. 2011). The increase in the sensitivity of sovereign credit risk to aggravations of the crisis makes the sovereign more vulnerable and, hence, more likely to default. This strongly affects the link between banks and sovereign credit risks and the risk transfer between the two entities.

### **2.2.1 The case of indirect bailouts**

Bailouts can be also indirect that is with no direct capital injection. In this case, bailouts take the form of bank debt guarantees by the government.

König et al (2014) confirms the risk transfer from banks to the sovereign also in case of an indirect bailout. In fact, by introducing a guarantee scheme, the government provides incentives for bank creditors to continue financing the bank and thereby reduces the likelihood of a bank run. By reducing the risk of a bank run the sovereign reduces the probability of default of the bank and in turn it reduces its credit risk. Nevertheless, in the case that the bank is run despite the guarantee, the government has to face additional financial distress. Anticipating this situation, sovereign creditors become more reluctant to roll over their claims. This affects negatively the ability of the government to repay its debt causing a sharp increase in the credit risk of the sovereign. Thus, also in the case of an indirect bailout we observe a risk shifting from banks to the sovereign.

In order to be successful, the guarantee schemes have to be credible. First, the guarantee has to be not too large. Second, also the balance sheet transparency plays an important role in the efficiency of the guarantee scheme since it affects the guarantee costs. For a guarantee scheme

to be successful the costs must be not too high. If the bank balance sheet transparency is low, the promise of guarantee increases the sovereign expected liabilities. Therefore, sovereign creditors become more reluctant to roll over their claims. Consequently, the sovereign credit risk raises since its probability of default is increased. This, in turn, weakens the effect of the guarantee and also bank creditors become less willing to prolong their funding (König et al. 2014).

### **2.2.2 Moral hazard and banks bailouts**

Accordingly to Acharya et al. (2014), Mariathan et al. (2014) and Dam et al. (2012), future financial sector incentives are distorted by the implementation of bailouts, because of moral hazard. Thus, moral hazard is one of the main problems of the bailout.

The expectation of a bailout by the government induces banks to engage in inefficient and high risk investments and to assume excessive financing risks, since they know that in the worst case they are rescued by the government. Hence, the likelihood of the enactment of a bailout, and so the risk shifting from banks to sovereign and all the problems that it carries, increases with moral hazard.

Mariathan et al. (2014) demonstrates that banks tend to be more leveraged, more weakly capitalized and more exposed to severe liquidity mismatch when they or their competitors are likely to benefit from a public support. In this way, expectations of public rescue packages become a significant determinant of financial instability.

Going more in depth, the perception of a bailout leads to excessive investments in risky assets. The excessive undertaking of risky investments however can be reduced with a higher supervision of banks activity and with a higher government efficiency. Moreover, in order to reduce the detrimental effect on leverage and capital quality, a useful mechanism is to restrict the range of the permissible activities set up by banks.

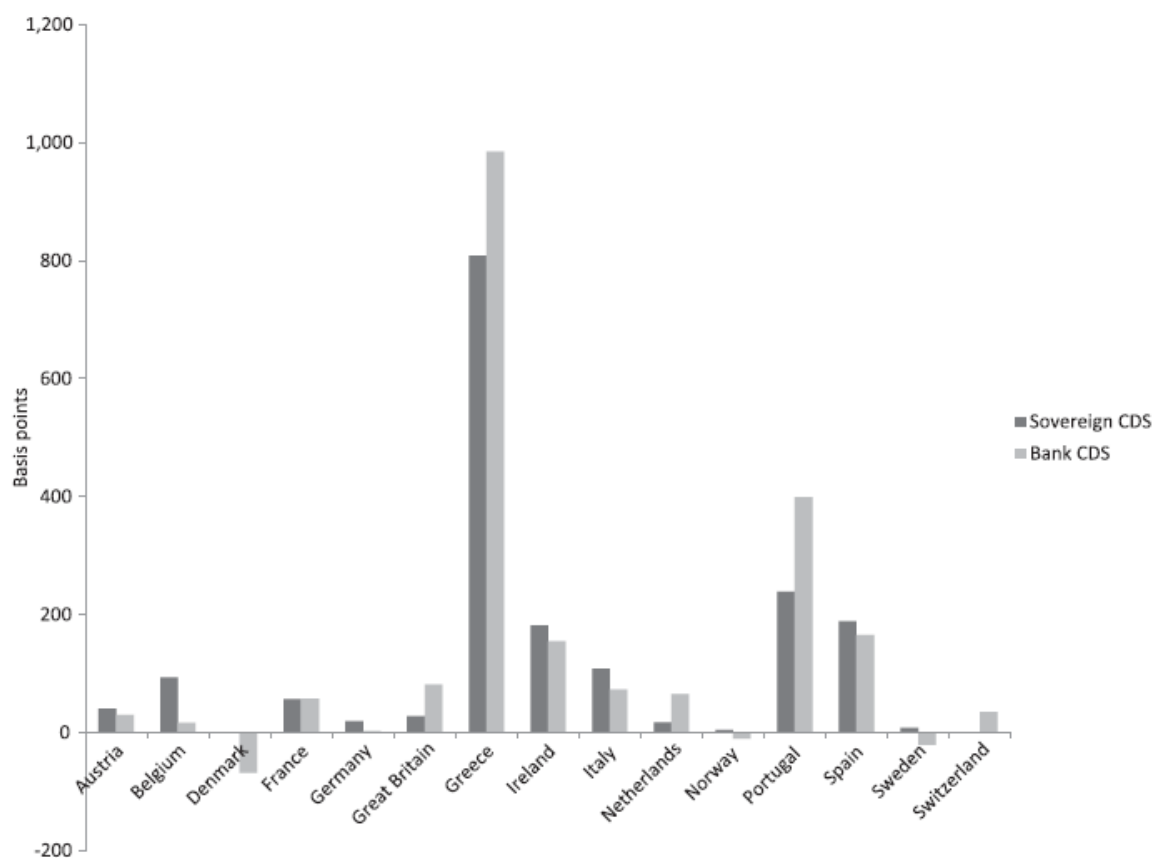
In addition, Mariathan et al. (2014) found that bailout expectations have a systemic effect. Moral hazard, in fact, increases with the increased likelihood of a public support to the bank competitors. Indeed, a greater expectation of support to competitors provides incentives for banks to engage in more risk-taking strategies.

To conclude, banks moral hazard is fostered by the expectation of a public intervention to restore financial stability. Thus, the perspective of a bank bailout has a significant role in the risk faced by banks. However, the higher risk taken by the bank increases the likelihood of the bank to be bailout by the government. This, in turn, increases the credit risk of the sovereign. Hence moral hazard, despite affecting banks risk taking, has significant indirect effects on sovereign credit risk.

### 2.3 The third phase: the post-bailout phase

The third phase covers a longer period after the bailouts. We showed before that the bailouts restore financial stability. However, after this initial reduction, banks credit risk increases again and reaches the level of sovereign credit risk. Thus, the post-bailout phase is characterized by a positive co-movement of banks credit risk and sovereign credit risk. In particular, aggravations in sovereign credit risk affect significantly banks credit risk. Evidence of this behavior can be found looking at the changes in banks and sovereign CDS spreads during the recent financial crisis. These are shown in figure 6<sup>9</sup>.

**Figure 6: Changes in banks and sovereigns CDS spreads in the post-bailout phase**



The figure shows the changes in sovereigns and average banks CDS spreads in the post-bailout phase for the Eurozone countries. The post-bailout phase goes from 22/10/2008 to 30/06/2010. The banks CDS spreads are computed as the equal-weighted average of banks CDS for banks headquartered in that country. CDS spreads are expressed in basis points. Source: Acharya et al. (2014).

As can be seen in figure 6, both sovereigns and banks CDS spreads re-widened as the crisis aggravated further. Moreover, both sovereigns and banks CDS spreads in most countries present similar magnitudes of changes. Thus, accordingly to what was said above, banks and sovereign CDS spreads strongly co-move after banks bailouts.

<sup>9</sup> Figure 6 is taken from Acharya et al. (2014). The authors consider as the post-bailout phase the period just after the bailouts, from 22 October 2008 to 30 June 2010. This period covers the important further aggravations of the crisis.

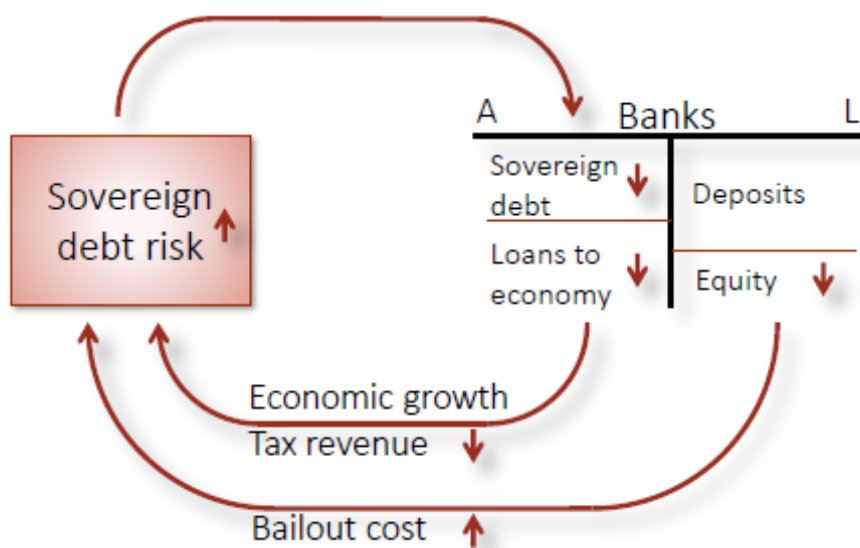


The country with the greatest changes in CDS spreads is Greece. Greece sovereign crisis spilled over to the country banking system, creating a twin crisis.

Moreover, the negative effects of an aggravation in sovereign credit risk on banks credit risk triggers a feedback loop between the two risks. Many studies refer to this feedback loop as to the “diabolic loop” for the magnitude of its effects.

Figure 7 gives a representation of the sovereign-banks credit risks “diabolic loop”.

**Figure 7: The diabolic loop**



Source: Brunnermeier et al. (2015).

As can be seen in figure 7, a distress in the financial sector, which affects the liquidity and the solvency of banks, increases the probability of a bailout, and, in turn, the costs of the bailout. Once the bailout is done the debt burden increases and, consequently, the sovereign credit risk (increased debt risk in the figure). A higher sovereign credit risk feeds back to banks credit risk through several channels, in particular through the depreciation of the banks sovereign debt holdings. This strongly affects banks solvency and consequently increases again the probability of a bailout. A new bailout increases the sovereign credit risk and the cycle starts again.

Moreover, a distressed bank reduces loans to the economy. This reduces economic growth and tax revenues. A reduced economic growth and lower tax revenues affect negatively the ability of the government to repay its debt and, as a consequence, the risk of a sovereign default increases. Thus, the sovereign credit risk increases again and this impacts on banks credit risk by increasing it. The cycle starts again.

As shown in figure 7, the main channel through which the increase of sovereign credit risk deteriorates banks credit risk, is the devaluation of sovereign debt holdings of banks.

However, going more in depth, there are four main channels through which sovereign credit risk affects banks credit risk:

- First of all, as said before, increases in sovereign credit risk cause losses on banks government bond holdings, thereby weakening their balance sheets. Banks often have large holdings of sovereign debt. Thus, an increase in sovereign credit risk is particularly damaging for it. Moreover, this effect is exacerbated by the strong home bias in the sovereign portfolios of banks, as will be seen below.

Banks then own also debt issued by foreign sovereigns in their portfolios. Also the increase in credit risk of foreign sovereigns affects banks credit risk.

- The deterioration of sovereign creditworthiness causes falls in the market price of sovereign bonds. This reduces the values of the assets that banks can use as collateral to secure wholesale funding.

Moreover, rating downgrades can exclude government bonds from eligible collaterals or increase the haircuts applied by the counterparties. As a consequence of government downgrade, also banks can suffer a rating downgrade which possibly reduces their market access.

- The deterioration of sovereign creditworthiness, and the subsequently increase in sovereign credit risk, weakens the credibility of implicit bailout guarantees provided by the government.
- Also the collateral framework of the ECB plays a significant role. The increasing enactment by the government of guarantees for banks in the same country tightens the link between banks and sovereign credit risks. The broadening of the eligible assets class to be used as collateral for the transaction with the ECB has increased the number of indirect bailouts<sup>10</sup>. So collateral frameworks increases the likelihood of the presence of the link between sovereign and banks credit risks.

The intensity of each of these channels is likely to depend on the characteristics of the banks (such as the level of capitalization, the reliance on funding sources, the quality of the loan portfolio) as well as on business models and lending strategies.

Thus, once the bailout is carried out a link between banks credit risk and sovereign credit risk is created. Moreover, in the period after the bailout sovereign credit risk strongly affects banks credit risk. Therefore, a worsening in sovereign stability conditions affects badly banks stability, and this leads to a feedback loop between banks and sovereign. The channels

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<sup>10</sup> Government guarantees increased greatly in advance of the second three-year Long Term Refinancing Operations in February 2012, especially in Italy. The run up to this LTRO also saw the inclusion of more than 10000 securities trading on non-regulated markets into the set of eligible collateral (Nyborg 2015).

through which the loop works are several and different are the conditions that strengthen the link and, consequently, exacerbate the effects of the loop.

### **2.3.1 Home country bias**

*Home country bias in sovereign debt holdings occurs when banks hold a significant high amount of domestic sovereign debt with respect to foreign ones.*

Home country bias characterized the majority of the European banks during the recent financial crisis. Indeed, the expanding sovereign debt was increasingly absorbed by the local (i.e. belonging to the same country) banking sector. Data from the crisis show that at the end of 2013 the amount of sovereign debt held by the domestic banking sectors of the Eurozone countries was more than twice than that held in 2007. On average, between 2010 and 2013, sovereign debt holdings of domestic banks (as opposed to foreign banks) increased by 5% of gross domestic product (GDP) (Becker et al. 2014). This huge increase in domestic public debt holdings was one of the major causes of the worsening of the link between banks and sovereign credit risks during the crisis.

As stated before, the holdings of sovereign debt of banks represent the major channel through which changes in sovereign credit risk are translated into changes in banks credit risk. Hence, this transmission is amplified in the case of home country bias. Banks with a strong home bias in their sovereign debt holdings are more severely affected by sovereign distress.

As stated by Altavilla et al. (2015), in principle sovereign stress may be transmitted to banks even if they hold no domestic sovereign debt, since it weakens the credibility of the implicit bailout guarantee provided by the government. It may also impact directly on the solvency of domestic firms, and hence on their creditor banks. Thus, sovereign stress may also be transmitted to banks via a “direct channel”, quite apart from their exposure to government debt. But this baseline effect will be amplified for banks that are heavily exposed (Altavilla et al. 2015).

Moreover, many studies focusing on the effect of home country bias on bank stability show a controversial effect: the holdings of domestic sovereign debt increase more in the banks belonging to the countries with the highest sovereign risk. This is a contradiction since banks that are already exposed to a high risk due to their sovereign higher credit risk should not invest in high risky debt. This is the case of Greece, Ireland, Italy, Portugal and Spain (the GIIPS), which showed an average increase in banks domestic sovereign debt holdings of 19 basis points, well above the European average. So, the major cases of home country bias were showed by all those countries which were more severely affected by the sovereign debt crisis.

Several are the determinants of home country bias. The most important are:

- Moral suasion: moral suasion, also referred to as financial repression<sup>11</sup>, consist in the government forcing domestic banks, through formal and informal mechanisms, to buy more domestic bonds and results in a forced home bias in banks holdings of domestic sovereign debt. This happens especially in moments of sovereign distress, when yields are high and demand is low. In fact, as shown by Becker et al. (2014), moral suasion was actively used by European countries during the sovereign debt crisis.

Sovereigns benefit from home bias. Nevertheless, if the cost of holding domestic sovereign debt is high, the financial sector may have no incentive to acquire this debt. In this case, sovereigns must induce domestic banks to buy sovereign debt (Gaballo et al. 2016).

There are two main channels through which the government can pressure local banks to buy domestic sovereign debt. First, direct government ownership. Publicly-owned banks indeed, should be more willing than private ones to surrender to government influence and purchase domestic debt at moments of sovereign distress.

Secondly, board seats control. To give an example, as stated by Becker et al. (2015), the Spanish saving banks “cajas” and the Italian banks whose major shareholders are “fondazioni”, are strongly influenced by the government through the board of directors.

Furthermore, bailed out banks are more subjected to government pressures. Indeed, evidence shows that recently bailed out banks buy more stressed domestic debt than other banks. Moreover, also the expectation that the bailout mechanisms will be national, and will favor those banks that hold more domestic sovereign debt can be seen as a sort of moral suasion.

- “Carry trade” hypothesis: a “carry trade” strategy is a trading strategy that consists in borrowing at a low interest rate and investing in an asset that provides a higher rate of return.

During the recent financial crisis, banks exploited the widening of yields spreads by betting on their subsequent convergence while short-term funding was available. These bets or “carry trades” were designed as investments in bonds of government mostly hit by the crisis financed with short-term debt (Acharya et al. 2014). This behavior resulted in an increase in government debt holdings for banks.

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<sup>11</sup> As can be read in Becker et al. (2014) the term financial repression dates back to work by Shaw (1973) and McKinnon (1973). Historically, the primary mechanism of financial repression was a discriminatory tax on the part of the financial system that channeled savings toward private uses, which resulted in an artificially low cost of domestic funding for government.

- Risk shifting hypothesis: following Crosignani (2014), banks reduce their lending in order to purchase more government bond rather than for cutting costs reasons. Indeed, highly leveraged banks buy domestic government bonds because of the high correlation with their other sources of revenue. In case of domestic sovereign default banks are protected by limited liability instead in case of no default home sovereign debt guarantees the highest payoff. This condition creates a risk-shifting incentive, so banks reduce lending to invest in the relatively more attractive domestic sovereign debt. Myopic governments permit this distortion in lending since banks act as buyer of last resort for government bonds.

- Regulatory arbitrage hypothesis: the euro-area prudential regulation, under Basel III, gives strong preferential treatment to sovereign debt over bank loans. Exposures to domestic sovereign are treated as risk-free for purposes of capital charges and there are no concentration limits on holdings.

Under the Capital Requirement Regulation (CRR) in fact, “exposures to Member States central governments and central banks denominated and funded in the domestic currency of that central government and central bank shall be assigned a risk weight of 0%”<sup>12</sup>.

Banks can improve their Tier 1 ratio<sup>13</sup> replacing private sector lending (that carries a positive risk weight) with purchases of domestic government bonds (which have 0% risk weight). Thus, by investing in high yield assets with low risk weights, banks increase their short term return on equity and they can meet capital requirements without the need to issue new capital.

- Information arbitrage hypothesis: home banks might prefer domestic securities since their information advantage may increase during crisis. Domestic banks might, for example, better evaluate the increased domestic political risk compared to foreign investors (Altavilla et al. 2015).

To conclude, the major effect of home country bias is to exacerbate the link between sovereign credit risk and banks credit risk. This happens since home bias amplifies the transmission of sovereign credit risk to banks credit risk through the exposures channel.

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<sup>12</sup> Regulation (EU) No 575/2013, art. 114 (4).

<sup>13</sup> Tier 1 ratio is the ratio between TIER 1 capital and risk weighted assets. TIER 1 capital is the primary component of bank capital in terms of quality and ability of absorbing losses. It is made up of Common Equity Tier 1 (CET) and Additional Tier 1 capital. They include capital instruments, retained earnings, other reserves and funds for general banking risks. Risk weighted assets consist in the total amount of bank assets each weighted for its risk. The Tier 1 ratio should be equal to at least 6% of the total risk exposure amount.

## Chapter 3

### The Banking Union

The European Union decided to set up the Banking Union in order to break the link between sovereign and banks credit risks and to avoid all the several problems due to this link.

Therefore, if the Banking Union can help to break the link, it could be considered as a fourth phase in the relationship between banks and sovereign credit risks.

This chapter presents the main features of the European Banking Union. In particular, the chapter shows the reasons underlying its creation and the ways in which it hopes to break the link between banks and sovereign credit risks.

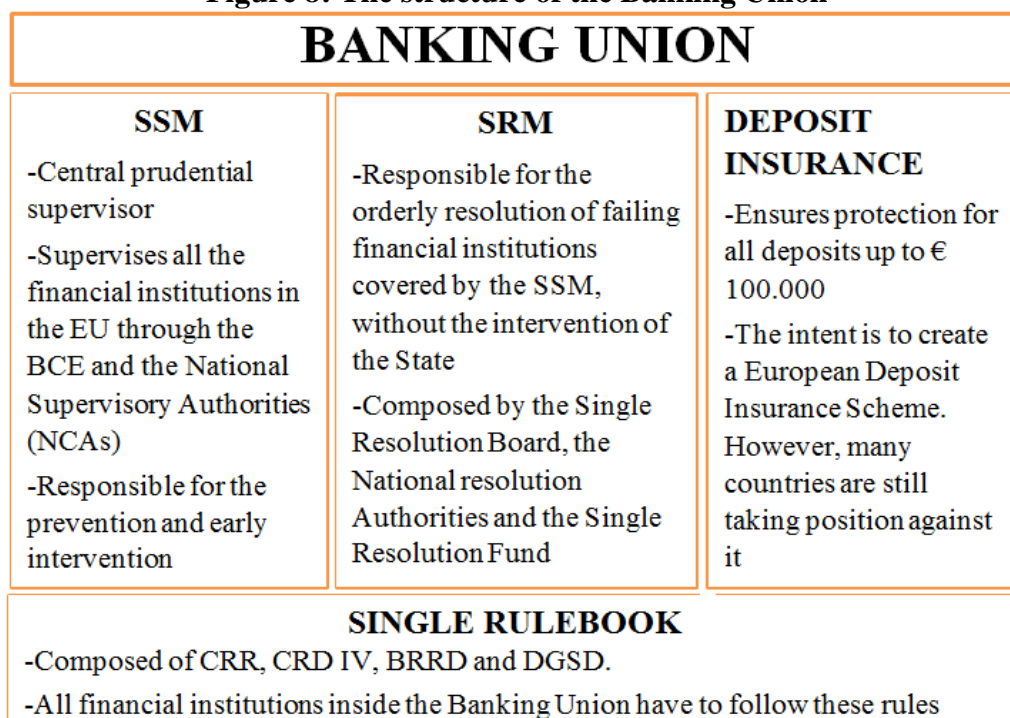
#### 3.1 The structure of the Banking Union

The Banking Union is based on three pillars: i) the Single Supervisory Mechanism (SSM); ii) the Single Resolution Mechanism (SRM); iii) the deposits insurance.

All these three elements follow a common set of rules contained in the Single Rulebook.

In addition, the European Stability Mechanism (ESM) was set up in order to provide an immediate assistance to the Member States in case of financial difficulties through a permanent system of firewall. Figure 8 gives a brief overview on the structure of the Banking Union and the tasks of its components.

**Figure 8: The structure of the Banking Union**



Source: author's own elaboration.

### **3.1.1 The Single Rulebook**

The Single Rulebook, term coined in 2009 by the European Council, represents the foundation of the Banking Union. It consists of a set of common rules that all financial institutions throughout the European Union must comply with.

The provisions of the Single Rulebook are set out in four main legislative acts: the Capital Requirements Regulation (CRR), the Capital Requirements Directive (CRD IV), the Bank Recovery and Resolution Directive (BRRD) and the Deposit Guarantee Scheme Directive (DGSD).

With these four acts the Single Rulebook permits first to prevent banks crises from happening by setting common capital requirements. Second, when crises happen the Single Rulebook provides a common framework to face and orderly manage them. Moreover, it sets out the rules to protect depositors in a common way throughout Europe.

The intent to create a uniform legal base for the European financial sectors came out during the recent crisis period. European banking legislation was based on rules which left room for significant divergences among countries. This has led to legal uncertainty, making possible for institutions to exploit regulatory loopholes, distorting competition and so on. In the crisis period these divergences had disruptive effects. In fact, the differences in regulatory requirements across Member States were one of the major causes of financial instability.

Thus, a single Rulebook was needed in order to make the European banking sector more resilient, more transparent and more efficient.

#### **3.1.1.1 The Bank Recovery and Resolution Directive (BRRD)**

In order to break the link between banks and sovereign credit risks the major tool is to intervene in the resolution procedure of the distress financial institution. The European Union acted in this direction by issuing first the Bank Recovery and Resolution Directive<sup>14</sup> and then integrating it with the SRM regulation<sup>15</sup>.

The Bank Recovery and Resolution Directive is the legislative act that regulates in a more comprehensive way the recovery and the resolution of distressed banks. It was enacted in order to reach a greater uniformity throughout Europe. In fact, all banks set up in one Member State of the European Union have now to comply with the BRRD.

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<sup>14</sup> Directive 2014/59/EU of the European Parliament and of the Council of 15 May 2014.

<sup>15</sup> Regulation (EU) No 806/2014 of the European Parliament and of the Council of 15 July 2014. The BRRD established minimum harmonization rules thus, the European Union, by setting up the Banking Union, integrated the BRRD with the SRM Regulation in order to achieve a complete uniformity of rules relating to the settlement of banks in crisis.

To manage a bank crisis in an orderly way, the BRRD sets out a set of actions and behaviours that must be followed by the competent authorities. All these actions start with the prevention, thus, well before the crisis.

Three phases are identified by the BRRD in the procedure for the recovery and resolution of banks in distress:

- **Preparation:** this phase is aimed at preventing the crisis.  
In this phase financial institutions have to draw up recovery and resolution plans. Recovery plans are intended to remove situations of weakness while resolution plans are intended to ensure an orderly resolution of the institution in crisis. Thus, these measures are emergency plans that permit to manage adequately crisis situations when they occur.
- **Early intervention:** the second phase coincides with the first stage of the crisis of banks when intervention to restore financial stability is still possible.  
In this phase competent authorities can still intervene in order to remedy the deteriorated financial condition of an institution. Examples of early intervention measures are requirement of changes in the business strategy or in the legal and operational strategy.
- **Resolution or crisis management:** the resolution phase occurs when the situation of a financial institution deteriorates beyond repair and early intervention measures are no longer implementable.

The BRRD identifies four resolution tools that can be implemented:

-*Sale of business tool* consists in the transfer of shares, other instrument or assets, rights or liabilities issued by the institution under resolution. The transfer must be made on commercial terms, to an institution that is not a bridge institution.

-*Bridge institution tool* consists in a mechanism that permits to sell shares, other instruments or assets, rights or liabilities of the institution under resolution to a temporary structure, wholly or partially owned by public authorities and controlled by the resolution authority.

-*Asset separation tool* consists in the transfer of assets, rights or liabilities of the institution under resolution to an “asset management vehicle”. This permits to separate clean assets from toxic ones. The main difference with the sale of business tool is that in the latter case the transfer is made to a private purchaser and on commercial terms, while in the asset separation tool the transfer is made to the asset management vehicle which is public owned.



*-Bail-in tool* consists in the write-down of the liabilities of the institution and in the conversion of debt in equity in order to restore the capital of the failing entity. In this way the costs arising from the failure of the institution are borne by the shareholders and the creditors. Moreover deposits up to € 100.000 are protected under the Deposit Guarantee Schemes.

However, the regulation cannot eliminate completely a public backstop. In this context, the regulation provides for a *government stabilization tool* which can be obtained only in case of very extraordinary situations of systemic risk.

An additional backstop can be found in the European Stability Mechanism as will be seen in the following paragraphs.

The BRRD was the first harmonization tool introduced by the European Union in order to face the several problems induced by the recent financial crisis. Significant was the introduction of the first phase of prevention. In fact during the recent financial crisis, if banks would have actively acted for prevention the effects of the crisis may not have been so devastating.

The other significant step was the introduction of the four resolution tools. These four instruments on one hand permit to minimize the intervention of the State, which was a great problem during the crisis, on the other however they affect significantly the position of shareholders. This is especially visible in the sale of business tool, where the sale is done without the consent of shareholders, and in the bail-in tool, where the shareholders in particular are the one that bear the costs of the resolution. Moreover, while the bridge institution tool and the asset separation tool are perceived as temporary measures, the bail-in tool and the sale of business tool are considered as definitive measures that change the situation of the resolved bank.

The BRRD was further integrated by the Banking Union regulation in order to have a more centralized implementation of all the actions established by the legislation.

Looking at the framework of the Banking Union, the Single Supervisory Mechanism and the Single Resolution Mechanism are responsible for the implementation of all the action of the three phases. In particular, the SSM intervenes in the first two phases in order to carry out all the prevention and early intervention activities. The SRM intervenes in the last resolution phase as the entity that manages the resolution.

### **3.1.2 The Single Supervisory Mechanism (SSM)**

The Single Supervisory Mechanism represents the first pillar of the Banking Union and is responsible for the supervision of all the financial institutions set up inside the Banking Union. It was set up on 15 October 2013 with the Council Regulation (EU) No 1024/2013 and it is fully operational since November 2014.

The SSM was established in order to ensure the safety and soundness of the European banking system, in order to increase the financial integration and stability of the European market, and in order to provide consistent supervision.

Accordingly to the legal definition, the SSM is “the system of financial supervision composed by the ECB and national competent authorities of participating Member States”<sup>16</sup>. The ECB is the body responsible for the efficient and consistent functioning of the SSM and supervises all the credit institutions of significant relevance (around 130 banking groups in the Euro area, covering more than 85% of the Euro area total banking assets). While the NCAs supervise the less significant ones (about 3400 institutions).

The ECB has both supervisory and investigatory powers in order to fulfil its tasks. Other tasks entrusted to the ECB are the granting or withdrawing of banking licenses, the ensuring of compliance with EU prudential rules.

Additionally to this direct control, the ECB carries out an indirect control on the less significant institutions. The direct supervision of these less significant institutions is in the responsibility of the NCAs which are subjected to the control of the ECB.

As regards the decision-making process within the SSM, the ECB has set up a new entity<sup>17</sup>, the Supervisory Board, which carries out all the supervisory tasks. The decisions proposed by the Supervisory Board must be approved by the Governing Council.

As for the international framework, the ECB cooperates with non-SSM supervisors. The ECB plays a strong role as host supervisor for the banks from countries outside the Euro area.

Thus, the SSM is an integrated system based on cooperation between the ECB, which figures as the largest supervisor in the world, and the national authorities, to deliver a European supervision, without national bias (Nouy 2014).

The establishment of the SSM was the first important step towards the Banking Union. It permits to have a greater uniformity throughout Europe, a greater coherence in the banking system and, having as central point the BCE, it assures that all the tasks are carried out more

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<sup>16</sup> Article 2, Council Regulation (EU) No 1024/2013.

<sup>17</sup> The ECB initially was only responsible for the monetary policy function. Now with the introduction of the SSM the ECB is responsible also for the supervisory tasks. Thus, as stated by article 25 CRD IV, it is important to maintain separated the two functions of the ECB. For these reasons the new Supervisory Board was established.

correctly and more efficiently with respect to the past. However, it was set up in a period of great distress. And this, as seen above, created some obstacles to its effective implementation.

### **3.1.3 The Single Resolution Mechanism (SRM)**

The Single Resolution Mechanism is the second pillar of the Banking Union and is the necessary complement to the Single Supervisory Mechanism.

The Single Resolution Mechanism consists of a system of rules and procedures common for all the financial institutions inside the Banking Union for the prevention of a crisis and the resolution of a failing entity. In this way, the European authorities want to ensure that when a bank is failing or likely to fail it can be resolved in a more orderly way with respect to the past, without systemic repercussions on the financial system, while minimizing reliance on public support (Bruzzzone et al. 2015).

The SRM was established by Regulation (EU) No 806/2014, of 15 July 2014, of the European Parliament and of the Council and is fully operational since 1 January 2016. It bases its functioning on the Bank Resolution and Recovery Directive (BRRD) and the SRM regulation. The SRM is made up of the Single Resolution Board (SRB) which is entrusted with a centralized power of resolution. The SRB is the owner of the Single Resolution Fund (SRF) whose purpose is to support financially the resolution procedures when the other measures are not sufficient. The SRF is financed by all financial institutions in the participating Member States.

Moreover, the SRB is supported by the National Resolution Authorities of each participating Member State. Other authorities involved in the resolution process are the European Commission, the European Council and the ECB, which carry out specific tasks related to the most political sensitive issues.

As for the application of the SRM, it covers all the institutions supervised by the SSM, both significant and less significant. The SRB is responsible for the resolution of the largest banks and of cross-border institutions (all those institutions also subjected to the direct supervision of the ECB), while all the remaining banks are subjected to the National Resolution Authorities.

Moreover, the SRM structure ensures that the first who bears the losses in case of a resolution procedure is no longer the sovereign but the shareholders and the creditors of the failing banks. This is possible, in particular, thanks to the bail-in resolution tool imposed by the BRRD. Thus, the SRM is the element of the Banking Union that mostly should allow to break the link between banks and sovereign credit risks. However, the introduction of the bail-in has made investors more reluctant to underwrite shares and obligations of banks since those

became more and more risky from the moment in which the regulation has established that the first who bears the losses are shareholders and creditors. Thus, the bail-in has to be structured in a correct way in order to avoid an inefficient problem of disinvestment and withdrawal of funds.

### **3.1.4 The deposits insurance**

The deposits insurance is the third pillar of the Banking Union. Its significance is due to the fact that the strengthening of deposits insurance increases the stability of the financial sector. This because a deposits insurance reinforces depositors confidence and reduces the probability of a bank run in case of financial distress.

The current system of deposits insurance is constituted by the set of all national Deposit Guarantee Schemes (DGSs). These already ensure that all covered deposits up to € 100.000<sup>18</sup> are protected. In particular, the national DGSs have the task to intervene in the crisis of a bank in order to repay depositors within the limits provided by law or in the higher limits set voluntary by the deposits insurance scheme.

However, since national DGSs can be vulnerable to local shocks, in November 2015 the European Commission proposed to establish a unique deposits guarantee scheme, the European Deposits Insurance Scheme (EDIS). As was seen above, despite the positive effects envisaged by the official proposal, the EDIS is not yet in place. In fact many countries, especially Germany and other Nordic states like Denmark, take position against the proposal of the European Commission.

The States that take position against the EDIS believe that a common insurance scheme at the European level is possible only after that the several risks of banks, in particular those related to the holdings of national government debt, are reduced. In fact, Germany and the other Nordic countries are worried that they may disproportionately pay to rescue depositors in other countries since the risk levels of banks across Europe are not homogeneous. For example, banks in Greece are more likely to fail than the German ones so Greece will benefit more than Germany from the EDIS. As a consequence, the EDIS will pay more for Greece than for Germany. This leads to a disproportional payment across States. Moreover, a common insurance could lead to moral hazard across the States, in particular the riskier ones. A

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<sup>18</sup> The original DGSD, Directive 94/19, required only a minimum coverage amount of € 20.000. It was a minimum harmonization measure and this resulted in a variety of different DGSs. During the recent financial crisis, this induced several depositors to transfer their funds to banks in countries with more favorable guarantee schemes. The European Commission, in order to avoid distortionary competition and to increase financial stability and confidence in the market, amended the directive and the coverage amount was set to € 100.000, uniformly throughout all the Member States.

solution proposed by the States is to average the contributions to the insurance fund for the risk of the sovereigns.

Another point of conflict is the independence of the insurance fund from the Single Resolution Fund. In fact, the proposal of the Commission envisages that the new Deposit and Insurance Fund will be managed by the Single Resolution Board which also manages the Single Resolution Fund. Several States take position against the double management of the Single Resolution Board since this could lead to significant conflicts of interest.

Thus, the EDIS implementation will be delayed. However, while these concerns should be taken seriously, it must be recognized that an incomplete Banking Union, if allowed to persist for long, can easily become an additional source of uncertainty and risk. Policymakers will have to make several modifications to the proposal in the next time which have to consider all the financial and legal consequences of the EDIS.

### **3.1.5 The European Stability Mechanism (ESM)**

The European Stability Mechanism is an intergovernmental organization created on 27 September 2012. It represents a permanent firewall for the Eurozone Member States<sup>19</sup>. It should safeguard and provide instant access to financial assistance programmes for Member States of the Eurozone in financial difficulty, with a maximum lending capacity of 500 billion. Eurozone Member States have to contribute to ESM capital. The major contributors are Germany, France and Italy.

ESM is composed of the Ministers of Finance of each Member State. It has replaced the European Financial Stability Facility (EFSF) and the European Financial Stability Mechanism (EFSM).

Initially, ESM was created as a backstop for Eurozone countries. It was used only to provide financial support to Member States in troubles. In particular, ESM provided loans to the European countries that experienced or were threatened by financial difficulties. Cyprus and Greece are examples of Member States that applied for ESM financial support.

Successively, with the creation of the Banking Union, this backstop role was accompanied by other tasks related to the support of the financial sector. Nowadays in fact, the ESM can also help and support troubled financial sectors of Member States by intervening in the recapitalization of banks in crisis. In particular, ESM intervenes in case of bank resolution when a Member State asks for assistance in recapitalizing a financial institution and neither

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<sup>19</sup> Only Eurozone Member State can apply for ESM financial assistance. EU Member States outside the Eurozone have no access to the funds provided by the ESM, but can apply for rescue loans from EU Balance of Payments programs, IMF and bilateral loans.

the private market nor the Member State will be able to conduct the recapitalization on their own without causing increasing financial distress. In this case, the ESM could buy the banks, manage the banks and appoint directors of the banks. ESM could acquire equity shares, invest in those banks and then reform them.

Moreover, each financial institution in trouble will be directly financed, so the support is not considered a State aid.

Thus, the ESM applies to systemic banks under recovery or resolution when neither bail-in by shareholders and creditors nor the use of the Single Resolution Fund have been sufficient. Hence, the ESM acts as an ultimate backstop.

### **3.2 The fourth phase: the Banking Union period**

The Banking Union was established in response to the severe consequences of the recent financial crisis. In fact, the earlier European framework, which combined national banking policy with European integration, was no longer able to sustain financial stability and the breakup of the Euro area could not be ruled out. It was time to create a common setup for the banking sector that was no longer national but wide spread across Europe.

The intent underlying the creation of the Banking Union was to make financial institutions and markets more stable and more resilient. Therefore, breaking the link between sovereign and banks credit risks became the main objective of the European Union which decided to set up the Banking Union. This was highlighted in the summit of Euro area heads of State and governments of 28 and 29 June 2012 where the leaders declared: “we affirm that it is imperative to break the vicious cycle between banks and sovereign”.

For these reasons the Banking Union could be considered as a fourth phase in the relation between credit risk of banks and credit risk of sovereigns. The Banking Union should be seen as the final phase in which the link between the two risks is broken thanks to new common supervisory and resolution authorities. A common framework for supervision and resolution, in fact, should ensure that banks credibility will depend more and more on the specific risk profile of the banks rather than on the financial strength of the Member States in which they are based.

However, the new setup does not eliminate at all the intervention of the State, as will be seen in the next paragraphs, and the presence of national entities is a basic element of the new supervision and resolution mechanisms. This may not eliminate at all differences across countries and the influences of the sovereigns on the financial sectors.

Thus, many are the positive effects related to the establishment of the Banking Union. It must be recognized that the project was carried on very fast considering all the steps that it has taken. Moreover, as argued by Angeloni (2016) the banking sector faced a recovery between mid-2012 to mid-2015, three years that coincide with the launch of the European Banking Union and the establishment of its first pillar. This means that the establishment of the Banking Union had positive effects on the banking sector.

The first step towards a complete Banking Union was the establishment of the Single Supervisory Mechanisms, which is entrusted with the supervision of all the European financial institutions. Thanks to a common supervision banks should become stronger and more immune to shocks. Moreover, a common supervision should ensure an effective enforcement of stricter prudential requirements for banks throughout Europe. Examples are the new capital requirements to which all banks of the Euro area are subjected, independently of their “nationality”. This, in turn, should make EU banks more solid, enabling them to manage in a more adequate way the risks linked to their activities and absorb all the losses in which they may incur.

Consequently, the confidence in all banks inside the Banking Union should increase since all banks are subjected to the same supervisor. This results from the fact that banks even if located in different Member States are subjected to the same rules and requirements, and regulations are applied in the same way throughout the Eurozone.

For all these reasons the creation of a common supervision mechanism was necessary in order to eliminate the shortcomings of the precedent legislation and the lack in transparency that characterized the precedent setup. The recent financial crisis, in fact, highlighted the very different situations of the banking sectors across countries. However, the SSM was introduced in a period in which the financial crisis was very severe, which made the desired effects more difficult to achieve. An example are the strict capital requirements to which banks were subjected. Banks had to increase their capital, most of the time significantly, in a period in which investors were reluctant to subscribe a capital increase. This made a bad situation worse.

Moreover, the second step in the establishment of the Banking Union was the introduction of a new common bank resolution procedure throughout Europe. The major aim of this new resolution mechanism is to ensure that failing banks will be resolved without taxpayers money. This will limit the negative effects on public debt and sovereign credit risk. In fact, under the Banking Union the resolution of a bank will be financed mainly by its shareholders and its creditors. The intent of the European Union to avoid the intervention of the State in the resolution of a failing bank is important and necessary in order to break the link between

sovereigns and banks. However, by introducing the bail-in the situation of shareholders is significantly affected. The concerns about banks default make investors and savers more reluctant to invest and deposit money in banks. And this, in the current period, is also disadvantageous for banks, because of the high capital requirement imposed by the authorities.

The last step towards a complete Banking Union is the establishment of a common deposit insurance scheme throughout Europe, the European Deposits Insurance Scheme. This should ensure that deposits, independently from the bank where they are set, will be subjected to the same level of protection. The EDIS should increase the confidence in banks inside the Banking Union by reducing the probability of a bank run. Thanks to the EDIS depositors should be more confident to be protected despite of the State in which the bank is located. In fact, the EDIS being European is not characterized by the vulnerability to large local shocks shown by national deposit guarantee schemes. Although the EDIS is presented with a lot of positive effects several States, in particular Germany and other Nordic States, are taking position against it as will be seen in the next paragraphs. Thus, it will take a long time since a European insurance scheme will be established.

The recent financial crisis made it necessary to build up the Banking Union, in particular, it anticipated a step that the European Union would have done in the future to complete the European Monetary Union. However, one must bear in mind that the Banking Union will affect and change significantly the banking sector with respect to the past, and this in a period of significant distress.

Breaking the link between banks and sovereign credit risks is thus the major aim of the Banking Union. However, there are other important objectives underlying the creation of the Banking Union. One is to restore financial market integration which was undermined by the recent financial crisis. The financial crisis, in fact, pushed fragmentation to levels similar to those seen before the Euro was introduced. One of the reasons for this decline in financial integration was the increasing concerns of investors about the financial situation of foreign financial sectors. Investors, thus, showed an increasing preference for national institutions as a result of the loss of trust in international markets. Thus, national bias increased and led to fragmentation at national level.

Moreover, it is important to restore financial integration in the Euro area since it contributes to the development of the financial system for example by increasing competition, expanding markets and offering greater opportunities for geographical risk diversification. This will improve the overall stability and reduce problems of asymmetry of information. Also significant is the fact that financial integration contributes to GDP growth. Maudos et al.



(2015) states that from 1999 to 2007, the economic impact of progress in the degree of financial integration contributed to 0,227 percentage point of annual GDP growth in the EU – 15 countries. Moreover, the financial fragmentation during the crisis implied a fall in the annual growth rate. Thus, establishing the Banking Union, that envisages more integration in the financial sector, should have positive effects on the economic growth.

Moreover, as stated by Costâncio (2015), the presence of the sovereign-bank link and the more and more pronounced fragmentation made the correct transmission of monetary policies increasingly difficult. Restore the correct functioning of the banking sector permits to reestablish the correct transmission of the monetary policy to the real economy through the Euro area.

Thus, a Banking Union is really needed in order to solve the several problems brought by the shortcomings highlighted by the recent financial crisis and in order to better face new crises.

# Chapter 4

## The model

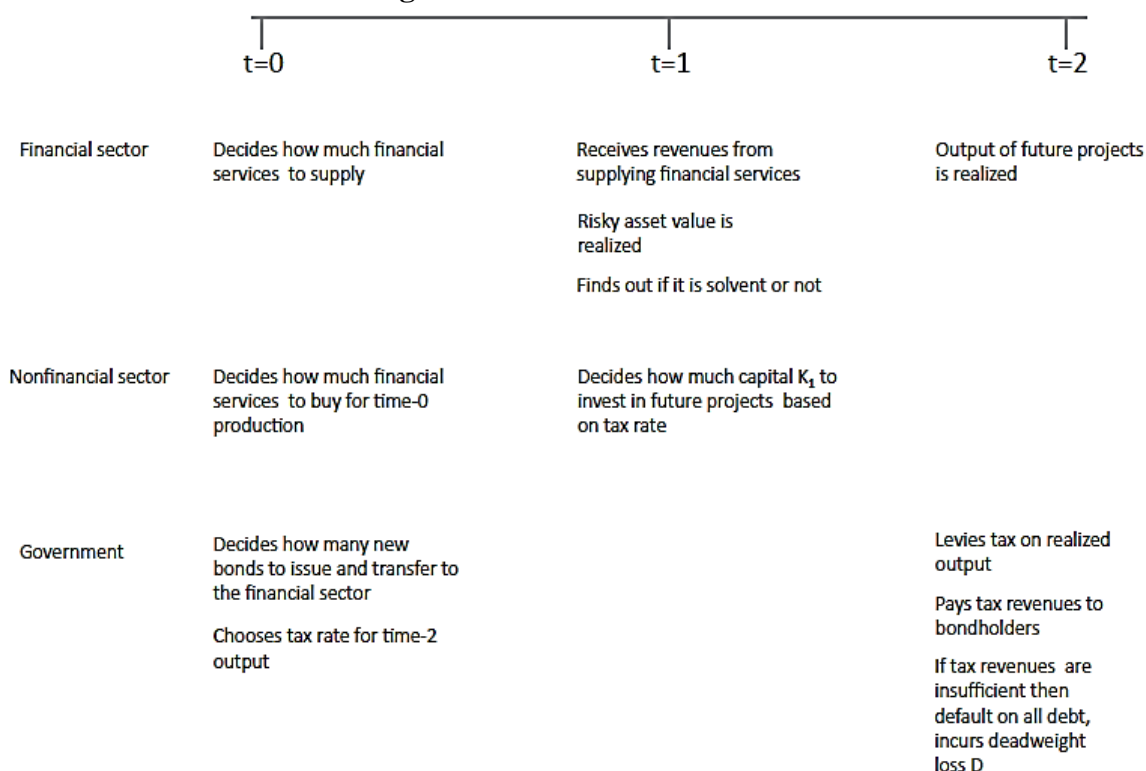
This chapter presents the main features of the theoretical model elaborated by Acharya et al. (2014) in order to better understand the empirical analysis. In particular it focuses on the structure and the equilibrium results of the model.

The following empirical analysis (Chapter 5) and what said above are based on the theoretical model presented by Acharya et al. (2014). The authors, in fact, elaborated a model that explains the three phases in the relationship between banks credit risk and sovereign credit risk.

### 4.1 The structure of the model

The model is constructed over three periods:  $t=0$ , 1 and 2. There are three economic sectors: the financial sector, the corporate sector (or non-financial sector) and the government. Financial and corporate sector constitute the productive economy. The outputs of the economy are consumed by a representative consumer. All agents are risk neutral.

**Figure 9: Timeline of the model**



Source: Acharya et al. 2014.

Figure 9 shows the timeline of the model. As will be seen more in detail in the following paragraphs, the financial sector faces a problem of maximization of its revenues coming from the supply of financial services; at the same time it has to remain solvent. As can be seen in figure 9, the financial sector decides how much financial services to supply at time  $t=0$  and gets the revenues at time  $t=1$ . At time  $t=1$  it knows if it will be solvent. For what concerns the government, it acts in order to maximize the output of the economy and thus the welfare of the consumer. In particular, it sustains the financial sector by doing a transfer. It does it in order to avoid the liquidation of the financial sector which is detrimental for the economy. Thus, the government decides at  $t=0$  the magnitude of the transfer and the tax rate. Only at time  $t=2$  the government levies taxes and knows if it is solvent. For what concerns the corporate sector, it wants to maximize its payoffs deriving from actual activities and investments in new projects. It does this by deciding at time  $t=0$  how much financial services to buy at time  $t=0$  and how much capital to invest in new projects at time  $t=1$ .

#### 4.1.1 The financial sector

The financial sector manager faces a problem of maximization of payoffs. In particular, at time  $t=0$  he has to decide the amount of financial services to supply in order to maximize the net expected payoffs at time  $t=1$ . The problem to solve is represented by the following equation:

$$\max_{s_0^S} E_0 [(w_s s_0^S - L_1 + \tilde{A}_1 + A_G + B_0) * 1_{\{-L_1 + \tilde{A}_1 + A_G + B_0 > 0\}}] - c(s_0^S) \quad (1)$$

where  $s_0^S$  is the amount of financial services supplied by the financial sector at time  $t=0$ ,  $w_s$  is the return per unit of financial services determined in equilibrium,  $c(s_0)$  are the costs, measured in units of consumption good, of the production of  $s_0$  unit of financial services. The production costs are assumed to be increasing in the amount of financial services produced, that is  $c'(s_0) > 0$ , and convex, that is  $c''(s_0) > 0$ .

Moreover,  $L_1$  is the face value of the liabilities of the financial sector that mature at time  $t=1$ ,  $\tilde{A}_1$  and  $A_G$  represent the values of the two types of assets held by the financial sector.  $A_G$  represents the value of the financial sector holdings of the existing stock of government bonds (already issued before the bailout),  $\tilde{A}_1$  represents the value of all the other assets held by the financial sector at time  $t=1$ .  $B_0$  is the transfer that the government makes to the financial sector at time  $t=0$ .

The financial sector manager obtains revenues from his activity only if the value of the assets ( $\tilde{A}_1 + A_G$ ) exceeds the value of the liabilities ( $L_1$ ). This solvency condition is represented by

the indicator function for the expression  $\{-L_1 + \tilde{A}_1 + A_G + B_0 > 0\}$ <sup>20</sup>. In case of insolvency the debtholders get all the assets and the wage revenues of the financial sector.

From a structural point of view, the financial sector is highly leveraged and highly exposed to systematic risk. This makes it particularly susceptible to debt overhang, that causes important distortion in investments, and to runs. Moreover, this makes financial sector debt difficult to restructure. Thus, the intervention of the government is needed to resolve the problem of debt overhang.

Finally, the financial sector is large so, the resources needed to resolve a crisis are large also with respect to tax revenues. This creates important trades off in the decisions that the government has to take in the case that a bailout is needed.

#### 4.1.2 The corporate sector

The corporate sector, or non-financial sector, has a capital stock  $K_0$  at time  $t=0$ . The corporate sector wants to maximize the net payoffs that occur at time  $t=1$  and  $t=2$ . The problem that has to be solved for the corporate sector is represented by the equation:

$$\max_{s_0^d, K_1} E_0 [f(K_0, s_0^d) - w_s s_0^d + (1 - \theta_0)\tilde{V}(K_1) - (K_1 - K_0)] \quad (2)$$

where  $f$  is the production function of the sector;  $K_0$ , the initial capital, and  $s_0^d$ , the amount of the financial services demanded by the corporate sector, are the inputs of the production function. The output of  $f$  is deterministic and consumption goods are produced at time  $t=1$ . The underlying assumption states that  $f$  is increasing in both inputs and concave.

At  $t=1$  the corporate sector has to decide how much capital  $K_1$  to invest, at cost  $K_1 - K_0$ , in a project  $\tilde{V}$  whose payoffs are realized at  $t=2$ . It is the continuation value of the corporate sector and is subjected to uncertainty. The expected payoffs of the project are given by  $V(K_1) = E_1[\tilde{V}(K_1)]$ . These are a function of the level of invested capital  $K_1$ . The underlying assumption is  $V'(K_1) > 0$  and  $V''(K_1) < 0$ , that is the expected payoffs are increasing in the level of invested capital and concave.

At time  $t=2$  the payoffs of the project are taxed at a tax rate  $\theta_0$  set by the government in order to pay back its debt.

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<sup>20</sup>The term  $w_s s_0^s$  is omitted from the solvency condition for reasons of simplicity without affecting the results.

### 4.1.3 The government

The aim of the government is to maximize the total output of the economy and, consequently, the welfare of the consumer. Thus, the government has to reduce the problem of debt overhang of the financial sector in order to increase the provision of financial services and, in turn, the output of the economy. In order to do this, at time  $t=0$  the government issues new bonds and transfers these to the balance sheet of the financial sector<sup>21</sup>. The new bond issued are equal to the old one, they mature all at time  $t=2$  and are repaid with the tax revenues gained by taxing (in  $t=2$ ) the payoffs of the corporate sector at the tax rate  $\theta_0$  (determined at  $t=0$ ). Thus, after the transfer to the financial sector the government has  $N_B+N_D$  amount of bonds outstanding, where  $N_D$  is the number of old bond and  $N_B$  is the amount of new bond issued for the transfer. The face value of a bond is equal to one so the face value of the total outstanding debt is equal to the number of outstanding bonds.

The government sets the tax rate at time  $t=0$  and the taxes are levied at  $t=2$  when the payoffs of  $\tilde{V}$  are realized. The realized taxes are equal to  $\theta_0\tilde{V}(K_1)$  and are used to pay bondholders of both new issued and old bonds,  $N_B+N_D$ . If the tax revenues are higher than the outflows for debt repayment the government runs a surplus. Otherwise the government defaults on its debt. It is assumed that by defaulting the government suffers a deadweight loss of  $D$ . This represents the loss of government reputation at an international level, the domestic loss of government credibility, the degradation of the legal system and so on. Thus, since default is costly there is incentive to avoid it.

Therefore, the problem faced by the government is to maximize the expected utility of the consumer that consumes the combined output of the financial and the corporate sectors. This problem is represented by the equation:

$$\max_{\theta_0, N_B} E_0 [f(K_0, s_0) + \tilde{V}(K_1) - c(s_0) - (K_1 - K_0) - 1_{def}D + \tilde{A}_1] \quad (3)$$

where  $f(K_0, s_0)$  is the production function; its inputs are the initial capital stock  $K_0$  and the amount of financial services provided in equilibrium  $s_0$ . As in the objective function of the financial sector,  $c(s_0)$  are the production costs of  $s_0$  units of financial services.  $\tilde{V}(K_1)$  are the payoffs of the project in which the corporate sector invests,  $\tilde{A}_1$  represent the value of the assets of the financial sector, not considering the government bonds holdings.  $1_{def}$  is an

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<sup>21</sup> The instruments of the government are simplified since the model does not focus on the optimal structure of the bailout. This does not affect the results. It is only important that the bailout is not free for the government, (i.e., it involves a net transfer from the government to the financial sector), and the larger is the debt overhang problem, the greater is the cost of the bailout (Acharya et al., 2014).

indicator function. It takes the value 1 when the government defaults, that is when the tax revenues are not enough to pay back the outstanding debt ( $\theta_0 V(K_1) < N_B + N_D$ ), 0 otherwise.

The maximization problem is subjected to the budget constraint  $B_0 = P_0 N_B$  (where  $P_0$  is the price of government bonds, both old and new, determined in equilibrium), and to the simultaneous choices of the financial and the corporate sector.

In addition on each government bond there is a CDS contract that protects the bond buyer in case of government default. This contract pays to the buyer the difference between the face value of the bond and the recovery value after default. The CDS contract matures at time  $t=2$  and at the same time the buyer pays the CDS fee, which is equal to  $1 - P_0$ .

#### 4.1.4 The representative consumer

The representative consumer consumes the output of the economy. The consumer has wealth  $W$  which he allocates between consumption and bonds and equity of the government and of the financial and the corporate sectors.

The consumer is risk neutral thus he has no time - discounting. He chooses at time  $t=0$  the portfolio allocation which maximizes its payoffs. Thus, it solves the following equation:

$$\max_{n_i} E_0 [\sum_i n_i \dot{P}(i) + (W - \sum_i n_i P(i))] \quad (4)$$

where  $P(i)$  and  $\dot{P}(i)$  are the price and the payoff of asset  $i$  respectively and  $n_i$  is the optimal amount of asset  $i$ .

The first order condition implies that the equilibrium price of an asset is given by its expected payoff,  $P(i) = E_0[\dot{P}(i)]$ .

## 4.2 Equilibrium results

The equilibrium analysis starts with the maximization problem of the financial sector.

First of all,  $p(\tilde{A})$  represents the probability density of  $\tilde{A}$ . Then,  $\tilde{A}_{Imin}$  represents the minimum realization of  $\tilde{A}_I$  that permits to the financial sector to not default. Thus, the first order condition of the financial sector becomes:

$$w_s p_{sol} - c'(s_0^s) = 0 \quad (5)$$

Where  $p_{sol}$  is the probability that the financial sector is solvent at  $t=1$ .

The analysis goes on with the maximization problem of the corporate sector at  $t=0$ .

The demand for financial services  $s_0^d$  of the corporate sector at time  $t=0$  is given by the

following first order condition:

$$\frac{\partial f(K_0, s_0^d)}{\partial s_0^d} = w_s \quad (6)$$

In equilibrium the demand and the supply of financial services are equal (Acharya et al., 2014):

$$\hat{s}_0^d = \hat{s}_0^s.$$

The two first order condition of the financial sector and the corporate sector show how debt overhang affects the provision of financial services.

In particular, the marginal cost of an extra unit of services to the economy,  $c'(s_0)$ , is less than the marginal gain,  $w_s$ , when the probability of insolvency of the financial sector is positive. In this case the allocation is suboptimal (Acharya et al., 2014). In fact, the probability of liquidation ( $p_{sol} < 1$ ) makes the social and private marginal benefit of an increase in the provision of financial services differ from each other. Thus, there is underprovision of financial services with respect to the first best case, that is when there is no insolvency probability ( $p_{sol} = 1$ ). For this reason an increase in the transfer  $B_0$ , made by the government, leads to an increase in the provision of financial services by raising the probability  $p_{sol}$  that the financial sector is solvent at time  $t=1$  (Acharya et al., 2014).

Thus, the intervention of the government, by making a transfer to the financial sector (which figures as a sort of bailout), can alleviate the underprovision of financial services.

#### 4.2.1 First case: optimal transfer under certainty and government solvency constraint

As for the optimization problem of the government, it is suitable to first consider a simplified setup. Therefore, two simplifying assumptions are introduced:

- The variance of output in time  $t=2$  is zero, thus  $\tilde{V}(K_1) = V(K_1)$ ; this means that there is no uncertainty.
- Government has to maintain solvency when establishing its policies.

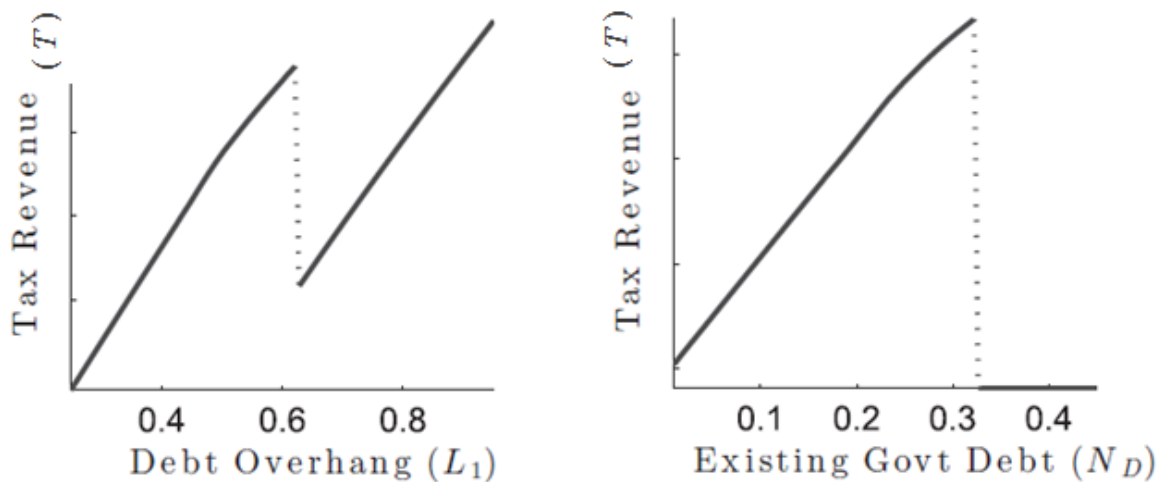
The second assumption implies that the government can issue only an amount of bonds that it can completely repay; this depends on the amount of tax revenues that the government decides to raise. Thus, since by the first assumption the tax revenues are exactly equal to  $T$ , and following assumption two, the government constraint becomes  $N_B + N_D = T$ . This means that the new issued bonds,  $N_B$ , and the already issued ones,  $N_D$ , have to be completely covered by the tax revenues,  $T$ .

Thus, the optimal transfer to the financial sector becomes  $B_0 = \theta_0 V(K_1) - N_D$ .

Looking at the first order condition with respect to the tax revenue  $T$ , it can be derived that the optimal tax revenues are equal to the marginal gain and the marginal loss of increasing tax revenues. Thus, increasing tax revenues increase the transfer  $B_0$ . Moreover, an increasing transfer induces an increase in the supply of financial services by the financial sector. Thus, all else equal, the marginal gain is large when the financial sector's probability of solvency is low and the debt overhang is significant (Acharya et al., 2014). Moreover, it has to be considered that increasing tax revenues can lead to a decrease in investments, and this causes a marginal underinvestment loss for the economy.

Thus, under the first two simplifying assumptions *there is a unique optimal tax revenue  $T$ , which is generated by an optimal tax rate that is strictly less than  $\theta_0^{max}$* <sup>22</sup>. The optimal transfer  $B_0$  is given by  $B_0 = T - N_D$ . The optimal tax revenue  $T$  is increasing in the debt overhang of the financial sector ( $L_1$ ) and in the amount of existing government debt ( $N_D$ ). In fact, the marginal gain of a higher transfer is larger when there is a bigger distortion in the provision of financial services. Thus, the government raises more tax revenues to generate a larger transfer in case of more severe financial sector debt overhang. This is shown in figure 10.

**Figure 10: Tax revenues given debt overhang and existing government debt**



The figure shows the behaviour of the tax revenues for different levels of debt overhang of the financial sector and for different levels of existing government debt. As can be seen in the left panel tax revenues increase with the level of debt overhang of the financial sector. In the right panel the tax revenues increase with higher existing government debt. Source: Acharya et al. 2014. Author's own modification.

Figure 10 shows the behaviour of the tax revenues for different levels of debt overhang of the financial sector and for different levels of government existing debt. Accordingly to what said

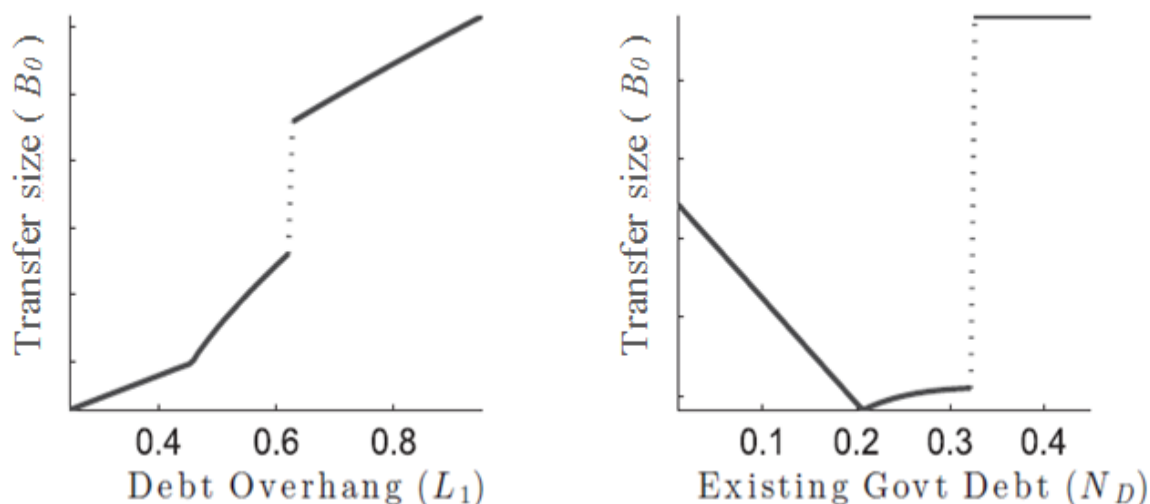
<sup>22</sup> The optimal tax rate is less than  $\theta_0^{max}$  due to the Laffer curve property of tax revenues. Moreover, the optimal tax rate will be strictly greater than zero if there is financial sector debt overhang ( $p_{sol} < 1$ ) since the transfer provides a marginal benefit (Acharya et al., 2014).



above the tax revenues increase with higher levels of debt overhang, as shown in the left panel. Moreover, the tax revenues increase also with higher levels of existing government debt. The figure anticipates also that at some point, where in the figure there is a discontinuity in the line, for the government is no longer advantageous to increase tax revenues. In fact, as will be seen in the next paragraphs, for high levels of debt overhang and high level of existing government debt, for the government it is more favourable to dilute existing debt instead of increasing tax revenues.

Moreover, the optimal transfer is increasing in the financial sector debt overhang ( $L_1$ ) and decreasing in the amount of existing government debt ( $N_D$ ). In fact, since the underinvestment cost of taxation is convex, optimal tax revenues increase less than one-for-one with existing government debt, and a greater existing government debt is associated with a smaller optimal transfer (Acharya et al., 2014).

**Figure 11: Transfer size given debt overhang and existing government debt**



The figure shows the behaviour of the transfer size for different levels of debt overhang of the financial sector and for different levels of existing government debt. As can be seen in the left panel the transfer size increases with the level of debt overhang of the financial sector. In the right panel the transfer size decreases with higher existing government debt. Source: Acharya et al. 2014. Author's own modification.

Figure 11 shows the behaviour of the optimal transfer for different levels of debt overhang of the financial sector and for different levels of existing government debt. Accordingly to what said above the optimal transfer size increases with increasing levels of debt overhang as shown in the left panel. While the optimal transfer size decreases for higher levels of existing debt, as shown in the right panel. Also in this case the figure, in particular the right panel, shows that at a certain point things changes. For the government in case of very high debt it is more advantageous to default and issue a very high transfer.

#### 4.2.2 Second case: optimal transfer when the government has the possibility to default

To go more in depth the second simplifying assumption is removed. Thus, the government has no longer to maintain solvency and it can default. Moreover, the first assumption is still maintained. Thus, the current setting of the model is characterized by no uncertainty about future output and tax revenues and by the fact that the government defaults only in the case that it issues new bonds  $N_B$  in excess of the tax revenues that remain after having repaid all the already existing bonds,  $T - N_D$ . It is useful to consider the government insolvency ratio given by:

$$H = \frac{N_B + N_D}{T}$$

This is the ratio between the total face value of the debt and the expected tax revenues. It maps the decision on how much new debt to issue. When there is no uncertainty (so that the first assumption is respected) default happens when the government raises  $H$  above 1, thus when the debt to repay is higher than the tax revenues with which to repay it. Raising  $H$  above one, hence making government default, has both benefits and costs. The costs are represented by the deadweight loss of default  $D$ . The benefits are given by the fact that increasing  $H$  above one generates a larger transfer by diluting the claim of existing debt on tax revenues. This allows the government to increase the transfer without increasing taxes and incurring in greater underinvestment (Acharya et al., 2014).

Thus, when there is no uncertainty the optimal choice of  $H$  is either 1 or infinity since it would be suboptimal to incur in the deadweight loss  $D$  without having extracted the total benefits from dilution. Raising  $H$  to infinity allows the government to completely dilute existing debt, thereby using all tax revenues for the transfer. Thus defaulting can be beneficial. The benefits from defaulting are affected by several factors. In particular, *the net benefit of defaulting is increasing in the financial sector debt overhang ( $L_1$ ) and in the amount of existing government debt ( $N_D$ )*. In fact, an increase in the financial sector overhang increases the marginal benefits from the transfer and, as defaulting enables the sovereign to generate a larger transfer, the financial sector overhang increases the net benefits of defaulting. Moreover an increase in the amount of existing government debt implies a larger benefit from defaulting by freeing-up more resources for the optimal transfer and by decreasing the optimal tax rate and associated underinvestment (Acharya et al., 2014). *Furthermore, the net benefit of defaulting is decreasing in the fraction of existing government debt held by the financial sector and in the deadweight loss  $D$* . In fact, an increase in the

amount of government bonds held by the financial sector makes default less desirable since it generates significant collateral damages to the balance sheet of the financial sector.

### 4.2.3 Third case: optimal transfer under uncertainty

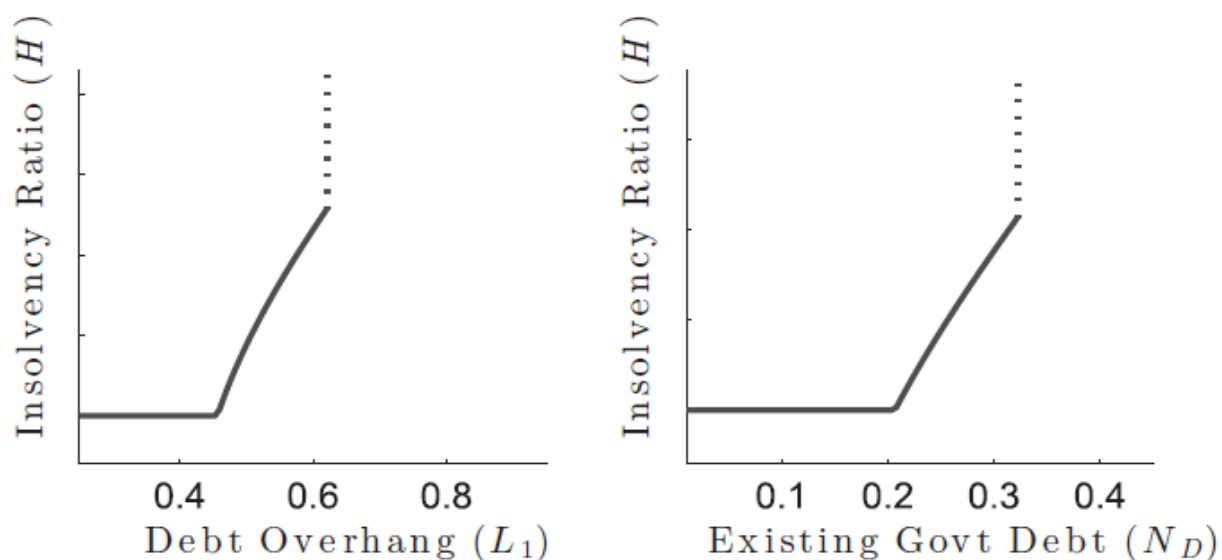
Finally also the first assumption is removed so that uncertainty on future output  $\tilde{V}(K_1)$  is introduced. The current setup of the model is now characterized by uncertainty on the future output and by the possibility that the government defaults.

With uncertainty the sovereign no longer chooses only between defaulting or no defaulting. Now it chooses both the optimal value of tax revenues (which was given in the previous cases with no uncertainty) and insolvency ratio  $H$ .

Raising  $H$  dilutes existing bondholders since it raises the total face value of debt without increasing expected tax revenues. By capturing a greater fraction of tax revenues, it generates a bigger transfer without the need to worsen underinvestment. The cost of this strategy is that it raises the sovereign probability of default. Hence, the sovereign sacrifices its own creditworthiness in order to alleviate debt overhang in the financial sector (Acharya et al., 2014).

Thus, when financial sector overhang is large enough, any further increase in it induces the government to increase the insolvency ratio instead of increasing tax revenues. This is shown in figure 12.

**Figure 12: Insolvency ratio given debt overhang and existing government debt**



The figure shows the behaviour of the insolvency ratio for different levels of debt overhang of the financial sector and for different levels of existing government debt. As can be seen in the left panel the insolvency ratio increases with the level of debt overhang of the financial sector. In the right panel the insolvency ratio increases with higher existing government debt. Source: Acharya et al. 2014. Author's own modification.

Figure 12 shows the behaviour of the insolvency ratio for different levels of debt overhang of the financial sector and for different levels of existing government debt. In case of high levels of debt overhang for the government is suitable to raise the insolvency ratio; this in fact rises for increasing levels of debt overhang, as shown in the left panel. Moreover, as shown in the right panel, for high levels of existing government debt the government increases the insolvency ratio.

Moreover increasing the insolvency ratio triggers an increase in the sovereign's probability of default, which raises the credit risk of the sovereign. *Financial credit risk thus "spills over" onto sovereign credit risk* (Acharya et al., 2014).

It is important to note that the government *chooses* to sacrifice its credit worthiness. In fact tax revenues are below the maximum value. The government instead of increasing  $H$  could increase the tax revenues but it chooses to dilute existing debt in order to avoid underinvestment problems.

The three different setups of the model highlight a loop between financial sector credit risk and sovereign credit risk. In fact, in order to alleviate the severe debt overhang of the financial sector, represented by a large  $L_1$ , the government has to make a large transfer to the financial sector. When the underinvestment costs of taxation are high, the government cannot increase tax revenues in order to make the transfer; thus, it has to raise the insolvency ratio and consequently dilute existing debt. By doing this the sovereign accepts a positive probability of default resulting in a positive relation between the level of sovereign debt and credit risk. In this way, financial sector credit risk "spills over" into sovereign credit risk (Acharya et al., 2014). Moreover, this happens especially when the level of sovereign debt is very high and to increase tax revenues is not the most efficient measure. In this case dilution of existing debt is more likely. This is what happens for example during crises where existing sovereign debt is usually high due to the several stimulus packages.

Moreover, a feedback loop generates from the credit risk of the sovereign to the credit risk of the financial sector once the sovereign assumes higher credit risk. In fact, when the sovereign becomes susceptible to credit risk, a negative shock that affects the creditworthiness of the sovereign feeds back to the financial sector credit risk.



## Chapter 5

### Empirical analysis

In this chapter we test empirically the presence of a link between sovereign credit risk and banks credit risk in Italy. In particular, following the work of Acharya et al. (2014), we test whether the link is present also for the Italian sovereign and the Italian banks, and whether the link is present only after the bailout period or if it is due to other reasons.

Moreover, we test whether the link is broken with the establishment of the Banking Union. Therefore, we analyzed also data of the period after the establishment of the Single Supervisory Mechanism.

To carry out our analysis we use data on banks and sovereign CDS spreads as measure of credit risk.

The chapter is structured as follows: a first paragraph gives an overview on the Italia situation from the beginning of the crisis till now; the next paragraphs present the data, the graphical analysis and the summary statistics; the fifth paragraph presents the regression analysis and the final paragraph concludes.

#### 5.1 The Italian situation: a brief overview

Like the majority of the European countries, also Italy was severely hit by the financial crisis that started in the United States and spread throughout the world. At the end of 2008 the Italian economy suffered an initial contraction. The situation worsened in 2009. In this year in fact, the Gross Domestic Product suffered a loss of 5%, the public debt reached the level of 115,1% of the GDP and the deficit increased by 2,6%<sup>23</sup>. Significant was also the collapse of the industrial sector. Also the unemployment increased significantly.

The situation seemed to recover during 2010 but soon worsened again in 2011 from when the GDP decreased significantly. In 2011 Italy showed the strongest deterioration across all European countries, except Greece and Portugal. The decrease in GDP continued also for 2012 and 2013 identifying Italy's recession.

The bad economic situation strongly affected the public finance and soon Italy entered into a sovereign debt crisis. From 2008 to 2010 the public debt rose from 103,6% to 119,0% of the GDP, reaching the amount of 1.843.015 millions of Euro<sup>24</sup>. An indicator of the worsening situation of the Italian debt was the spread between the German Bunds and the Italian Titoli

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<sup>23</sup> Data from Ministero dell'Economia e delle Finanze (2010).

<sup>24</sup> Data taken from Ministero dell'Economia e delle Finanze (2010).

del Tesoro which rose significantly since 2008. Starting from 100 basis points at the beginning of 2008 the spread rose up to 176 basis points in December 2009. The Italian sovereign debt crisis reached its worst period in summer 2011. From that point the spread rose up to 500 basis points in November 2011.

The sovereign debt crisis of Italy had three important causes:

- An already high level of public debt well before the financial crisis.
- A limited GDP growth in the period before the crisis.
- A poor credibility of the government.

For what concerns the banking sector, Italian banks were hit by the crisis not really because of their holding of toxic products (which were of small dimensions) but because of the great amount of domestic debt holdings. 60% of the portfolio of the five major banks in Italy (Intesa Sanpaolo, Unicredit, Monte dei Paschi di Siena, Banco Popolare, Ubi Banca) consisted of Italian government bond, around 100 billion of government bonds<sup>25</sup>. These banks showed significant losses in the second week of July 2011: they lost around 8 billion of their capitalization<sup>26</sup>.

Thus, the huge amount of holdings of public debt made Italian banks strongly sensitive to the worsening of the Italian sovereign debt crisis.

Moreover, the situation of Italian banks was worsened by the high amount of non-performing loans that they owned.

From 2012 to 2015 the banking sector continued to show bad conditions. A sign of improvement started at the end of 2015 which was mirrored by the decrease in the CDS spreads and in the Expected default frequency. The rescue of four banks in November did not affect significantly the stability of the banking sector and the establishment of Fondo Atlante in 2016 was welcomed by the market. 2016 showed a new worsening in the banking sector. This may reflect the increasingly uncertainty in growth prospects. The propensity to assume risk at the end of 2015 remained limited. This showed up in a limited credit lending to households and firms.

Moreover, now the economy shows a gradual recovery. The debt to GDP ratio is expected to decrease by 0.3 percentage points in 2016<sup>27</sup>.

At the beginning of 2016 the European Commission updated its estimates of sustainability indicators for the public finances. The new estimates confirm the sustainability of Italy's public finance: the discounted present value of future budget revenues, net of that of future

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<sup>25</sup> Data taken from Pavesi (2011).

<sup>26</sup> Data taken from Anon. (2011).

<sup>27</sup> Data taken from Banca d'Italia (2016).

expenditures, is more than sufficient to repay the present public debt. Furthermore, the Commission judges the risk of tensions in the sovereign debt securities market to be low in the short term, a conclusion supported by an analysis that considers the value of a broad set of macroeconomic and financial variables. The commission underscores, however, that the ratio of debt to GDP will stay high in the medium term (Banca d'Italia, 2016).

## **5.2 Data**

In order to develop the empirical analysis we focus on the crisis that affected Italy from the end of 2007 to middle 2016.

We consider as a measure of credit risk Credit Default Swaps spreads. We collected data on Italian sovereign and banks CDS spreads from Datastream. In particular, we collected data on daily sovereign and banks CDS spreads from 14 December 2007 to 19 April 2016.

We found data on CDS spreads for different maturities: 6 months, 5 years and 30 years. We focus on these three maturities to get an overview on the short-run, medium-run and long-run. For what concerns Banks CDS we collected data on the six most important Italian banks: Banco Popolare, Intesa Sanpaolo, Banca Popolare di Milano, Monte dei Paschi di Siena, Unione di Banche Italiane (UBI) and Unicredit.

For the regression analysis we used a broad panel of aggregated data of all banks. Moreover, for the graphical analysis we also made a simple average of the data of these six banks. We also computed a banks average without introducing the data on Monte dei Paschi di Siena. This was done in order to avoid distortions deriving from the distress that the bank suffered, which was not due directly from the crisis.

For what concerns the robustness analysis, we collected data on foreign sovereigns CDS in order to control for the credit risk of other countries. For our purposes we computed the simple average of the sovereign CDS of all the European countries available in Datastream.

We also collected data on banks equity returns to control for banks fundamentals.

## **5.3 Preliminary graphical analysis**

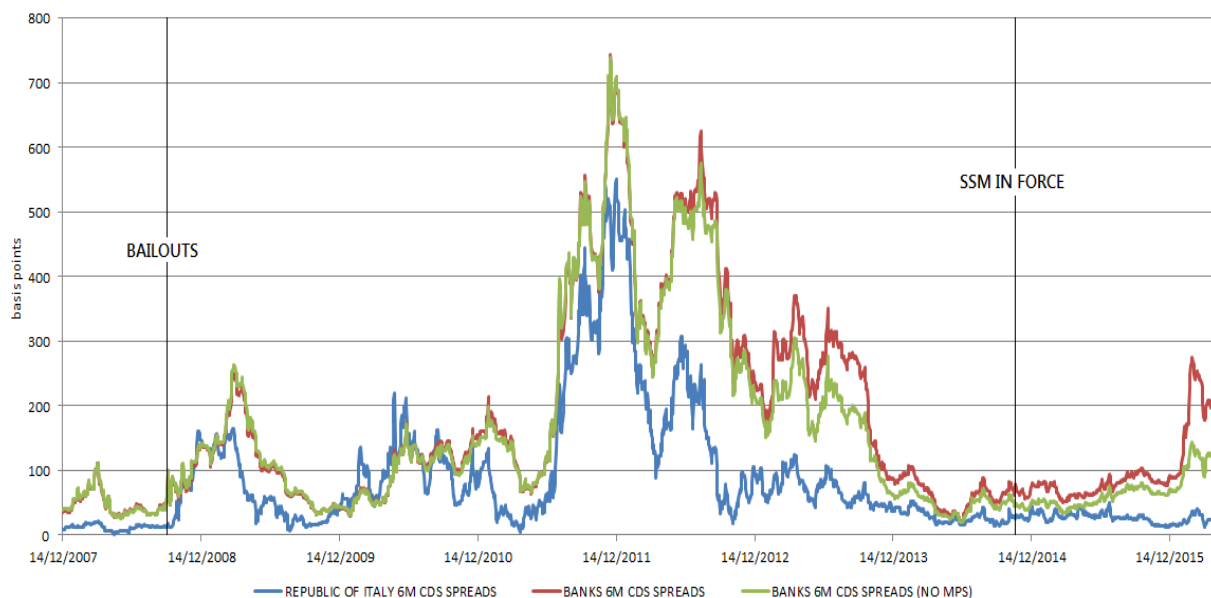
We started the analysis by doing a graphical representation of CDS spreads for the considered period. This was done in order to have a first insight into the presence of the link between sovereign and banks credit risks.

We do the analysis for CDS with 6-month, 5-year and 30-year maturities.

We started the analysis considering the spreads of CDS with 6-month maturity. Results are shown in figure 13.



**Figure 13: Sovereign CDS spreads and banks CDS spreads (6-month maturity)**



The figure shows the spreads of sovereign and banks CDS with 6-month maturity for the period 14/12/2007 to 19/04/2016. The sovereign CDS spreads are represented by the blue line. The banks CDS spreads are represented by the red line and are computed as the simple average of the CDS spreads of the six major Italian banks. The green line represents the average bank CDS spreads without considering in the computation of the average Monte dei Paschi di Siena CDS spreads. This was done because the bank suffered a significant distress due to reason well beyond the financial crisis.

Source: author's own evaluation.

Figure 13 shows the spreads of sovereign and banks CDS with 6-month maturity for the period from 14 December 2007 to 19 April 2016. The blue line represents the sovereign CDS spreads while the red line shows the average bank CDS spreads. We also introduce the green line which shows the average bank CDS spreads without Monte dei Paschi di Siena CDS spreads.

From the figure we can identify a co-movement of the CDS spreads of banks and sovereign. The lines representing the CDS spreads follow almost the same path. This is a sign of the presence of a link between sovereign credit risk and banks credit risk.

The trend of the CDS spreads shows the start of the crisis in 2008. The level of the CDS spreads in fact, increases significantly in this period. Moreover, from the figure we can identify the recovery between 2009 and 2010 and the subsequent worsening of the crisis in 2011. Between 2011 and 2012 the CDS spreads show a huge increase, which indicates a severe phase of the crisis. In this period in fact, as mentioned above, Italy faced the most severe peak of the sovereign debt crisis.

The high levels of CDS spreads were translated into corresponding high levels of credit risk. Italy in this period in fact, faced a downgrade in Standard and Poor's ratings and its creditworthiness was worsening more and more.

Moreover, from the figure we can identify a slow recovery starting in 2013. In 2014 the levels of CDS spreads are again low almost around the levels before the crisis.

From 2015 sovereign CDS spreads and banks CDS spreads start to diverge one from each other. This could be a sign of the effectiveness of the Banking Union in breaking the link.

We said above that the crisis in Italy affected first the public finance still burdened with high levels of public debt. The worsening situation then moved to the banking sector through the massive holdings of public bonds that the banks held in their balance sheets. This succession of facts can be identified in figure 13. In fact, for the initial period, approximately till 2011, the sovereign CDS spreads show higher levels with respect to banks ones. This means that the sovereign was in a worse condition than the banks in that period. The only exception is in 2009 when banks felt the negative effects of the banking crisis that was affecting the rest of the world. From around 2011 banks CDS spreads start to be higher than sovereign ones, and remain always above.

We repeat the analysis for the 5-year maturity CDS spreads and the 30-year maturity CDS spreads. Results are shown in Annex 1 and Annex 2. From this additional analysis we found that also for the medium- and long-run there is evidence for a co-movement between sovereign and banks CDS spreads.

Thus, for all three maturities we find evidence of a link between sovereign and banks credit risks also for Italy during the crisis. This is particularly strong in the post-bailouts period and seems to break after the establishment of the Banking Union.

Following the work of Acharya et al. (2014), the next step was to understand if, once verified the presence of the link, this shows the three phases presented in chapter 2. This means that we verify whether also for Italy the presence of the link between sovereign and banks credit risks started with the bailouts and worsened in the following period. In addition, we verified whether the establishment of the Banking Union breaks this link.

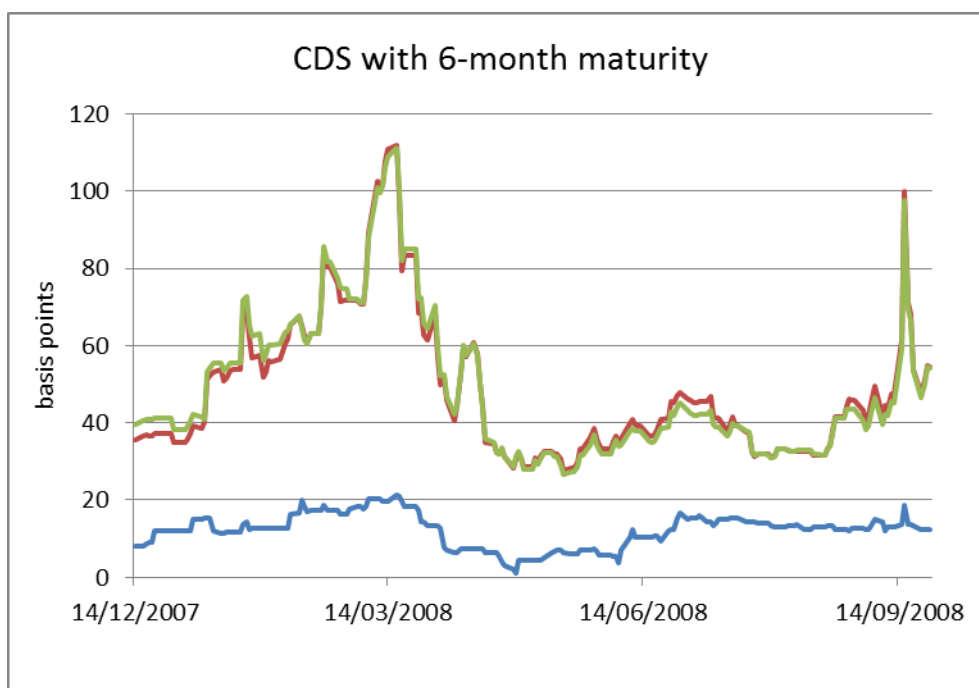
Even if in Italy there were no bailouts we consider this period in order to verify if Italian sovereign and banks were affected by the events that occurred in Europe.

In order to conduct the graphical analysis we divided our data into four different period: a pre-bailout period from 14 December 2007 to 25 September 2008, a bailout period from 26 September 2008 to 30 October 2008, a post-bailout period from 31 October 2008 to 1 January 2013 and a Banking Union period from 1 January 2015 to 19 April 2016. We

stopped the post-bailout period at the beginning of 2013 in order to not capture the effect of the Banking Union and we started the last period in 2015 to be sure that the effects of the Banking Union are already present since the SSM is already entered into force.

We started by analyzing the period before the bailouts. This is shown in figure 14.

**Figure 14: CDS spreads in the pre-bailout period (6-month maturity)**



The figure shows the spreads of sovereign and banks CDS with 6-month maturity for the pre-bailout period (14/12/2007-25/09/2008). The sovereign CDS spreads are represented by the blue line. The banks CDS spreads are represented by the red line and are computed as the simple average of the CDS spreads of the six major Italian banks. The green line represents the average bank CDS spreads without considering in the computation of the average Monte dei Paschi di Siena CDS spreads. This was done because the bank suffered a significant distress due to reason well beyond the financial crisis.

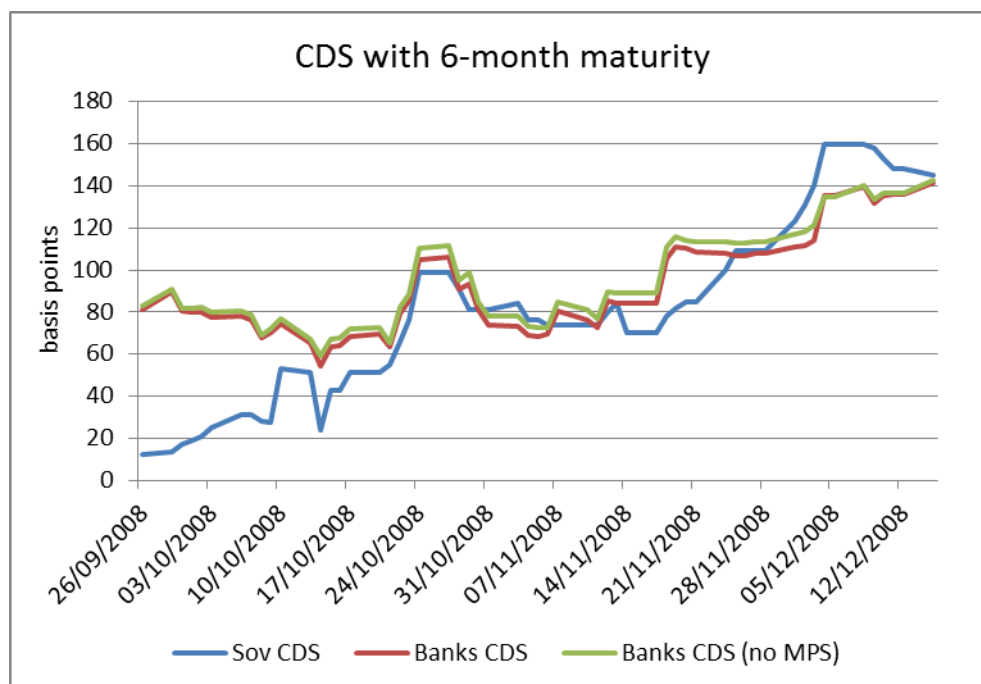
Source: author's own evaluation.

Figure 14 shows the spreads of sovereign and banks CDS with 6-month maturity for the pre-bailout period (14/12/2007-25/09/2008). The spreads are still low, which means that the credit risks of banks and sovereign are so far not a concern.

Moreover, before the bailout we can see that the two lines, sovereign and banks ones, follow different patterns. In particular, we can see that banks CDS spreads show peaks that sovereign CDS spreads do not show. This supports the idea that before the bailouts there is no link between sovereign and bank credit risks.

We went on with the analysis of the bailout period. The results are shown in figure 15. The figure shows the spreads of sovereign and banks CDS with 6-month maturity for the bailout period.

**Figure 15: CDS spreads in the bailout period (6-month maturity)**



The figure shows the spreads of sovereign and banks CDS with 6-month maturity for the bailout period. The sovereign CDS spreads are represented by the blue line. The banks CDS spreads are represented by the red line and are computed as the simple average of the CDS spreads of the six major Italian banks. The green line represents the average bank CDS spreads without considering in the computation of the average Monte dei Paschi di Siena CDS spreads. This was done because the bank suffered a significant distress due to reason well beyond the financial crisis.

Source: author's own evaluation.

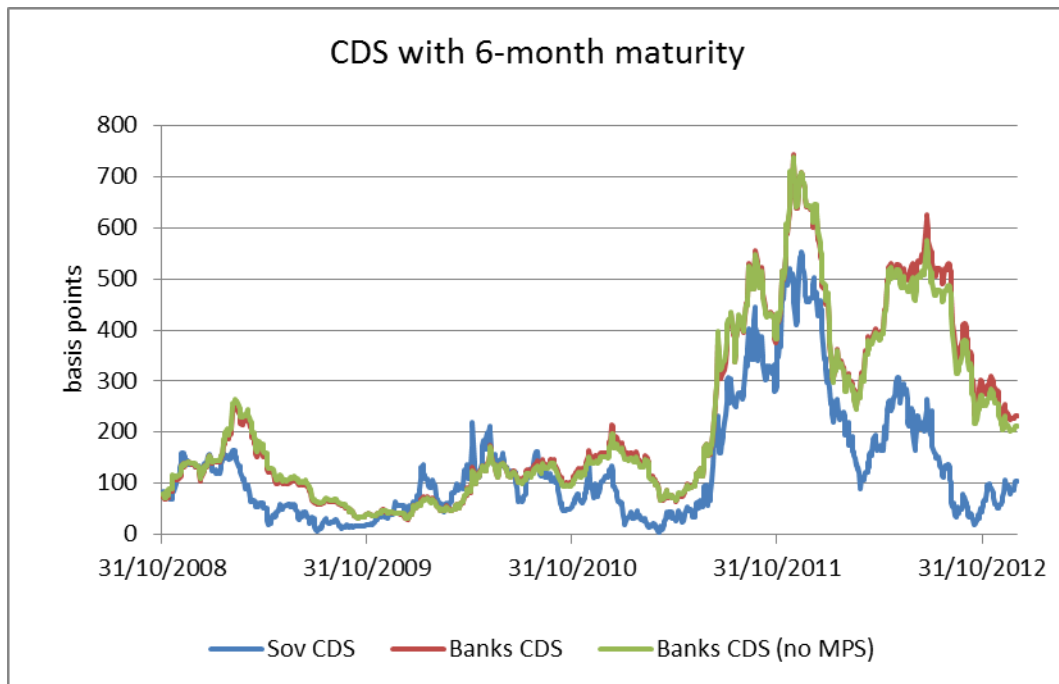
As can be seen in figure 15, the lines start to converge. This could be an indication of the start of the link in this period. The risk shifting between sovereign and banks credit risks is not clear for the 6-month maturity CDS. This could be due to the fact that actually Italy does not carry out bailouts.

We continued with the analysis of the post-bailout period. Results are shown in figure 16. The figure shows spreads of sovereign and banks CDS with 6-month maturity, for the post-bailout period (31/10/2008-01/01/2013).

The figure gives strong support to the hypothesis that after the bailouts sovereign and banks credit risks start to co-move. In fact, the line representing sovereign CDS spreads and banks CDS spreads follow the same patterns.

Moreover, we can identify a huge peak in spreads in the period 2011-2012, corresponding to the most severe period in the Italian crisis. Results are common across all maturities.

**Figure 16: CDS spreads in the post-bailout period (6-month maturity)**



The figure shows the spreads of sovereign and banks CDS with 6-month maturity, for the post-bailout period (31/10/2008-01/01/2013). The sovereign CDS spreads are represented by the blue line. The banks CDS spreads are represented by the red line and are computed as the simple average of the CDS spreads of the six major Italian banks. The green line represents the average bank CDS spreads without considering in the computation of the average Monte dei Paschi di Siena CDS spreads. This was done because the bank suffered a significant distress due to reason well beyond the financial crisis.

Source: author's own evaluation.

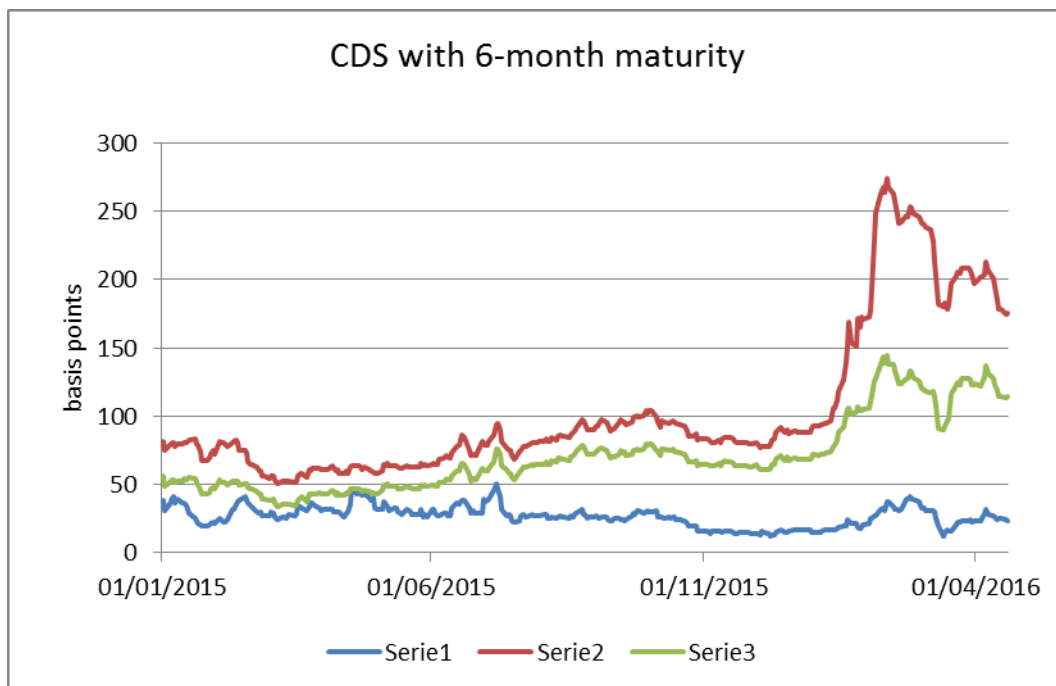
Finally, we analyzed the period after the establishment of the first pillar of the Banking Union in figure 17. The figure shows the spreads of sovereign and banks CDS with 6-month maturity for the Banking Union period (01/01/2015-19/04/2016).

We can notice that the spreads of sovereign and banks CDS start to diverge. Banks CDS are higher than sovereigns one. This could mean that with the establishment of the SSM the link starts to break.

We repeat the analysis of each period also for 5-year maturity CDS and 30-year maturity CDS. Results are presented in annex 1 and annex 2.

Also for these two maturities, findings support the hypothesis that the link starts in the period of the bailouts and becomes stronger in the post-bailout period. Moreover, during the Banking Union the link seems to become weaker and to break.

**Figure 17: CDS spreads in the Banking Union period (6-month maturity)**



The figure shows the spreads of sovereign and banks CDS with 6-month maturity for the Banking Union period (01/01/2015-19/04/2016). The sovereign CDS spreads are represented by the blue line. The banks CDS spreads are represented by the red line and are computed as the simple average of the CDS spreads of the six major Italian banks. The green line represents the average bank CDS spreads without considering in the computation of the average Monte dei Paschi di Siena CDS spreads. This was done because the bank suffered a significant distress due to reason well beyond the financial crisis.

Source: author's own evaluation.

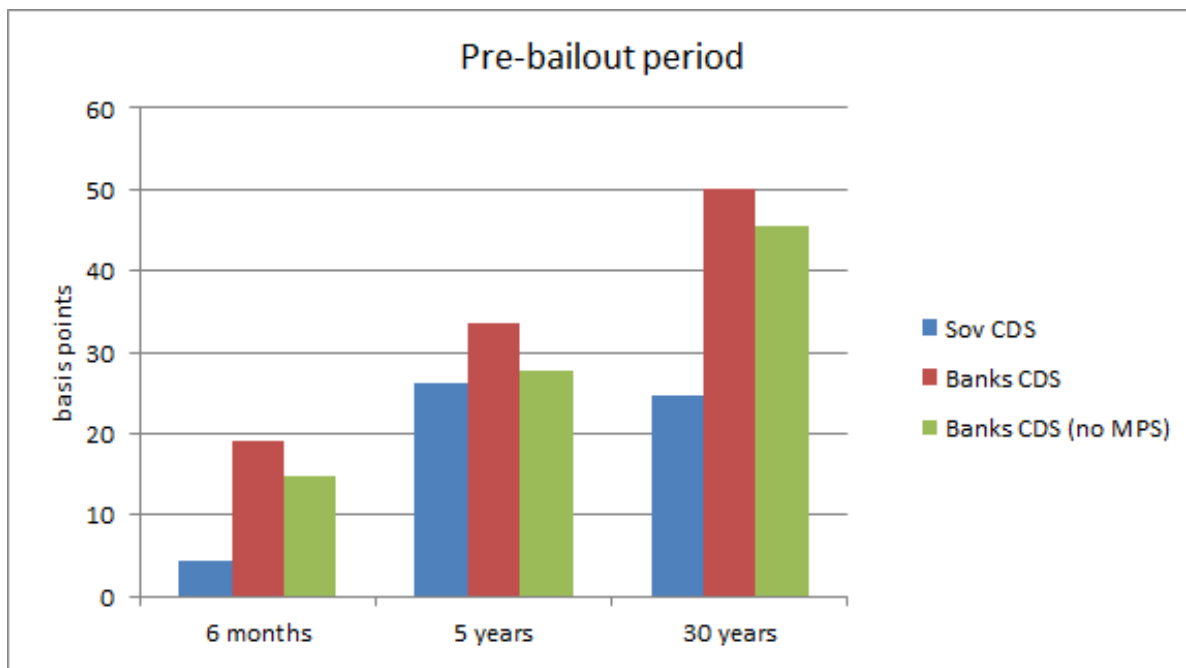
After the graphical analysis of the trend of the CDS spreads we move to a graphical analysis of the changes in CDS spreads during the four different phases mentioned above.

We analyzed the changes in CDS spreads from the beginning to the end of each phase. We developed the analysis for sovereign CDS spreads and average bank CDS spreads and also in this case we consider two different computations of the average, with and without Monte dei Paschi di Siena.

We present the analysis for CDS with 6-month, 5-year and 30-year maturities.

We started with the analysis of the changes in CDS spreads for the pre-bailout phase, from 14 December 2007 to 25 September 2008. Figure 18 shows the results. The red and the green bars represent the changes in banks CDS spreads during the pre-bailout period while the blue bars represent the changes in CDS sovereign spreads.

**Figure 18: Changes in spreads of CDS in the pre-bailout period**



The figure shows the changes in spreads of sovereign and banks CDS with 6-month, 5-year and 30-year maturities for the pre-bailout period (14/12/2007-25/09/2008). The changes in CDS spreads are calculated as the difference in spreads from the beginning to the end of each phase. For the average bank CDS we have two different measures. One is given by the simple average of the CDS spreads of the six major Italian banks, including Monte dei Paschi di Siena, represented by the red bars. The second, represented by the green bars, is given by the simple average of banks CDS spreads without including Monte dei Paschi di Siena CDS in the computation. This was done because the bank suffered a significant distress due to reason well beyond the financial crisis.

Source: author's own evaluation.

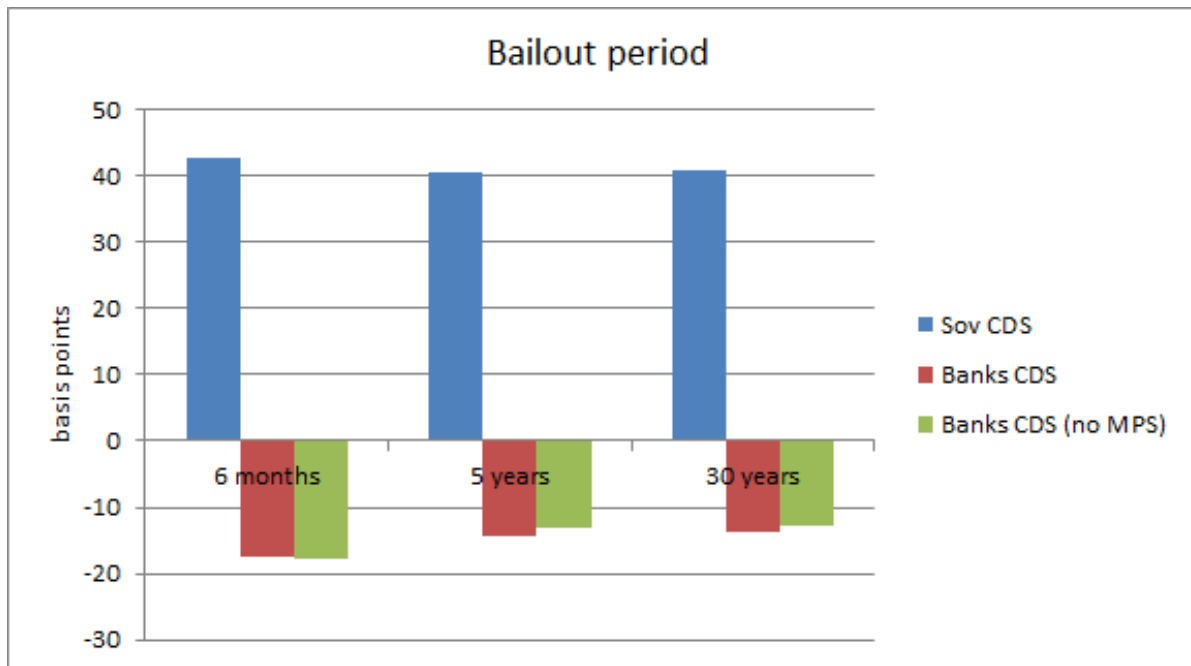
We can notice that the changes in banks CDS spreads during the pre-bailout period are greater than the changes in sovereign CDS spreads. This supports the idea that sovereign credit risk and banks credit risk move independently in this initial phase.

However, for the CDS with 5-year maturity we cannot get the same conclusion. In fact, the changes in sovereign CDS spreads are similar to those of banks CDS spreads.

The analysis goes on focusing on the changes in CDS spreads for the bailout phase (from 26 September 2008 to 30 October 2008). This is shown in Figure 19.

The results support the hypothesis that with the bailouts there is a risk shifting from banks to sovereign. Figure 19, in fact, shows that during the bailout period sovereign CDS spreads face an increase while banks CDS decrease. This mirrors the opposite movements of sovereign and banks credit risks.

**Figure 20: Changes in spreads of CDS in the bailout period**



The figure shows the changes in spreads of sovereign and banks CDS with 6-month, 5-year and 30-year maturities for the bailout period (26/09/2008-30/10/2008). The changes in CDS spreads are calculated as the difference in spreads from the beginning to the end of each phase. For the average bank CDS we have two different measures. One is given by the simple average of the CDS spreads of the six major Italian banks, including Monte dei Paschi di Siena, represented by the red bars. The second, represented by the green bars, is given by the simple average of banks CDS spreads without including Monte dei Paschi di Siena CDS in the computation. This was done because the bank suffered a significant distress due to reason well beyond the financial crisis.

Source: author's own evaluation.

We continued analyzing the changes in CDS spreads for the post-bailout phase. The results are shown in figure 20.

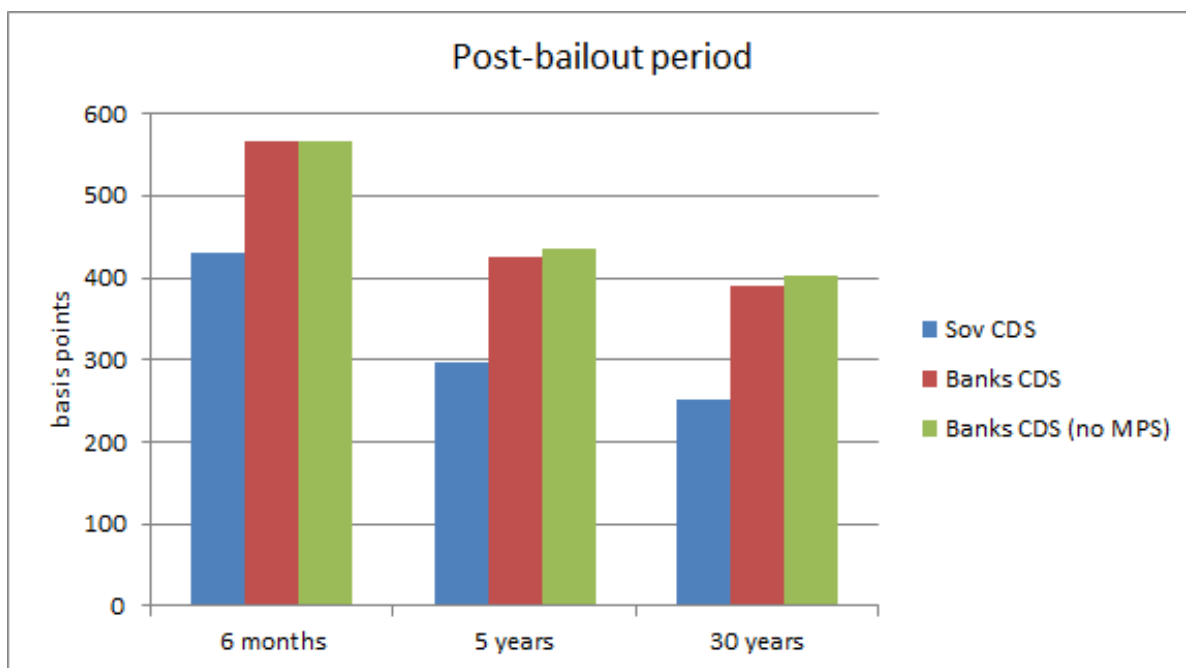
Sovereign CDS spreads show similar changes to those of banks CDS spreads. This supports the hypothesis that after the bailouts banks CDS spreads start again to increase and reach the level of sovereign CDS spreads.

Moreover, the two risks exhibit similar changes. This supports the hypothesis that the sovereign credit risk affects significantly banks credit risk.

The results are consistent for all three different maturities.



**Figure 21: Changes in spreads of CDS in the post-bailout period**



The figure shows the changes in spreads of sovereign and banks CDS with 6-month, 5-year and 30-year maturities for the post-bailout period (31/10/2008-01/01/2013). The changes in CDS spreads are calculated as the difference in spreads from the beginning to the end of each phase. For the average bank CDS we have two different measures. One is given by the simple average of the CDS spreads of the six major Italian banks, including Monte dei Paschi di Siena, represented by the red bars. The second, represented by the green bars, is given by the simple average of banks CDS spreads without including Monte dei Paschi di Siena CDS in the computation. This was done because the bank suffered a significant distress due to reason well beyond the financial crisis.

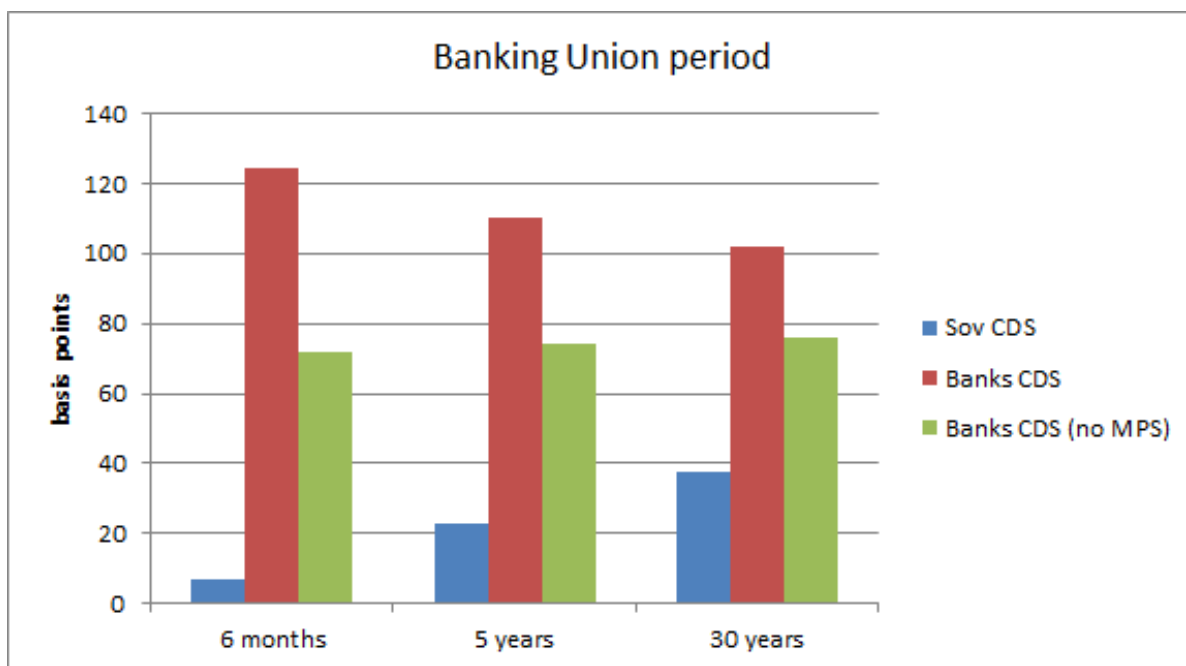
Source: author's own evaluation.

Finally, we analyze the changes in CDS spreads for the Banking Union phase. The results are shown in figure 21.

We can notice that banks CDS face greater changes in spreads with respect to sovereign CDS spreads. This supports the hypothesis that sovereign credit risk and banks credit risk move independently. Therefore, sovereign credit risk no longer affects banks credit risk. This actually could be an indication of the fact that the establishment of the Banking Union breaks the link.

Conclusion are analogous for all three maturities.

**Figure 21: Changes in spreads of CDS in the Banking Union period**



The figure shows the changes in spreads of sovereign and banks CDS with 6-month, 5-year and 30-year maturities for the Banking Union period (01/01/2015-19/04/2016). The changes in CDS spreads are calculated as the difference in spreads from the beginning to the end of each phase. For the average bank CDS we have two different measures. One is given by the simple average of the CDS spreads of the six major Italian banks, including Monte dei Paschi di Siena, represented by the red bars. The second, represented by the green bars, is given by the simple average of banks CDS spreads without including Monte dei Paschi di Siena CDS in the computation. This was done because the bank suffered a significant distress due to reason well beyond the financial crisis.

Source: author's own evaluation.

Thus, the analysis of the changes in CDS spreads gives support to the hypothesis that in the bailout period we have a risk shifting from banks to sovereign, in the post-bailout period the sovereign and the banks credit risk are linked, and in the Banking Union period the link becomes weaker and breaks. Not clear is the behavior of credit risk in the pre-bailout period since the behavior of CDS with 5-year maturity does not really support our hypothesis of no link in this initial phase.

## 5.4 Summary statistics

After the graphical analysis we move to analyze the data. We first compute summary statistics for the periods before, during, and after the bailouts and the Banking Union period for sovereign CDS spreads (*Sovereign CDS*), average bank CDS spreads (*Banks CDS*), the

average equity returns (*Bank Equity Return*) and the average spreads of foreign sovereigns CDS (*Foreign CDS*).

Results are shown in figure 22.

**Figure 22: Summary statistics**

	Obs.	Mean	Std. Dev	5th percentile	50th percentile	95th percentile
<b>Pre-bailout (14/12/2007 to 25/09/2008)</b>						
Sovereign CDS (bp)	816	12,186	4,28	4,25	12,75	18,5
Banks CDS (bp)	816	50,650	21,63	26,5	45,66	99
Bank Equity Return	816	4%	1,98%	3,51%	3,51%	11,93%
Foreign CDS (bp)	816	24,03	9,649	10,562	23,33	40,715
<b>Bailout (01/06/2008 to 30/10/2008)</b>						
Sovereign CDS (bp)	125	44,82	27,327	12,25	43	99
Bank CDS (bp)	125	76,25	20	48,54	73	110
Bank Equity Return	125	3,51%	0	3,51%	3,51%	3,51%
Foreign CDS (bp)	125	209,52	99,46	64,11	219,02	344,48
<b>Post-bailout (31/10/2008 to 01/01/2013)</b>						
Sovereign CDS (bp)	6527	131,861	116,865	17,21	97,372	409,541
Bank CDS (bp)	6527	222,99	188,8	40	142	624,31
Bank Equity Return	6527	-5,43%	9,64%	-20,22%	2,94%	3,06%
Foreign CDS (bp)	6527	687,084	815,268	90,581	197,226	2226,838
<b>Banking Union (01/01/2015 to 19/04/2016)</b>						
Sovereign CDS (bp)	2034	26,826	7,662	14,62	27,52	39,79
Bank CDS (bp)	2034	104,067	120,47	14,88	63,5	221,45
Bank Equity Return	2034	4,51%	0%	4,51%	4,51%	4,51%
Foreign CDS (bp)	2034	2053,094	6,024	2043,652	2053,268	2066,044

The table provides summary statistics for the periods before, during, and after the bailouts and the Banking Union period. *Sovereign CDS* includes the sovereign CDS spreads, *Banks CDS* includes the average bank CDS spreads, *Bank Equity Return* is the average bank equity return and *Foreign CDS* includes the average spreads of foreign sovereigns CDS spreads. *Sovereign CDS*, *Banks CDS*, *Foreign CDS* are expressed in basis points (bp).

Source: author's own evaluation.

We have 9502 observations for each variable. In particular, 816 observations for the pre-bailout period, 125 for the bailout period, 6527 for the post-bailout and 2034 for the Banking Union period.

Analyzing the results, we can see that in the pre-bailout phase the sovereign CDS and the average bank ones are low at 12 basis points and 50 basis points, respectively. In the bailout phase we see an important increase in the sovereign CDS spreads which move to 44,82 basis points, while average bank CDS spreads increase to 76,25 basis points. We can see that sovereign CDS spreads increase fourfold while banks increase not so significantly as sovereign ones.

In the post-bailout phase we see a huge increase in the CDS spreads levels of both average bank and sovereign, which move, respectively, to around 223 basis points and to 132 basis points. This huge increase in CDS spreads indicates the emergence of important sovereign and bank credit risks in Italy.

Finally, in the last phase, we see a gradual decrease in both sovereign and average bank CDS spreads which move to 27 basis points and 104 basis points, respectively.

We notice that the spreads of sovereign CDS faced a greater reduction in their levels. Also banks CDS decrease in this period.

From the summary statistics we can see that from the start of the crisis CDS spreads, both sovereign and banks ones, increased significantly. This indicates the worsening of the credit risk of both banks and sovereign during the crisis. In the Banking Union period the spreads decreased again.

Foreign CDS show an increase since the initial phase. In particular, in the Banking Union phase there are significantly high values. These mirrors the high risk of Greece.

Banks average equity returns show a significant decrease since the start of the crisis. They recover only in the Banking Union period.

## **5.5 Regression analysis**

We now undertake the regression analysis in order to test our preliminary findings in the graphical analysis.

Following Acharya et al. (2014), we estimate all regressions at the daily level. This permits to have a larger dataset.

To test the presence of the link between sovereign credit risk and banks credit risk, we verify whether changes in sovereign credit risk affects significantly banks credit risk. We do this by testing if a variation in the daily change in the logarithm of sovereign CDS spreads has a significant impact on the daily change in the logarithm of bank CDS spreads. We transformed our data in logarithms in order to reduce the impact of outliers.

Furthermore, following Acharya et al. (2014) we add three controls to get rid of some factors that can create a link between sovereign and banks credit risks even in absence of a direct feedback mechanism.

We first include time fixed effects to capture all the changes in macroeconomics fundamentals (like employment, economic growth) that affect both banks and sovereign credit risks and do not vary over time.

We then consider that banks hold also bond of foreign sovereigns, thus, the worsening in the credit risk of foreign sovereigns could affect the credit risk of the bank. Following the work of Acharya et al. (2014), we control for the risk of foreign sovereigns debt exposure by using the spreads of foreign sovereigns CDS.

Finally, we consider the fact that also a reduction in profitability affects negatively the credit risk of a banks. Controlling for banks' own equity returns will control for the impact of any country-level shocks which could affect the activity of the bank and eliminate sovereign CDS as an explanatory variable (Acharya et al., 2014).

Thus, following Acharya et al. (2014), our regression function is:

$$\begin{aligned} \Delta \log(\text{Bank CDS}_{it}) = & \alpha_i + \delta_t + \beta_1 \Delta \log(\text{Sovereign CDS}_t) + \beta_2 \Delta \log(\text{Foreign CDS}_t) + \\ & + \beta_3 \text{Bank Equity Return}_{it} + \varepsilon_{it} \end{aligned}$$

where our dependent variable,  $\Delta \log(\text{Bank CDS}_{it})$ , is the change in the natural logarithm of the CDS spreads of banks  $i$  from day  $t$  to day  $t+1$  and the dependent variable,  $\Delta \log(\text{Sovereign CDS}_t)$ , is the change in the logarithm of sovereign CDS spreads from day  $t$  to day  $t+1$ . The parameter of interest  $\beta_1$  shows the relationship between daily change in the logarithm of sovereign CDS spreads and daily change in the logarithm of banks CDS spreads.  $\Delta \log(\text{Foreign CDS}_t)$  is the control for the risk of foreign counterparties and  $\beta_2$  is its coefficient.  $\beta_2$  is also of independent interest since it gives a measure of sensitivity of banks credit risk with respect to foreign sovereigns credit risk changes.  $\text{Bank Equity Return}_{it}$  is the control for the bank' own equity and  $\beta_3$  is its coefficient, finally  $\alpha_i$  is the intercept,  $\delta_t$  captures the time fixed effect and  $\varepsilon_{it}$  is the error term.

We present the analysis on CDS with 6-month and 30-year maturities, since they show the greatest evidence in the results. Result for regressions on data on CDS with 5-year maturity are presented in annex 1.

We present separated results for the different four phases mentioned above. For the pre-bailout, post-bailout, and Banking Union periods we have two specifications: one shows the results of the regression controlling for the foreign sovereigns credit risk, the other includes also the banks equity returns control. For the bailout phase we have only the specification with the introduction of the foreign sovereigns credit risk. We must drop the other specification because of lack of data.

In all specification we control for time fixed effects.

To support the hypothesis that there is a link between sovereign and banks credit risks that starts after the bailouts we should find no significant effect of our independent variable,  $\Delta \log(\text{Sovereign CDS}_t)$ , on the dependent one,  $\Delta \log(\text{Banks CDS}_{it})$ , in the pre-bailout phase

while a significant effect in the post-bailout phase. Moreover, to test the hypothesis that the Banking Union helps to break the link we should find no significant effect of  $\Delta\log(\text{SovereignCDS}_t)$  on  $\Delta\log(\text{Banks CDS}_{it})$  in the Banking Union phase.

Figure 23 shows the results on aggregate data on CDS with 6-month maturity<sup>28</sup>.

**Figure 24: Regressions results (CDS with 6-month maturity)**

	$\Delta\log(\text{Banks CDS})$						
	Pre-Bailout		Bailout	Post-Bailout		Banking Union	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<b><math>\Delta\log(\text{SovereignCDS})</math></b>	0,161** (0,0227)	0,1608** (0,0226)	0,1888** (0,0721)	0,1097** (0,0063)	0,1096** (0,0063)	0,2195** (0,0157)	0,2194** (0,016)
<b><math>\Delta\log(\text{Foreign CDS})</math></b>	0,17** (0,0475)	0,1689** (0,0474)	0,1244 (0,1298)	0,5204** (0,0198)	0,5205** (0,02)	7,2528 (5,1083)	7,2518 (5,108)
<b>Bank Equity Return</b>		-0,011** (0,0052)			-0,0313** (0,0701)		-0,0539** (0,0045)
<b>Time Fixed Effect</b>	YES	YES	YES	YES	YES	YES	YES
<b>Observations</b>	816	816	125	6527	6527	2034	2034
<b>Banks</b>	4	4	5	6	6	6	6
<b>R<sup>2</sup></b>	0,0851	0,0815	0,1293	0,2096	0,21	0,1263	0,3238

The figure shows the results of the regression of  $\Delta\log(\text{Banks CDS}_{it})$  on  $\Delta\log(\text{Sovereign CDS}_t)$ . For these regression were used aggregate data on spreads of CDS with 6-month maturity. Columns (1), and (2) cover the pre-bailout period (14/12/2007-25/09/2008). Column (3) covers the bailout period (26/09/2008-30/10/2008). Columns (4) and (5) cover the post-bailout period (31/10/2008-01/01/2013). Columns (6) and (7) cover the Banking Union period (01/01/2015-19/04/2016).  $\Delta\log(\text{Sovereign CDS}_t)$  includes the daily change in the natural logarithm of sovereign CDS spreads,  $\Delta\log(\text{Banks CDS}_{it})$  includes the daily change in the natural logarithm of banks CDS spreads,  $\text{Bank Equity Return}_{it}$  represents banks equity returns and  $\Delta\log(\text{Foreign CDS}_t)$  includes the daily change in the natural logarithm of average spreads of foreign sovereigns CDS spreads.  $\Delta\log(\text{Sovereign CDS}_t)$ ,  $\Delta\log(\text{Banks CDS}_{it})$  and  $\Delta\log(\text{Foreign CDS}_t)$  are expressed in basis points (bp). Specifications (1), (3), (4) and (6) include the control variable variables  $\Delta\log(\text{Foreign CDS}_t)$ . Specifications (2), (5) and (7) include both control variables  $\Delta\log(\text{Foreign CDS}_t)$  and  $\text{Banks Equity Return}_{it}$ . In all specification we control for time fixed effects. Standard deviations are in parenthesis. \*\* indicates statistical significance at a 5% level.

Source: author's own evaluation.

We started by analyzing the pre-bailout period. Differently from what expected, there is evidence of a relation between sovereign and banks credit risks also before the bailouts for the Italian context. In fact, the coefficient  $\beta$  is statistically significant and a variation of 1 basis point in the daily change in the logarithm of sovereign CDS spreads leads to a 0,16 basis point

<sup>28</sup> Standard deviations are in parenthesis. \*\* indicates statistical significance at the 5% level.

increase in the daily change in logarithm of banks CDS spreads. Our parameter of interest remains statistically significant also after the introduction of the control. These results confirm that for Italy sovereign credit risk actually affects banks credit risk and this well before the bailouts, contrary to what we supposed. We have to remember that Italy had a very high level of public debt well before the start of the crisis and part of the debt was held by the financial sector.

Thus, one important results is that the bailouts were not the trigger factor of the link in the case of Italy. This is consistent with the results that we found in the bailout period. In fact, the independent variable remains significant and, instead of decreasing, it increases. This is coherent with the fact that Italy did not carry out bailouts in this period.

For what concerns the  $\Delta \log(\text{Foreign CDS}_i)$  variable, it is statistically significant in this first phase, while it loses significance in the bailout period. This could be an indication of the fact that the foreign States that carried out bailouts really took the risk of banks in these period.

In column (2) we add the banks equity returns as control.  $\Delta \log(\text{Sovereign CDS}_i)$  remains statistically significant. Moreover, the equity return control is statistically significant. This means that changes in profitability affects the credit risk of banks, in particular an increase in profitability reduces the credit risks of banks.

We then move to the post-bailout phase. Column (4) and (5) shows the results of the regressions. We can see that the coefficient of interest is, as expected, statistically significant and positive. In particular, when sovereign CDS spreads rise also banks CDS spreads rise: for an increase of 1 basis point in the daily change in logarithm of sovereign CDS spreads there is a 0,11 basis point increase in daily change in logarithm of banks CDS spreads. The results are robust to the inclusion of the controls.

$\Delta \log(\text{Foreign CDS}_i)$  is statistically significant. The link to foreign sovereigns risk is, thus, again present in the post bailout phase.

The equity return still affects the credit risk of banks.

Finally, we analyze the Banking Union phase. Column (6) and (7) shows the results. Differently from what expected the coefficient of  $\Delta \log(\text{Sovereign CDS}_{it})$  is statistically significant, also after the inclusion of the controls. This means that the link between the two credit risks is still present.

Interesting to note is the fact that  $\Delta \log(\text{Foreign CDS}_i)$  is no longer statistically significant. This could mean that the Banking Union starts to affect the foreign exposures.

More interesting are the results of the regressions on 30-year maturity CDS.

Results are shown in figure 24<sup>29</sup>.

**Figure 24: Regression results (CDS with 30-year maturity)**

	$\Delta\log(\text{Banks CDS})$						
	Pre-Bailout		Bailout	Post-Bailout		Banking Union	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<b><math>\Delta\log(\text{SovereignCDS})</math></b>	0,9506** (0,0796)	0,9566** (0,0796)	0,359** (0,07254)	0,276** (0,0088)	0,2757** (0,0089)	0,4214** (0,0276)	0,4212** (0,027)
<b><math>\Delta\log(\text{Foreign CDS})</math></b>	0,1151** (0,0321)	0,115** (0,0322)	0,0698 (0,0738)	0,1936** (0,0127)	0,1946** (0,0126)	2,1304 (2,228)	2,14 (2,281)
<b>Bank Equity Return</b>		-0,0137** (0,0031)			0,0479** (0,0045)		-0,0973** (0,021)
<b>Time Fixed Effects</b>	YES	YES	YES	YES	YES	YES	YES
<b>Observations</b>	816	816	125	6527	6527	2034	2034
<b>Banks</b>	4	4	5	6	6	6	6
<b>R<sup>2</sup></b>	0,1792	0,18	0,2805	0,2465	0,2467	0,2047	0,2777

The figure shows the results of the regression of  $\Delta\log(\text{Banks CDS}_{it})$  on  $\Delta\log(\text{Sovereign CDS}_t)$ . For these regression were used aggregate data on spreads of CDS with 30-year maturity. Columns (1), and (2) cover the pre-bailout period (14/12/2007-25/09/2008). Column (3) covers the bailout period (26/09/2008-30/10/2008). Columns (4) and (5) cover the post-bailout period (31/10/2008-01/01/2013). Columns (6) and (7) cover the Banking Union period (01/01/2015-19/04/2016).  $\Delta\log(\text{Sovereign CDS}_t)$  includes the daily change in the natural logarithm of sovereign CDS spreads,  $\Delta\log(\text{Banks CDS}_{it})$  includes the daily change in the natural logarithm of banks CDS spreads,  $\text{Bank Equity Return}_{it}$  represents banks equity returns and  $\Delta\log(\text{Foreign CDS}_t)$  includes the daily change in the natural logarithm of average spreads of foreign sovereigns CDS spreads.  $\Delta\log(\text{Sovereign CDS}_t)$ ,  $\Delta\log(\text{Banks CDS}_{it})$  and  $\Delta\log(\text{Foreign CDS}_t)$  are expressed in basis points (bp). Specifications (1), (3), (4) and (6) include the control variable  $\Delta\log(\text{Foreign CDS}_t)$ . Specifications (2), (5) and (7) include both control variables  $\Delta\log(\text{Foreign CDS}_t)$  and  $\text{Banks Equity Return}_{it}$ . In all specification we control for time fixed effects. Standard deviations are in parenthesis. \*\* indicates statistical significance at a 5% level.

Source: author's own evaluation.

From figure 24 we get results that support our hypothesis. Although, the link is still present we can see that it weakens substantially in the Banking Union phase. The parameter of interest drops from 0,95 in the pre-bailout period to 0,42 in the Banking Union period. This indicates that in the long-run the Banking Union has a positive effect on the link between sovereign and banks credit risks.

Also for CDS with 30-year maturity  $\Delta\log(\text{Foreign CDS}_t)$  is significant both in the pre-bailout and in the post-bailout period. The equity returns affect banks credit risk in each period.

<sup>29</sup> Standard deviations are in parenthesis. \*\* indicates statistical significance at the 5% level.



## 5.6 Results

In the initial graphical analysis we found evidence for the presence of a link between sovereign credit risk and banks credit risk. In fact the spreads of sovereign and average bank CDS move together. This results are robust for various CDS maturities we considered.

Analyzing graphically each period separately we found support for our hypothesis: the bailouts triggered a relationship between sovereign and banks credit risks that should be broken after the establishment of the Banking Union. In particular, from the graphical analysis we found that in the pre-bailout phase sovereign CDS spreads and banks CDS spreads move differently. We take it as an indication of no link in this phase. In the post-bailout phase we found evidence for the link. The CDS spreads in fact move together.

Moreover, focusing on the period after the establishment of the Single Supervisory Mechanism, we found evidence for the breaking of the link in the analysis of the average bank. The CDS spreads in fact diverge.

In the regression analysis we found support for our hypothesis on the presence of the link between sovereign and banks credit risks. The parameter of interest is statistically significant, which means that sovereign credit risk affects significantly banks credit risk. These results are valid also after the inclusion of controls such as time fixed effects, foreign sovereigns exposures risk and the profitability of banks.

Contrary to what we expected, in the pre-bailout period there is still the link between the two credit risks. This could have different reasons. This could be due to the lack of data since our collection starts only at 14 December 2007. Moreover, the burden of the Italian public debt was already significant well before the start of the crisis.

However, more significant is the fact that, coherently with the fact that Italy did not carry out bailouts, in the bailout period we do not find evidence for a risk shift between sovereign and banks.

Finally, for what concerns the Banking Union period we found that the link is still present. In particular, in the short term there are no effects of the establishment of the Banking Union on the link between sovereign and banks credit risks. This could be due to the fact that the Banking Union is not fully completed. Moreover, one has to bear in mind that Italy is still facing problems in the banking sector, ranging from Banca Popolare di Vicenza to Monte dei Paschi di Siena. This could affect the effectiveness of the Banking Union in the short term.

Different are the results for the long-run. We found in fact that the Banking Union affects positively the link by weakening it.

Interesting to note that the effects of the Banking Union are more present for foreign sovereigns credit risk. In the Banking Union in fact foreign sovereigns credit risk does no longer affect banks credit risk.

To conclude, we found evidence that Italian sovereign credit risk affects Italian banks credit risk. moreover, the Banking Union seems to weaken this link only in the long term.



## Conclusions

The events of the crisis started in 2008 worsen the financial stability of the banking sectors in the world. Several countries, especially in Europe, were forced to carry out bailouts in order to restore financial stability.

As shown by many authors, these bailouts were the trigger factor of the link between sovereign and banks credit risks. In fact, just after the bailouts the two credit risks showed to be linked, in particular an increase in sovereign credit risk was mirrored by an analogous decrease in banks credit risk. This was due to a risk shifting from banks to sovereign. However, after this initial risk shifting banks credit risks increased again and reached the levels of sovereign credit risk. From that moment sovereign credit risk affected negatively banks credit risk.

All this happened because the bailouts were of significant size and, thus, impacted severely on the public debt. The more and more increasing levels of public debt deteriorated the creditworthiness of the sovereign. As a consequence the credit risk of the sovereign increased significantly.

Moreover, local banks hold significant amounts of sovereign debt in their balance sheet. Through this holding the deterioration of sovereign credit risk was transmitted to banks credit risk. The bad situation became even worse since the relation between sovereign and banks translated into a vicious cycle.

The European Union decided to intervene in order to break this link. In 2012, in fact, the EU decided to establish the Banking Union, which through its three pillars, should avoid further interventions of the States in restoring the stability of the financial sector. This is done by, first, avoiding instability in the financial sector and, second, in case of financial instability by referring to shareholders and creditors to rescue the failing financial institution.

The first step in breaking the link was the establishment of the Single Supervisory Mechanism which permitted to reach uniformity in the supervision of European financial institutions. This was an important step since the differences across countries were one of the reasons that worsened the financial crisis. This first pillar is responsible to make financial institutions more stable and resilient in order to avoid future crises.

The second step was the establishment of the Single Resolution Mechanism. It was the natural complement of the Single Supervisory Mechanism since a common supervision could not work with a national resolution. The effectiveness of the Single Resolution Mechanism in

breaking the link is due to the fact that it avoids the intervention of the State in the rescue of failing financial institutions.

The next step in completing the Banking Union, towards which the EU has to work, is the establishment of a common insurance scheme. This is necessary in order to avoid bank runs and, thus, making financial institutions more stable. The establishment of a common deposit insurance scheme is necessary because, without it, the effects of national shocks are not yet avoided.

We tested the presence of the link between banks and sovereign and the effectiveness of the Banking Union in breaking it by using data on Italian sovereign and Italian banks CDS.

We found that the link between sovereign and banks credit risks is present also in Italy. Moreover, we found that the link is present also in the pre-bailout period. This could be due to the fact that Italy had already a high level of debt well before the start of the financial crisis and the GDP growth in those year was very low. Moreover, a high amount of the public debt was held by financial institutions.

For what concerns the risk shifting from banks to sovereign during the bailout period we did not find clear evidence. This is due to the fact that Italy did not carry out bailouts. This is consistent also with the fact that the link does not start with the bailout while well before it.

For what concerns the effectiveness of the Banking Union, we found evidence for the fact that in the short term the Banking Union has no effect on the link between Italian banks and Italian sovereign. The effects are evident only in the medium- and long-run. This could be due to the fact that it is no long time ago that the Banking Union was made into force and the effects are not clear. Moreover, it is not fully completed. This means that also the establishment of the third pillar must be done in a short time.

We can conclude that the European Union is working in the right way in order to stabilize the financial markets. The establishment of the Banking Union is the right measure, although several things has to be done, in particular the establishment of the third pillar.

## Annex 1

### Analysis of 5-year maturity CDS

Figure A.1.1 shows the spreads of 5-year maturity CDS.

**Figure A.1.1: Sovereign CDS spreads and banks CDS spreads (5-year maturity)**



The figure shows the spreads of sovereign and banks CDS with 5-year maturity for the period 14/12/2007 to 19/04/2016. The sovereign CDS spreads are represented by the blue line. The banks CDS spreads are represented by the red line and are computed as the simple average of the CDS spreads of the six major Italian banks. The green line represents the average bank CDS spreads without considering in the computation of the average Monte dei Paschi di Siena CDS spreads. This was done because the bank suffered a significant distress due to reason well beyond the financial crisis.

Source: author's own evaluation.

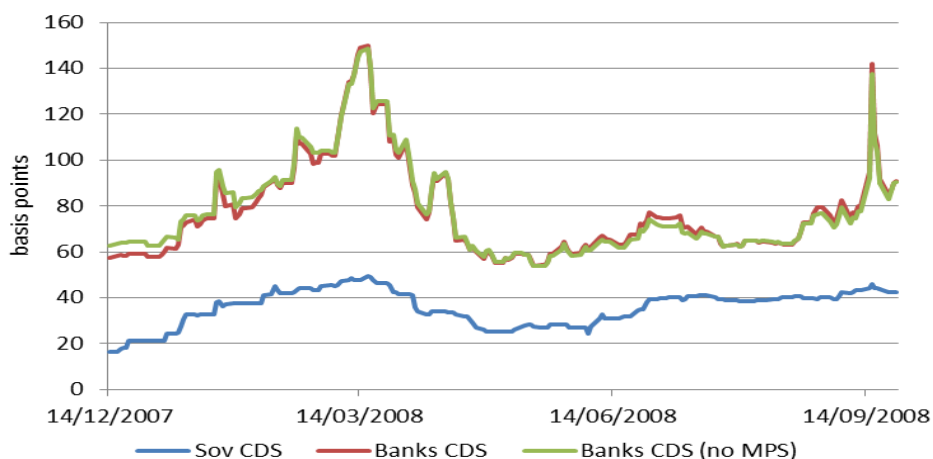
As can be seen in the figure, sovereign CDS spreads and banks CDS spreads move together. This indicates that also in the medium-run case there is a relation between the credit risk of sovereign and the credit risk of banks. Also in figure A.1.1 we add the average bank CDS spreads computed without Monte dei Paschi di Siena.

From the figure we identify the development of the crisis in Italy: the start in 2008 with the increase in CDS spreads, the first recovery in 2010 and the severe worsening of the crisis in 2011 that continued for the following years. 2014 shows a significant reduction in CDS spreads and in 2015 sovereign and banks CDS start to diverge.

We move to the analysis for each period. Figure A.1.2 shows the spreads of sovereign and banks CDS with 5-year maturity for the pre-bailout period (14/12/2007 -25/09/2008).

We can notice that before the bailout sovereign CDS and banks ones follow different patterns. This supports the idea that before the bailouts there is no link between sovereign and bank credit risks.

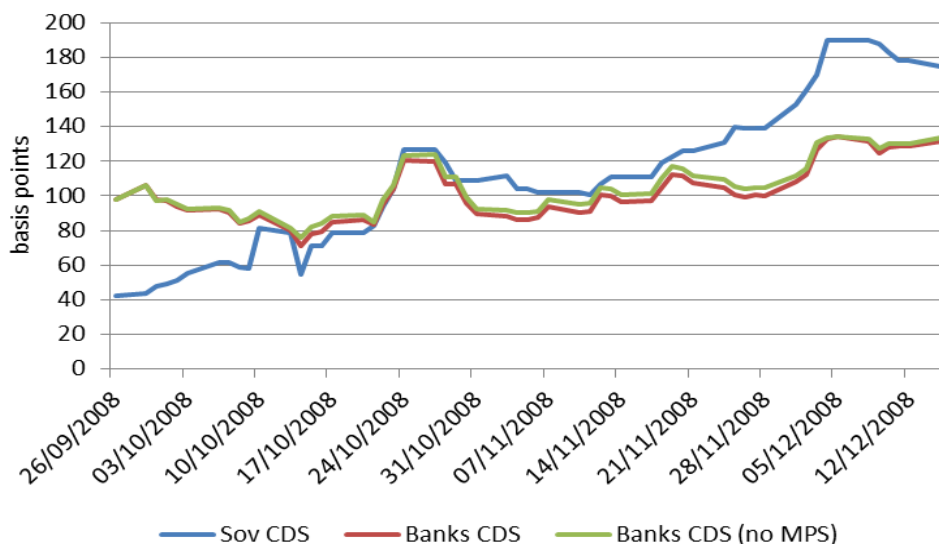
**Figure A.1.2: CDS spreads in the pre-bailout period (5-year maturity)**



The figure shows the spreads of sovereign and banks CDS with 5-year maturity for the pre-bailout period (14/12/2007-25/09/2008). The sovereign CDS spreads are represented by the blue line. The banks CDS spreads are represented by the red line and are computed as the simple average of the CDS spreads of the six major Italian banks. The green line represents the average bank CDS spreads without considering in the computation of the average Monte dei Paschi di Siena CDS spreads. Source: author's own evaluation.

Figure A.1.3 shows the spreads of sovereign and banks CDS with 5-year maturity for the bailout period.

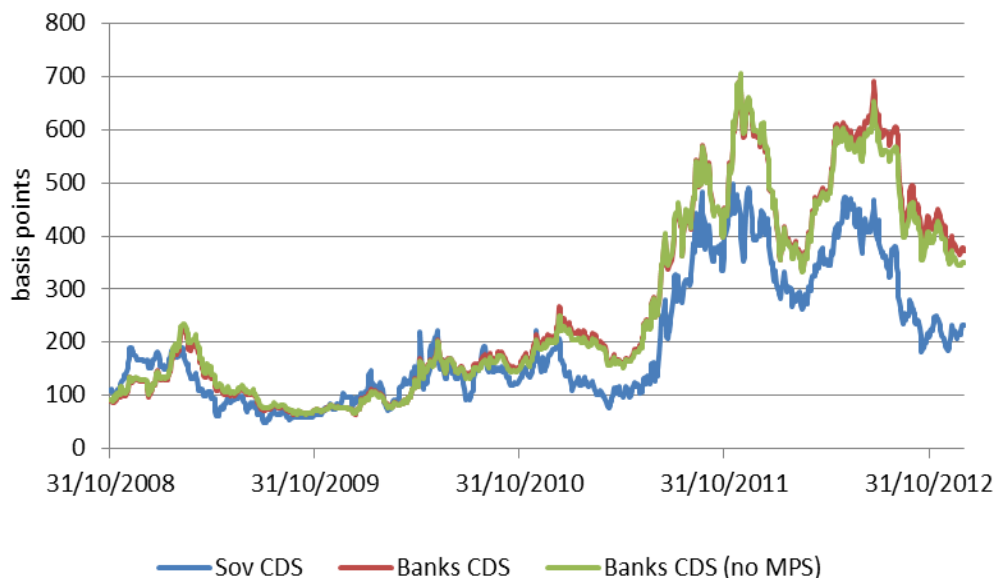
**Figure A.1.3: CDS spreads in the bailout period (5-year maturity)**



The figure shows the spreads of sovereign and banks CDS with 5-year maturity for the bailout period. The sovereign CDS spreads are represented by the blue line. The banks CDS spreads are represented by the red line and are computed as the simple average of the CDS spreads of the six major Italian banks. The green line represents the average bank CDS spreads without considering in the computation of the average Monte dei Paschi di Siena CDS spreads. Source: author's own evaluation.

As can be seen in figure A.1.3, the lines start to converge. This supports the hypothesis of the start of the link in this period. Moreover, the line of the sovereign CDS at some point goes above the line of banks CDS spreads. This could indicate that there is a risk shifting from banks to sovereign. This was not clear with CDS with 6-month maturity.

**Figure A.1.4: CDS spreads in the post-bailout period (5-year maturity)**



The figure shows the spreads of sovereign and banks CDS with 5-year maturity, for the post-bailout period (31/10/2008-01/01/2013). The sovereign CDS spreads are represented by the blue line. The banks CDS spreads are represented by the red line and are computed as the simple average of the CDS spreads of the six major Italian banks. The green line represents the average bank CDS spreads without considering in the computation of the average Monte dei Paschi di Siena CDS spreads. Source: author's own evaluation.

Figure A.1.4 shows the spreads of sovereign and banks CDS with 5-year maturity for the post-bailout period (31/10/2008-01/01/2013).

The figure supports the hypothesis that after the bailouts sovereign and banks credit risks start to co-move. In fact, the line representing sovereign CDS spreads and banks CDS spreads follow the same patterns.

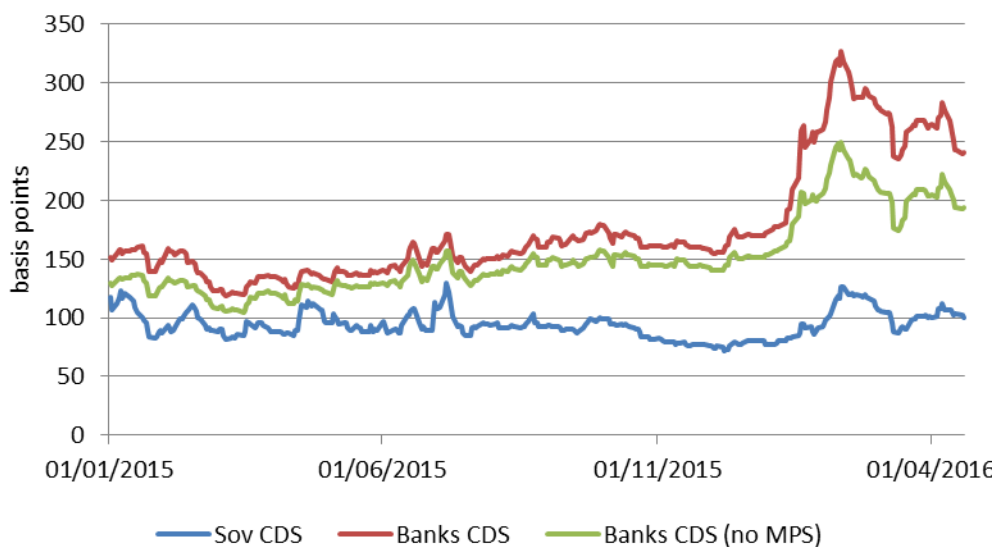
Moreover, we can identify a significant increase in CDS spreads in the period between 2011 and 2012 when the crisis reached the most acute phase.

Figure A.1.5 shows the spreads of sovereign and banks CDS with 5-year maturity for the Banking Union period (01/01/2015-19/04/2016).

From the figure we can notice that the spreads of sovereign and banks CDS start to diverge. This could indicate that the Banking Union breaks the link between sovereign and banks credit risks.



**Figure A.1.5: CDS spreads in the Banking Union period (5-year maturity)**



The figure shows the spreads of sovereign and banks CDS with 5-year maturity for the Banking Union period (01/01/2015-19/04/2016). The sovereign CDS spreads are represented by the blue line. The banks CDS spreads are represented by the red line and are computed as the simple average of the CDS spreads of the six major Italian banks. The green line represents the average bank CDS spreads without considering in the computation of the average Monte dei Paschi di Siena CDS spreads.

Source: author's own evaluation.

We move to the regression analysis. Figure A.1.6 shows the results.

We found that in the medium-run the link between sovereign and banks credit risks is still present. In fact, our independent variable is statistically significant. This is verified also after the inclusion of the controls.

For what concerns the Banking Union period we found that the link is still present but it has become weaker. The parameter of interest in fact drops from 0,6 to 0,3. This means that the establishment of the Banking Union is thought to be effective in weakening the link in the medium-term.

There is no evidence of the risk shifting from banks to sovereign in the bailout period, however the effect of sovereign credit risk on banks credit risk has become weaker.

In the post-bailout period the effect of sovereign credit risk on banks credit risk becomes again stronger.

For what concerns the foreign sovereigns credit risk, the control variable is significant only in the pre-bailout and in the post-bailout period.

The equity returns variable is always significant.

**Figure A.1.6: Regressions results (CDS with 5-year maturity)**

	$\Delta\log(\text{Banks CDS})$						
	Pre-Bailout		Bailout	Post-Bailout		Banking Union	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<b><math>\Delta\log(\text{SovereignCDS})</math></b>	0,6012** (0,0611)	0,6013** (0,0611)	0,3137** (0,0784)	0,3051** (0,0205)	0,3049** (0,0205)	0,325** (0,0860)	0,3254** (0,0861)
<b><math>\Delta\log(\text{Foreign CDS})</math></b>	0,1921** (0,0344)	0,1921** (0,04)	0,1037 (0,0979)	0,1556** (0,0358)	0,156** (0,0358)	4,115 (2,113)	4,1143 (2,1133)
<b>Bank Equity Return</b>		-0,019** (0,00347)			-0,0303** (0,0084)		-0,0968** (0,0193)
<b>Time Fixed Effect</b>	YES	YES	YES	YES	YES	YES	YES
<b>Observations</b>	816	816	125	6527	6527	2034	2034
<b>Banks</b>	4	4	5	6	6	6	6
<b>R<sup>2</sup></b>	0,1676	0,17	0,2519	0,0765	0,111	0,174	0,18

The figure shows the results of the regression of  $\Delta\log(\text{Banks CDS}_{it})$  on  $\Delta\log(\text{Sovereign CDS}_t)$ . For these regression were used aggregate data on spreads of CDS with 5-year maturity. Columns (1), and (2) cover the pre-bailout period (14/12/2007-25/09/2008). Column (3) covers the bailout period (26/09/2008-30/10/2008). Columns (4) and (5) cover the post-bailout period (31/10/2008-01/01/2013). Columns (6) and (7) cover the Banking Union period (01/01/2015-19/04/2016).  $\Delta\log(\text{Sovereign CDS}_t)$  includes the daily change in the natural logarithm of sovereign CDS spreads,  $\Delta\log(\text{Banks CDS}_{it})$  includes the daily change in the natural logarithm of banks CDS spreads,  $\text{Bank Equity Return}_{it}$  represents banks equity returns and  $\Delta\log(\text{Foreign CDS}_t)$  includes the daily change in the natural logarithm of average spreads of foreign sovereigns CDS spreads.  $\Delta\log(\text{Sovereign CDS}_t)$ ,  $\Delta\log(\text{Banks CDS}_{it})$  and  $\Delta\log(\text{Foreign CDS}_t)$  are expressed in basis points (bp). Specifications (1), (3), (4) and (6) include the control variable  $\Delta\log(\text{Foreign CDS}_t)$ . Specifications (2), (5) and (7) include both control variables  $\Delta\log(\text{Foreign CDS}_t)$  and  $\text{Banks Equity Return}_{it}$ . In all specification we control for time fixed effects. Standard deviations are in parenthesis. \*\* indicates statistical significance at a 5% level.

Source: author's own evaluation.

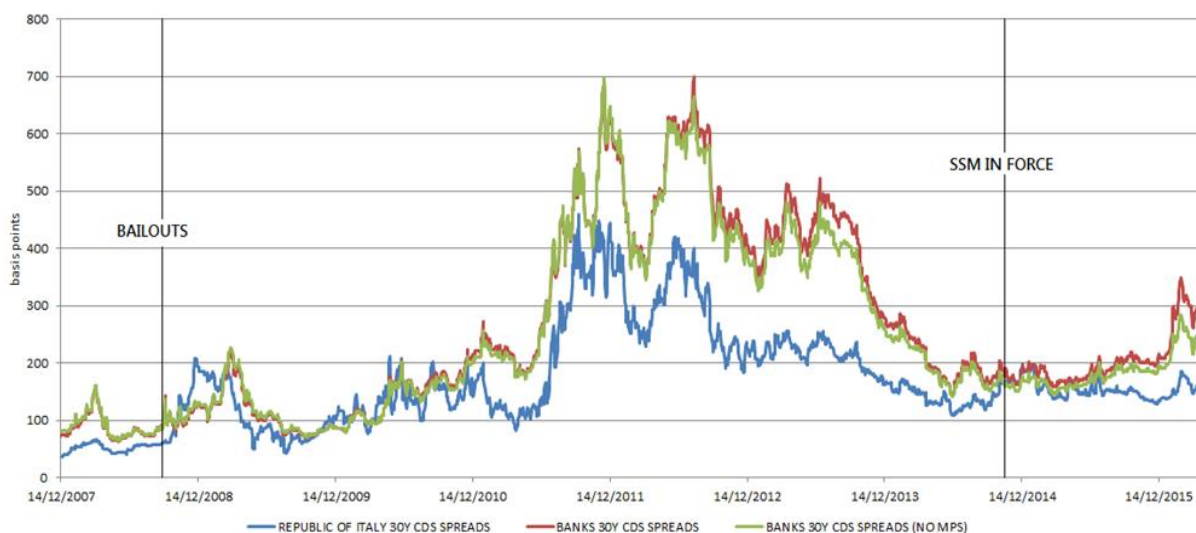


## Annex 2

### Analysis of 30-year maturity CDS

Figure A.2.1 shows the spreads of 30-year maturity CDS.

**Figure A.2.1: Sovereign CDS spreads and banks CDS spreads (30-year maturity)**



The figure shows the spreads of sovereign and banks CDS with 30-year for the period 14/12/2007 to 19/04/2016. The sovereign CDS spreads are represented by the blue line. The banks CDS spreads are represented by the red line and are computed as the simple average of the CDS spreads of the six major Italian banks. The green line represents the average bank CDS spreads without considering in the computation of the average Monte dei Paschi di Siena CDS spreads. This was done because the bank suffered a significant distress due to reason well beyond the financial crisis.

Source: author's own evaluation.

As can be seen in the figure, also in the long-term sovereign CDS spreads and banks CDS spreads move together. This supports the hypothesis that there is a relation between the credit risk of sovereign and the credit risk of banks. Also in figure A.2.1 we add the average bank CDS spreads computed without Monte dei Paschi di Siena.

From the figure we identify the development of the crisis in Italy: the start in 2008 with the increase in CDS spreads, the first recovery in 2010 and the severe worsening of the crisis in 2011 that continued for the following years. 2014 shows a significant reduction of CDS spreads and in 2015 the sovereign and the banks CDS start to diverge.

We move to the analysis for each period. Figure A.2.2 shows the spreads of sovereign and banks CDS with 30-year maturity for the pre-bailout period (14/12/2007-25/09/2008).

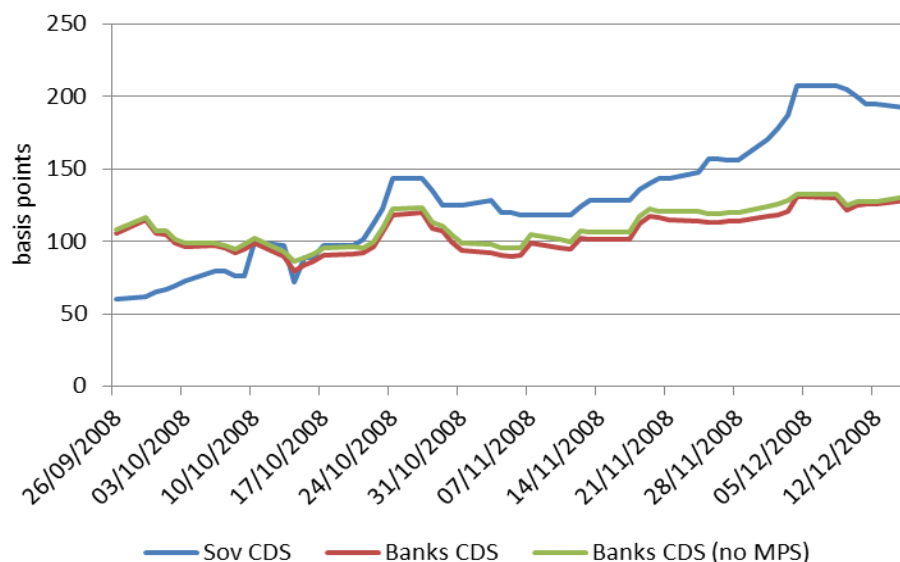
**Figure A.2.2: CDS spreads in the pre-bailout period (30-year maturity)**



The figure shows the spreads of sovereign and banks CDS with 30-year maturity for the pre-bailout period (14/12/2007-25/09/2008). The sovereign CDS spreads are represented by the blue line. The banks CDS spreads are represented by the red line and are computed as the simple average of the CDS spreads of the six major Italian banks. The green line represents the average bank CDS spreads without considering in the computation of the average Monte dei Paschi di Siena CDS spreads. Source: author's own evaluation.

From figure A.2.2 we can see that sovereign CDS and banks CDS follow different patterns. This supports the idea that before the bailouts there is no link between sovereign and bank credit risk.

**Figure A.2.3: CDS spreads in the bailout period (30-year maturity)**



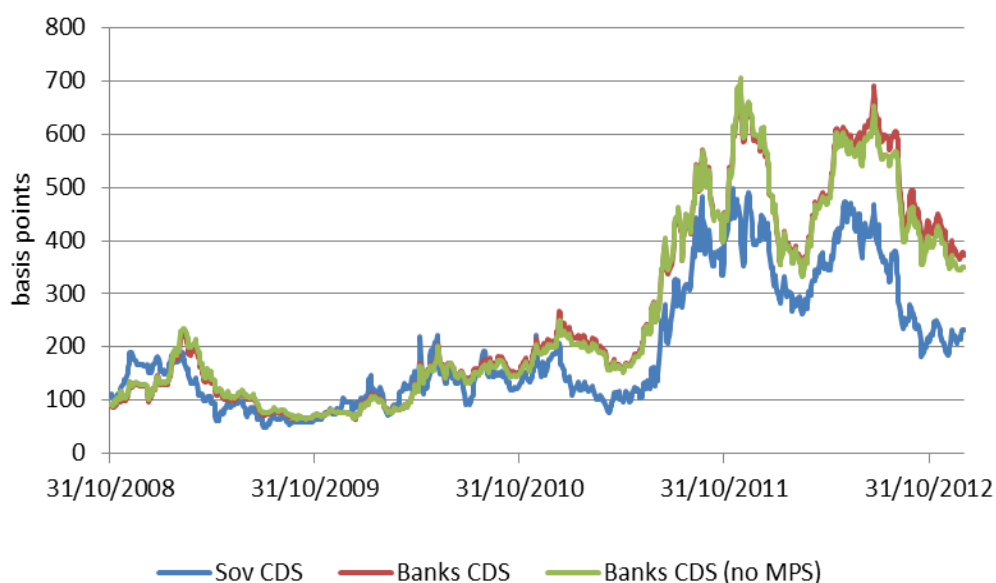
The figure shows the spreads of sovereign and banks CDS with 5-year maturity for the bailout period. The sovereign CDS spreads are represented by the blue line. The banks CDS spreads are represented by the red line and are computed as the simple average of the CDS spreads of the six major Italian banks. The green line represents the average bank CDS spreads without considering in the computation of the average Monte dei Paschi di Siena CDS spreads. Source: author's own evaluation.

Figure A.2.3 shows the spreads of sovereign and banks CDS with 30-year maturity for the bailout period. Sovereign CDS and banks CDS start to converge. This could indicate the start of the link in this period.

Moreover, the line of the sovereign CDS at some point goes above the line of banks CDS spreads. This could indicate that there is a risk shifting from banks to sovereign. This was not clear with CDS with 6-month maturity.

Figure A.2.4 shows the spreads of sovereign and banks CDS with 30-year maturity for the post-bailout period (31/10/2008-01/01/2013).

**Figure A.2.4: CDS spreads in the post-bailout period (30-year maturity)**



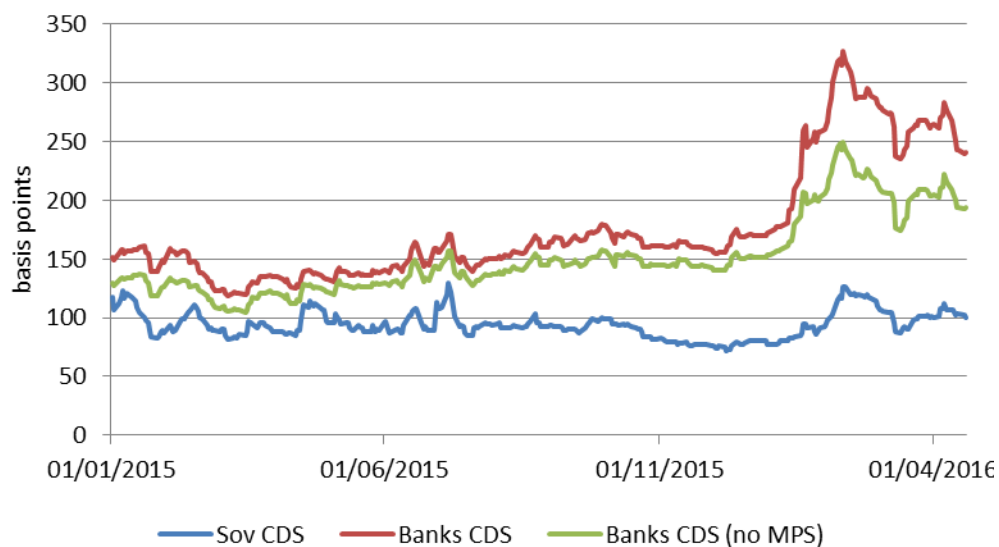
The figure shows the spreads of sovereign and banks CDS with 30-year maturity, for the post-bailout period (31/10/2008-01/01/2013). The sovereign CDS spreads are represented by the blue line. The banks CDS spreads are represented by the red line and are computed as the simple average of the CDS spreads of the six major Italian banks. The green line represents the average bank CDS spreads without considering in the computation of the average Monte dei Paschi di Siena CDS spreads. Source: author's own evaluation.

The lines representing sovereign CDS spreads and banks CDS spreads follow the same patterns. This supports the hypothesis that in the post-bailout period sovereign credit risk strongly affect banks credit risk.

Moreover, we can identify a significant increase in the spreads in the period between 2011 and 2012 when the crisis reached the most acute phase.

Figure A.2.5 shows the spreads of sovereign and banks CDS with 30-year maturity for the Banking Union period (01/01/2015-19/04/2016).

**Figure A.2.5: CDS spreads in the Banking Union period (30-year maturity)**



The figure shows the spreads of sovereign and banks CDS with 5-year maturity for the Banking Union period (01/01/2015-19/04/2016). The sovereign CDS spreads are represented by the blue line. The banks CDS spreads are represented by the red line and are computed as the simple average of the CDS spreads of the six major Italian banks. The green line represents the average bank CDS spreads without considering in the computation of the average Monte dei Paschi di Siena CDS spreads.

Source: author's own evaluation.

From the figure we can notice that the spreads of sovereign and banks CDS start to diverge. This could indicate that the Banking Union breaks the link between sovereign and banks credit risks.

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