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“Credit Risk Contagion: evidences from
Germany and Italy”

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Introduction

As a consequence of the 2008 financial crisis, a problem of sovereign credit risk hit European countries. Because of the lack of a common framework to deal with banks crisis, the rescue operations in their domestic banking sectors made by several countries caused an increase in the interdependence of banks and sovereigns. These rescue operations caused a transfer of risk from the banking to the sovereign sector causing a deterioration in the creditworthiness of the sovereigns. This loss has originated a negative feedback loop between the two entities, credit risks of banks and sovereign became interconnected such that an increase in one of the two was mirrored by an increase also in the other one.

The loop originates mainly from the domestic exposures within banks portfolios. A deterioration of the creditworthiness of the sovereign cause a loss of value of its bonds and so losses in the balance sheets of the banking sector. These losses cause a reduction in the lending activities of the banks and so a lower stimulus to the real economy. The consequent contraction in the real economy causes lower profits in terms of taxation for the sovereign and thus a further decrease in its creditworthiness thus generating a vicious negative loop.

Several studies have investigated the dynamics under the loop and in particular they have focused on the financial crisis period in Europe where the effects of the loop has been blamed for deepening the effects of the crisis and making the recovery even harder. European banks were caught by the crisis with great exposures to their domestic sovereigns and this created the basis for the development of the contagion between banks and sovereigns.

In particular the effects of the feedback loop were greater in the so called "periphery countries" in which the home bias of the banks portfolios was greater.

We decided to find evidences on the presence of a contagion between sovereign and banking credit risk through the analysis of the 5Y CDS.

First we made a country analysis for Italy by identifying some economic events at the country level that could have had an influence on the link. We find evidences of the presence of the link and of its reinforcement as a consequence of banks bailouts in 2016 and 2017. Furthermore, the link has become stronger especially in the very recent period, after the election of the new government. Political instability has caused in fact both sovereign and banking CDS to increase.

Finally we made a comparison analysis between Italy and Germany, a "periphery" and "core" country to find evidences of the presence of the contagion and see if there are differences in the dimension of the phenomenon.

We indeed found the presence of the link also in Germany but here, the strength of the link

is lower with respect to the Italian case. In both countries the link seems to have been attenuated after the use of non conventional monetary policies of the ECB in order to support the weak economies of the Euro area and especially after the introduction of the Single Resolution Mechanism which was a further step to a more integrated banking sector in Europe.

In order to present our analysis the work is structured as follows.

The first chapter gives an introduction and a description of the negative feedback loop that originates from the contagion between the sovereign and the domestic banking sectors of many countries and of its transmission channels.

Chapter 2 presents the evidences of the contagion especially in Europe during the financial crisis and presents the countries' and banks' characteristics that facilitate its development.

The third chapter presents the solution suggested by the literature in order to solve the creation and the development of the feedback loop.

Finally, Chapter 4 are presents the two analysis with their results. For both analysis we study the daily change in 5Y CDS of the sovereigns and the banking sectors. We first made a graphical analysis and then we provide the results of the linear regression analysis and those of the non linear approach with the use of the quantile regression.

Chapter 1

The Diabolic Loop

Prior to the financial crisis there was no sign of sovereign credit risk in the developed economies but after 2008 it has become a significant problem for many developed countries, mostly in Europe.

Due to the absence of a common policy framework for handling the banking crisis and the lack of a single resolution mechanism, several governments were forced to rescue troubled banks headquartered in their countries during the financial crisis, especially in Europe. These rescue operations have increased national debt burdens and caused a deterioration of public finances. As a consequence, the interdependence of banks and countries has increased causing negative feedback loops between their financial conditions.

The crisis has further intensified the link between bank and country risk especially in the vulnerable countries where banks, as major investors in government bonds, are affected by governments defaulting on their debt through direct losses. Bank bailouts programs changed the composition of banks' and sovereign balance sheets and affected the linkage between the default risk of governments and their local banks thus making the negative sovereign-bank loop one of the main amplifying factors of distress during the financial crisis of 2008.

1.1 Definition

The aforementioned interdependence between banks and governments is a kind of two-way negative feedback loop between sovereign and banking risk. This “diabolic loop” has been a key feature of the global financial crisis, in particular in the vulnerable countries of the periphery of the euro area.

In these countries, the deterioration of the creditworthiness of the governments reduced the value of the bank's holding of domestic sovereign debt thus reducing their perceived solvency and curtailing their lending activity. This resulting distress of banks increased the chances that banks would have to be bailed out by the domestic government and therefore increasing the sovereign distress even further, engendering a “bailout loop” (Brunnermeier et al. 2016). Moreover, the credit crunch led to a reduction in tax revenue which weakened the government solvency triggering a “real economy loop”.

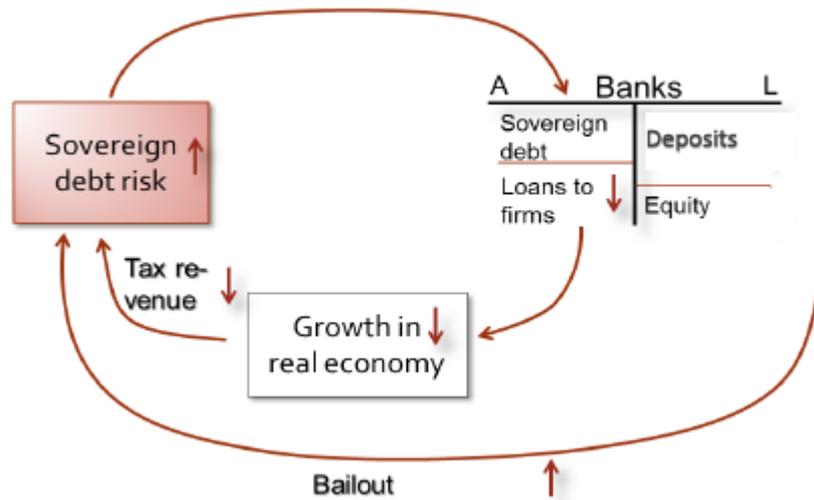


FIGURE 1.1: Real economy diabolic loop. Source: Brunnermeier et al. (2016)

The relationship between financial and sovereign credit risks and economic growth is not accidental but it represents a “tale of two debt overhang problem”. When financial sectors are undercapitalized, as after the financial crisis, the resulting debt overhang reduces banks’ incentives to provide credit to the real economy and so governments are engaged in financial sector bailouts. Such bailouts are costly and carry the risk of a “Pyrrhic victory” for the sovereigns (Acharya et al. (2014)). In fact, bailouts require immediate issuance of additional debt by governments in order to stop creditors of distressed or insolvent financial firms. This will increase the sovereign credit risk through the liabilities side of the balance-sheet. On the other hand, the sovereign runs the risk of becoming indebted to the point that another debt overhang will occur in their economy and this will lead to higher taxes in the future and dilutes long-run returns on real-sector and human-capital investments in the private sector. The under-investment in the economy can cause a slowdown in growth and productivity in the sovereign thus affecting the sovereign credit risk through the asset side of the balance sheet.

There is clearly a trade-off between the two debt overhangs and this can cause the sovereign to sacrifice its creditworthiness in order to alleviate the financial sector overhang. Paradoxically, the deterioration in the sovereign creditworthiness increases the risk that the credit problems will feed back adversely into its financial sector through the direct holdings of government debt by the financial sector (home bias) and the creditor guarantees provided by the sovereign.

1.2 Transmission Channels

The “diabolic loop” originates from several factors and then develops itself through different channels. The main factors that originate the loop have been figured out by Pagano et al. (2016), who showed that there are three main features to the feedback loops:

- Home bias of bank’s sovereign debt portfolios;
- Inability of governments to commit not to bailout domestic banks;

- Free capital mobility;

Holdings of domestic sovereign bonds are clearly the main ingredient for the development of the loop. The importance of bonds for financial institutions is due to the fact that usually long-term government bonds are used by banks as collateral to short-term loans with which they cover their liquidity needs. For this reason, the ability of banks to be liquid is strictly connected with the quality of the bonds they hold and thus with their ratings. The rating of government bonds is in turn connected with the perception of the strength of the government by international investors. So, as long as investors and rating agencies are concerned about the possibility that the government will not be able to fully pay off its debt, the rating of government bonds will decline thus affecting the profitability of the financial sector. In fact, the bias in bank's portfolios makes their value and solvency strictly dependent on the fluctuations in the perceived solvency and market value of government debt.

The inability of governments to commit not to bail out domestic banks contribute to the feedback from bank to government distress because the bailout is optimal once banks are distressed. So, if governments decide to rescue troubled domestic banks, there will be a transfer of risk from banks to the sovereign. Moreover, rating downgrades of government bonds raises doubts about the ability of a government to save systemic financial institutions from impending insolvency.

Finally, the free capital mobility ensures that the market value of domestic government debt reflects also the international investor's perception of future government solvency thus increasing the influence that the solidity of the government has on the value of sovereign bonds hold by banks in their portfolios.

As said before, the effects of the "diabolic loop" pass through different channels and more specifically the feedback is a "two ways" one so there are two different directions. The double direction of causality goes from the sovereign to the banking and vice versa.

The first direction considered is that from sovereign risk to banking risk and it develops from three main transmission canals:

- Banks' balance sheet;
- Ratings of public and private issuers;
- Government's guarantees;

The transmission through the bank's balance sheet is a matter of credit risk and in particular it is related with the excessive exposure to domestic sovereign debt.

As seen before, the deterioration or improvement of the creditworthiness of the government may cause some losses or gains on the bank's portfolios of sovereign securities and can also affects bank's standing on the loans to the government. The impact of the losses depends on the way in which the securities are carried on the balance sheet. If they are carried at market value, a fall in the value of the sovereign bonds has a direct effect on bank's profit and loss statements.

It has also an effect on the equity leverage, while if they are reported at amortized cost, the losses will be reported only when the securities are impaired. On the other hand, this exposes the bank to some problems in funding conditions prior to the occurring of the impairment and investors can become concerned about the solidity of the bank.

The bias is due to several factors like hedging motives, legal risk, transaction costs and informational frictions but the main contribution is given by the current regulations which give claims on the government preferential treatment over those on private borrowers.

Government bonds are usually used as collateral for short-term loans and so for the liquidity needs of banks but they are also used to secure wholesale funding from central banks, private repo market, issuance of covered bonds and to back OTC derivative positions. An increase in sovereign risk reduces the funding capacity of the banks through the reduction in the availability and eligibility of collateral thus reducing the volume of secured loans and as a consequence short-term refinancing options for banks.

This reduction is transmitted through different mechanisms: first, the value of sovereign bonds influences directly the value of the collateral pool thus if the former decreases the latter will do the same. Secondly, if the credit rating of the bonds declines due to some concerns of investors and rating agencies on the ability of the government to pay off its debt, a haircut will be applied on refinancing operations of banks and by the ECB in its lending operations to commercial banks¹

Another important point is that national authorities apply reduced risk weights to bank's claim on the sovereign where the holding company is incorporated, denominated and founded in the domestic currency. In Europe for example, partly reflecting Basel II, a zero risk weight is given to most of the debts issued by EU sovereigns, including those in the euro area. Basel III and the EU treat government bonds of Member States as risk-free, highly liquid assets and exclude them from capital requirements and large exposure regimes thus giving an incentive to banks to hold them in their portfolios. In the light of what has been said before, several studies have investigated the reasons why banks are so exposed to domestic government bonds. In particular, Angelini-Grande-Panetta, in a study made for the Bank of Italy, outlined how banks in all European countries had been virtually reducing their exposures for several years. But in the fall of 2008, after the Lehman default, they resumed purchases of domestic government bonds. Usually under normal circumstances banks have no incentive to buy government paper, despite the preferential treatment the regulations grant to this form of investment, so what the authors figured out was that the increasing exposures and the home bias of portfolios was a consequence of the 2008 financial crisis.

Three hypotheses have been advanced on which were the reasons why the crisis triggered the resurge of the home bias (Battistini et al. (2013)):

- Moral suasion: high risk sovereign issuers may exert “moral suasion” on their domestic banks to increase their domestic sovereign holdings to support the demand for sovereign

¹During Main Refinancing Operations and Long Term Refinancing Operations of the ECB the 20% of operations is secured by government bonds.

debt when it is low. In times of fiscal distress governments prompt domestic banks to purchase additional amounts of domestic sovereign bonds because market demand is low. The government needs to do this because undersubscribed auctions for sovereign debt damage governments' credibility and push sovereign bond yields up, raising debt refinancing costs.

The development of the mechanism of the moral suasion is strictly related to three facts (Ongena et al. 2016):

- The main determinant of newly issued sovereign debt is the amount of maturing sovereign debt which the government needs to roll over;
- The amount of retiring government debt is pre-determined because it is the outcome of choices typically made years before by previous governments;
- Domestic banks are more likely to be “morally swayed” than foreign banks, through explicit and implicit threats to those banks that decide not to cooperate.

The dimension of the suasion is dependent on the so called distinction between “high need” and “low need” months (Ongena et al. 2016). The former are those when the total amount of new debt auctioned by the domestic government is above the country-specific median for the period because of high refinancing need stemming from a large amount of maturing debt. In the high need months, the risk of undersubscribed auctions is greater and also the risk of higher yields. Domestic banks were substantially more likely to purchase domestically-issued sovereign debt than foreign banks in high need months. The effect is more pronounced for state-owned banks and for those with initial holdings of domestic sovereign debt. We can expect the government to strategically pick the banks it chooses to influence, in particular those that aren't already saturated with domestic sovereign debt. Domestic banks are more likely to be influenced because they are more vulnerable to explicit and implicit threats if they decide not to cooperate. They also have more to lose in terms of funding costs and so if an auction fails they are more likely to comply with their government request to buy additional bonds.

- Gambling for resurrection/Carry trade: under-capitalized banks may have “gambled for resurrection” by engaging in carry trades thus getting cheap liquidity from the ECB and investing it in high-yielding bonds;
- Comparative advantage/re-nationalization: in the case of a collapse of the euro, banks' liabilities will be redenominated into new national currencies and so banks try to hedge redenomination risk by matching their assets and liabilities at the national level, replacing foreign assets with domestic ones.

The impact through the balance sheet is not only in terms of credit risk but also in terms of liquidity and funding risk. Governments bonds are typically used as collateral, therefore a fall in their price can trigger margin calls or larger haircuts thus reducing the liquidity that can be obtained via given nominal amount of sovereign paper.

The second channel of the sovereign-bank dependence hangs on the connection between ratings of public and private issuers. The effect of the ratings works in two ways.

First, due to the rating ceilings, according to which all the major domestic banks are rated at or below the respective sovereign, usually sovereign downgrades lead to downgrade of domestic banks.

Secondly, downgrades reduce the value of bank's liabilities and the loss of investment grade status can make sovereign ineligible as collateral in funding operations or unsuitable for certain categories of investors such as pension funds and insurance companies thus affecting costs of bank's debt and equity funding. Rating downgrades cause banks to pay higher spreads on their bond funding and reduce their market access. In addition, institutional investors, restricted to investment grade bonds, could be forced to liquidate their holdings of bank bonds if the rating falls below the threshold.

The financial crisis made evident this dependence. In fact, 64% of domestic banks saw their credit ratings lowered in the six months that followed a sovereign downgrade.

The final channel is that of governments' guarantees (Leonello 2018) and it is related to the fact that systemic banks have usually an implicit government guarantee which lowers the cost of debt funding.

Especially after the collapse of Lehman Brothers, many government bailout programs consisted in providing explicit guarantees of no deposit debt as well as various troubled assets. The role played by guarantees to financial institutions in the emergence of banking and sovereign debt crisis is due to the link between depositor's and investor's withdrawal decisions. In fact, creditor's rollover decisions and the number of depositors running affect the resources available to the government and thus the amount of guarantees given. The fewer investors roll and the more depositors run the larger will be the amount that the government will need to transfer to the banking sector thus tightening its budget. Sovereign creditors expected repayment will be lower and the probability of a sovereign default will increase. This complementarity sets the ground for the negative feedback loop between bank and the sovereign, the increase in the probability of a sovereign default translates into reduced effectiveness of the guarantees in limiting instability in the banking sector. Downgrading bonds make government guarantees for individual institutions or specific liabilities less credible.

Guarantees affect the probability of a banking crisis and a sovereign default in a non-trivial way because they are beneficial for bank's stability as they improve the available resources. They reduce the probability of a banking crisis but they are detrimental for the sovereign solvency because they represent a disbursement for the government and thus increase the probability of a sovereign default. The reduction in the probability of a banking crisis due to the guarantees will improve sovereign stability by reducing transfers of resources to the banking sector.

The direct and the indirect effect work in opposite directions so the overall effect of the guarantees can be positive or negative. It is positive when an increase in the guarantees leads to a

significant reduction in the probability of a banking crisis and to a drop in the probability of a sovereign default despite the disbursement for the government.

The direction of causality, as we said, can also be reversed; the risk of banks defaults raises the financing costs of sovereigns and a banking crisis can trigger a surge in sovereign risk. Indeed, a financial crisis may require the government to support financial institutions. The rating of a country is strictly connected to the activity of supplying credit because a credit crunch curbs investments and has a negative impact on growth thus reducing tax revenues. Fear of a credit supply collapse can push governments to intervene and directly support their domestic banks through guarantees, capital injections or by buying up loss-making assets.

For all the reasons discussed above it can be seen that once a shock causes a weakening of the sovereign, or of the banking system, a self-reinforcing feedback loop can easily develop. Tensions in the sovereign debt market affect banks' funding conditions thus affecting also domestic households and firms. By weakening the economy, a credit squeeze leads to a decline in borrowers' creditworthiness and to further tensions in the sovereign's situation because of less fiscal revenues and the need of fiscal tightening. This will result in a depression of the credit growth with a negative effect on bank's interest margin and profitability.

1.3 A Model for the Loop

Acharya et al. (2014) developed a model in order to describe the dynamic of the loop. The model consists of three economic sectors: financial, non-financial and government.

The first two sectors produce aggregate output while the financial sector is leveraged and underinvests due to the debt overhang problem.

By assumption restructuring the financial sector debt is impossible (prohibitively expensive) so the government may undertake a bailout of the financial sector by a transfer from the rest of the economy, funded in the future by raising taxation.

To fund the bailout, the government issues new bonds thus alleviating the under provision of the financial services. Of course the size of the bailout depends on the existing debt because the greater the debt the lower the ability to undertake the bailout, the so called Laffer curve property.

Raising taxes in fact has two effects: capturing a greater portion of future value of the non financial sector but also decreasing the incentive to the non financial sector to invest in future projects thereby reducing tax revenues. The announcement of the bailout lowers the price of the government debt causing a collateral damage to the financial sector holdings of the debt. The combination of high debt overhang and large existing debt cause the underinvestment cost of fully funding the bailout with tax revenues to be high. As a consequence, the government should sacrifice its creditworthiness by issuing new debt without a corresponding increase in tax revenues.

The government accepts a positive probability of default resulting in a positive relationship between sovereign's debt level and credit risk. In this way the financial sector credit risk "spills over" into sovereign credit risk, a positive relationship between its level of debt and its credit spread is created.

When the sovereign takes on credit risk there is a feedback loop from the credit risk of the sovereign to that of the financial sector so as a consequence of the collateral damage, any subsequent adverse shock that reduces the creditworthiness of the sovereign feeds back to the financial sector's credit risk via its sovereign exposures. Every shock that affects output growth and thus tax revenues will lower sovereign's own debt values and increase the financial sector's risk of default. This is due to the decrease in both the value of bond holdings and government guarantees that benefit the financial sector. The direct loop occurs through the value of the transfer pledged to the financial sector, the decrease in the value of financial sector government bond holdings and the decrease in the value of explicit and implicit government guarantees.

These channels induce post-bailout co-movement between the financial sector's and sovereign credit risks in contrast with the impact of the bailout announcement because the financial credit risk decreases and the sovereign credit risk increases.

Chapter 2

Analysis of the contagion

In recent times, much attention has been focused on the increase of sovereign bond yields in the euro area especially after the collapse of Lehman Brothers in September 2008. Several governments adopted financial sector rescue packages thus increasing the interconnection between bank and sovereign risk. Since government rescues typically lead to an increase in public debt, when investors perceive that a banking crisis may erupt, they increase their perception of default risk and thus increase sovereign spreads.

In the existent literature, different model and methods have been used to make inference on the contagion between banks and sovereign credit risk. In particular, the major evidences come from the Eurozone especially during the financial crisis.

The effects and the dynamic of the loop can be seen from different perspectives. First of all, the rising and development of the link between the two credit risks can be identified through different phases. Secondly, financial institutions showed different behaviours depending on the location of their home country.

It has been demonstrated that also some specific characteristics by inducing banks to hold more sovereign debt securities and thus increasing the home bias in their portfolios, has contributed to widen the connection between sovereign and banking credit risk.

Finally, monetary and fiscal policies contribute to create the basis for the development of the loop.

2.1 The Evolution of the Loop

Before the starting of the financial crisis there was no sign of sovereign credit risk in the developed economies but from the fall of 2008 sovereign risk has become a significant problem for many of them.

European policy makers have adopted two main approaches to deal with sovereign and banking risk during the global financial crisis. On the one hand governments have implemented bank rescue policies through capital injections, debt guarantees or deposit guarantees, on the other hand, monetary policy provided liquidity to banks by intervening in sovereign debt markets through outright purchases or by giving implicit guarantees against a speculative run.

The rising and the evolution of the contagion between sovereign and banking credit risk in Europe can be described by identifying three phases (Acharya et al. 2014):

- Pre-bailout phase;
- During bailout phase;
- Post bailout phase.

After the financial crisis of 2008 sovereign yields that were converging since the introduction of the euro, sharply diverged. The increase in the dispersion was parallel to that of the CDS premium on sovereign bonds.

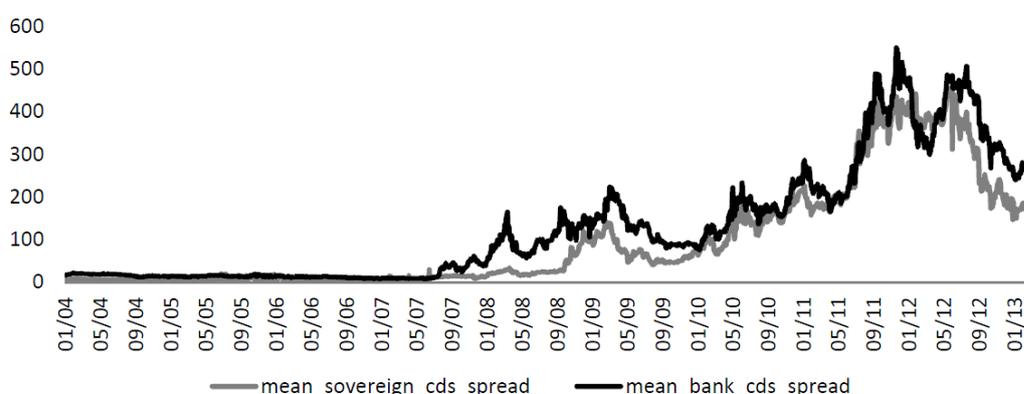


FIGURE 2.1: The figure show the average EU daily mid quote CDS spreads from the beginning of 2004 to the beginning of 2013. The average is made by taking six of the largest European economies (France, Germany, Italy, Portugal, Sweden and Spain). The black line is related to the European banking sector while the grey line is related to the sovereign CDS.

Source: Avino et al. 2014

As we can see from figure 2.1, sovereign and bank CDS spreads were converging during the pre-crisis period. From the beginning of the financial crisis in 2008 they started to diverge having a quite unstable path and a rise in their values. This indicates the emergence of a significant bank and sovereign credit risk in Europe. This fact can be seen by looking at the excess correlation between sovereign and bank CDS. If a bank holds more sovereign debt of a country, it is more likely to suffer losses when the default risk perception of that country increases. A bank with a one standard deviation higher exposure to a certain country rather than another has an excess correlation ¹ with the first country 1.34% points higher (De Bruyckere et al. 2013).

The pre bailout period has been considered as starting at the beginning of 2007 and ending at the end of 2008. Here it can be seen a large increase in bank CDS and almost no change in the sovereign. Credit risk of the financial sector was increasing without an impact on the

¹As simple correlation can be misleading during high volatile periods, the authors decided to use excess correlation defined as correlation over and above what can be expected from economic fundamentals (De Bruyckere et al. 2013)

sovereign credit risk. European banks entered this period with substantial exposures to the so called GIPSI countries (Greece, Italy, Portugal, Spain, and Ireland) which soon became the most risky ones because of the effects of the crisis. The exposures to these countries remained pretty constant over the following two years (Acharya et al. 2013). In this pre bailout phase there are no signs of a direct feedback loop between the two credit risks.

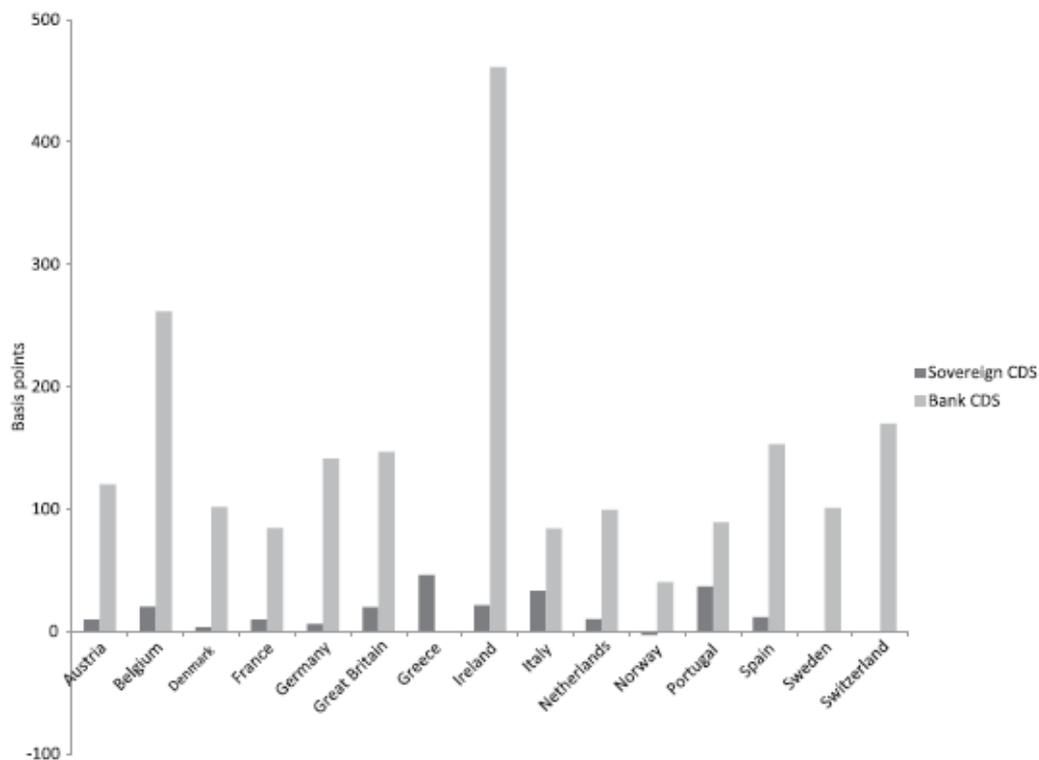


FIGURE 2.2: CHANGE IN SOVEREIGN AND BANK CDS BEFORE BAILOUT

The figure shows the change in average bank and sovereign CDS for the period that goes from 1\1\2007 to 25\09\2008. Banks CDS are the equal weighted average of bank CDS for bank headquartered in the country.

Source: Acharya et al. 2014

After the Irish bailout on September 30, 2008, also other western European countries announced some bailout programs consisting mainly in of debt guarantees, equity injection or asset purchase programs. These bailouts programs triggered the raising of the sovereign CDS spreads while it can be seen that banks CDS slightly decreased. Bailout programs contribute to decrease the banking credit risk but at the expenses of a rising in the sovereign one. In particular, a 10% rise in sovereign CDS rates led to a 5.8% decrease in banks CDS rates.

In the post bailout period both CDS increased with strong co-movements suggesting that they may feedback on each other. A 10% increase in sovereign CDS leads to a 0.9% increase in bank CDS. Starting from 2010 in fact banks started to managed their sovereign portfolios by increasing their sovereign exposures to Italy, Spain and Portugal in a period in which the yield spreads of these countries were widening (Acharya et al. 2013) thus exposing themselves to the

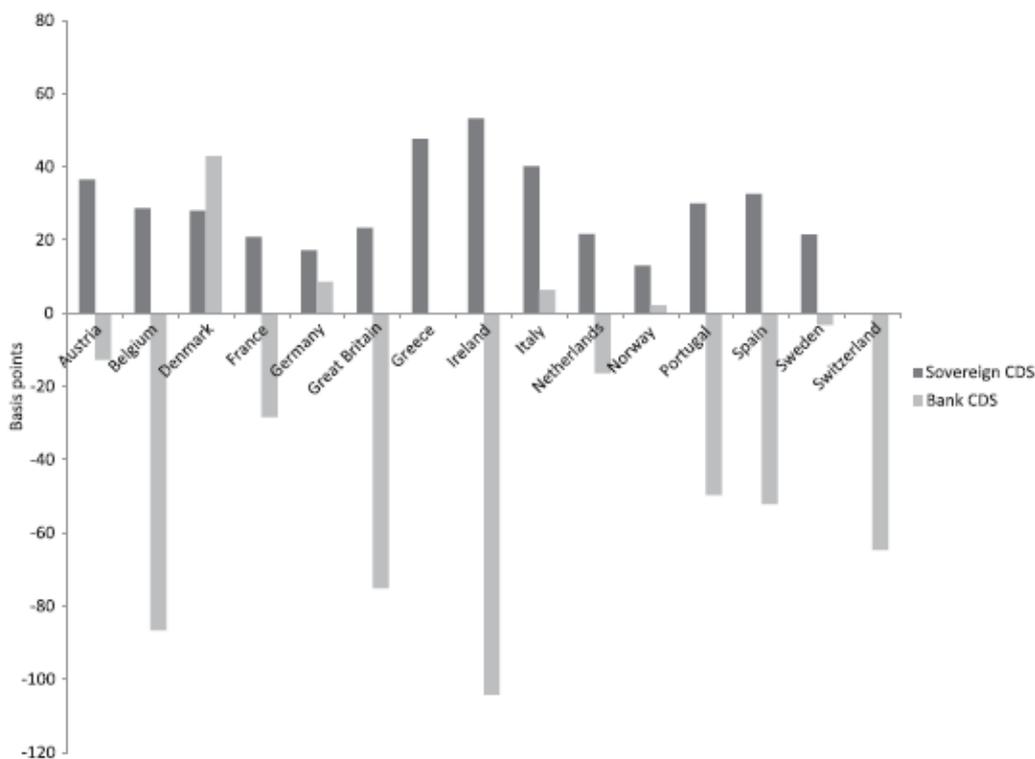


FIGURE 2.3: CHANGE IN SOVEREIGN AND BANK CDS DURING BAILOUT

The figure shows the change in average bank and sovereign CDS for the period that goes from 26\09\2008 to 21\10\2008. Banks CDS are the equal weighted average of bank CDS for bank headquartered in the country.

Source: Acharya et al. 2014

risk of a possible deterioration of the creditworthiness of these countries and/or an increase in their credit risk. In particular, also the level of government debt and the level of financial sector distress seemed to have a predictive power for the future level of sovereign CDS and the high level of public debt is a typical characteristic of these countries. The contagion between the two credit risks is indeed greater for countries with a high debt to GDP ratio (De Bruyckere et al. 2013). This because higher debt ratios reduce the probability of a bailout in the banking sector and increase the credit risk level of banks through bonds in the portfolios.

However, this predictive power is not present in the pre bailout period while it becomes evident in the other two periods. In particular, a 10% increase in pre bailout levels of the level of government debt and of the financial sector distress leads to a 10% and a 13% increase in sovereign CDS respectively (Acharya et al 2014).

Post bailouts there is a situation of “private to public risk transfer” (Alter et al. 2012) in fact the effects of a sovereign shocks have permanent effects on banks CDS spreads while the banking sector shocks are less important. Changes in sovereign CDS spreads contribute permanently to the financial sector CDS spreads while changes in banks risk of default affects sovereign CDS spreads only transitorily.

Furthermore starting from 2012 the behaviour of banks reversed. While in previous years banks

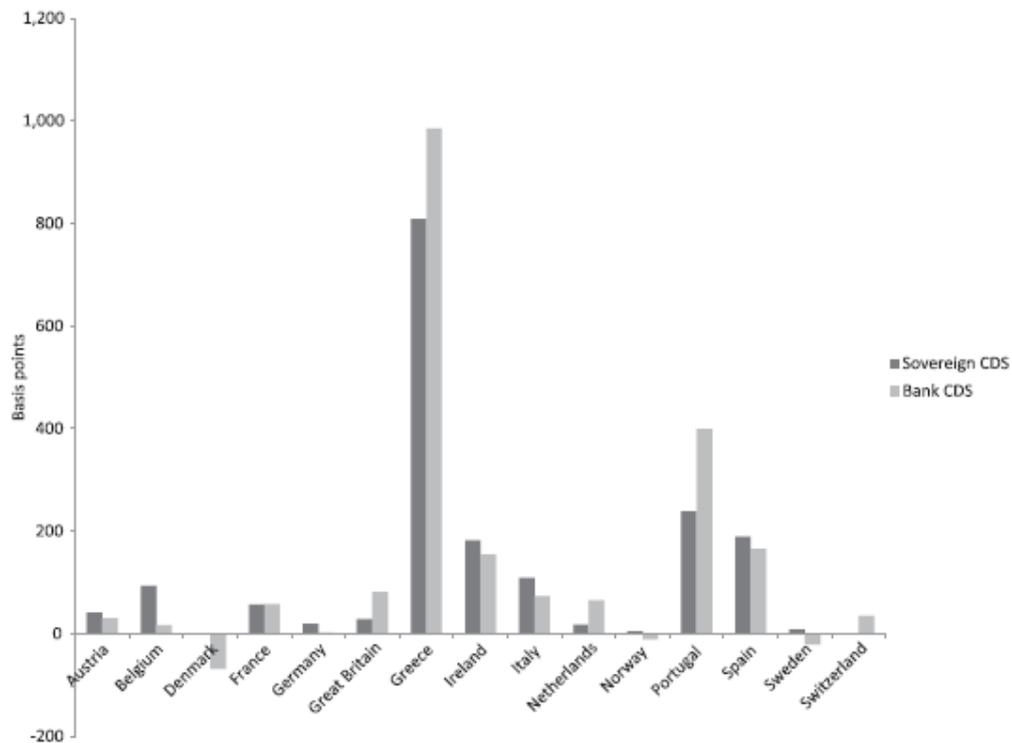


FIGURE 2.4: CHANGE IN SOVEREIGN AND BANK CDS POST BAILOUT
 The figure shows the change in average bank and sovereign CDS for the period that goes from 22\10\2008 to 30\06\2010. Banks CDS are the equal weighted average of bank CDS for bank headquartered in the country.

Source: Acharya et al. 2014

were increasing their exposures to GIIPS countries, from 2012 they started to substantially increase their exposures to their domestic sovereigns while non-domestic banks even decreased their holdings (Acharya et al. 2013). Greater holdings of sovereign bonds increased the possibility of a contagion with sovereign credit risk and the possibility of a feedback loop between the two risks.

This shows how banks were not passively caught by the emergence of the sovereign debt crisis but they actively increased risky sovereign debt position in their portfolios. GIIPS banks were those that increased more their sovereign exposures. Between December 2011 and June 2012 Italian banks invested 37 billion in domestic sovereign debt, Spanish 13 billion while banks of core countries left their exposures quite unchanged (Acharya et al. 2013).

It can be concluded that banks bailouts transferred risk from banks balance sheets to sovereigns and this triggered the rise in sovereign credit risk.

This transfer triggered also the surge of a direct feedback loop between the two risks. Bailouts, in fact, created a credit risk for the sovereign and this cause the price of the debt to become sensitive to macroeconomic shocks. Furthermore, changes in the sovereign credit risk affected the financial sector risk through: the ongoing bailout payments and subsidies, direct holdings of government debt and explicit and implicit government guarantees. Also foreign exposures were a crucial factor in the pricing of bank credit risk after bailouts. Effects were also greater for countries which are within a monetary union and this explains why the effects of the loop

had a huge importance during the European financial crisis.

When they have to decide to intervene with support to the financial sector governments clearly face an important trade-off: on one hand bank bailouts ameliorate the underinvestment problem of the financial sector, on the other hand they reduce the investment incentives of the nonfinancial sector due to the corresponding increase in future taxation.

Usually in the short run bailouts are funded by issuing new bonds which dilutes existing bondholders and raises sovereign credit risk. The two-way feedback loop, as seen before, is thus generated between sovereign and financial sector credit risk because of the exposures of financial firms on the value of government debt through direct holdings of bonds and the value of the government guarantees.

2.2 “Core” Countries vs “Periphery” Countries

The behaviour of financial institutions has been quite different depending on the location of the banks. In particular, the Euro zone countries can be divided in two groups: “core countries” (Austria, Belgium, Estonia, Finland, France, Germany, Luxembourg, Malta, the Netherlands and Slovakia) and “periphery” countries (Cyprus, Greece, Ireland, Italy, Portugal, Slovenia and Spain).

As seen in Chapter 1 the negative feedback loop between sovereign and banks pass through different transmission channels. In particular, the holdings of domestic sovereign debt seem to be the most powerful one as these holdings determine the bias of banks’ portfolios.

Sovereign yields differentials particularly reflect both the differences in sovereign default risk (country risk factor) and in country’s exposure to common or systemic risk (Altavilla et al. 2015). Systemic risk represents the danger of a Eurozone breaks up and the implied currency redenomination.

Data show that domestic sovereign exposures are greater in the stressed (periphery) countries than in the “core” countries (4.9% against 3.8%), hence portfolios of stressed countries are more “home-biased” and so more exposed to the possible effects of the sovereign risk. Moreover, periphery countries accumulated sovereign debt faster thus exposing themselves to changes in sovereign credit risk more than the core countries.

Data show also that, especially in the stressed (periphery) countries, after 2011 banks with greater public ownership increased their domestic sovereign exposure at a faster path than the others (Figure 2.5). This suggests that, consistently with the moral suasion hypothesis, these banks used the liquidity provided by the ECB (two vertical lines in the figure) to fund purchases of domestic public debt or to use it as a collateral to obtain liquidity.

In both types of countries, banks increased their domestic exposures in response to an increase in the common risk, the so called “turn back home”. In fact, when banks fear the possibility that some of their assets could be redenominated in a new currency at an unfavourable exchange

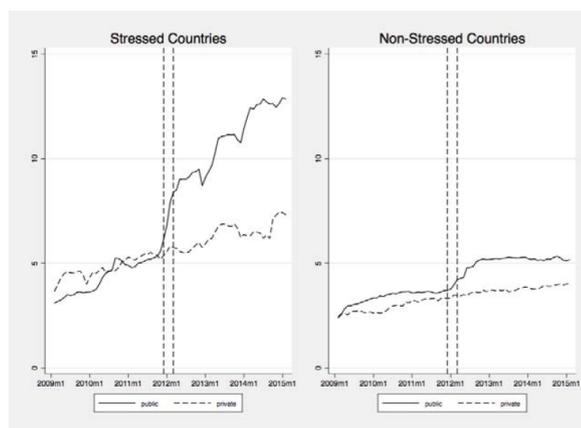


FIGURE 2.5: DOMESTIC SOVEREIGN EXPOSURES AND BANK OWNERSHIP

The lines show the average monthly exposure of banks. Public banks are those with a fraction of public ownership above the relevant country average in 2008. Private banks are those with a fraction that is below the relevant country average.

Source: Altavilla et al. 2015

rate due to the possibility of a break of the European system they tend to start to buy sovereign bonds. This outlines that the increased risk of euro collapse and currency redenomination has led to a greater home bias of portfolios during the financial crisis.

Following the moral suasion hypothesis, stressed-countries banks with more public ownership and less regulatory capital increased their sovereign holdings more than other banks and recently bailed out banks bought domestic debt as a consequence of the moral suasion provided by their domestic governments. A 1% decrease in sovereign prices leads to an increase in domestic sovereign holdings of publicly-owned bank 0.35% greater than that of the private ones and in particular bailed out banks increased their holdings by 6.44% more than the other banks (Altavilla et al. 2015)

As showed by the analysis this hypothesis predicts a greater home bias in sovereign debt portfolios only for banks in stressed (periphery) countries and not in non-stressed (core) ones. Banks of a non-distressed country seeking for high yields would have invested in foreign distressed countries bond during the crisis rather than in domestic ones.

If we instead look at the relationship between domestic risk exposures and yield differentials we can see that by decomposing the yield differential in a country risk and a common risk component:

- When the country risk factor increases banks in the periphery countries respond by increasing their exposures to domestic debt thus increasing the exposures to such risk of their own country that is increasing and this is consistent with the hypothesis of the moral suasion and the carry trade;
- When the common risk factor increases in most Eurozone countries banks react by raising their domestic exposure, so the home bias of their portfolios and this is consistent with the comparative advantage hypothesis.

There are also evidences of a cross-country spillover of the feedback loop (Fratzscher et al 2015), in particular from core countries and periphery countries and vice versa. Effects are particularly stronger when the contagion goes from sovereign shocks to banking shocks. Spillovers are larger from the periphery to the core countries. This happens because core countries' banks have large exposures to periphery sovereigns due to the high yields of their bonds.

A positive shock to sovereign or banks CDS in the periphery by 100 points cause an increase in the corresponding market of the core countries by 15 and 29 basis points respectively. The impact from the periphery to the core has been larger than that of the opposite direction and the main important feature of this is that the core countries constitute the much larger share of the euro area and thus of the underlying debt market.

The exposures to the possible negative effects of the feedback loop are greater in those countries that are considered as stressed. Banks therein situated are more affected by the country risk factor because periphery countries are considered as less solid and their creditworthiness deteriorates faster especially during financial crisis thus affecting, as we saw, the value of banks portfolios. Core countries are less exposed to the country risk factor because of the greater stability, but they are quite equally exposed to the systemic factor and the connected risk of redenomination of the assets. The reactions of banks with respect to this fact are pretty much the same across the two types of countries.

2.3 Banks characteristics that facilitate contagion

As seen before rescue schemes have caused a risk transfer from the private to the public sector thus increasing bank and sovereign interdependence. Some specific bank characteristics have been identified as facilitators to the creation and transmission of the contagion.

In particular, holdings of sovereign debt are affected by different banks' characteristics such as: the fraction of public share ownership, government bailout history and regulatory capital ratio. Public ownership, previous occurrence of a bailout and low capitalization are associated with a greater tendency to increase holdings of distressed government debt (Altavilla et al. 2015).

In Chapter 1 we highlighted that three main causes can trigger an increase in banks' sovereign debt exposures: moral suasion, carry trade and comparative advantage. Some specific bank characteristics expose banks to one of these causes.

Moral suasion is typical of public owned banks. This because they should be more willing to surrender to public influence than private banks and thus they should purchase more domestic debt during distressed times. Of course local banking groups are more exposed to this type of government pressure than foreign ones. Also recently bailout banks are more sensitive to government pressure.

The carry trade hypothesis is instead a characteristic of poorly capitalized banks which have an incentive to buy higher yield public debt to gamble for resurrection. During the financial crisis, in fact, banks exploited a widening of yield spreads betting on their subsequent convergence,

while short-term funding was still available. Incentives were much stronger for weakly capitalized banks that improved their regulatory capital without the costs of raising fresh equity, as these exposures had zero capital requirements (Acharya et al. 2013).

The level of capitalization of the banks is expressed by their TIER 1 capital which serves as a buffer for unexpected losses such as value losses on sovereign debt. In general, a one standard deviation increase in Tier 1 capital ratio leads to a decrease in the excess correlation between sovereign and bank CDS of about 2.06% (De Bruyckere et al. 2013). This means that better capitalized banks expose themselves less to the sovereign credit risk and to the loop.

Also bank size is important, in general, larger banks have lower excess correlation between their CDS and the sovereign CDS because they are perceived as “too big to fail” and so they can count on an implicit government support. Usually for big institutions, the government is expected to intervene when they are in trouble or prone to default. As expected, a standard deviation increase in the bank size leads to a reduction in correlation with foreign countries and an increase in that with the home country, consistently with the existence of a guarantee channel. Larger banks have lower correlation with foreign countries because being too big to fail they can rely on implicit support from the government thereby being less sensitive to spill overs. The link with the home country is instead opposite because the default risk of banks is more strongly correlated to the default risk of their home country because the perceived riskiness is connected with the probability of a government intervention.

As long as banks use sovereign bonds as collateral in short-term funding operations, their propensity to use this type of funding has an impact on their exposures to the effects of the loop. Data show that banks with higher propensity of short-term funding have higher excess correlations in their CDS. A one standard deviation rise in short term funding leads to an increase in sovereign exposures of 25%.

2.4 Effects to the Real Economy

As we saw in Chapter 1 one of the effects of the feedback loop is that of reducing the incentive for the banks to lend money to the real economy. Pagano, Simonelli et al. (2015) investigated the connection between the response of banks’ lending to sovereign stress and their holdings of domestic public debt. An increase in sovereign risk may lead more exposed banks to cut corporate lending because of the large capital losses from debt repricing and because of the raise in their funding costs. The results show that banks’ sovereign exposures amplified the impact of sovereign stress on bank lending and in particular in stressed countries the more exposed banks raised their loan rates more in response to sovereign stress.

Furthermore, sovereign exposures amplified the transmission mechanism of risk from governments to banks and the correlation between CDS premium of banks and sovereigns became more correlated in stressed countries. Larger sovereign exposures led banks to cut more their lending activity, in fact 1 standard deviation drop in the price of government bonds reduces

the loan growth by 1.4 percentage points. Moreover, parent's bank losses on sovereign debt also influenced the lending activity of their foreign subsidiaries. This shows the effect of the feedback loop on the real economy. In fact, by reducing their lending activities banks reduce loans to firms thus reducing the economic growth of the country and as consequence also the tax revenue for the government. Sovereign default risk is indeed affected by the banking sector by at least two channels. First, the government might be compelled to act as a lender of last resort or to recapitalize banks with public money. Secondly, financial intermediaries' balance sheets adjustments are important for aggregate liquidity and financial stability which affects both government fiscal position and credit availability for the economy as a whole which in turns affect government spending and revenue (Gerlach et al. 2010)

2.5 Monetary and Fiscal Policies Effects

Non-standard monetary policy of the ECB and bank bailout policies by national governments affected the relation between sovereign and banking credit risk. Bank bailouts have reduced solvency risk of the banking sector but at the expenses of raising the credit risk of sovereigns. Monetary policies were in most of the cases effective in lowering both credit risks.

It has been noted that monetary policies had different effects depending whether they were announced or implemented (Fratzscher et al. 2015). The ECB monetary policies were:

- Securities Market Program;
- Longer Term Refinancing Operations;
- Outright Monetary Transactions.

The announcements of the securities market program were initially quite effective in lowering both sovereign and banking CDS spreads however their implementation seems to have increase banking risk and left unaffected the sovereign risk.

The other non-standard ECB policies have, on the contrary, different stories. The implementation of the LTROs initially increased both risks but then contributed to lower the banking risk. Outright Monetary Transactions lowered the sovereign CDS spreads by 56 points. One of the problem of the LTRO facilities was that they seemed to have provided an incentive especially to Spanish and Italians banks to significantly build up and increase their exposures to their sovereign debt by strengthening the nexus between financial and public sector in the two periphery countries (Acharya et al. 2013). ECB liquidity injections have also contributed to increase the role of moral suasion and carry trade in augmenting the domestic exposures of banks. Monetary policy seems to have facilitated sovereign debt purchases by public banks rather than by undercapitalized ones thus amplifying more the effects of moral suasion exerted by sovereigns rather than the carry trade channel. (Altavilla et al. 2015)

Considering the euro area as a single entity, the direct and the overall effect between sovereign

risk and banking risk are positive, statistically and economically significant in both directions. A one standard deviation increase in bank risk causes an increase in sovereign risk of 0.14 standard deviations. The reverse effect is stronger with a variation of 0.46. Also non-financial credit shocks positively affect the two risks.

Banks bailout policies such as debt and deposit guarantees and capital injections into banks were effective in reducing banking credit risk. Oppositely these policies had a much smaller impact on sovereign risk and in some cases they induced an increase in the credit risk of national governments. To conclude all the findings, suggest that bailout policies lower default risk of domestic banking sector but at expenses of a higher default risk of the sovereigns.

How diabolic is the loop depends also on the way fiscal policy responds (Diniz et al. 2017). As seen before a default episode forces banks to deleverage leading to lower investments and lower output. On the other hand government needs to require higher taxes or lower government spending. Therefore, one of the main factors driving what happens to the economy is the fiscal response after the default.

Debt default can lead to either change (reduce) the amount of taxes required for debt repayment or allow for more government spending. The fiscal response following a sovereign default can differ in two dimensions: changes in different taxes and the post default amount of debt can evolve in different ways.

When there is a change only in lump sum taxes, say a fall, the debt fall (40%) and then recovers slowly and the debt among banks' assets drops on impact (50%). This is because banks are forced to deleverage because of the decline of their net worth and the leverage constraints. Capital prices decrease and private credit is reduced; this leads to a drop in investments. The drop in asset demand because of the massive sell increase spread of capital return over the risk free rate. The final result is a fall in the level of capital and output.

In the case of an increase in government spending, in the short run, the effect is pretty similar to that of the lump sum. However, around ten quarters the difference become pronounced. The increase in government spending following default reduces consumption and investments, contributing to worsen the loop. Investment reaches a fall of 10% and consumption of 5%.

Changes in labor and consumption taxes: lower income taxes cause workers to supply more labor. Pre-tax wages are lower but post-tax wages are larger and the lower labor cost is an incentive for firms to invest. Interest rates are larger in order to give an incentive to households to save, so the financial disruption is quickly offset by the effect of lower labor costs. Output goes up despite the initial drop in capital shock, household's utility increases in the long run so in general households are better off following the debt restructuring.

What we can say is that sovereign debt restructuring coupled with a change in labor taxes does not generate a diabolic sovereign bank loop because the fall in value of debt does not reduce banks' lending capacity.

In the case of consumption taxes the initial response of wages is pretty similar but a fall in consumption taxes reduces the incentives for savings hence decreasing deposits and investments. The combination of debt restructuring and consumption taxes leads to a fall in economic activity.

For what concerns taxes on capital income and banks, this increases capital accumulation and output. The fall in bank taxes leads to a positive effect on bank credit and have a positive effect on investments. Sovereign debt restructuring is better than an increase in taxes on bank's profits. Both in this case and in case of labor taxes, the deleterious effects of sovereign default on the banking system are more than compensated by the relatively lower taxes. The response of the economy is different in the short and long run. In the short run output and consumption react more strongly in case of labor taxes while in the case of deposits and banking taxes, investment is stimulated in the short-run but the output peaks only after 5 years. In terms of their effect on the sovereign-bank loop taxes on banks' profits and on deposits play very similar roles.

We can conclude that the benefits of a sovereign debt restructuring that avoids larger taxes on banks or on capital income appear mostly in the long run while debt restructuring in place of consumption taxes provides some short run boost to the economy but has significant negative effects in the long run. Sovereign default forces leveraged-constrained banks to deleverage, which has a negative impact on investment and output. As it turns out, different fiscal policy responses interact with this deleveraging effect in different ways: increasing government consumption crowds out investment, which prevents the economy from recovering in the medium run. Lower labor taxes raise the marginal productivity of capital and the demand for investment, which more than offsets the losses from financial disruption. Lower consumption taxes also raise the labor supply in the short run, but the stimulus for consumption crowds out investment and hence hurt the economy in the medium run. Lower taxes on banks offset the effect of default and affect marginal lending decisions, so the effect on investment is positive. Lower taxes on deposits affect the economy in a very similar way by reducing the costs of funds for investment.

Chapter 3

Solutions to the Loop

The events of the recent financial crisis shed light on the need of an improvement of the euro area financial architecture to make it less vulnerable to crisis. Within this need there is also the reduction of the effects of the feedback loop seen in the previous chapters.

The crisis confirmed that it is impossible to fully insulate the banking system from a distressed domestic sovereign. Increasing the international financial integration and thus the close links between banks and sovereigns imply that the global financial stability depends on fiscal conditions in each individual country. Advanced country governments need to try to move to implement credible strategies to stabilize and reduce the debt level. This will anchor the market views about sovereign risk and avoid negative spill overs on banks (Panetta 2011).

To avoid the effects of the loop there is the need for a separation of the solvency of central governments from that of domestic banking sectors through adequate regulation to reduce the systemic risk both for the national economy and the international financial system (Pockrandt et al. 2012)

The main contribution to the development of the loop and its effects came from the EU prudential regulation. In particular the decision to assign a zero risk weight to government bonds, as seen before, played a crucial role. The choice was made under Basel I because of the crucial role of sovereign bonds in the functioning of financial markets, with the aim to encourage the development of local bond markets and the desire to avoid interference with fiscal and monetary policies (Visco et al. 2016).

By giving strong preferential treatment to sovereign debt over bank loans, treating it as risk-free asset for purposes of capital charges and imposing no concentration limit on holdings, the regulation gave incentives to European banks to hold and accumulate more sovereign debt thus increasing their exposures to possible negative effect deriving from the lower creditworthiness of their domestic sovereigns. Banks were encouraged to invest in high-yield sovereign debt rather than lending to firms and households and strengthen the impact of sovereign stress on lending.

Possible solutions to weaken the effects of the loop could come from a better regulation of the banking sector and the creation of safe assets that can be used as an alternative risk-free asset to sovereign bonds.

In order to break the loop policy makers must remove one of the three ingredients saw in Chapter 1. They should drastically reduce the domestic bias of banks' sovereign exposures or find

ways through which governments can credibly precommit to abstain from bailing out distressed banks or finally impose controls on international capital flows to prevent the flight to quality by domestic sovereign debt holders and bank depositors at times of sovereign stress (Brummeneier et al. 2013). The last one of the proposed policy has been implemented mostly in Greece and Cyprus but only as an ex-post outcome of the extreme instances of the diabolic loop and not as an ex-ante policy to prevent the operation of the loop.

3.1 Regulation

What is important in terms of regulation is to alleviate the contagion between bank and sovereigns. What policy makers should do is to decrease the probability of contagion and, when contagion occurs, decrease the intensity of the risk spillovers.

Actions are thus necessary in three dimensions (De Bruyckere et al. 2013):

- Make banks more robust: for a bank is important the degree of capital adequacy and the reliance much on the money market funding. Capital and liquidity constraints must be more stringent and policymakers and supervisors should give incentives to bank to adjust their business model accordingly to these restrictions. Furthermore, being the asset holding channel one of the main important for the transmission of the contagion, there might be scope for concentration limits in sovereign bond portfolios in various dimensions.
- Make public finances more resilient and sustainable;
- Weaken the bank sovereign link.

Of much importance is also dealing with bankruptcies. Brunnemeier et al. (2011) propose two elements:

- A credible orderly bankruptcy procedure for the sovereigns that minimizes the risk of contagion;
- A Eurozone wide-bank resolution regime able to prevent contagion and protect European depositors.

Resolution mechanisms should be in place to deal with distressed banks.

The creation of the banking union is crucial to address the core linkages at the root of the doom loop because it ensures that future sovereign debt restructurings will not automatically trigger sovereign debt distress (Bénassy-Quéré et al. 2018).

In the long run capital market integration will be necessary to improve financial system's ability to absorb asymmetrical shocks. The bank sovereign vicious circle remains deeply present even after the encouraging early development of the SSM and SRM. Policymakers should accelerate the effort to de-risk the financial sector in particular by solving the problem of NPL and by reducing incentives for sovereign concentration risk by adopting also a European Deposit Insurance Scheme. Risk weights on all assets, including sovereign debt, should be allowed to

vary with realized risk (Ongena et al. 2016).

The shift from national bailout to bail-in in the handling of banking crisis, embodied in the BRRD legislation has in some way weakened the bank-sovereign loop, but it is far from having broken it. The main initiative should be to avoid that national governments use their domestic banking systems for non-commercial purposes of national economic policies. First of all is important to reduce home bias in banks' portfolios. Incentives to reduce concentrated exposures to specific sovereigns must be given. Suggestion could be to introduce "sovereign concentration charges" for those banks that hold sovereign exposures to any euro area country in excess of a threshold.

Useful could be also the creation of a European deposit insurance system that creates equal protection for all insured euro area depositors and precludes geographical ring fencing. It should be managed by a single authority at the European level and it must differentiate some elements across countries:

- Maintain incentives for governments by pricing country-specific risk in the calculation of insurance premiums;
- Losses should first be borne by the relevant national compartment of EDIS¹ while common funds can be tapped only in large systemic crisis which overburden one or more national compartments.

The banking union requires geographically diversified banking groups within the euro area. This cross border integration should not lead to an excessive size of the largest banking groups that would then benefit from a perceived "too big to fail status" (Bénassy-Quéré et al. 2018).

Attention must also be put on the interaction between the banking sector and government fiscal conditions (Panetta 2011):

- If the risk on sovereign debt remains high, authorities should closely monitor the interaction between sovereign risk and regulatory policies which provide banks with strong incentives to hold large amounts of government debt;
- Banks need to have strong capital bases;
- During a sovereign crisis authorities should ensure that there is sufficient transparency on bank's sovereign exposures.

Finally, authorities should monitor by mitigating the negative impact on bank funding:

- Bank supervisors and central banks with liquidity surveillance mandates could invest additional resources to improve their capacity to conduct stress tests that focus on the impact of a sovereign shock on the liquidity position of banks;

¹European Deposits Insurance Scheme

- Central banks might consider having flexible operational frameworks that allow them to supply funding to a diverse set of counterparties and accept a broad range of collateral during a crisis, to ease banks' immediate liquidity pressures;
- Sovereign debt management offices might consider changing operational aspects of their OTC derivatives transactions to mitigate the propagation of sovereign risk.

3.2 Lack of a Safe Asset

One of the main problems of European financial markets seems to derive from the lack of safe assets. Safe assets importance is related to the fact that the actual financial system relies heavily on them and they are also crucial both for private and public investors and for the ECB itself. Safe assets allow market participants to transfer risks, like liquidity or market risk, without creating new risks like counterparty credit risk (Brunnemeier et al. 2016).

A substantial part of the banks' balance sheet must be in safe assets, as defined by the financial regulators and many large classes of investors such as pension funds must hold a significant amount of safe assets in their portfolios. Also risky private investors need to park investments in safe vehicles. Finally, during the implementation of its conventional monetary policies the ECB should exchange money for safe bonds.

The most used safe assets are, by now, U.S. Treasury bills and bonds but Europe, despite having a large economy, developed financial markets and one of the world's reserve currency, does not supply a safe asset as the U.S. one. In the Eurozone, in fact, there is no safe asset that guarantees a pay-off at virtually any point in time and state of the world, including crisis (Brunnemeier et al. 2016).

In the absence of such a safe asset regulators and policy makers have treated euro area sovereign bonds as safe. Bonds such as those of Germany and Greece have been treated in the same way even though they were traded at widely different prices in the market. ECB have accepted all sovereign bonds of the member states in its discounting operations. The situation boosted the rise of the diabolic loop leading to the need for the creation of a safe asset that banks can hold without being exposed to sovereign risk.

By storing value in safe assets, rather than the risky sovereign bonds of the nation-state in which they reside, banks can avoid the effects of the diabolic loop between their solvency and that of their sovereign.

A union wide safe asset ensures that the flight to safety capital flows occur across assets rather than countries. In fact, another consequence of the lack of a European safe bond was that bonds of some European countries (centre) have satisfied the demand for safe assets causing, in crisis times, flows of capital from the periphery to the centre and, in boom phases, from the centre to the periphery. These two ways of searching for yield and searching for "safe" heaven caused large capital account imbalances in the euro area (Brunnemeier et al. 2011).

In 2016 European banks hold 1.9tn of euro sovereign bonds, many of which were risky. The

asymmetric provision of safe assets caused by the “flight to safety” created distortion and this was particularly pronounced in Europe because Germany supplies 83% of triple-A rated euro denominated sovereign debt (Brunnemeier et al. 2016). During the pre-crisis capital flowed from non-vulnerable countries to vulnerable countries as a consequence of the perceived relative abundance of investment opportunities and the absence of foreign exchange risk. As a result bond spreads were compressed and investors treated all euro area nation-states’ bonds as safe. In 2009 the short term capital flows started to reverse as the perceived risk that some euro securities might be redenominated in a different currency at a devaluated exchange rate rose. As a consequence borrowing costs for vulnerable countries increased. Flight to safety capital flowed from high-risk to low risk countries.

In order to solve this problem the main important solution proposed is that of the so called European Safe Bonds. These bonds will have all the characteristics of safety in order to let banks diversify their portfolios without relying too much on government bonds and will be able to prevent the flow of capital caused by the “flight to safety”.

3.2.1 European Safe Bonds (ESBies)

The main proposal for trying to solve the problems related to the lack of a safe asset is the creation of a European Safe Bond (ESBies) (Brunnemeier et al. 2011). This bond will be issued by a European debt agency in accordance with European treaties and it will have all three main characteristics:

- Liquidity;
- Minimal risk of default;
- Denomination in a currency with a stable purchasing power.

It will be liquid because these bonds will be traded in large volumes as they serve as safe haven for investors looking for a negative correlation with other yields.

It will be safe because it is designed to minimize risk of default and it will be issued in euros thus having the benefits of the ECB’s anti-inflation commitment.

ESBies will be freely traded on the market and will be held by banks, investors and central banks. By being combined with an appropriate regulation they will be able to solve the problem of the feedback loop and of the flight to safety.

Banks will be able to better diversify their portfolios by having an alternative to sovereign bonds which break the dependence from public finances.

Functioning

“ESBies are securities issued by a European Debt Agency (EDA) composed of the senior tranche on a portfolio of sovereign bonds issued by European states, held by that agency and potentially further guaranteed through a credit enhancement.” (Brunnemeier et al. 2011) More

specifically the EDA should buy the sovereign bonds of member nations according to some fixed weights with no possibilities of changing them as a response to any crisis, perceived or real. There is no room for the EDA to bailout a nation that have difficulties in placing its sovereign debt. The sovereign bonds bought will be taken passively as assets in the balance sheet and used as collateral to issue two types of securities (Figure 3.1):

- The first one would grant the right to a senior claim to the payments from the bonds held in the portfolio. A relatively large cut off threshold will be settled and losses under that threshold will not affect the bonds repayments. Furthermore the EDA by using some initial capital paid in by the member states will offer a further guarantee on the payment;
- The second security is composed of the junior tranche on the portfolio bonds. It will be sold to willing investors on the market. In contrast with the first security this will be risky because its expected return will reflect any risk that a state may fail to honour in full its debts. Any loss will be absorbed by the owners of the security and not by the EDA.

The tranching point into which the junior is subordinated to the senior is set accordingly to a pre specified standard. The suggestion is to set 70% represent by ESBies and 30% by EJBies (Brunnermeier et al. 2016)

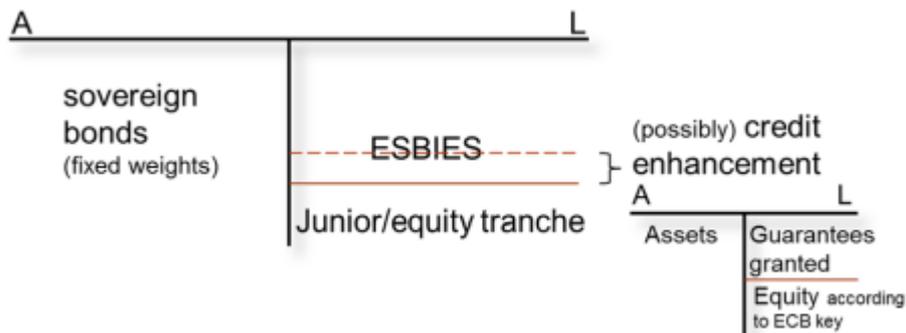


FIGURE 3.1: GRAPHICAL REPRESENTATION OF TRENCHING WITH POSSIBLE CREDIT ENHANCEMENT

Source: Brunnermeier et al. 2011

European banks, pension funds and the ECB would be a natural starting clientele for the ESBies and, as their reputation will grow; they could be used as Treasury Bills are used today and also as a reserve currency asset by non-member countries.

In order to be effective the ESBies depends on two regulatory changes:

- The ECB would grant direct preferential treatment to ESBies by accepting them as its main form of collateral in repo and discounting operations. The holdings of bonds will

thus be indirect through the ESBies. Of course it will only hold the safe tranche of the bond. In this way conventional monetary policies won't create credit risk and the ECB will have a safe balance sheet;

- Banking regulators would give a zero risk weight to ESBies but not automatically to the other sovereign bonds.

Benefits

The introduction of the safe bonds will have several benefits for the financial stability of the euro area.

- First of all the change in bank regulation, the appropriate risk weights and the ECB haircuts to sovereign bonds will eliminate the mispricing affecting the European sovereign bonds.
- Secondly the shift of bank portfolios from risk sovereign debt to safe ESBies will lead banks to still hold national bonds but only against the appropriate regulatory capital that their risk reflects. As ESBies give claim on the safest portion of the cash flow that is generated from a well-diversified portfolio of bonds, banks could avoid having huge exposures to national bonds which are at the basis of the diabolic loop between sovereign and banking crisis.
- The EDA will capture some of the “safe haven” premium that investors are willing to pay in exchange for the safety and liquidity of the asset, now taken by Germany on its sovereign bonds.
- The “flight to quality” will be shifted out of the junior tranche and into the ESBies rather than out of one European region and into another thus stabilizing portfolio of sovereign debt.
- ECB will benefit by conducting open market operation using ESBies that can be used as safe assets in exchange of money. The ESBies could also be used for unconventional monetary policies if they are exchanged for riskier securities.
- The safety of the ESBies does not rely on any particular government to extract resources by taxation;
- They require no change in European treaties.

Weights of the Portfolio

The objective is to assign a weight equal to the average weight of the country's GDP in overall Eurozone GDP making an average on the previous 5 years. The past average allow to avoid that a country suffers a terrible shock in a year falling into a recession with the need to borrow

abroad and causing the EDA having to reduce its holdings of that country's bonds potentially deepening the crisis. Finally it does not give an incentive to the sovereigns to trick the ESDA by inflating the provisional estimates of GDP as the final GDP numbers are usually only known with some delay. The detailed weights for country are depicted in figure 3.2.

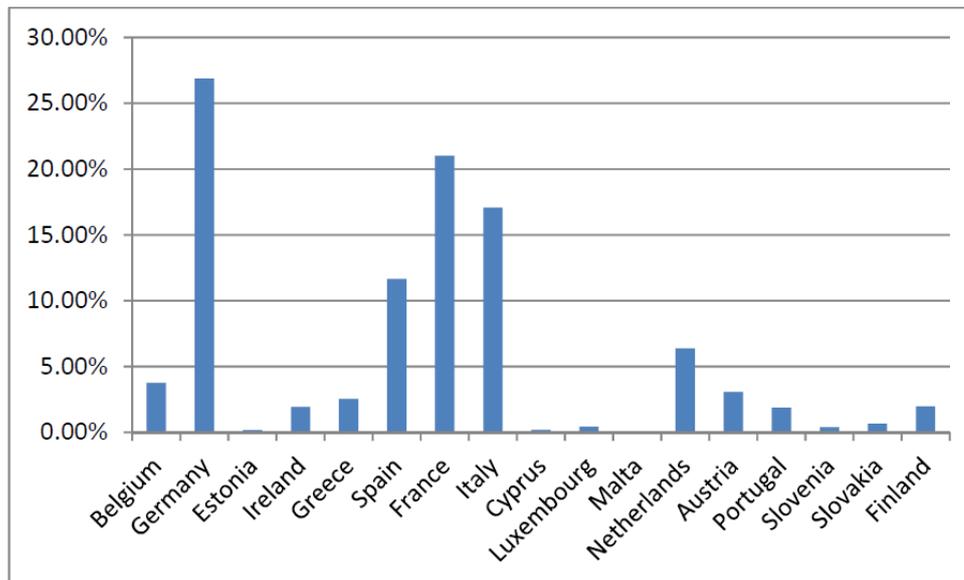


FIGURE 3.2: COUNTRY WEIGHTS IN THE ESBies

Source: Brunnemeier et al. 2011

Safety

The features ensuring the safety of the ESBies are three:

- **Diversification or pooling:** by pooling together different bonds it will be less likely that they will default all together at the same time. The expected losses in the overall pool are thus lower.
- **Trencing:** being the senior tranche of the bond portfolios ESBies are the first to get payed from the revenue of the bonds;
- **Credit enhancement:** it is provided by a public entity in order to avoid that private market parties by providing guarantees become too big to fail.

The creation of the ESBies will lead European countries to enter the more easily capital markets thus reducing the panic that is currently running the market. They will reduce the contagion between banks and sovereign risk and in the event of a collapse of the EMU project they will stabilize markets.

Chapter 4

Empirical Analysis

In this chapter, we present an empirical analysis of the link between sovereign and banking credit risk by using sovereign and banking CDS.

As we saw in the previous chapters the link between the credit risk of the sovereign and the banking credit risk can be a crucial element for the creation and development of the negative feedback loop with its negative effects on the economy. What we will do in this chapter is to find if there are evidences of this link in Italy and Germany and we will try to make a comparison between the two countries.

Our work is divided in two sections. The first one deals with the Italian case. We analyze the credit risk contagion in the country by dividing the data window in five sub-periods referring to some economic facts happened at the country level.

In the second part, instead, we make a comparison between Italy and Germany. Here we divide the data window in three sub-periods referring to some economic policy decisione taken by the ECB.

To conduct the analysis, we use CDS spreads as measures of credit risk.

The chapter is structured as follows: the first paragraph gives a general overview of the economic situation of the two countries in the data window, the second paragraph presents the data for both countries and the third gives a general graphical analysis for the two countries. The following paragraphs present the Italian case analysis and the comparison analysis. For both analyses we first made a preliminary graphical analysis and a summary statistics and finally an empirical analysis. The last paragraph concludes.

4.1 The Economic Situation: brief overview

Here we provide an overview of the economic situation of the two countries in the data window considered in our analysis. First, we decided to choose these two countries because of the big differences in their creditworthiness. Germany is the more stable country in the Eurozone while Italy because of the high debt and the political instability is perceived as a quite risky country. Because of this different economic situations the two countries were hit by the financial crisis and react to it in different ways. Furthermore as we saw in Chapter 2 in terms of sovereign credit risk Germany is defined as a “core” country, while Italy is a “periphery” country and this

leads to different behaviour of their financial sectors and to different levels of contagion and effects of the loop (Altavilla et al. (2015)).

4.1.1 Italy

Like in the majority of the European countries, the financial crisis of 2008 severely hit Italy. The main features of the Italian crisis were the already high level of public debt before the starting of the crisis, the limited GDP growth before the crisis and the poor credibility of the political class.

Starting from 2008, Italy experienced periods of stagnation and recession with losses on GDP and increasing public debt. In 2009 the global GDP decreased by 1.2% and Italy experienced a contraction of 5%¹. There was a slight recovery in 2010 with the GDP that increased by 1.7% but this did not coincide with an inversion in tendency.

From 2011 on, the GDP continued to decrease because of the recession that was hitting the country. In 2017, the Italian GDP was still 6² percentage points below its pre-crisis level.

The economic situation was reflected also in public finances causing a sovereign debt crisis. In 2011, the “spread” reached 500 points and the rating agency Standard Poors’ downgraded the country.

The Italian financial system was not affected too much because of the low international dimension of Italian banks. After the Lehman default and the contagion to the real economy of all the European countries, Italy saw a decrease in investments, income and consumption. This was particularly because most of the economies hit by the crisis were commercial partners of Italy. The increasing spread became a problem for the activity of the financial sector because Italian banks had a huge quantity of domestic bonds in their portfolios (60% of bond portfolios of the five major Italian banks were made of Italian sovereign bonds³). This caused a lack of credibility of the financial system causing banks to be undercapitalized and facing a huge liquidity risk. Meanwhile the public debt started to increase since 2008.

The main problems of the banking sector were not toxic products but their holdings of domestic debt. As we saw, the five major banks had 60% of their portfolios made of sovereign bonds. These exposures left the banking sector highly exposed to the credit risk of the sovereign. The share of banks’ assets consisting in Italian sovereign debt securities tripled from 3.5% in 2007 to 10.1% in 2013 and went up to 10.5% in June 2015⁴. The share in total securities went from 18.7% to 39.8%⁵. The government had to intervene in order to rescue some financial institutions. At the end of 2015 there was the resolution of 4 small banks (Banca Marche, Banca Etruria, CariFerrara and CariChieti) which costed 5.3 billion. In the middle of 2017, the rescue of Banca Monte Paschi with a public intervention of 5.4 billion and a private support of 4.3

¹Data taken from: “Relazione sull’economia e la finanza pubblica per il 2010”

²Data taken from: Panetta (2018)

³Data taken from: Il sole 24 ore (Pavesi)

⁴Data taken from: Affinito et al. (2016)

⁵Data taken from: Affinito et al. (2016)

billion⁶ and that of Veneto Banca and Banca Popolare di Vicenza with the help of Banca Intesa San Paolo and a cost of 11.2 billion⁷.

Today the banking sector is emerging from a prolonged period of distress. The lending to the private sector is growing since 2016 and the flow of NPL has been decreasing since 2014 (2% of total loans⁸). The holdings of domestic debt are decreasing since the pick of 2015 (120 billion⁹).

In 2017, the Italian economic growth strengthened considerably. GDP has been supported by domestic demand. The projections tell that the net international investment position will turn positive in three years from now.

After having increased by 30 percentage points since the start of the crisis, the debt to GDP ratio has remained broadly stable thanks to the increase in GDP growth and to persistent primary surpluses. Public debt remains high.

The banking sector is in a recovery phase with growing lending activity to the private sector since 2016 and the flow of NPL decreasing since 2014. Banks are selling large amounts of non-performing loans in the market: 30 billion in 2017 and other 25 billion expected for 2018. Improvement can be seen also on the liabilities side with declining funding costs and declining credit spreads over the others leading banks.

Important changes have been made also to the industrial organization of the banking sector. The reform of the mutual banking sector led more than 300m small cooperative banks to become part of the three largest banking groups.

4.1.2 Germany

As for all the other European economies, also Germany was hit by the recent financial crisis. In 2009 the German economy contracted by a 5%¹⁰ while there was a drop of 3.7% in the euro zone overall.

In 2008 the annual economic growth rate fell to 1% and in 2009 it became negative (-4.7%). Germany was an export dependent country and its GDP fell by a cumulative 6.6 percentage points over five successive quarters from the beginning of 2008 but then it bounced back to its pre-crisis level in the first quarter of 2011¹¹.

Although real GDP growth in Germany remained stable until 2008, German banks were among the first to suffer from the financial crisis mainly because of the substantial exposures to structured credit products originated in the US.

The main causes of the banking sector problems were (Hufner (2010)):

- The activities of the Landesbanken which benefitted from government guarantees without a proper business model;

⁶Data taken from: Il sole 24 ore (Carli)

⁷Data taken from: Panorama (Telara)

⁸Data taken from: Panetta (2018)

⁹Data taken from: Panetta (2018)

¹⁰Data taken from Ahearn et al. (2009)

¹¹Data taken from: Storm et al. (2014)

- Weak capitalization and high fragmentation of the whole banking system;
- Deficiencies in banking regulation and supervision.

In the short run substantial government intervention were fundamental for the stability of the system; as of August 2009, the volume amounted to 24% of GDP.

Two of the specialized private banks, Hypo Real Estate and Industrie-Kreditbank and the two big banks Deutsche Bank and Commerzbank experienced large losses. HRE, IKB and Commerzbank had to be rescued with government interventions. The recapitalization of Commerzbank was made in the middle of 2009 with an amount of 18 billion¹² while Hypo Real Estate was rescued and nationalized with an injection of 35 billion of liquidity¹³.

Only Deutsche Bank saved herself without government intervention (Behr et al. 2015).

The success and the recovery of the country was due to stimulus and bailout programs which include 480 billion to sustain banks and had an overall cost amount to 4% of GDP. From 2011 the GDP has started growing again, 2.2% in 2017¹⁴.

Today Germany has the strongest economy in the Euro area but despite this its banking sector is quite weak and this, as we saw has forced the government to intervene often to give support to its domestic banks. The total amount of help given to the financial sector amounts to more than 7% of the GDP from the beginning of the crisis in 2008 (Pavesi sole24ore 5 gen 2016). In general the banking sector has a problem of weak capitalization.

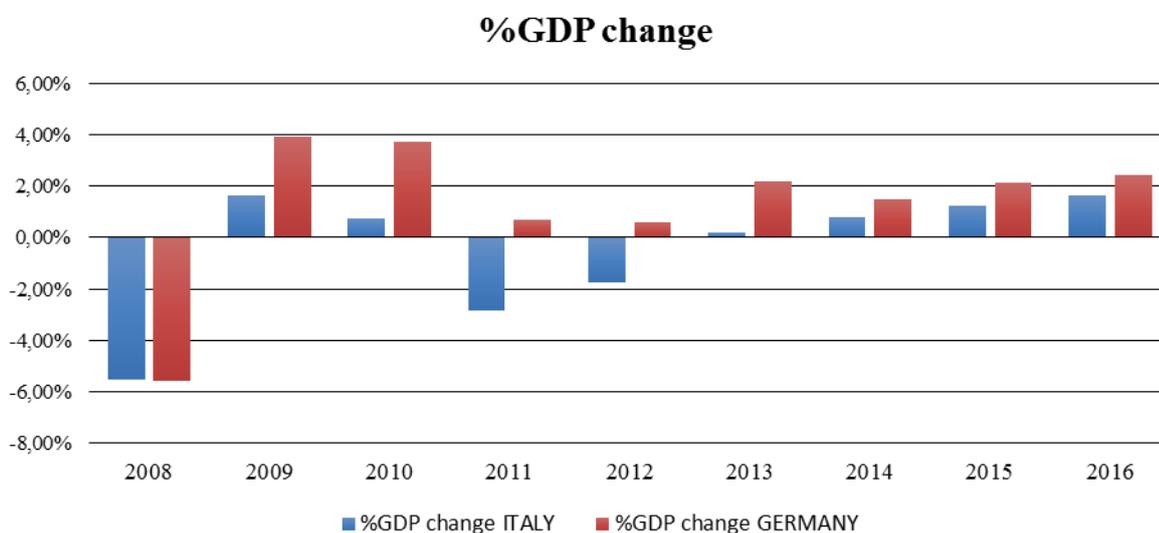


FIGURE 4.1: The figure shows the percentage GDP change for the two countries from 2008 to 2016. We can clearly see different trends between the two countries. Germany had a positive % change starting from 2009 while Italy experienced positive changes only in the last four years starting from 2013.

Source: Author's own evaluation

¹²Data taken from: Genner et al. (2009)

¹³Data taken from: Buder et al. (2011)

¹⁴Data taken from: statistisches bundesamt

4.2 Data

In order to develop the empirical analysis, the work focuses on a 10-year window of data which cover the financial crisis and the post-crisis period. Data go from 22 October 2008 to 22 October 2018.

To deal with the loop, we decided to use Credit Default Swaps (CDS) spreads.

CDS contracts are useful because they are bilateral agreements that represent a protection provided by the CDS seller to the buyer. The seller is committed to compensate the buyer in case of the occurrence of a pre-defined credit event. The buyer makes regular payments to the seller (CDS spread) and in return receives a compensation for his loss in case of a credit event. When a credit event occurs, the seller compensates the buyer for the loss by either paying the face value of the bond in exchange for the defaulted one (physical settlement) or by paying the difference between the post-default market value (determined by an auction procedure) of the bond and the par value (cash settlement). CDS differ from a typical insurance contract because: the party who buys the CDS do not necessarily have to hold the assets that create the risk exposure and because they are traded over the counter while insurance contracts are generally not traded. For the reason aforementioned CDS contracts are usually used as trading instruments rather than insurance instruments.

Given their structure, the CDS spread capture the credit risk of the underlying asset and CDS markets react quite instantly to changes in credit risk so the premium reflects market perceptions in real time. They are more effective than bonds in pricing default risk because; the latter represent also other forms of risk. Furthermore, the price of a CDS reflects the expected loss in case of default and so it is less influenced by other factors such as liquidity.

For these reasons CDS can easily been used to measure the mutual contagion in the credit risk of banks and sovereign.

We collected all CDS quotes from Datastream. As a measure of the risk, we will use the 5Y senior debt CDS contracts of the governments and the banking sector of the two countries. The choice of the 5Y CDS was made because they are known to be the most actively traded and therefore the most liquid ones.

For what concerns the bank CDS we constructed a pool of six of the major banks of the two countries whose data were available. We used an asset-weighted average of the banks by taking the data from the 2016 financial statements. The two pools are presented in the table.

According to the assets of each group we assigned a weight of 43% to Intesa, 36% to Unicredit, 3.5% to Mediobanca, 8% to MPS, 4% to BNL and 5.5% to UBI for the Italian pool. For the German one a 54% as been assigned to Deutsche Bank, 7% to Bayerische, 17% to Commerzbank, 9% to Landesbank Baden-Wuerttemberg, 7% to Norddeutsche Landesbank and 6% to Landesbank Hessen-Thuringen.

POOL OF BANKS	
ITALY	GERMANY
Banca Nazionale Del Lavoro	Bayerische Landesbank
Intesa San Paolo	Commerzbank
Medio Banca	Deutsche Bank
Monte dei Paschi	Landesbank Baden-Wurttemberg
UBI Banca	Landesbank Hesse-Thuringen
Unicredit	Norddeutsche Landesban k

TABLE 4.1: The table shows the two pools of banks taken as a representation of the banking sector of the two countries
Source: author's own evaluation

4.3 Preliminary Analysis

First we give a graphical representation of the CDS spreads considered in our analysis and we try to study the evolution of the banking and sovereign CDS of both countries. We start from the study of the whole period for both countries in order to have a general graphical overview of the data window considered.

Figure 4.2 shows the spreads of sovereign and banks CDS with 5Y maturity during the selected period from 22 October 2008 to 22 October 2018. The blue line represents sovereign CDS while the red one represents the asset-weighted average of banks CDS.

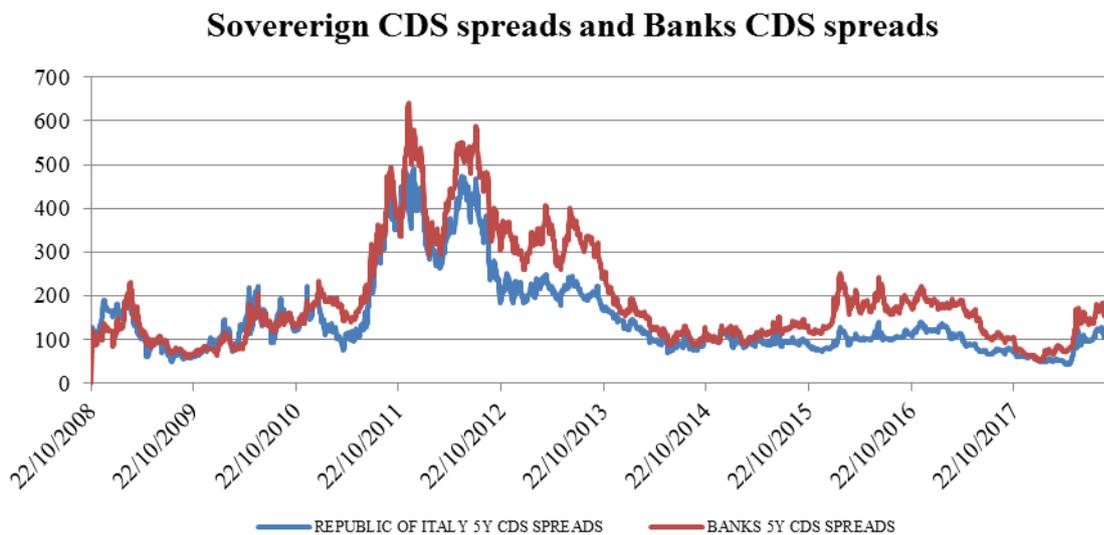


FIGURE 4.2: The figure shows the spreads of sovereign and banks CDS with 5-year maturity for the period 22/10/2008 to 22/06/2018. The blue line represents the sovereign CDS spreads. The red line represents the banks CDS which are computed as the asset weighted average of the CDS spreads of the six Italian banks within the selected pool.

Source: Author's own evaluation

From the figure, we can easily identify a co-movement of the two CDS series. The two lines

show a similar path suggesting that there could be a link between the two risk represented by CDS.

There is quite stable trend at the beginning of the sample with a slight increase during 2008 because of the start of the financial crisis and the Lehman Brothers default. A slight recovery can be seen in the following two years. The situation worsened on 2011 with the intensification of the crisis and the start of the sovereign debt crisis. Both sovereign and banks CDS increased sharply, this coincides with the worst period for the country with the spread reaching its maximum value (500 points) and a political instability due to the resignation of Silvio Berlusconi and the following Monti's government.

The high level of the CDS reflected the high level of sovereign credit risk of that moment which coincided with a downgrade of the country from the rating agencies. A slight recovery can be seen from 2013 with both CDS returning gradually to their pre-crisis levels.

From 2015 we can see a divergence of the two series as a sign that something could have reduced the link between the two CDS series. We can see a kind of turmoil in the banks CDS series around 2016 probably due to the bailout of Banca Marche, Banca Etruria, CariFerrara and CariChieti (5.3 billion) and around 2017 with the bailout of Veneto Banca and Banca Popolare di Vicenza and the recapitalization of Banca Monte dei Paschi.

If we look more deeply at the figure, we can see that the two lines overlap and cross each other. At the beginning of the sample the two CDS spreads are quite at the same level with the sovereign ones that are quite higher. This can be a clue of the link between the two credit risk. At the beginning the major risk was that of the sovereign with the value of the bond decreasing because of the higher spread and the high level of public debt of the country. When the sovereign debt crisis erupted, we can see a cross between the two lines with the banks CDS that became higher. This was probably due to the transfer of the risk from the sovereign to the banks due to the home bias of banks portfolios which decreased their value as a consequence of the deterioration of the creditworthiness of the country and the subsequent decrease of the value of the government bonds.

Figure 4.3 presents the same data for Germany. The blue line represents sovereign 5Y CDS spreads while the red one represents the asset-weighted average of banks 5Y CDS spreads.

First, we can see that both values of sovereign and bank CDS spreads are much lower than the Italian ones. This reflects the different perception of the riskiness of the two countries. What can be easily seen from the figure is that the Banks CDS are above the sovereign CDS spreads during the whole period. This gives evidence to the fact that, as we saw before, the German banking sector, despite the strong economy of the country, presents many weaknesses and this is reflected in the high credit risk perception of the investors.

The two series follow quite a different path.

Sovereign CDS have a more regular trend without great shocks. There is an increase in the values at the beginning of the sample due to the rescue of the Hypo Real Estate bank at the end

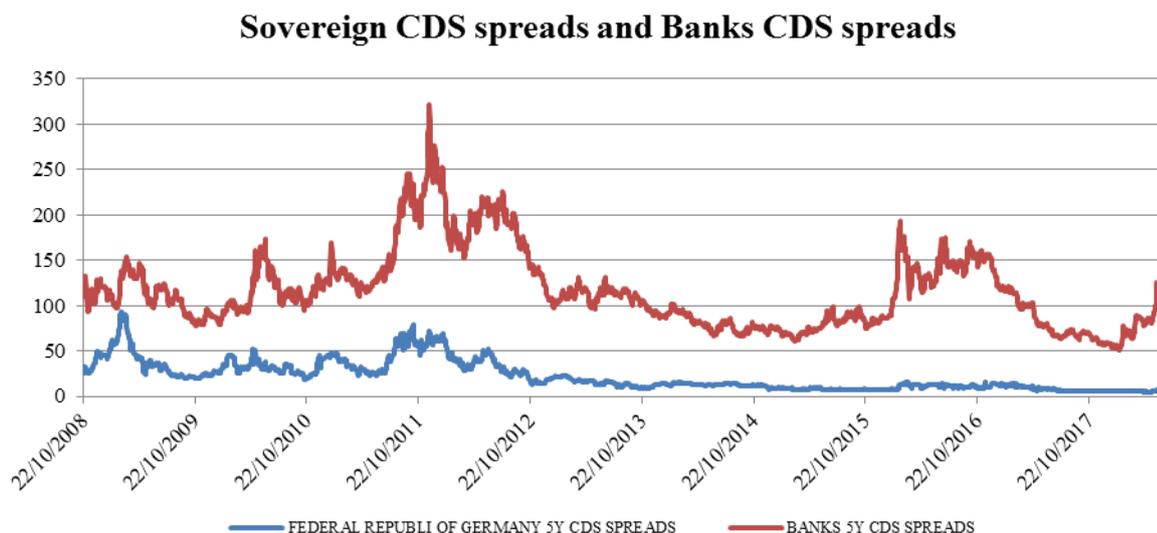


FIGURE 4.3: The figure shows the spreads of sovereign and banks CDS with 5-year maturity for the period 22/10/2008 to 22/06/2018. The blue line represents the sovereign CDS spreads. The red line represents the banks CDS which are computed as the asset weighted average of the CDS spreads of the six German banks within the selected pool.

Source: Author's own evaluation

of 2008 and the stimulus package for the economy and the recapitalization of Commerzbank at the beginning of 2009. The path then is almost constant in the following years with an increase in 2011 due to the sovereign debt crisis. From 2012 starts a recovery phase with a declining trend as a consequence of the solidity of the creditworthiness of the country.

For what concerns the banks CDS, we can see an unstable general path. The initial trend as we saw was due to the rescue of Commerzbank and Hypo Real Estate.

From 2010 we can see an increasing trend with a sharp rise in the value following the sovereign debt crisis.

A recovery phase started in 2012 with a stable path until the beginning of 2016. Here the turmoil is probably due to the crisis of Deutsche Bank which lost value on its shares since 2015 and received a downgrade from Standard Poor's Global Ratings in the middle of 2016. Deutsche bank as we saw represents a big percentage weight in our pool of banks because of its dimensions so a shock in its CDS levels causes an increase also in the pool level.

The preliminary analysis just presented gives a primary picture of the differences between the two countries. On one hand, Italy presents greater values of both bank and sovereign CDS because of the greater riskiness of the country. The difference as we could expect is more evident for the sovereign bonds and it is clearly the situation described by the "spread" with Germany perceived as a low risk country.

For the banking sector, the difference is not so marked and this suggests that despite the sovereign stability of the country, the German banking sector is not stable as well and this could be a starting point for the contagion of the two credit risks.

In general we saw that the comovement of the two lines is more evident in Italy and this could suggest that we can expect the link between sovereign and banking credit risk to be greater in Italy than in Germany where the sovereign has a low risk level.

4.4 Contagion in Italy

In this section we provide an analysis of the contagion between sovereign and banking risk in Italy. Within the 10-years time horizon we identify 5 economic events that could have influenced credit risk in the country:

- PERIOD 1: from 22/10/2008 to 15/11/2011. This period goes from the post Lehman Brothers default to the nomination of the Monti's government;
- PERIOD 2: from 16/11/2011 to 26/04/2013. The period covers the duration of the Monti's government;
- PERIOD 3: from 29/04/2013 to 23/06/2016. This is the period of bailouts, it includes the resolution of Banca Marche, Banca Etruria, CariFerrara and CariChieti, the rescue of Veneto Banca and Banca Popolare di Vicenza and the recapitalization of Banca Monte dei Paschi di Siena;
- PERIOD 4: from 24/06/2016 to 01/06/2018. The period goes from the rescue of the banks to the election of the Conte's government;
- PERIOD 5: from 04/06/2018 to 22/10/2018. The period relates to the first 5 months of the Conte's government.

First of all, we provide a graphical analysis of each of the 6 periods.

Figure 4.4 shows sovereign and banks CDS in the first period. The period goes from the post default of Lehman brothers to the begin of Monti's government. As we can see, at the beginning of the period both CDS levels were pretty low and show a common path. There is an initial increasing trend as a consequence of the Lehman Brothers default but then the two CDS levels seemed to have recovered until the beginning of 2010. This suggests that a real credit risk problem was not in place.

When in 2010 the effects of the financial crisis started to become greater and in 2011 the sovereign debt crisis erupted both banks and sovereign CDS began to increase. A credit risk problem for the country arose from both the government perspective and the banking one.

This change of trend may have facilitated the surge of a contagion between the two risk in fact we can see that the two levels of CDS comoves before and after the start of the crisis.

Period 2 (Figure 4.5) covers the duration of Monti's government. The nomination of the new government took place during the most severe period for the country with the spread reaching

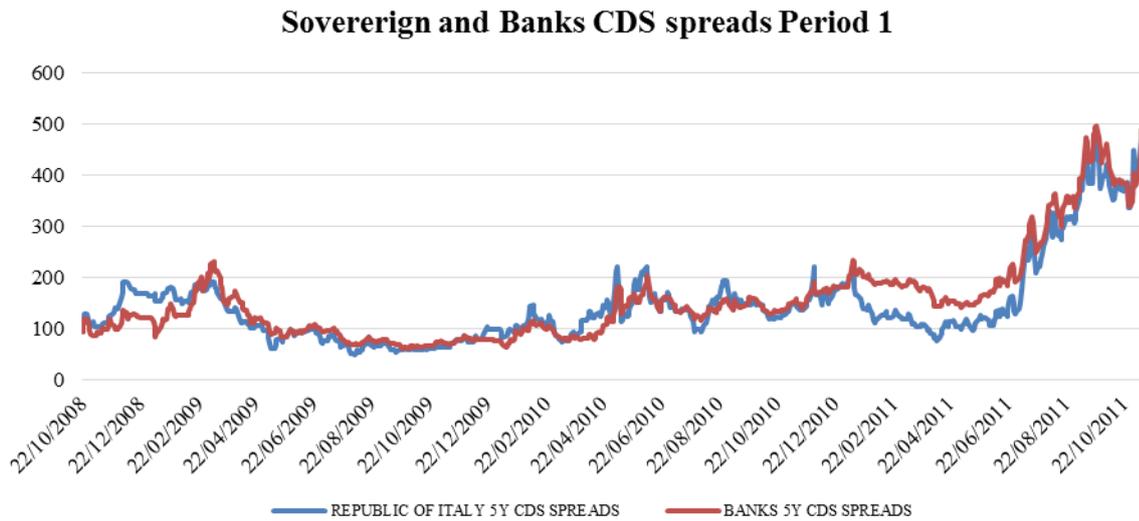


FIGURE 4.4: The figure shows the spreads of sovereign and banks CDS with 5-year maturity for Period 1. The blue line represents the sovereign CDS spreads. The red line represents the banks CDS which are computed as the asset weighted average of the CDS spreads of the six Italian banks within the selected pool.

Source: Author's own evaluation

is highest value at 500 points. Therefore from figure 4.5 we can see that at the beginning both CDS level has high values which remains high during the whole period. Despite that, a general declining trend can be seen for both sovereign and banking credit risk as a consequence of the austerity measures ("decreto salva Italia") taken by the government in order to reduce public expenditure and gain the trust of international investors. At the end of the period even if the values remain still high we can see a kind of stabilization of the two risks.

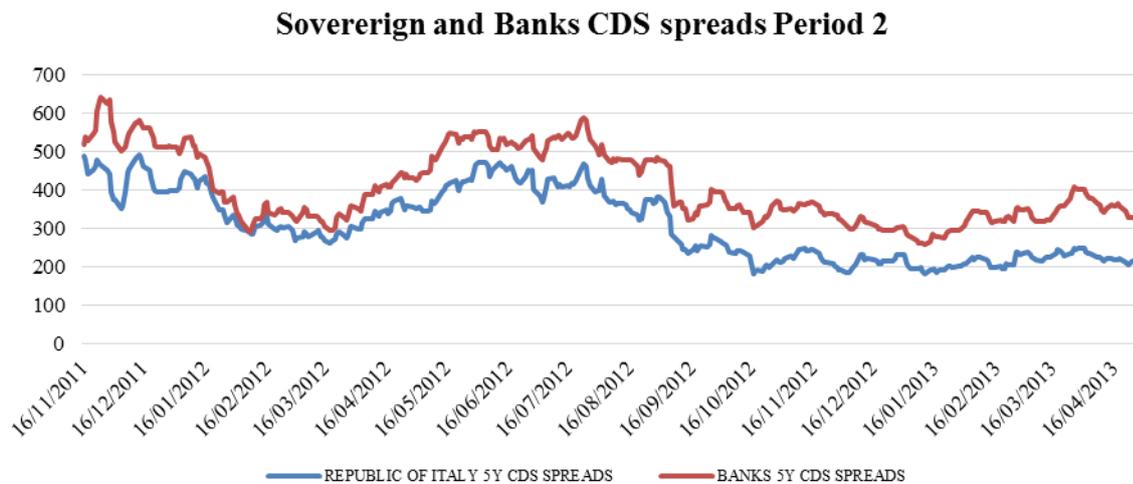


FIGURE 4.5: The figure shows the spreads of sovereign and banks CDS with 5-year maturity for Period 2. The blue line represents the sovereign CDS spreads. The red line represents the banks CDS which are computed as the asset weighted average of the CDS spreads of the six Italian banks within the selected pool.

Source: Author's own evaluation

In period 3 (figure 4.6) we can see that after an initial upsurge there is an overall declining trend for both CDS. This suggests that the austerity measures of the government were effective in reducing the risk of both sovereign and the banking sector. The two lines follow a quite common path suggesting that a link between the two risks is still in place.

The two lines also overlap in some moments suggesting that a transfer of risk could have happened between the two entities. At the end of the period we can see a slight increase in banks CDS.

In the last part of the period in fact Italy experienced the bailout and the recapitalization of some financial institutions. In 2016 the initial increase in the banking sector CDS spreads is due to the resolution of 4 banks (Banca Marche, Banca Etruria, CariFerrara e CariChieti). The CDS level of the banking sector remains high also in 2017 as a consequence of the rescue of Veneto Banca and Banca Popolare di Vicenza and the recapitalization of Banca Monte dei Paschi di Siena. The trend is quite increasing especially for banks CDS as a reflection of the turmoil of the financial sector which has culminated with the rescue operations of the banks. Here we expect the contagion between the two risks to have become stronger as we can see that the two CDS series comove especially in the initial and in the last part of the period.

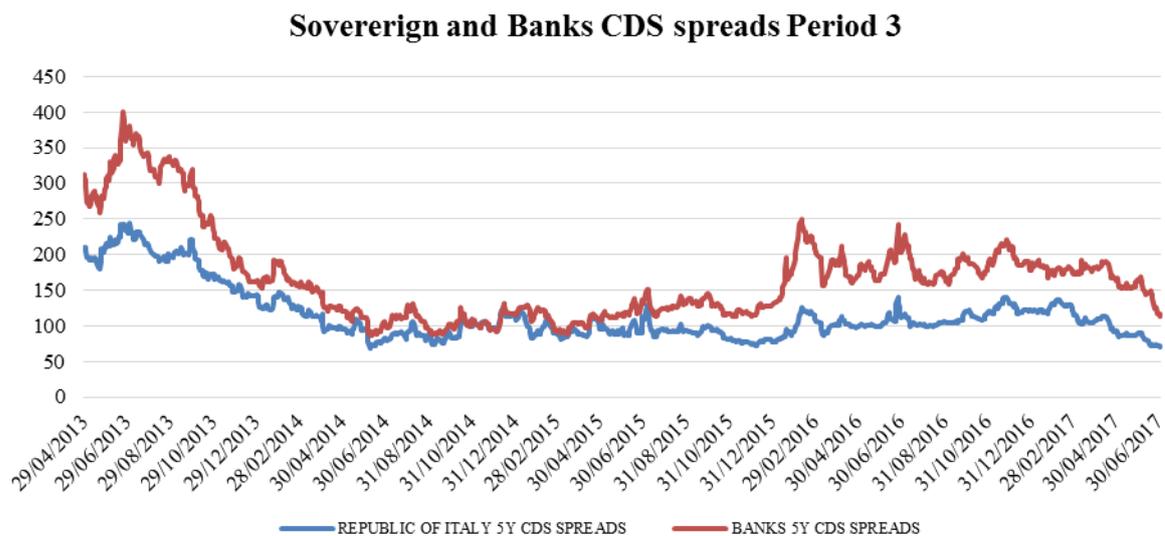


FIGURE 4.6: The figure shows the spreads of sovereign and banks CDS with 5-year maturity for Period 3. The blue line represents the sovereign CDS spreads. The red line represents the banks CDS which are computed as the asset weighted average of the CDS spreads of the six Italian banks within the selected pool.

Source: Author's own evaluation

Period 4 goes from the recapitalization of Monte dei Paschi to the beginning of Conte's government. In figure 4.7 we can see that after the bailout operations in the banking sector both sovereign and bank CDS have a stable quite declining trend until the middle of the period. The declining trend is much more visible for the banking sector in fact the two lines overlap each other at the beginning of 2018. This suggests that the rescue operations helped reducing the risk

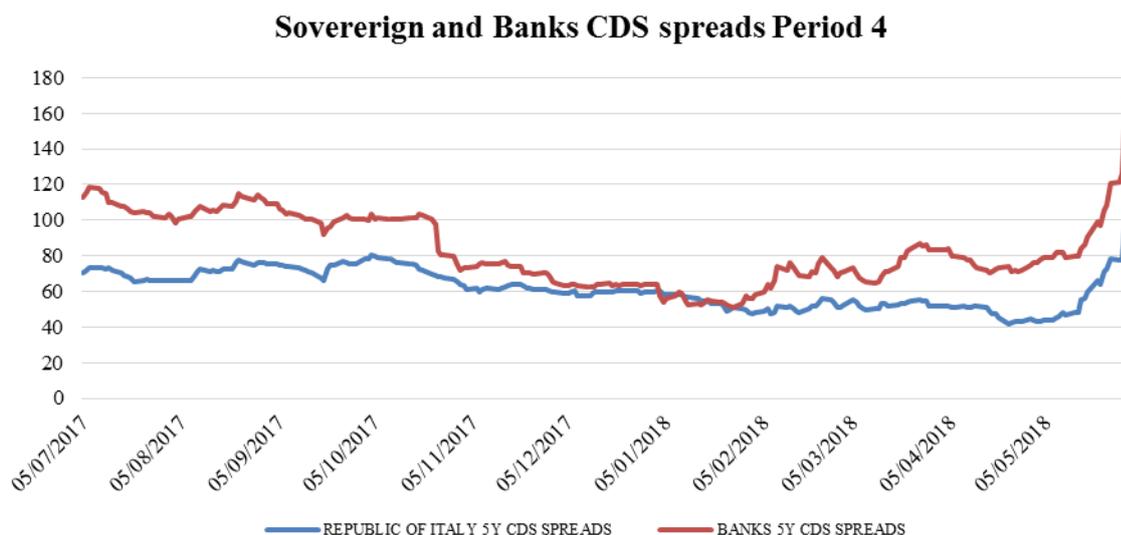


FIGURE 4.7: The figure shows the spreads of sovereign and banks CDS with 5-year maturity for Period 4. The blue line represents the sovereign CDS spreads. The red line represents the banks CDS which are computed as the asset weighted average of the CDS spreads of the six Italian banks within the selected pool.

Source: Author's own evaluation

on the banking sector but as the level of sovereign CDS does not decline in the same way maybe some of the risk has been transferred from the banking to the sovereign as a consequence of the rescue operations aforementioned. Especially in the case of Banca Monte dei Paschi government guarantees played a crucial role and this could have caused a transfer of the risk.

At the beginning of 2018 we can see that both level of CDS started to increase probably as a consequence of the political instability due to the end of Gentiloni's government and the following elections that took place in March 2018. Because of the elections and the reinforcement of an anti-Europe current of thought in the country the stability of the country was compromised also because of the negotiations of the "contratto di governo". This political uncertainty is reflected in the rise of both CDS as long as we approach the nomination of the Conte's government.

Finally, the last period covers the first 5 months of the Conte's government. We can see from Figure 4.8 a slight increasing trend in both the curves probably due to the speculation to the possibility of an exit of the country from the European Union.

The path is more increasing in the final part of the period as a consequence of the discussion upon the "Documento di Economia e Finanza" which gave a rise in the spread level with German 10Y Bunds and increased the riskiness of the country. During the overall period we can see that the two lines comove so we can expect that the contagion between the two credit risk is still in place and may have increased with respect to the previous periods.

The graphical analysis just made shows that in quite all the periods considered the two CDS series present a comovement suggesting that a link between the two risks is in place. In particular from the empirical analysis we expect lower connection in the first period and an increase in

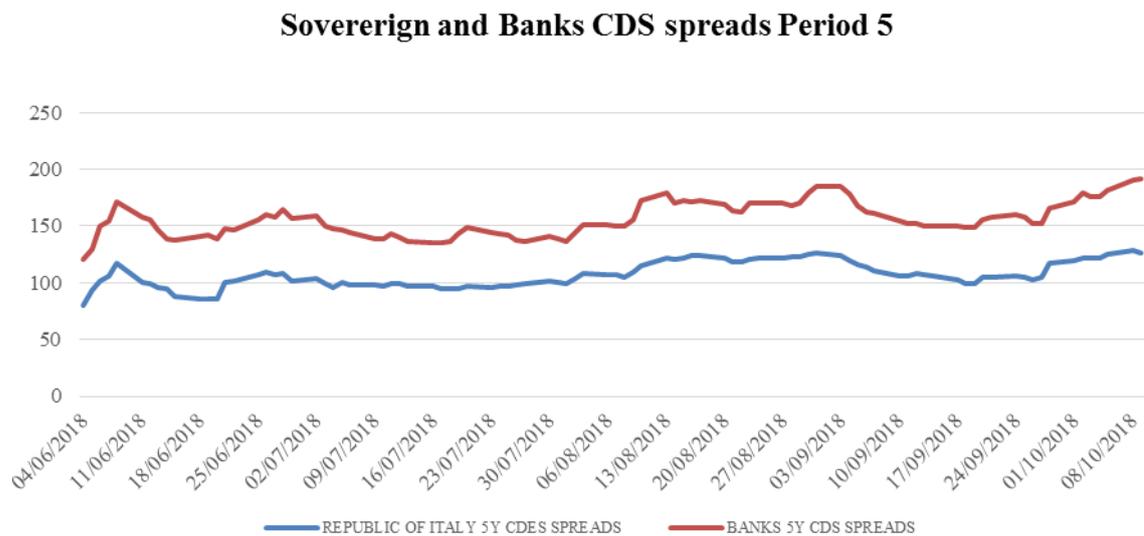


FIGURE 4.8: The figure shows the spreads of sovereign and banks CDS with 5-year maturity for Period 5. The blue line represents the sovereign CDS spreads. The red line represents the banks CDS which are computed as the asset weighted average of the CDS spreads of the six Italian banks within the selected pool.

Source: Author's own evaluation

the other periods starting from the sovereign debt crisis. Especially in the last period in which the political instability has increased the level of the spread we should find an increase in the strength of the link.

In the following sections we will present the empirical analysis in order to find if there are evidences of what we have said in the graphical analysis.

4.4.1 Empyrial Analysis

We now present the regression analysis in order to find evidences of what we said in the preliminary graphical analysis.

Based on the model used by Caporin et al. (2017) we estimate all the regression in the data sample on a daily basis in order to have a large and significant dataset. We tested the presence of a contagion between sovereign and banking credit risk.

To do so we verify whether changes in banking credit risk affects significantly sovereign credit risk. More specifically we test if a variation on the daily change in the logarithm of banks CDS spreads has a significant effect on the daily change in the logarithm of sovereign CDS.

Moreover, following Caporin et al. (2017) we add in the model a set of controlling variables of some international risks.

First, we include Euro Stoxx 50 Index and the Euro Stoxx 50 Volatility Index (VSTOXX), then we controlled also for Oil price (OIL) and the liquidity risk in the money market (LIQ). The liquidity risk is computed as the difference between the 1-month Euribor and the Repo spread. Finally, as European banking systems are quite connected we control also for European banking

sector daily CDS spreads.

All Data are taken from DATASTREAM.

Our work is divided in two sections. First we run a linear OLS regression analysis on the data and then, to provide more evidences of what we found with the linear approach, we use also the non linear approach of the quantile regression.

Before presenting the results of the two regression analysis we provide a summary statistics.

Summary Statistics

Here we provide a summary statistics for the data of each period selected for the analysis. Results are presented in table 4.2.

We have 2609 observations for each variable. More specifically we have 800 observations for the first period, 378 for the second, 1092 for the third, 238 for period 4 and 101 for the fifth and last period.

If we look at the numbers we can see that sovereign CDS are high in the first two periods as a consequence of the sovereign debt crisis. On the other hand domestic banks CDS are higher in the second and third period. European banks CDS instead show high levels in the first two periods.

From a general point of view we can see that the levels of the three variables of interest are quite high in the first three periods as a consequence of the financial crisis while they generally decrease in the following two periods.

Linear Regression Results

Now we present the first part of the analysis, which consists of a multiple linear regression of the model presented before by using the OLS estimator with robust standard errors.

The regression function is the following:

$$\Delta \log(ITA_t^i) = \alpha_i + \beta_{j,1}^i \Delta \log(ITABanks_t) + \beta_{j,2}^i \Delta \log(EUBanks_t) + \beta_{j,3}^i \Delta \log(STOXX_t) + \beta_{j,4}^i \Delta \log(VSTOXX_t) + \beta_{j,5}^i \Delta \log(LIQ_t) + \beta_{j,6}^i \Delta \log(OIL_t) + u_t$$

Where the dependent variable ITA is the change in the natural logarithm of Italian government CDS from day t to $t+1$ while the explanatory variable of interest ITABanks is the change in natural logarithm of CDS in the pool of banks built by the author from day t to $t+1$.

The parameter of interest is thus β_1 and it shows the relationship between the daily change in sovereign CDS and domestic banking sector CDS spreads. The other controlling variables express the daily change in the logarithm of each of the index described above and they are useful to control for other type of international risks that could have affected the sovereign credit risk. Of a kind of interest is also the coefficient β_2 since it gives the relationship between daily change

Period 1	Obs.	Mean	Std. Dev.	Min	Max
ITA	800	146.584	84.938	48	498.659
ITABanks	800	156.245	91.096	60.048	517.071
EUBanks	800	242.383	82.124	123.136	489.483
STOXX	800	2641.467	279.701	1809.98	3068.002
VSTOXX	800	31.465	10.776	18.36	76.54
LIQ	800	-0.263	0.275	-0.675	0.863
OIL	800	80.837	23.342	33.73	126.64
Period 2					
ITA	378	308.842	90.928	182.919	491.409
ITABanks	378	406.181	93.111	259.445	642.191
EUBanks	378	382.089	83.411	254.106	552.179
STOXX	378	2455.253	175.707	2068.664	2749.273
VSTOXX	378	24.231	5.737	14.86	41.21
LIQ	378	-0.523	0.207	-0.777	0.14
OIL	378	110.990	7.304	88.69	128.14
Period 3					
ITA	1092	115.861	38.291	69.25	244.6
ITABanks	1092	168.143	65.105	85.485	399.987
EUBanks	1092	154.144	45.664	85.246	291.177
STOXX	1092	3172.909	262.788	2511.828	3828.784
VSTOXX	1092	20.633	4.949	11.16	40.8
LIQ	1092	-0.2175	0.153	-0.638	0.29
OIL	1092	70.304	28.264	26.01	117.15
Period 4					
ITA	238	61.694	1.123	42.039	107.93
ITABanks	238	83.977	20.438	51.308	169.232
EUBanks	238	78.002	12.871	41.121	103.491
STOXX	238	3512.016	88.924	3278.715	3697.4
VSTOXX	238	14.749	3.3936	10.68	34.74
LIQ	238	-0.370	0.001	-0.374	-0.366
OIL	238	62.970	8.430	46.47	80.42
Period 5					
ITA	101	108.754	12.505	80.519	134.47
ITABanks	101	159.117	18.927	120.805	209.128
EUBanks	101	98.479	5.744	85.064	109.669
STOXX	101	3407.001	77.467	3194.407	3527.176
VSTOXX	101	14.854	1.999	11.44	21.24
LIQ	101	-0.370	0.001	-0.372	-0.368
OIL	101	76.127	4.146	68.38	85.16

TABLE 4.2: Summary Statistics - Italian Analysis

in sovereign CDS and daily change in the European banking sector CDS.

$j=1,2,3,4,5$ refers to the five periods considered and u_t is the error term.

In support of the hypothesis that a link between the two credit risks does exist we should find a statistically and economically significant effect of our explanatory variable of interest ITABanks on the dependent variable or at least an effect of the EUBanks variable, which gave the effects of the European banking sector.

Results of interest are presented in table 4.3. The whole results of the regression are available in Appendix A.

LINEAR REGRESSION					
	Period1	Period 2	Period 3	Period 4	Period 5
ITABanks	0.494*** (4.69)	0.679*** (8.46)	0.556*** (11.67)	0.664*** (4.35)	0.913*** (7.40)
EUBanks	0.625** (2.96)	0.076 (1.61)	0.012 (0.94)	0.021 (0.83)	-0.043 (-1.29)

TABLE 4.3: The table shows the results of the OLS estimation of the model. Only the two variables of interest are presented with the coefficient for each period and the related value of the *t-test* for the significance of the coefficient.

t statistics in parentheses: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Source: author's own evaluation

First, we can see that, as we expected, coefficients of the variable ITABanks are statistically significant in each period. This is an evidence of the presence of a contagion between the two credit risks.

In particular starting from the first period we can see that the coefficient of the Italian banking sector is significant at a 1% level, a 1% change in the daily CDS of Italian banks corresponds to a 0.49% change in Italian daily sovereign CDS. Here also the coefficient of EUBanks is significant meaning that before the start of Monti's government and more specifically of the sovereign debt crisis, there was a comovement of the sovereign credit risk with both the domestic banking sector and the European banking sector.

Starting from the second period with the intensification of the sovereign debt crisis the link became stronger and bigger. During Monti's government a 1% change in banking daily CDS was followed by a 0.67% basis points change in sovereign CDS. From this period on the coefficient of the European banking sector became no more significant so, from the surge of the sovereign debt crisis, sovereign credit risk became much more connected with the domestic banking sector and the comovement with the European one stopped.

The coefficient of ITABanks decreased a little in the third period after Monti's government. Probably the austerity measures helped to stabilize both CDS and reduce the strength of the link. During the bailout period in fact the coefficient is still significant but has a slightly lower

value. A 1% change in Banking CDS causes a 0.55% change in the sovereign ones. EUBanks coefficient is still not significant.

Probably because of the interventions to rescue the banking sector in the fourth period the coefficient is higher (0.66) meaning that, as suggested by the graphical analysis, these operations caused a transfer of risk from the banking to the sovereign sector reinforcing the link between the two credit risks. Especially for the recapitalization of Monte dei Paschi in fact government guarantees played a crucial role and this could have been a factor for the increase in the strenght of the link.

Finally, in the fifth period after the election of the new government the coefficient is still positive and statistically significant, a 1% change in daily Banking CDS is followed by a 0.9% change in sovereign CDS. The contagion is thus still in place and has increased. In this period in fact because of the proposal of the government to increase the deficit in the sovereign debt to 2.4% as declared in the "Documento di economia e finanza" and the discussions upon the possibility of an exit from the monetary union of the country, the spread has increased (300 basis points) and the trust of international investors has decreased causing a deterioration in the creditworthiness of the country and thus an increase in both CDS series as we saw in the graphical analysis. These facts could have caused a reinforcement of the link between the two risks with the banking sector more exposed to changes in sovereign credit risk and vice versa.

In general we can see that the coefficient of the banking sector is statistically and economically significant in all the five periods meaning that the link between sovereign and banking credit risk has been in place from the very beginning of the financial crisis, after the Lehman Brothers default, and it is still in place now.

The link reinforced with the outbreak of the sovereign debt crisis, decreased after the austerity measures of the Monti's government and then increased again after the banks bailout and especially in the last period after the election of the Conte's government.

Starting from a value of 0.49 in the first period the coefficient reached a 0.91 in the last one showing that the link is still in place and is becoming stronger, this could be an element for the development of the diabolic loop between the sovereign and the banking sector seen in the previous chapters.

Quantile regression - Theoretical Aspects

The main advantage of using quantile regression is that it is a powerful way to investigate possible parameters instability. In fact co-movements between variables can be different in crisis times than in more normal periods. Operations such as banks bailouts or recapitalization happen during turmoil periods characterized by extreme market conditions so the results found with the linear regression of our analysis, which covers the sovereign debt crisis and the post phase, can be biased. Indeed, during periods of turmoil response variables are subject to extremely large realizations (Caporin et al. 2017).

In our analysis we are interested on the significance and the value of the parameters β_1 and β_2

especially before and after some specific economic events. We are interested on changes that occur to the coefficient and in particular if they are greater or lower before and after the event. Usually these events have implications on the size and the sign of the shock, the quantile regression allows for a flexible conditioning. It conditions the regression to large, small, positive, and negative shocks and it is implicitly testing conditional on a large and varied set (Caporin et al. 2018).

The linear approach estimates are related to the stability of the parameters so this estimation approach suffers from parameters instability for reasons extraneous to a change in the underlying coefficient. The linear model could in fact suffer from endogeneity, omitted variables bias or the relationship between the variables could be itself unstable, thus non-linear so that the transmission of larger shocks could be different from that of lower shocks. In all these cases the instability of the OLS estimates could be wrongly interpreted in favour of the contagion between the two risks. Quantile regression is robust to such an error (Caporin et al. 2018).

Quantile regression, which is a non linear approach, allows us to test for different impacts of the explanatory variables across quantiles of the dependent variable so we can see if the results of the OLS regression are biased as a consequence of different effects of the variables in the different quantiles. In order to verify this we simply run some hypothesis test on the coefficient of different quantiles obtained by the quantile regression estimation.

If we start from a simple model as the one presented by Caporin et al. (2018):

$$y_{i,t} = \beta y_{j,t} + w_t$$

where $y_{i,t}$ is the dependent variable, $y_{j,t}$ is our variable of interest and w_t represents all the other lagged control variables of the model. β is the parameter of interest.

The quantile regression evaluate the linear coefficient β conditionals on the different realizations of $y_{i,t}$ and investigates whether they are different across those realizations, in particular in the presence of large or small realizations.

When considering QR, we model the quantiles of the conditional distribution of $y_{i,t}$, given the knowledge of $y_{i,t}$. Second, if the relationship between $y_{i,t}$ and $y_{j,t}$ is estimated as a linear regression with time invariant innovation term, the relationship for the quantiles is also linear (Caporin et al. 2018). Precisely, the quantiles will be:

$$y_{i,t}(\tau) = \beta_{\tau,0} + \beta_{\tau,1} y_{j,t} + F_{w_t}^{-1}(\tau)$$

where $\beta_{\tau,0}$ is the intercept, τ is the quantile of interest, $y_{i,t}(\tau)$ is the τ -quantile of the conditional distribution of $y_{i,t}$ and $F_{\tau}^{-1}(W_t)$ is the unconditional quantile of the innovation density. Of course the coefficients in the linear quantile model are quantile-depedent.

When the model is truly linear for all realizations of $y_{i,t}$, so the model is truly:

$$y_{i,t} = \beta_0 + \beta_1 y_{j,t} + w_t$$

for any quantiles of $y_{i,t}(\tau)$, then the two coefficients coefficients β will be equal across quantiles. For example β_1 of the quantile $\tau=0.5$ will be equal to β_1 of the quantile $\tau=0.9$ and thus equal to β_1 .

In this case, the regression lines estimated for the different quantiles will just be "parallel" lines as shown in Figure 4.9

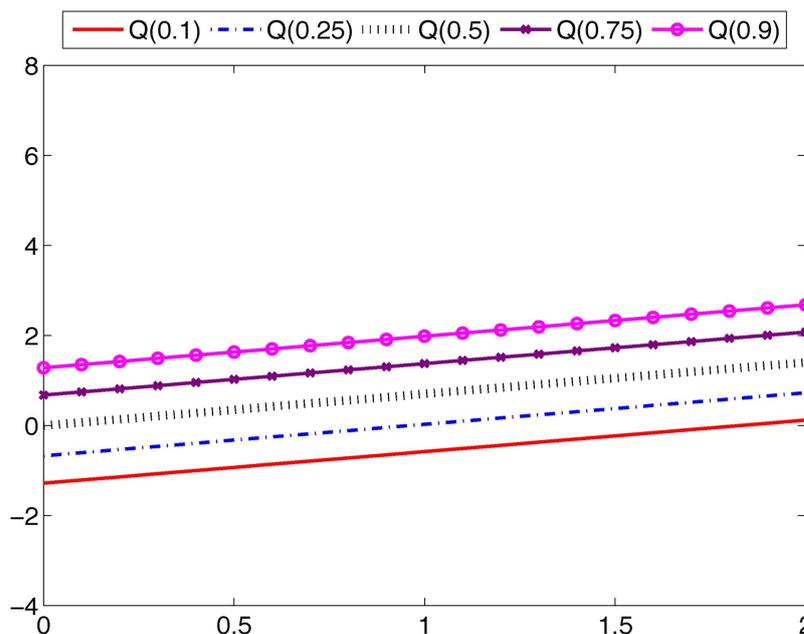


FIGURE 4.9: The figure reports quantile regression lines $y_{i,t}(\tau) = \beta_{\tau,0} + \beta_{\tau,1} y_{j,t} + F_{w_t}^{-1}(\tau)$ when the true underlying model is linear, that is $\beta_{1,\tau} = \beta_1$, or the coefficients does not change across quantiles. In the representation the coefficient is always equal to 0.5, and therefore the slope coefficient of the regression line is always the same across values. The regression line is represented with the different values of $y_{j,t}$ reported in the horizontal axis and the quantile realizations $y_{i,t}(\tau)$ reported in the vertical axis. The difference among quantiles is characterized by the intercept $F_{\tau}^{-1}(W_t)$ which is the unconditional quantile of the innovation density (that does depend on the quantile τ). The coefficient $\beta_{0,\tau}$ has been set equal to 0.

Source: Caporin et al. (2018)

If instead the true underlying model is not linear the quantile estimation lines will become those in figure 4.10.

In our analysis we thus will perform in particular two different tests on the parameters. First a "slope equality test" to verify the coefficients stability across quantiles and secondly a "symmetry" test to evaluate the slope changes when moving from the left side to the right of the median.

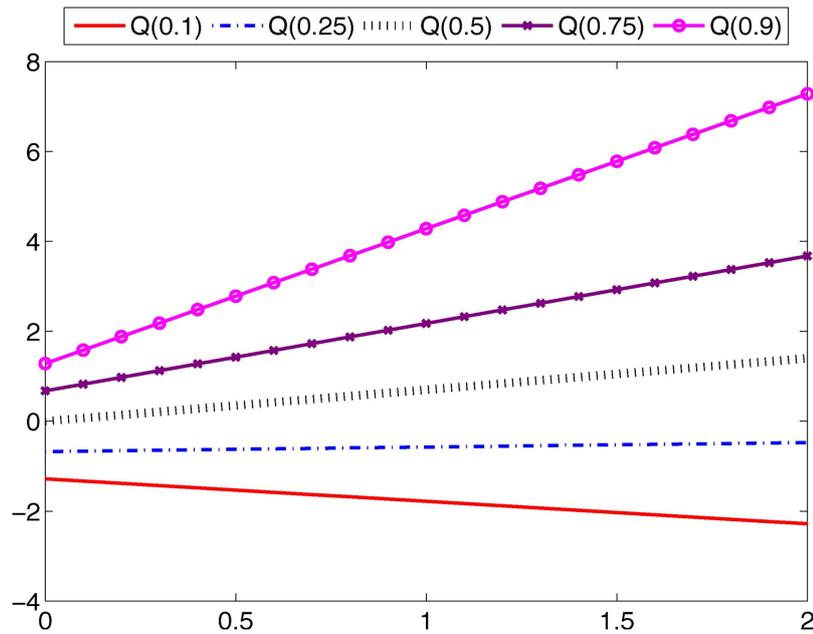


FIGURE 4.10: The figure reports quantile regression lines $y_{i,t}(\tau) = \beta_{\tau,0} + \beta_{\tau,1} y_{j,t} + F_{w_t}^{-1}(\tau)$ when the true underlying model is non-linear, that is $\beta_{1,\tau}$ changes across quantiles. In the representation we have $\beta_{1,0.1} = -0.5$, $\beta_{1,0.25} = 0.0$, $\beta_{1,0.5} = 0.5$, $\beta_{1,0.75} = 1$, $\beta_{1,0.9} = 2$. The regression line is represented with the different values of $y_{j,t}$ reported in the horizontal axis and the quantile realizations $y_{i,t}(\tau)$ reported in the vertical axis. The difference among quantiles is characterized by the intercept $F_{\tau}^{-1}(W_t)$ which is the unconditional quantile of the innovation density (that does depend on the quantile τ). The coefficient $\beta_{0,\tau}$ has been set equal to 0.

Source: Caporin et al. (2018)

Quantile Regression Results

As we said before to find further evidences of the results obtained with the OLS regression we use a quantile regression approach on the same data. The great utility of the quantile regression is to test for different impacts of the explanatory variables across quantiles of the dependent variable.

This is useful especially during turmoil periods such as those considered in our analysis. Variables could indeed be subject to extreme market conditions and reach values distant from the normal scenario causing the linear regression results to be biased. By running some hypothesis tests on the parameters of different quantiles we can state if in the specific period the variables present a non linear relationship.

By using quantile regression we hypothesize that a specific quantile of the density of the variable of interest (Italian sovereign CDS changes) is a linear function of a set of covariates.

We thus considered the quantile regression estimation of the previous Q model, where the estimated parameters are associated with a specific quantile (τ).

This allows to recover the τ -quantile of the dependent variable conditional on the set of the covariates.

The model thus is defined as follow:

$$\begin{aligned} Q_{\tau}(\Delta \log ITA_t^i) = & \alpha_{j,\tau}^i + \beta_{j,1,\tau}^i \Delta \log(ITABanks_t) + \beta_{j,2,\tau}^i \Delta \log(EUBanks_t) \\ & + \beta_{j,3,\tau}^i \Delta \log(STOXX_t) + \beta_{j,4,\tau}^i \Delta \log(VSTOXX_t) + \\ & + \beta_{j,5,\tau}^i \Delta \log(LIQ_t) + \beta_{j,6,\tau}^i \Delta \log(OIL_t) \end{aligned}$$

Our purpose through the quantile regression is to run two specification tests (Caporin et al. 2017) in order to see if the covariates have different impacts at the different quantile levels of the dependent variable.

First, we will perform a “slope equality test” to verify the coefficients stability across quantiles. The null hypothesis is the equality of the quantile regression coefficients at the chosen quantile levels and its rejection suggests that the covariates have different impact at the different quantiles of the dependent variable.

In particular we perform our test in three specific quantiles by assigning to τ the values 0.1, 0.5 and 0.9.

Our hypothesis test for the slope equality is:

$$\begin{aligned} H_0 : & \beta_{j,10} = \beta_{j,50} = \beta_{j,90} \\ H_1 : & H_0 \text{ rejected} \end{aligned}$$

Second, we will evaluate the symmetry of the coefficients by evaluating if their slope changes when moving from the left side to the right side of the median. Our interest is to see if there are some asymmetric responses after specific events.

The hypothesis test for the simmetry is:

$$\begin{aligned} H_0 : & \beta_{j,10} + \beta_{j,90} = 2 * \beta_{j,50} \\ H_1 : & H_0 \text{ rejected} \end{aligned}$$

In the following table are reported the results for the equality slope and the symmetry slope tests on the two coefficients of interest: ITABanks and EUBanks. Both test have been run on three tau levels: 10%, 50% and 90%.

From table 4.4 we can see that in Period 1 all the p-values for both the variables are above 5% so we do not reject the null hypothesis. The same can be said for Period 2 and Period 5.

In Period 3 the p-values for the variable of interest ITABanks are quite low for both tests. The null hypothesis is thus rejected and we can say that the coefficients are not stable so the variable

ITALY				
Slope Equality			Simmetry	
	ITABanks	EUBanks	ITABanks	EUBanks
P1	0.391	0.452	0.172	0.237
P2	0.992	0.287	0.990	0.426
P3	0.098	0.111	0.032	0.037
P4	0.373	0.087	0.215	0.040
P5	0.827	0.938	0.539	0.845

TABLE 4.4: The table shows the p-values of the slope equality and simmetry tests on the parameters. Tests were made on three different quantiles identified by $\tau = 0.1, 0.5, 0.9$

Source: author's own evaluation

ITABanks has different effects in the three different quantiles of the dependent variable distribution and the slope of the estimation line is different as well. As we saw before, it was a period of banks bailouts by the government and this could have caused the explanatory variables to reach more extreme values due to the market conditions. The rejection of the null hypothesis tells us that in the period the relation between the variables is non linear so the use of the quantile regression which is a non linear approach gives better results. The estimates of the quantile regression are reported in table 4.5.

QUANTILE REGRESSION P3			
	[q10]	[q50]	[q90]
ITABanks	0.556*** (7.50)	0.474*** (11.78)	0.584*** (8.60)

TABLE 4.5: The table shows the results of the quantile estimation of the model. The coefficient of the variable of interest ITABanks is reported in the three different quantiles with the corresponding value of the *t-test* for the significance of the coefficient. The three quantiles are identified by $\tau = 0.1, 0.5, 0.9$

t statistics in parentheses: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Source: author's own evaluation

As we can see from the table the coefficients are quite different among the three quantiles and in particular both in the upper and in the lower quantiles the coefficient is higher meaning that the link between the two credit risks is greater in the upper and lower part of the distribution. The coefficient of the median quantile (0.474) is also quite different from that obtained through the linear regression (0.556). We can conclude that the banks bailouts caused a location and scale shift of the effects of the variable.

In period 4 we find an opposite situation but as we saw from the OLS regression the coefficient of EUBanks is not statistically significant in that period so the different effects through the quantiles are not of our interest.

Finally we can say that the quantile regression analysis gives support to the efficiency and unbiasedness of the linear estimation presented before. In fact as we saw a part from the third period characterized by high uncertainty in the banking sector due to the rescue of the banks, in the other periods coefficients seem to have stable effects across quantiles of the dependent variable.

4.5 Germany vs Italy Analysis

We now extend our analysis in order to make a comparison between countries. We decided to compare Italy and Germany because as we saw they belong to different “categories” identified by the existent literature. On one hand Germany is considered a core country so it is less exposed to the risk of contagion, on the other side Italy is considered a periphery country and due to the lower perceived solidity of the country it is more exposed to the contagion and the possible effects of the loop.

As we saw also from the preliminary general graphical analysis, Germany, despite being the most powerful economy of the euro area has a banking sector that shows many weaknesses and this is reflected in the quite high level of banking CDS, while Italy seems to be more risky both at a country and banking level.

By using the same model as before we conducted a separate analysis for both countries by dividing the sample period using common economic events at European level. These events are mainly related to some monetary operations of the ECB:

- PERIOD 1: from 22/10/2008 to 14/05/2010. This period goes from the start of the financial crisis to the implementation of the “Securities Markets Programme” of the ECB through which the ECB made some intervention in the secondary market of some euro area government bonds. The aim of the program was to reduce interest rates and thus alleviate the lending activity of the banking sector.
- PERIOD 2: from 17/05/2010 to 31/12/2015. The period goes from the “Securities Markets Programme” to the entry into force of the second pillar of the Banking Union, the Single Resolution Mechanism. Within the period there is also the first Outright Monetary Transaction which caused the end of the Securities Market program.
- PERIOD 3: from 01/01/2016 to 22/10/2018. The periods start with the SRM and ends in October 2018.

As we made for the Italian case analysis, we now provide a first graphical analysis of the two series in each of the 3 periods considered. As we already described the graphical evolution for the Italian case in the previous sections, we now focus on the German case.

The graphical analysis for the Italian case is available in Annex B.

In period 1 (Figure 4.11) we can see that the two trajectories of the lines at the beginning

are quite different and do not show a quite similar trend. Banks CDS present a quite unstable path at the beginning while they become more stable from the second part of the period with a further increase in the very final part.

Sovereign CDS show an increasing trend at the beginning and then a stable trend in the rest of the period. At the end of the period as for the banking ones there is an unstable path. We will expect the link between the two risks to be low during the period. The period considered is in fact antecedent the sovereign debt crisis that could have been a triggering factor for the comovements of the two CDS.

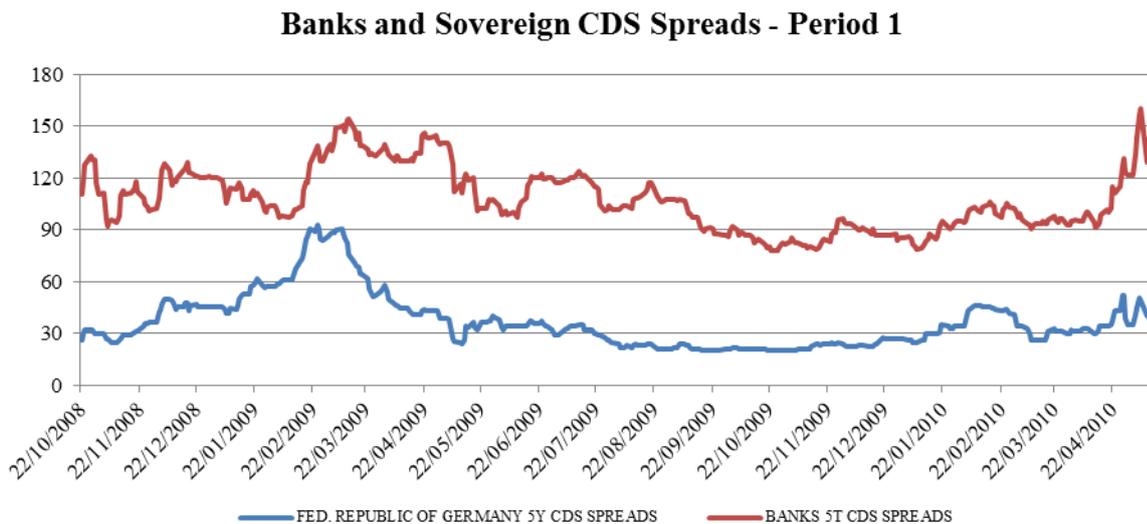


FIGURE 4.11: The figure shows the spreads of sovereign and banks CDS with 5-year maturity for Period 1 in Germany. The blue line represents the sovereign CDS spreads. The red line represents the banks CDS which are computed as the asset weighted average of the CDS spreads of the six German banks within the selected pool.

Source: Author's own evaluation

At the beginning of the second period (Figure 4.12) we can see that the two lines starts to comove more than in the previous period. The banking sector shows a more unstable path but we can see that generally when there is a surge in the banking sector this also happens in the sovereign CDS meaning that probably the two risks became more connected during the period. The increase in both CDS levels is due to the start of the sovereign debt crisis, we can see that the effects on the banking sector are quite higher with respect to those in the sovereign CDS that show a quite little increase in their values.

Figure 4.13 is related to the third and final period. Here we can see that sovereign CDS are very stable along the whole period. In the post crisis period the stability of Germany has increased much also as a consequence of the recovery of the economy.

CDS spreads of the banking sector on the contrary show a quite unstable path. At the beginning

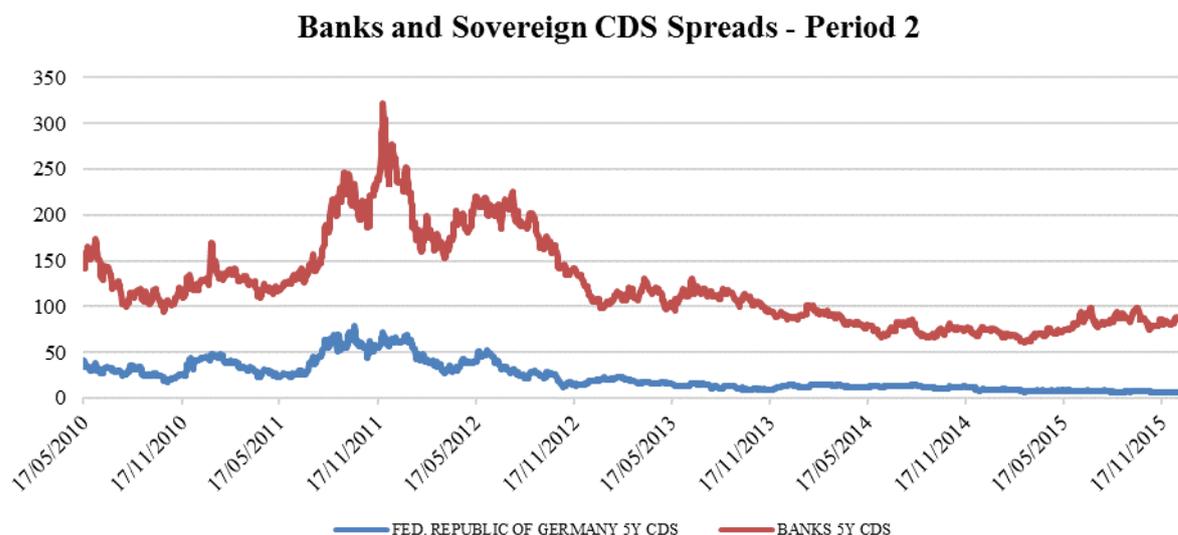


FIGURE 4.12: The figure shows the spreads of sovereign and banks CDS with 5-year maturity for Period 2 in Germany. The blue line represents the sovereign CDS spreads. The red line represents the banks CDS which are computed as the asset weighted average of the CDS spreads of the six German banks within the selected pool.

Source: Author's own evaluation

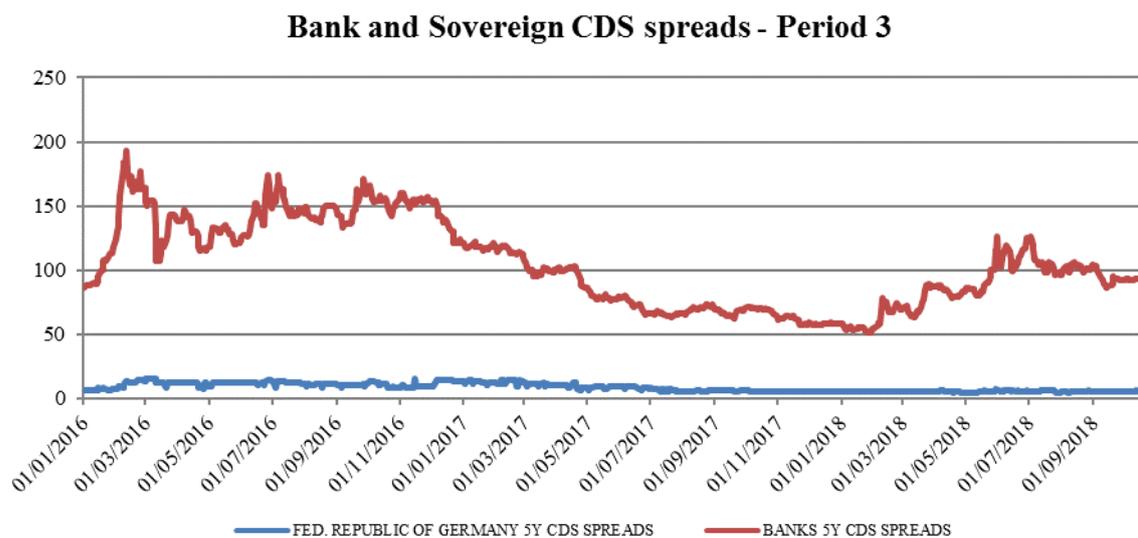


FIGURE 4.13: The figure shows the spreads of sovereign and banks CDS with 5-year maturity for Period 3 in Germany. The blue line represents the sovereign CDS spreads. The red line represents the banks CDS which are computed as the asset weighted average of the CDS spreads of the six German banks within the selected pool.

Source: Author's own evaluation

we can see a general increasing trend due, as we saw, to the great problems faced by Deutsche bank which is the greatest banking group in the country. For this reason the CDS of the bank have a higher weight inside our pool of banks and so the problem faced by the single entity are reflected in the path of the banks pool CDS.

At the beginning of 2017 we can clearly see a declining trend until the beginning of 2018. Here sovereign CDS remain very stable but the banks CDS start to increase again thus reflecting the weaknesses of the German banking sector.

If we compare what we have seen until now for Germany with the Italian situation we can clearly see that the two lines show a more evident common path in Italy than in Germany. This suggests that probably with the empirical analysis the coefficients will be lower for Germany indicating that the dimension of the contagion is lower with respect to Italy.

We now continue with the empirical results.

4.5.1 Summary Statistics

In the previous section we analyzed the data from a graphical point of view, now we provide a summary statistics for the data of each period selected for the analysis. Results are presented in table 4.5, we report only the variables of interest for the econometric analysis.

We have 2609 observations for each of the variables. In particular there are 408 observations for the first period, 1469 for the second one, and 732 for the last period.

If we look at the numbers we can see that Italian sovereign CDS average value is higher in the second period while German sovereign CDS has a greater median in the first one. In the German case the average sovereign CDS is indeed decreasing across the three periods.

For what concerns the banking CDS the two countries seem quite similar. We find the greatest average value in the second period while the average value is quite lower in the other two periods. Especially in Germany the mean of the last period is quite similar to that of the first period so bank CDS seem to have returned to the pre-sovereign debt crisis values after the implementation of the ECB monetary policy measures. For Italy instead the mean in the last period is higher with respect to that of the first one.

In general we can say that by looking at the numbers we can clearly see the great difference in the risk of the two countries with Italy much riskier both in the sovereign and in the banking sector.

4.5.2 Empirical Analysis

As we did for the Italian case alone we now provide an empirical estimation to find evidences of the contagion between sovereign and banking credit risk that we found in the graphical analysis. Our purpose is that of making a comparison between the two countries in terms of percentage change of the coefficients of interest between the periods selected.

Period 1	Obs.	Mean	Std. Dev.	Min	Max
ITA	408	107.092	39.433	48	219.959
ITABanks	408	101.717	33.638	60.048	230.556
GER	408	36.905	15.888	20	92.5
GERBanks	408	107.757	18.294	77.816	160.668
EUBanks	408	195.163	54.23246	123.136	336.7
STOXX	408	2589.469	294.936	1809.98	3017.85
VSTOXX	408	34.431	11.929	19.8	76.54
LIQ	408	-.332	.333	-.675	.863
OIL	408	63.925	14.166	33.73	88.09
Period 2					
ITA	1,469	187.117	107.828	69.25	498.659
ITABanks	1,469	238.178	133.961	85.485	642.191
GER	1,469	23.398	16.019	6.64	79.289
GERBanks	1,469	123.047	48.770	61.135	321.76
EUBanks	1,469	250.800	117.3743	90.227	552.179
STOXX	1,469	2866.058	400.4552	1995.011	3828.784
VSTOXX	1,469	23.524	6.893	12.71	53.55
LIQ	1,469	-.252	.232	-.777	.192
OIL	1,469	94.700	23.690	35.26	128.14
Period 3					
ITA	732	92.415	25.304	42.039	140.5
ITABanks	732	145.985	48.432	51.308	250.413
GER	732	8.523	3.283	5.000	15.56
GERBanks	732	104.222	33.589	51.335	193.483
EUBanks	732	119.254	39.928	41.121	229.959
STOXX	732	3305.982	248.468	2680.351	3697.4
VSTOXX	732	18.117	5.661	10.68	39.9
LIQ	732	-.362	.0221	-.375	-.255
OIL	732	55.556	12.955	26.01	84.94

TABLE 4.6: Summary Statistics - Comparison Analysis

Linear Regression

The two models used for the two countries are the same as the one used for the Italian case. The only difference is the division of the data window. We set as dependent variable the sovereign CDS and as explanatory variables domestic Banking sector CDS, European Banking sector CDS and the control variables already presented.

The two models are the following respectively for Italy and Germany:

$$\Delta \log(ITA_t^i) = \alpha_i + \beta_{j,1}^i \Delta \log(ITABanks_t) + \beta_{j,2}^i \Delta \log(EUBanks_t) + \beta_{j,3}^i \Delta \log(STOXX_t) + \beta_{j,4}^i \Delta \log(VSTOXX_t) + \beta_{j,5}^i \Delta \log(LIQ_t) + \beta_{j,6}^i \Delta \log(OIL_t) + u_t$$

$$\Delta \log(GER_t^i) = \alpha_i + \beta_{j,1}^i \Delta \log(GERBanks_t) + \beta_{j,2}^i \Delta \log(EUBanks_t) + \beta_{j,3}^i \Delta \log(STOXX_t) +$$

$$\beta_{j,4}^i \Delta \log(VSTOXX_t) + \beta_{j,5}^i \Delta \log(LIQ_t) + \beta_{j,6}^i \Delta \log(OIL_t) + u_t$$

As we did before we start from the linear estimation of the two models, Table 4.6 and 4.7 show the results respectively for Italy and Germany.

LINEAR REGRESSION ITALY			
	Period1	Period 2	Period 3
ITABanks	-0.011 (-0.08)	0.812*** (19.15)	0.568*** (6.36)
EUBanks	1.844*** (4.89)	0.015 (1.23)	0.014 (0.70)

TABLE 4.7: The table shows the results of the OLS estimation of the model for the Italian case. Only the two variables of interest are presented with the coefficient for each period and the related value of the *t-test* for the significance of the coefficient.

t statistics in parentheses: * p<0.05, ** p<0.01, *** p<0.001
Source: author's own evaluation

LINEAR REGRESSION GERMANY			
	Period1	Period 2	Period 3
GERBanks	0.165 (1.55)	0.502*** (7.32)	0.421** (2.61)
EUBanks	1.406*** (7.28)	0.09** (3.05)	-0.06 (-1.35)

TABLE 4.8: The table shows the results of the OLS estimation of the model for the German case. Only the two variables of interest are presented with the coefficient for each period and the related value of the *t-test* for the significance of the coefficient.

t statistics in parentheses: * p<0.05, ** p<0.01, *** p<0.001
Source: author's own evaluation

What we can easily notice from the estimation results is that the two countries have a quite common situation for what concern the comovement between sovereign CDS and domestic banks CDS. The coefficient is in fact non significant in Period 1 while it became positive and statistically significant in the other two periods.

We can see that in general coefficients are lower for Germany meaning that the contagion is less pronounced here with respect to Italy. We should have expected this since, as we saw from the graphical analysis, German sovereign CDS are very stable across the data window and the comovement between the two CDS series is less evident in the country.

In period 1, prior to the beginning of the Securities Market Program and the European sovereign debt crisis, the coefficient of the domestic banking sector for both countries is not statistically significant while the coefficient of EUBanks is on the opposite positive and significant. More

specifically respectively for Italy and Germany a 1% increase in daily change in European banking CDS is followed by a 1.8% and a 1.4% increase in daily change of sovereign CDS.

This suggests that prior to the sovereign debt crisis a contagion was in place only between the sovereign and the European-banking sector. This means that probably the sovereign CDS were more exposed to changes in the systemic component of the risk rather than of the country specific component.

As we said before the situation changes in the following periods. In period 2 both coefficients of the domestic banking sector became positive and statistically significant. In Germany the European banking sector coefficient is still positive and statistically significant but it is lower with respect to the previous period, the link with the European banking sector is still in place. In Italy the coefficient is not statistically significant. A 1% increase in daily change of the domestic banking sector is followed by a 0.8% increase in daily change for Italy and a 0.5% daily change for Germany in the sovereign CDS.

In the last period, after the introduction of the Single Resolution Mechanism, the situation is similar to that of period 2. The coefficient of the domestic banking sector is still positive and statistically significant but the value is lower with respect to the previous periods for both countries. In Italy the coefficient is 0.56 while it was 0.8 in the previous period and for Germany the coefficient is 0.42 while it was 0.50 previously.

What we can say in the end is that the link in the two countries presented a quite similar behaviour. Prior to the start of the sovereign debt crisis and the "securities market program" the contagion was at a European level while after sovereign credit risk became much more connected with the domestic banking sector. The link was stronger during the second period considered while it seems to have been attenuated after the introduction of the Single Resolution Mechanism.

A better comparison can be made by looking at the percentage change of the coefficients between the periods. In particular from period 2 to period 3 the coefficient of the domestic banking sector has decreased of 30% in Italy and of 16% in Germany so the policy measures of the ECB were more effective in Italy. We could expect this since the non conventional measure of monetary policy made by the ECB were addressed especially to those countries that were more hit by the crisis and Italy was one of this.

Quantile regression

As we did for the Italian case analysis we now try to find stronger evidences of what we found with the OLS regression by using the quantile regression. In particular we look if the relationship between the variables is a linear one or not.

As we done before we will perform the slope equality and the symmetry test of the coefficients for both countries in order to find if the covariates have different effects in the different quantiles of the dependent variable.

The null hypothesis are the same as before for both the tests.

First we rewrite the two models as follow:

$$Q_\tau(\Delta \log ITA_t^i) = \alpha_{j,\tau}^i + \beta_{j,1,\tau}^i \Delta \log(ITABanks_t) + \beta_{j,2,\tau}^i \Delta \log(EUBanks_t) \\ + \beta_{j,3,\tau}^i \Delta \log(STOXX_t) + \beta_{j,4,\tau}^i \Delta \log(VSTOXX_t) + \\ + \beta_{j,5,\tau}^i \Delta \log(LIQ_t) + \beta_{j,6,\tau}^i \Delta \log(OIL_t)$$

$$Q_\tau(\Delta \log GER_t^i) = \alpha_{j,\tau}^i + \beta_{j,1,\tau}^i \Delta \log(GERBanks_t) + \beta_{j,2,\tau}^i \Delta \log(EUBanks_t) \\ + \beta_{j,3,\tau}^i \Delta \log(STOXX_t) + \beta_{j,4,\tau}^i \Delta \log(VSTOXX_t) + \\ + \beta_{j,5,\tau}^i \Delta \log(LIQ_t) + \beta_{j,6,\tau}^i \Delta \log(OIL_t)$$

We now present the results of the tests on the parameters (Table 4.7 and 4.8).

ITALY				
	Slope Equality		Simmetry	
	ITABanks	EUBanks	ITABanks	EUBanks
P1	0.249	0.385	0.494	0.247
P2	0.091	0.183	0.554	0.093
P3	0.243	0.403	0.093	0.178

TABLE 4.9: The table shows the p-values of the slope equality and simmetry tests on the parameters. Tests were made on three different quantiles identified by $\tau = 0.1, 0.5, 0.9$

Source: author's own evaluation

GERMANY				
	Slope Equality		Simmetry	
	GERBanks	EUBanks	GERBanks	EUBanks
P1	0.910	0.006	0.983	0.003
P2	0.208	0.270	0.119	0.883

TABLE 4.10: The table shows the p-values of the slope equality and simmetry tests on the parameters. Tests were made on three different quantiles identified by $\tau = 0.1, 0.5, 0.9$

Source: author's own evaluation

From the tables we can see that for the Italian case the p-values of the domestic banking sector for both tests are above a 5% and this provides evidences in favour of the unbiased of the linear regression results.

The European banking sector coefficients instead are high enough to not reject the null hypothesis at a 95% level for both test in all the three periods.

If we look at the quantile regression results for period 3 we can see in fact that

In general parameters show to be stable across quantiles giving more evidence on the significance of the linear regression estimates made in the previous section.

For what concerns Germany it was not possible to run the tests for the last period because of the presence of many null values in the logarithm of the daily change in German sovereign bonds. However in the first two periods we can see that the p-value of both test performed on GER-banks coefficient are above 5% so we do not reject the null hypothesis.

For the European banking sector instead, in Period 1 the variable seemed to have had different impacts at the different quantiles. We will thus report the results of the quantile regression for the three quantiles in Period 1 (Table 4.11).

QUANTILE REGRESSION P1			
	[q10]	[q50]	[q90]
EUBanks	1.50*** (3.61)	0.95*** (4.93)	1.81*** (5.96)

TABLE 4.11: The table shows the results of the quantile estimation of the model. The coefficient of the variable of interest EUBanks is reported in the three different quantiles with the corresponding value of the *t-test* for the significance of the coefficient. The three quantiles are identified by $\tau = 0.1, 0.5, 0.9$ t statistics in parentheses: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Source: author's own evaluation

From the table we can see that the effects of the variable ITABanks have been quite different in the three quantiles and especially they are greater in the upper part of the distribution.

Conclusions

As a consequence of the financial turmoil caused by the events of the financial crisis of 2008, many European countries were forced to rescue their troubled domestic banking sectors. This has caused a transfer of risk from the banking sector to the sovereign and thus created a link between sovereign and banking credit risk. A change in one of the two risks is mirrored by a consequent change in the other one.

The transfer of risk and the contagion between the credit risks can be a triggering factor for the development of the so called "diabolic loop", a negative feedback loop that originating from the reducing creditworthiness of the sovereign cause problems to the activity of the domestic banking sector and thus reduces the stimulus to the real economy, as seen in chapter 1. The reduction in the creditworthiness can be easily captured by the level of the CDS on sovereign and banking bonds which measure the credit risk of both entities.

In order to study the presence of such a link in Italy we decided therefore to use 5Y CDS in order to conduct an empirical analysis. We decided to look at the contagion from the side that goes from the banking sector to the sovereign.

First we focused our attention on Italy and in particular we found that the contagion was in place since the beginning of the financial crisis in 2008 and is still in place today. The implementation of the austerity measures of the Monti's government seemed to have lower the dimension of the link but the following rescue operations made in the banking sector during 2016 and 2017 raised the connection between the two risks. Finally in the light of the very recent political events of the country after the election of the new government we decided to see also if something has happened to the link after the elections. We indeed found that the political instability caused by the new government and the collision between the economical decision of the government and the guide lines given by the European Union, which have caused the increase in both sovereign and banks CDS, have increased the interconnection between the two risks thus giving greater exposure to the possible effects of the feedback loop to the country.

After the country level analysis we made a comparison between Italy and Germany. We divided the data window in three periods, the first one is prior to the sovereign debt crisis, the second one includes the development of the non conventional monetary policies of the ECB and the third goes from the implementation of the Quantitative Easing to the recent days.

We found a quite common behaviour of the link in both countries, in fact prior to the sovereign debt crisis a link is in place but not between the sovereign and the domestic banking sector but between the sovereign and the European banking sector. Probably as a consequence of the

increase in the domestic exposures of the domestic banking sectors in the two countries in the following two periods the link became quite evident. However we can see that the non conventional monetary policies of the ECB seemed to have reduced the link but it has not disappeared. The contagion thus is not only a matter of weak countries like Italy which has high public debt, low GDP growth and a weak banking sector. As we saw also countries like Germany which have one of the strongest economies in the Euro Area show the presence of the contagion.

The effects that the persistence of the contagion could have on the whole economy of a country has been highlighted in Chapter 1. As long as the sovereign and the banking sector remain interconnected shocks that increase the risk related with one of the two cause an effect on the risk of the other and this is reflected in lower stimulus to the real economy.

Policy makers must be concerned about this when taking economic policy decisions. Every choice made at a country level which causes a decrease in the trust of international investors and thus increases the credit risk of the country does not remain limited to the sovereign itself but today is also reflected in the banking sector and thus to the real economy through the lending activity which is so important for firms.

Crucial will be in the future the attempts to try to reduce and eliminate the contagion especially at the European level. Many solutions have been suggested and were presented in Chapter 3 and they should be the starting point for a concrete intervention in order to mitigate the effects of the loop. As we saw in the analysis the interventions made by the ECB in order to make the European banking sector more integrated and stronger seemed to have weakened the effects of the loop. However the contagion is still in place and its effects still represent huge problems for the recovery of European countries.

Appendix A

Regressions Results

In this section we report the whole results of the linear regressions made in the analysis. First of all we present those of the Italian case analysis and then that of the comparison analysis.

	(1)	(2)	(3)	(4)	(5)
	ITA	ITA	ITA	ITA	ITA
ITABanks	0.494*** (4.69)	0.679*** (8.46)	0.556*** (11.67)	0.664*** (4.35)	0.913*** (7.40)
EUBanks	0.625** (2.96)	0.0759 (1.61)	0.0123 (0.94)	0.0214 (0.83)	-0.0437 (-1.29)
STOXX	-0.477* (-2.18)	-0.692*** (-4.18)	-0.559** (-2.82)	0.118 (0.36)	-0.389 (-0.51)
VSTOXX	0.0308 (0.81)	0.0116 (0.41)	0.0128 (0.49)	-0.00323 (-0.08)	-0.0943 (-1.05)
LIQ	-0.0219 (-0.89)	-0.115** (-3.14)	0.00796 (0.25)	2.207 (1.13)	-2.519 (-0.92)
OIL	0.0300 (0.43)	0.0469 (0.45)	0.0894* (2.47)	0.186 (1.82)	-0.0895 (-0.45)
_cons	0.000152 (0.10)	-0.00103 (-0.86)	-0.000276 (-0.39)	0.0000103 (0.01)	-0.000100 (-0.04)
N	800	378	1092	238	100

t statistics in parentheses

* p<0.05, ** p<0.01, *** p<0.001

FIGURE A.1: The figure shows the results of the linear regression for the Italian case alone. All the control variables are reported.

Source: Author's own evaluation

	(1)	(2)	(3)
	ITA	ITA	ITA
ITABanks	-0.0113 (-0.08)	0.812*** (19.15)	0.568*** (6.36)
EUBanks	1.844*** (4.89)	0.0154 (1.23)	0.0142 (0.70)
STOXX	-0.248 (-1.46)	-0.591*** (-5.04)	-0.605 (-1.89)
VSTOXX	-0.00457 (-0.11)	-0.00796 (-0.40)	-0.0252 (-0.78)
LIQ	-0.00462 (-0.17)	-0.0217 (-0.57)	-0.325 (-1.12)
OIL	-0.0548 (-0.83)	0.0611 (1.09)	0.106* (2.48)
_cons	-0.000212 (-0.11)	-0.000151 (-0.19)	0.000141 (0.17)
N	408	1469	731

t statistics in parentheses

* p<0.05, ** p<0.01, *** p<0.001

FIGURE A.2: The figure shows the results of the linear regression for the Italian case in the comparison analysis. All the control variables are reported.

Source: Author's own evaluation

	(1) GER	(2) GER	(3) GER
GERBanks	0.165 (1.55)	0.502*** (7.32)	0.421** (2.61)
EUBanks	1.406*** (7.28)	0.0995** (3.05)	-0.0641 (-1.35)
STOXX	0.102 (0.64)	-0.410* (-2.35)	-0.869 (-1.34)
VSTOXX	-0.0577 (-1.07)	-0.0193 (-0.61)	-0.153* (-2.42)
LIQ	-0.0225 (-1.04)	-0.0166 (-0.57)	-0.171 (-0.16)
OIL	-0.186** (-2.93)	0.0811 (0.89)	0.0612 (0.33)
_cons	0.000159 (0.08)	-0.000917 (-0.72)	-0.000393 (-0.12)
N	408	1469	731

t statistics in parentheses

* p<0.05, ** p<0.01, *** p<0.001

FIGURE A.3: The figure shows the results of the linear regression for the German case in the comparison analysis. All the control variables are reported.

Source: Author's own evaluation

Appendix B

Italy - Graphical Analysis

In this section we provide the graphical analysis for the Italian case in the comparison analysis. We will study the evolution of the the two CDS series from a graphical point of view in ache of the three periods considered in the analysis.

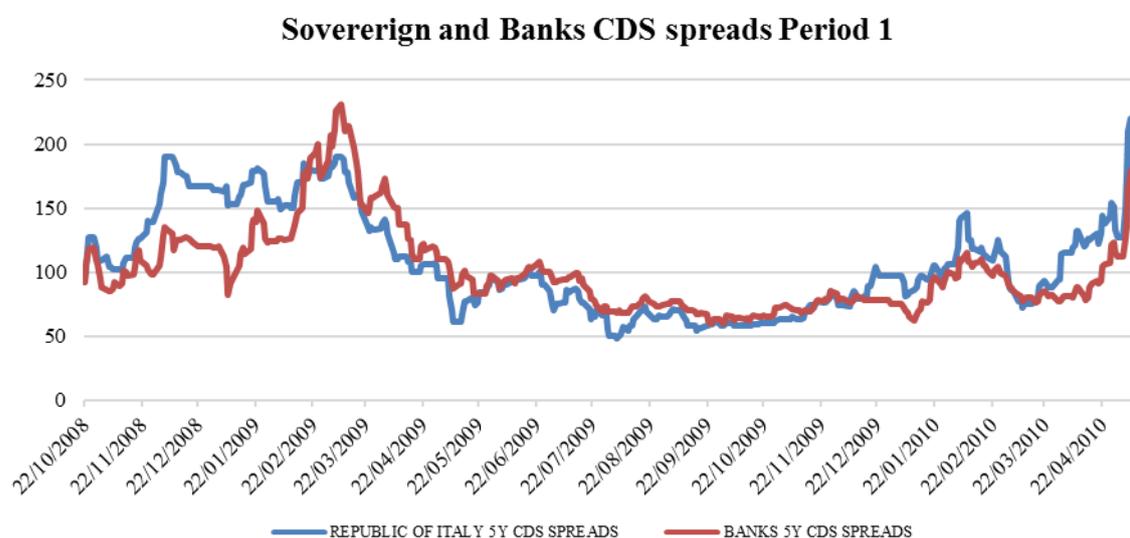


FIGURE B.1: The figure shows the spreads of sovereign and banks CDS with 5-year maturity for Period 1. The blue line represents the sovereign CDS spreads. The red line represents the banks CDS which are computed as the asset weighted average of the CDS spreads of the six Italian banks within the selected pool.

Source: Author's own evaluation

In period 1 we can see that the two series comove especially in the central part. Differences in the pattern can be seen at the beginning and at the end of the period. There the sovereign credit risk is greater than the banking one.

In both cases we can see thta the sovereign risk has increased but was not followed by a simoul-taneous increase also in the banking risk.

We can imagine that here the link between the two risks is quite low.

In period 2 we can see that the two lines overlap at the beginning of the period and comove for the rest of the period. Both CDS levels increase in 2011 with because of the start of the sovereign debt crisis and remain quite high until the end of 2013. As we saw in the singular

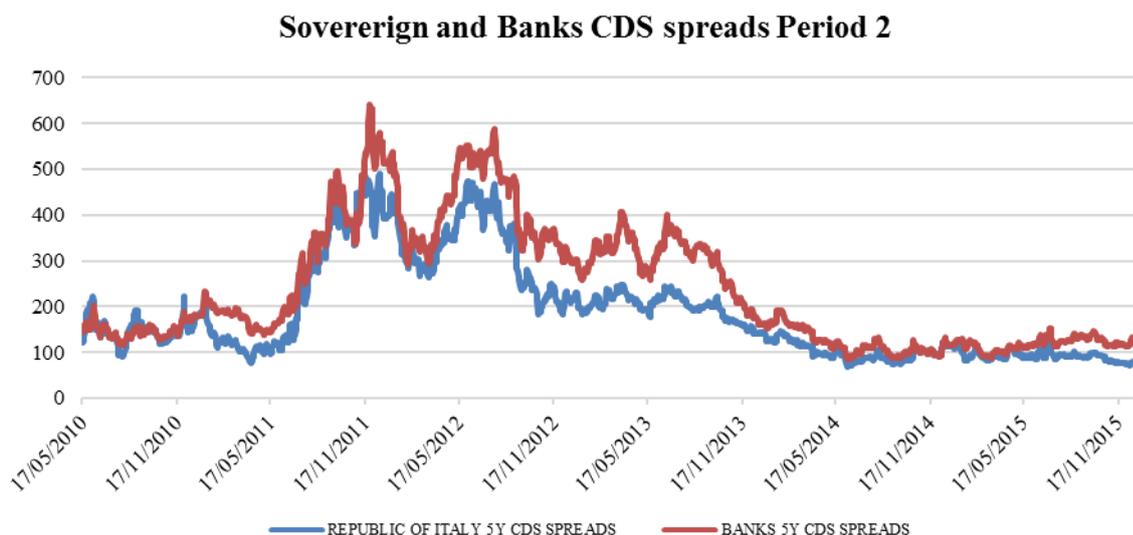


FIGURE B.2: The figure shows the spreads of sovereign and banks CDS with 5-year maturity for Period 2. The blue line represents the sovereign CDS spreads. The red line represents the banks CDS which are computed as the asset weighted average of the CDS spreads of the six Italian banks within the selected pool.

Source: Author's own evaluation

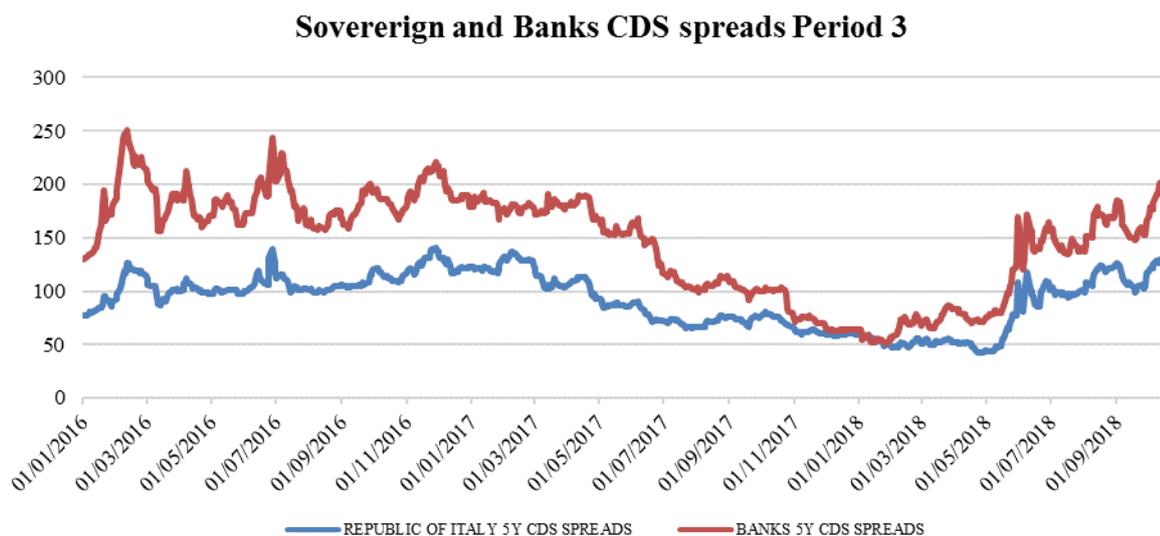


FIGURE B.3: The figure shows the spreads of sovereign and banks CDS with 5-year maturity for Period 3. The blue line represents the sovereign CDS spreads. The red line represents the banks CDS which are computed as the asset weighted average of the CDS spreads of the six Italian banks within the selected pool.

Source: Author's own evaluation

country analysis during these phase the country experienced the worst consequences of the financial crisis with the spread reaching 500 points. From 2014 both CDS levels start to decrease and we can notice that this is more pronounced for the banking sector ones. The two lines overlap each other at the end of 2014 and then while sovereign CDS remain quite stable, the banking one start to increase again.

We will expect the link between the two risks to have become more stronger with respect to the

previous period.

Finally, in the last period (figure B.3) we can see that the the two series have a great comovement at the beginning and a quite stable and then declining trend especially for the banking CDS.

At the end of the period especially starting from march 2018 when the political instability after the elections hit the country, both CDS series start to rise and comove.

As for the previous period we expect the link between the two credit risks to be still in place.

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