



UNIVERSIDADE CATÓLICA PORTUGUESA

The relationship between sovereign risk and bank risk

Trabalho Final na modalidade de Dissertação
apresentado à Universidade Católica Portuguesa
para obtenção do grau de mestre em Finanças

por

Ricardo Alfredo Teixeira da Costa Branco

sob orientação de
Professor João Filipe Monteiro Pinto

Católica Porto Business School
Abril 2016

To my son João

Acknowledgements

Having reached to the end of another journey, I would like to acknowledge everyone that contributed to this thesis.

My first words of gratitude are undoubtedly to Professor João Pinto for his guidance and support but also because of the extra motivation provided that allowed me to exceed my expectations. This work was an important chance to learn even more and, without a question, this objective was reached.

To my family, who supported this journey from the beginning, although the many obstacles faced, always encouraging myself to never give up: as they usually say “calm waters does not make a good sailor”.

Finally, a word to my son and my wife. I knew that this journey would be very demanding to myself, but I realized that it was also extremely challenging to them.

Resumo

O principal objetivo desta dissertação passa por estudar empiricamente a relação entre o risco bancário e o risco soberano. Paralelamente, e controlando por variáveis micro e macroeconómicas, estudou-se ainda o efeito causado pela crise financeira e pelo programa de compra de obrigações hipotecárias por parte do Banco Central Europeu (BCE) no spread de crédito de obrigações emitidas por bancos da Europa Ocidental entre 1 de Janeiro de 2000 e 31 de Dezembro de 2011. A amostra utilizada, que serviu de base para a elaboração da análise empírica, é composta por 16,860 observações, dividindo-se em três categorias de obrigações: Obrigações Hipotecárias (covered bonds) – 10.920 observações; Obrigações tradicionais (bank bonds) – 5.695 observações; e obrigações garantidas por créditos (securitization bonds) – 245 observações.

Tendo por base a análise estatística realizada, concluiu-se que a crise financeira de 2007/2008 teve um impacto substancial no aumento do risco bancário, já que os spreads praticados após o seu início aumentaram substancialmente. Concluímos também que (i) o risco soberano influencia o spread das obrigações emitidas pelos bancos, após controlar por variáveis micro e macroeconómicas; (ii) em tempos de crise financeira a relação entre o risco soberano e o risco bancário torna-se mais estreita; e (iii) este efeito verifica-se para Covered Bonds e Bank Bonds, mas não para Securitization Bonds, tendo subjacente qualquer uma das três proxies utilizadas para medir o risco soberano (Rating, Yields de obrigações e CDS). Relativamente ao risco soberano, conclui-se que os CDS são a proxy do risco soberano que influencia de forma mais significativa as obrigações emitidas pelos bancos. Conclui-se ainda que os países com melhor solidez financeira fornecem uma rede de proteção aos “seus” bancos em tempos de crise. Adicionalmente, concluiu-se que o programa de compra de

obrigações hipotecárias por parte do BCE atingiu os seus objectivos primários, permitindo uma redução do custo de financiamento dos bancos. No entanto, com o início da crise da dívida soberana os seus efeitos foram-se desvanecendo. Os resultados obtidos mantêm-se mesmo quando são introduzidas variáveis contabilísticas e financeiras dos bancos nos modelos de regressão.

Palavras-chave: Risco Bancário, Risco Soberano, *Spread* de crédito, Obrigações, Covered Bonds, Securitization, *Credit Default Swaps*.

Abstract

This dissertation aims to empirically analyze the relationship between Bank Risk and Sovereign Risk. Simultaneously, and controlling for micro and macroeconomic variables, it also examines the impact of both the financial crisis and the first Covered Bond Purchase Programme launched by the European Central Bank on bank bond credit spreads.

Using a sample of 16,860 bonds – 10,920 Covered Bonds; 5,695 Bank Bonds; and 245 Securitization Bonds - issued by Western European banks between January 1, 2000 and December 31, 2011, we found that: (i) the 2007/2008 financial crisis had a significant impact on banking risk, because it led to a rise of banks' funding costs, as the spreads paid at time of issuance increased substantially; (ii) the sovereign risk affects the bonds spreads, after controlling micro and macroeconomic variables; (iii) specially in times of financial distress, sovereign and bank risk relationship becomes more tight. This effect affects more specifically Covered Bonds (CB) and Bank Bonds (BB), but not Securitization Bonds (SB). To measure sovereign risk, we used three proxies: Rating, Credit Default Swaps (CDS) and Government Bond Yields. We also concluded that CDS are the sovereign risk proxy that influences more significantly bond spreads; countries with better soundness provide a safety net to "their banks" in times of financial crisis; and the ECB Covered Bond Purchase Programme fulfilled their main goals leading to a decrease in credit spreads. However, with the appearance of the Sovereign Debt Crisis, the effects started to fade. For robustness tests, we used bank's accounting and financial ratios, and the results proved to be the same.

Keywords: Banking Risk, Sovereign Risk, Credit spread, Bonds, Covered
Bonds, Securitization, Credit Default Swaps.

Contents

Acknowledgements.....	iii
Resumo.....	v
Abstract.....	vii
Contents.....	ix
List of figures.....	xi
List of tables.....	xiii
INTRODUCTION.....	15
1. LITERATURE REVIEW.....	20
1.1 Banking vs Sovereign Risk.....	20
1.2 Covered Bond Purchase Programme.....	24
1.3 Sovereign Risk: how to measure it?.....	25
2. HYPOTHESES AND SAMPLE SELECTION.....	27
2.1 Hypotheses.....	27
2.2 Sample Selection.....	30
2.2.1 Description of Variables.....	31
3. UNIVARIATE ANALYSIS.....	44
3.1 Descriptive statistics by Bond Type.....	44
3.2 Credit Spread over time by Issuer Country.....	48
3.3 Credit Spread over time by deal type.....	51
3.4 Spread by Issuer Country and by Bond Type.....	51
3.5 The impact of the Financial Crisis on BB, SB, and CB Credit Spreads.....	54
3.6 Analysis of Covered Bonds (CB), Bank Bonds (BB) and Securitization Bonds (SB).	58
4. REGRESSION ANALYSIS.....	60
4.1 Regression Results.....	61
4.1.1 The impact of pricing factors on credit spreads.....	61
4.1.2 Sovereign risk and bank risk.....	71
4.1.3 The 2007-2008 financial crisis and the impacted of sovereign risk on bank risk.....	77

4.1.4 Countries with Triple A and banks funding conditions.....	82
4.1.5 Countries with international finance assistance and banks funding conditions.....	85
4.1.6 The impact of the first Covered Bond Purchase Programme (CBBP)	88
4.1.7 Robustness tests	93
5. CONCLUSION.....	98
References	101

List of figures

Figure 3.1. Credit spread across time by issuer country	48
Figure 3.2. Credit spread across time by issuer country (Germany, Greece, Ireland, Portugal & Spain).....	49
Figure 3.3 Credit Spread over time by deal type	51
Figure 3.4. Credit Spread by Deal Type and Issuer country	54
Figure 3.5. Credit Spread by Country Rating for CB.....	56
Figure 3.6 Spread by Country Rating, before and after crisis, For BB	57
Figure 3.7 Spread by Country Rating, before and after crisis, for SB	57
Figure 4.1 Period of Analysis CBPP1	89
Figure 4.2 Graphic presentation of the spread evolution through the periods ..	91

List of tables

Table 3.1 Descriptive statistics for BB, CB, and SB	45
Table 3.2 Credit spread across time by issuer country.....	50
Table 3.3 Credit Spread by Deal Type and Issuer Country	53
Table 3.4. The impact of the Financial Crisis on Credit Spreads	55
Table 3.5 Covered bonds, bonds and securitization classification	59
Table 4.1 Variables used in the Hypotheses	61
Table 4.2 Chow Test for differences on credit spread determinants.....	62
Table 4.3 Regression Analysis on the impact of the independent variables on the credit spread	65
Table 4.4 Standardized coefficients of table 4.3.....	69
Table 4.5 Regression analysis by sovereign risk variable	74
Table 4.6 Standardized regress coefficients of table 4.5	76
Table 4.7 Regression analysis on the impact of the financial crisis	79
Table 4.8 Standardized coefficients of regressions presented on table 4.7.....	81
Table 4.9 Regression analysis on the effect of Triple A countries during the financial crisis	84
Table 4.10 Regression analysis on the effect of countries under financial assistance during the financial crisis.....	87
Table 4.11 Credit spread values during different periods of analysis	90
Table 4.12 Regression analysis on the effect of covered bond purchase programme	92
Table 4.13 Regression Analysis on the impact of the independent variables on the credit spread Using Financial Ratios.....	96
Table 4.14 – Rating Scale.....	107

Table 4.15 Variables Description, related Empirical Literature, Expected Sign and Findings (1)	108
Table 4.16 Variables Description, related Empirical Literature, Expected Sign and Findings (2)	109

INTRODUCTION

Since 1929 that the world didn't observed a financial crisis so severe. The bankruptcy of the investment bank Lehman Brothers¹, announced in September 15, 2008 unleashed a financial turmoil that would affect the world. The seriousness of the situation led Henry Paulson², United States Secretary of Treasury and Ben Bernanke³, FED's Chairman, to set up an emergency meeting in Washington with the senior legislators from both parties of the congress and the senate. The subject was that it was necessary to collect 700 Billion dollars to inject in the financial market to unlock the credit market. Paulson said "Unless you act, the financial system of this country and the entire world will meltdown in a matter of days". Bernanke also claimed "If we don't do this tomorrow we will not have an economy on Monday". The main consequence of the financial crisis was that the market of banking credit simply frozen, leading to a significant increase in the funding costs of financial institutions. All the banking system is based in a very simple but highly important feeling that it's trust and despite all the signs, the bailout of Bear Stearns, the nationalization of Fanny Mae and Freddie Mac in September 7, 2008, the bankruptcy of Lehman was the final blow in the market trust. Investors started to wonder if the United States Government saved two of the largest financial institutions and, at the same time would let a bank to fail, then any bank could go bankrupt. The problem was that with the

¹ Lehman Brothers Holdings Inc. was an investment and a global financial services bank. Was founded in 1850 and announced its bankruptcy in 15th September of 2008 mainly because its exposure to the subprime crisis. It is commonly accept has the trigger of the financial crisis.

² Henry Merrit Paulson Jr, also known as Hank Paulson, was the 74th Secretary of treasury of the United States of America

³ Benjamin Shalom Bernanke (Ben Bernanke) was the president of the Federal Reserve System (FED) between February 1, 2006 and February 3, 2014.

complex connections between the financial institutions all around the world a problem with an American bank would affect banks and financial institutions worldwide. In September 27, 2008 the United Kingdom bail out Bradford & Bingley, in October 3, 2008 Germany gave assistance to Hypo Real, in October 13, 2008 Spain opened a line of credit of one hundred billion Euros, Germany a line of credit of five hundred billions, etc. The existing literature (Zaghini, 2014) has shown that after the onset of the financial crisis, the connection between banks and countries, in terms of risk, became tighter due to the enormous liquidity injections in banks provided by governments. *Imperio absenti chaos regit*, or “Too Big to Fail⁴” was an expression that started to be heard as an excuse to some of the bailouts.

The 2007/2008 financial crisis came to show us, once more, the importance that the financial system has to the economy. Through the period of crisis, several non-financial companies filed bankruptcy, but governments didn't bailout them as it did with banks. In April, 2012 the Portuguese Central Bank issued an instruction, N^o 15/2012, limiting the rate that banks could pay to depositors. This measure only wanted to limit the funding costs of banks or to stop them from growing to levels that banks could not support. (Beau, Hill, Hussain, & Nixon, 2014) developed an article about bank funding costs. In short, banks finance their activity through retail funding, such as deposits, wholesale funding, such as

⁴ (Labonte, 2015) states that financial firms are said to be Too Big to Fail when policy makers judge that their failure would cause unacceptable disruptions to the overall financial system because of their size or interconnectedness. Additionally, this concept leads to another important point that if a firm will not be allowed to fail creates moral hazard. This means that if creditors and counterparties believe that governments will rescue TBTF firms they will have less incentive to monitor their riskiness (Kaufman, 2013) concludes that firms are TBTF when their insolvency is perceived to have material adverse spillover effects on other firms and sectors. In other words they believe that the losses are perceived to do serious collateral damage. Such as (Labonte, 2015), he points an important cost with this special insolvency resolutions that is the moral hazard. He states that this procedure reduces market discipline and encourage excessive risk-taking.

bonds, loans from other banks, repo transactions, covered bonds, asset securitization bonds, and equity. Money is the commodity that banks transact and if the price of it goes up, the bank has two choices: (i) it absorbs the higher cost of funding, reducing its profitability; or (ii) increases the coupon rates on new loans and, if possible, on existent ones, creating significant difficulties to companies and families. In the worst case scenario, borrowers can simply be unable to repay their loans, which impose losses in banks' balance sheets with a direct impact in their solvency ratios. We can thus conclude that banks' funding costs can affect the growth of the economy and inflation (deflation) being an important variable in monetary policy.

On May 7, 2009 ECB Executive Board announced a Covered Bond Purchase Programme (CBPP) up to 60 billion Euros. The Decision of the European Central Bank of July 2, 2009 on the implementation of the CBPP (ECB/2009/16) describes the following objectives:

- Promoting the ongoing decline in money market term rates;
- Easing funding conditions for credit institutions and enterprises;
- Encouraging credit institutions to maintain and expand their lending to clients;
- Improving market liquidity in important segments of the private debt securities market.

Using a sample of 16 860 bonds issued by banks during the 2000-2011 period, this work studies the impact of several micro (bond characteristics and banks' accounting and market data) and macroeconomic variables in bond credit spreads issued by banks. We use three different bond instruments: Bank Bonds⁵,

⁵ A bond is a type of debt instrument where basically you lend money to a larger borrower such as a corporation or a governmental institution where the issuer enters into a legal agreement to compensate the

Covered Bond⁶, and securitization bonds.⁷ The onset of the financial crisis, triggered by the collapse of Lehman Brothers announced in September 15, 2008 is an important mark in this investigation, since one of our objectives is to examine its impact on bond credit spreads issued by Western European banks. We also wonder to determine which variable is the most suitable to be used as a proxy for the Sovereign risk - sovereign credit rating, sovereign credit default swaps or yields on treasury bonds. The guarantees provided implicitly by countries to “their” banks during the financial crisis will also be examined, trying to analyze the role of these guarantees in the cost of funding of banks belonging to triple A countries versus those who were financial assisted. We will also investigate the impact of the ECB CBPP on the bank’s cost of funding.

Our results show that the common pricing determinants of the cost of funding differ significantly between Covered Bonds, Bank Bonds and Securitization Bonds. We demonstrate that the 2007/2008 financial crisis had a significant influence in the cost of funding, namely on CB and BB credit spreads. The sovereign risk, represented by sovereign rating, Credit Default Swaps (CDS) and Government Yields, are important variables in determining the cost of funding, especially in times of financial crisis. Additionally, we conclude that CDS is the variable that better captures sovereign risk. Countries with higher ratings provide a safety net to “their banks” in times of financial crisis. Inversely,

Lender (the bondholder) through periodic interest payments in the form of coupons and to repay the original sum (the principal) in full on a stipulated date, which is known as the bond’s “maturity date.” (Thau, 2011)

⁶ Covered bonds are debt instruments secured by a cover pool of mortgage loans (property as collateral) or public-sector debt to which investors have a preferential claim in the event of default. ((ECBC), 2014) (Carbó-Valverde, Rosen, & Rodríguez-Fernández, 2011) (Prokopczuk, B. Siewert, & Vonhoff, 2012)

⁷ Process where loans are package and sold backed by securities. The most common are Mortgage Backed Securities (MBS), Asset backed Securities (ABS) and Collateralized debt Obligations (CDO) (Vink & Thibeault, 2008).

countries that had international financial assistance imposed higher funding costs for “their” banks. The Covered Bond Purchase Programme, announced in May 7, 2009 fulfill their main objectives easing funding conditions for credit institutions.

This work contributes to show that different types of funding instruments are differently affected by common pricing factors. It also contributes to a better comprehension of the relation between the sovereign and banking risk, which is very important for public governors because changes on sovereign risk determinants, such as GDP growth, fiscal balance, external balance, inflation (Cantor & Packer, 1996) can affect significantly the funding conditions of banks. Additionally, it empathizes the effects of a financial crisis on bank’s funding conditions and shows the important role played by the soundness of countries in the funding conditions of banks. Finally, it shows that the first CBPP lowered the funding costs of western European banks, achieving one of the main goals of the programme.

The present work is organized as follows: Next section presents the literature review, where prior theoretical and empirical studies regarded the relationship between bank and sovereign risks are reviewed. In section 3 we present the research hypotheses and describe our sample. Section 4 details the descriptive statistics of the three different bank debt instruments used in this study – bonds, covered bonds, and asset securitization bonds. In section 5 the results of the regression analyses are presented and discussed. Finally, section 6 summarizes the dissertation.

1. LITERATURE REVIEW

With the unwind of the 2007/2008 financial crisis and the massive bank bailouts applied to the financial sector by countries all over the world, the relation between banking⁸ and sovereign⁹ risk has been studied by several authors. As since 1929 that we didn't had a financial crisis with this magnitude, the empirical studies have succeeded by studying not only the banking and sovereign risk but also what other variables can determine bank's cost of funding.

1.1 Banking vs Sovereign Risk

(Gómez-Puig, Sosvilla-Rivero, & K.Singh, 2014) in an attempt to identify the linkage between sovereign and banking risk developed an investigation using Contingent Claim Analysis as an indicator of banking risk and the 10-Year government yield spread over Germany's bonds as a measure of sovereign risk. Using data from banks belonging to ten euro area countries in the 2005-2013 period, authors find that (i) the linkage exists significantly in time of major crisis and the contagion goes from banks to sovereigns; (ii) until the collapse of Lehman Brothers the great majority of all episodes of contagion where from sovereign to banks, as a consequence of economic stagnation and decrease on the growth rates

⁸ The risk of a Bank incorporates several types of risk that it may incur during its activities. (Barrios, Iversen, Lewandowska, & Setzer, 2009) divides credit risk in three types: (i) default risk as the probability that the issuer fails to meet their obligations, (ii) credit spread risk is the one based on the price performance of the bond and is defined by the probability that the market value of the bond will be less than the value of other comparable quality bond and (iii) downgrade risk which reflects the possibility of downgrade by a credit rating agency. In our work, we will only consider the credit risk represented has the probability of default of the Issuer.

⁹ Probability of a Country to default

of Gross Domestic Product (GDP) in the euro area. However, since the dawn of the financial crisis, the majority of all episodes where from banks to sovereign. An important fact of this study is that Germany and Luxembourg were excluded and that when investor's confidence decrease German Bunds were a safety harbor to investments. In conclusion, authors found that there is a bidirectional linkage between bank and sovereign risk, and that during specific times and circumstances the source of the epicenter varies.

(Acharya, Drechsler, & Schnabl, 2014) also study the loop between sovereign and bank risk. Using CDS rates on European Countries and banks between 2007 and 2011, authors present two main conclusions. First, bailouts triggered the rise of sovereign credit risk and after that changes on sovereign CDS explain significantly changes on banks CDS. Second, greater financial sector distress predicts larger bank bailouts, increasing sovereign credit risk and consequently higher debt-to-GDP ratios across countries.

(Alter & Schuler, 2012) studied the interdependence between the default risk of countries that belong to the Eurozone and the default risk of their domestic banks. Using daily CDS data during the 2007-2010 period, they found that: (i) before bailouts, the increase in countries' default risk has its origin in financial sector; and (ii) after the financial crisis, banking sector default risk became strongly influenced by sovereign risk, increasing the sensitivity of sovereign risk because of shocks in the financial sector.

In studying the link between banking and sovereign risk (Gerlach, Schulz, & Wolff, 2010) conducted an investigation in which euro area sovereign bond spreads were used as dependent variables. They concluded that aggregate risk factor, and size and structure of national banking sectors are important determinants of sovereign bond spreads. In times of aggregate risk increasing, economies with larger banking sectors experience a rise on risk and consequently

on spreads. Additionally, banks with lower equity ratios have also to pay larger sovereign risk premiums. This findings leads us to conclude that in times of financial instability, banks with lower equity cushions and countries with larger banking sectors increase significantly the financial effort of countries if they have to bailout their banks. This leads to an increase of public debt and ultimately to an increase on sovereign risk. Considering that sovereign spreads decrease with the increase of bank's equity ratio, they suggest that governments should require banks to hold more equity in order to reduce aggregate risk.

(Gabbi & Sironi, 2005) have investigated empirically the main factors that affect the pricing of corporate bonds. Using a database with the yield issuance spreads on Eurobonds issues on almost 600 major corporations from fifteen developed countries during 1991 to 2001, they have arrived to the following main conclusions: *(i)* rating, provided by Moody's or Standard & Poor's, are one of the most important variable in determining the spread between the yield to maturity of corporate bonds and the equivalent Treasury securities; *(ii)* during this period, the investors' reliance on rating agencies' judgment has increased; *(iii)* variables such as the amount of fees charged, the number of managers in the bond issuing syndicate, and the issuance process - representing the primary market efficiency -, and the expected secondary market liquidity explain corporate bonds cross-sectional issuance spread variability. Another interesting conclusion is that rating agencies discordance regarding the credit rating assigned are perceived by investors as a sign of higher uncertainty about the default risk of the issuers.

(Zaghini, 2014) studied the determinants of the premium paid on bond issuance by banks resident in the Unites States, Euro area and the United Kingdom during the 2006-2011 period. The author focuses on the systemic relevance of the implicit and explicit guarantees provided by countries to "their" banks. The author proves that the crisis induced deterioration in bank's funding conditions, leading also to a liquidity crisis and the freezing of the credit markets.

With the bailout of several financial institutions and the injection of liquidity in credit markets, concerns about public finances in several countries of the euro zone led to problems in the sustainability of public finances and deterioration of sovereign creditworthiness. As a consequence, banks from those countries started to suffer the same problem with increasing of their CDS spreads and rating downgrades which ultimately led to worse funding conditions. The author also concludes that countries with Triple A Rating provided a safety net to their home banking system, while countries without it could not give that implicit support increasing the funding costs of banks. This rating effect was more explicit in the years of the financial crisis. Regarding to other variables studied in the paper, their conclusion were that: (i) bonds with higher ratings usually get lower spreads; (ii) looking to the type of bond issued, subordinated debt is more expensive than senior bonds, while covered bonds coefficient was considered statistically not different from zero; (iii) government guarantees generated a reduction in the issuance premium, proving that that AAA countries provide additional security and that the spread paid reflects the characteristics of the guarantor rather than the issuer; (iv) banks' CDS are highly significant and, as expected, an increase in the CDS premiums leads to an increase in the cost of funding; (v) and looking to the size and systemic relevance, the safety net benefits provided by the Too Big to Fail theory induces a reduction on the premium paid on the primary debt market. However, when interacted with the systemic relevance and the crisis effect, before crisis banks with higher relevance pay a lower spread, but after crisis the signal reversed. In short, their findings show that the link between sovereign and banking risk is particularly significant in crisis periods.

1.2 Covered Bond Purchase Programme

The ECB has been using Covered Bond Purchase Programmes¹⁰ to unfreeze credit markets after the 2007/2008 financial crisis and the subsequent European sovereign debt crisis. There is scan research on the impact of these ECB programs on both credit markets and pricing of bank debt instruments. (Beirne, Dalitz, & Ejsing, 2011) concluded that the first CBPP has fulfill its primary objectives. First, it stimulated a considerable reactivation of covered bonds being issue in the primary market, which has consolidated the image that covered bonds where an important funding instrument, increased the primary market activity and revived market segments, at least temporary. As a consequence, funding conditions on the Eurozone started to improve significantly and if it wasn't the sovereign debt crisis that started in 2010, the effects could had been more lasting.

The (ECB, 2010)presents the main conclusions about the covered bond market developments and the Covered Bond Purchase Programme (CBPP). Announced in May 7, 2009 the purchases started on July 6, 2009 and ended in

¹⁰ The ECB/2009/16 decision of the European Central Bank (ECB) of July, 2 2009 explains the main guidelines of the implementation of the first covered bond purchase programme, namely the scope of the outright purchase of Covered Bonds and the eligible criterions. In the first programme the amount established to fulfill the programme was 60 billion euros to purchase eligible covered bonds between June of 2009 and June of 2010.

In November, 3 2011 the ECB/2011/17 Decision of ECB implemented a second covered bond purchase programme with an estimation of 40 billion euros to purchase eligible covered bonds between November 2011 to October 2012. The objectives were practically the same of the first one: (i) easing funding conditions for credit institutions and enterprises; (ii) encouraging credit institutions to maintain and expand lending to their clients. In October, 15 2014, the ECB/2014/40 decision of the ECB on a third programme was implemented. In this programme the objectives referred are: (i) enhance the transmission of monetary policy, (ii) facilitate credit provision to the euro area economy, (iii) generate positive spill-overs to other markets and (iv) contribute to a return of inflation rates to levels closer to 2 %.ECB estimates to make monthly purchases up to 60 billion until March of 2017.

June 30, 2010. With the aim of improving financial institutions funding conditions, market liquidity of covered bonds, encouraging and easing credit conditions, the measures adopted were ultimately to spur credit growth. One of the results was a growing number of credit institutions that turned to use covered bonds as a funding instrument. As a consequence, the liquidity of the covered bonds secondary market improved significantly. In the primary market, it re-activation was notorious with 25 banks issuing covered bonds for the first time. Overall, the effectiveness of the CBPP was proved. Although the negatives effects of the sovereign debt crisis in the first months of 2010, there was a significant improvement in the functioning of the covered bond market and a tightening in spreads between covered bond yields and swap rates.

(Szczerbowicz, 2014) investigated the impact of the European Central Bank's (ECB) unconventional policies on bank and government borrowing costs. Regarding to the CBPP1 and CBPP2, the paper confirms the results of (Beirne, Dalitz, & Ejsing, 2011) study. These programmes were effective in lowering covered bonds spreads and had a spillover effect on covered bond purchases, especially in reducing sovereign bond markets distress. Another important fact was that these measures aimed to reduce banks funding constrains and covered bond spreads. However, spreads diminished in all studied countries with the exception of Ireland and Portugal.

1.3 Sovereign Risk: how to measure it?

There are three important variables that have been used as a proxy for sovereign risk: (i) credit rating provided by rating agencies; (ii) credit default swaps (CDS), (iii) or government bond yields. (Longstaff, Pan, Pedersen, & Singleton, 2011) define CDS as an insurance contract that allows investors to buy protection against the event of default or a debt restructuring. They claim that the advantage of using CDS data, comparing with bond data, is that the market

is typically more liquid resulting in more accurate estimates of credit spread and returns. Regarding the use of credit ratings, (Remolona, Scatigna, & Wu, 2007) present the following main advantages: (i) rating agencies explain their criteria and rating methodologies; (ii) they regularly review and report the correspondence of their ratings with historical default rates, and (iii) rating agencies stake their business on the accuracy of their ratings. The main disadvantage is that they focus on a long-term horizon and respond only to the component of credit quality changes that are perceived to be permanent. The main question is that investors more and more care about credit quality in the short term and ratings don't have the ability to provide precise point-in-time measures of risk. In the same line of reasoning, (Zhu, 2004) argues that comparing both bond and CDS markets, CDS moves ahead of the bond market in price adjustment, particularly for United States entities.

(Casu, Clare, Sarkisyan, & Thomas, 2013) analyzed the effect of accessing to the securitization market on bank performance. Using United States commercial bank data from 2001 to 2008, the authors found that securitizing banks tend to be more profitable institutions, with a more diversified funding structure but with higher funding costs and also with higher credit risk exposure. Additionally they tend to hold larger and less diversified loan portfolios, have less liquidity and capital, and a significant lower loan growth rate.

2. HYPOTHESES AND SAMPLE SELECTION

2.1 Hypotheses

Having as primary objective the study of the relation between banking risk and Sovereign Risk we raised 6 hypotheses:

1. The impact of pricing factors on credit spread differs significantly between Bank Bonds, Covered Bonds and Securitization Bonds.

[(Vink & Thibeault, 2008), (Pinto & Santos, September 2015)]

2. The sovereign risk has a significant positive impact on bank risk, after controlling for other micro and macro pricing factors.

[(Acharya, Drechsler, & Schnabl, 2014), (Alter & Schuler, 2012), (Zaghini, 2014), (Caporale, Matousek, & Stewart, 2009), (Panetta, 2011)]

3. The 2007-2008 financial crisis increased significantly the impact of sovereign risk on bank risk.

[(Gómez-Puig, Sosvilla-Rivero, & K.Singh, 2014), (Alter & Schuler, 2012) (Zaghini, 2014)]

4. Countries with Triple A rating provided a safety net on “their” banks funding conditions, during the 2007-2008 financial crisis.

(Zaghini, 2014)

5. Countries that had international finance assistance witnessed a deterioration on “their” bank’s funding conditions.

6. The first Covered Bond Purchase Programme (CBBP) eased the funding conditions during the 2007-2008 financial crisis.

[(Beirne, Dalitz, & Ejsing, 2011), ((ECBC), 2014), (Szczerbowicz, 2014)]

Regarding the first hypothesis, we will conduct a study using regression analyses and standardized coefficients regression to prove that the impact of pricing factors on credit spread differs significantly between Bank Bonds (BB), Covered Bonds (CB) and Securitization Bonds (SB). Additionally, we will use the Chow Test of structural change to check if the estimated coefficients for CB, BB and SB are the same. A descriptive analysis will also be made to support the hypotheses. As said above, we will use the calculation of the Standardized Regress Coefficients. When we run a normal regression, the output gives us coefficients that are unstandardized because we cannot compare them in the majority of the cases. For example, we cannot compare volatility and maturity independent variables because they have widely varying means and variances. Spread and these variables are usually significantly positively related. However, what is really important is to know what the trade-offs are. For example, if a bank wants to lower its cost of funding what would be the best decision: wait for the markets to stabilize or issue Bonds/Loans with lower maturities? This example may not be practical but show us the limitations that a normal regression has. To minimize this we will use the "Beta" option in the regress command in Stata.

The main purpose of the second hypothesis is to investigate the impact of sovereign risk on bank risk. In order to do that we will use regression analysis and standardized coefficients regression. We will use firstly country rating as a proxy for sovereign risk. Then we will check our results using credit default swaps and government bond yields as alternative proxies.

With the third hypothesis we intend to study the impact of the financial crisis on the relationship between sovereign and bank risk. We argue that the financial crisis increased significantly the impact of sovereign risk on the spreads for the three forms of bank funding, CB, BB and SB. Regression analysis and standardized coefficients regression will also be implemented.

With the fourth hypothesis we aim to investigate the effect of a Country with triple A Credit Rating during the financial crisis on bank's cost of funding. In line with the analysis implemented by (Zaghini, 2014), we will examine if a country with a triple A rating in fact provides additional security in the issuance of BB or CB by "their" banks.

On the contrary, in the fifth hypothesis we intend to study exactly the opposite. We argue that countries that were financial assisted by international institutions induced a deterioration on "their" banks funding conditions. These two hypotheses are very important to understand the connection between the banks' cost of funding and the soundness of their countries.

Another important fact was the launch of the Covered Bond Purchase Programme. Announced in May 7, 2009 this programme had the important task of minimizing the effects of the financial crisis triggered by the bankruptcy of Lehman Brothers which lead to a halt in interbank market activity. This hypothesis intends to investigate if the programme fulfilled its main monetary policy objectives easing funding conditions (Beirne, Dalitz, & Ejsing, 2011). For that we will first conduct a descriptive analysis comparing the mean and median spreads through the period of analysis. Then, a regression analysis comparing the effects of the CBPP1 announcement had on credit spreads will be implemented.

2.2 Sample Selection

Our sample includes bond offers data drawn from DCM Analytics databases for the 2000-2011 sampling period. Although the data drawn from DCM Analytics relates to several types of bonds, we include only those with a deal type code of “corporate bond-investment-grade”, “corporate bond-high yield”, “asset-backed security” (ABS), “mortgage-backed security” (MBS), and “covered bonds”. Data on macroeconomic variables, such as Risk Free Rate, slope of the Euro swap curve, Volatility, Sovereign Credit Default Swaps and Government Yields was obtained from DataStream¹¹. Additionally, accounting and market data for banks was drawn from Bankscope.¹² Since DCM Analytics does not provide an identification code we hand-matched banks in the Bankscope database with issuer names for Bank Bonds and Covered Bonds and issuer-parent names for Securitization Bonds in DCM Analytics database.

Since we wish to study the impact of sovereign risk on banking risk, we select from our full sample those issues that have complete data on credit spread. We also require that the bank was headquartered in Western Europe and that the tranche size (in Euro millions) be available. These screens have yielded a sample of 16,860 observations, of which 10,920 were classified as covered bonds (€ 2,429.4 billion), 5,695 as bank bonds (€ 3,041.9 billion), and 245 as securitization bonds (€ 188.7 billion).

¹¹ DataStream is provided by Thomson Reuters

¹² Bankscope is a global database of bank’s financial statements, rating and intelligence. It combines comprehensive financial statements with a wide range of other banking intelligence including ratings, an analysis model, bank structures, news, AML documentation and banking research. It also provides information on 32,000 banks and it’s used by over 90% of the world’s top 1,000 banks. Is compiled by Bureau van Dijk Electronic Publishing

2.2.1 Description of Variables

We use *credit spread* as a proxy for banking risk, being the dependent variable in our regression models. The credit spread represents the credit risk of the issuer, defined as the uncertainty associated with potential loss of either principle or interest on a fixed income obligation (Jacobs, Karagozoglu, & M., 2010); i.e., corresponds to the price for the risk associated with the financing instrument at issuance. The spread is thus computed as the margin yielded (in bases points) by the security at issue above a corresponding currency treasury benchmark with a comparable maturity.

We consider the following control variables as determinants of the credit spread:

- Country Rating

Country Rating is approximated by Standard & Poor's country rating; i.e., the S&P's country credit rating at close. The rating is converted as follows: AAA=1, AA+=2, and so on until D=22. Thus, this variable measures from 1 for the countries with the lowest risk to 22 for the countries of highest risk. A positive coefficient is expected since countries with a lower score number (highest quality) have lower country risk. The reviewed empirical studies found that country-specific effects on bank ratings, and consequently on their funding conditions, evidences that in some countries, banks have systematically higher rating (Caporale, Matousek, & Stewart, 2009). (Arezki, Candelon, & Sy, 2011) also found that sovereign rating downgrades have statistically and economically significant spillover effects both across countries and financial markets. (Caselli, Gandolfi, & Soana, 2016) studied the impact of sovereign rating changes on domestic bank shares prices and argues that The Committee on the Global

Financial System (2011) recognizes that sovereign downgrades have direct negative repercussions on the cost of bank debt and equity funding. Regarding to our deal types, CB, BB and SB we do not find any empirical study that includes country rating as a regressor to test the impact of country credit risk on *credit spread*. In short, a positive effect on the spread is expected since banks headquartered in countries with lower risk tend to give and special protection in default (Zaghini, 2014).

- Credit Rating

This variable represents the rating assigned by a credit rating agency at the time of issuance. It describes the creditworthiness of the instrument or its relative credit quality. We use a rating classification scheme based on 22 rating scales for two rating agencies. Loan and bond ratings are thus based on the S&P and Moody's rating at the time of issuing the bond or closing the loan, and converted as follows: AAA=Aaa=1, AA+=Aa1=2, and so on until D=22 [(Sorge & Gadanez, 2008), (Vink & Thibeault, 2008), and (Gatti, Kleimeier, Megginson, & Steffanoni, 2013)]. This means that the higher the value the lower the rating. (Gabbi & Sironi, 2005), (Zaghini, 2014) and (Zähres, 2012) have studied the relationship between *credit rating* and *credit spread* and they found that: (i) *credit rating* is one of the most important determinants of credit spreads; and (ii) the higher the credit risk, meaning a higher rating, the higher the credit spread, creating a positive relationship among this two variables..

- Time to Maturity

Time to Maturity is the maturity of bonds, in years. Bonds with longer maturities tend to be more risky than loans or bonds with shorter maturities or average lives, because predictability of future cash flows weakens with horizon.

Therefore, investors usually demand higher premium for longer term securities. Empirical results show that lenders get a higher remuneration in investment grade bonds for being exposed to risk for a longer period of time [e.g., (Jones, Mason, & Rosenfeld, 1984), (Sarig & Warga, 1989), (He, Hu, & Lang, 2000), (Duffie & Singleton, 2001), and (Sorge & Gadanecz, 2008)] However, the literature has been more controversial regarding the term structure of credit spreads for non-investment grade bonds [see, among others, (Sarig & Warga, 1989), (Fons, 1987), (Helwege & Turner, 1999), and (Sorge & Gadanecz, 2008)]. (Sorge & Gadanecz, 2008) detect that credit spreads for both investment-grade and speculative-grade bonds are a positive linear function of maturity. Regarding securitization bonds, (Vink & Thibeault, 2008) find a significant negative relationship between spread and (i) CDOs with a maturity lower than 5 years (low maturity); and (ii) MBS with a maturity longer than 15 years (high maturity). However, the coefficients on ABS with low maturity and high maturity are insignificant. Thus, the variable expected sign cannot be determined clearly from the empirical literature.

- Risk free rate

We use as a proxy for the *risk-free rate* the three-month German Treasury bill at the time of issuing the bonds. (Eichengreen & Mody, 1998) and (Kamin & Von Kleist, 1999) find that the general level of interest rates is an important determinant of the pricing of bonds. We expect that *Risk free rate* will have a significant negative impact on credit spreads since higher yields mean better economic conditions and thus lower probabilities of default[(Collin-Dufresne, Goldstein, & Martin, 2001), (Longstaff, Pan, Pedersen, & Singleton, 2011)].

- Slope of the Euro swap curve

The inclusion of the *slope of the Euro swap curve* (obtained as the difference between the five-year Euro swap rate and the 3-month Libor rate) as an additional control variable is motivated by the following reasons: (i) it corrects for the fact that bonds credit spread might be measured over base rates of different maturities; and (ii) it controls for varying inflation expectations, which might have different impact on pricing fixed versus floating rate debt. (Sorge & Gadanecz, 2008) find that a steeper US Treasury yield curve is associated with lower spreads. (Hu & Cantor, 2006) find that structured finance spreads are highly correlated with the slope of the swap curve. We expect that a steeper euro yield curve will reduce credit spreads since it might represent a positive expectation on economic growth, leading to better financial performances.

- Volatility.

Volatility refers to the amount of uncertainty or risk associated with changes in an asset's value. A higher volatility means that an asset's value can potentially be spread out over a larger range of values; i.e., the price of the financial assets can change dramatically over a short time period in either direction. On the contrary, a lower volatility means that an asset's value does not fluctuate dramatically, but changes in value at a steady pace over a period of time. We use the Chicago Board Options Exchange Volatility Index (VIX) as a proxy for market volatility. VIX reflects a market estimate of future volatility, based on the weighted average of the implied volatilities for a wide range of strikes. We expect a positive relationship between *Volatility* and *credit spread* as borrowers will require a higher return in the presence of higher volatility. [(Pinto J. F., 2013), (Fabozzi & Kothari, 2007), (Davidson, Wolff, & A., 2003) (Collin-Dufresne, Goldstein, & Martin, 2001)].

- Number of banks

The bank involvement measured by the *number of banks* supporting the transaction can be used to approximate a deal's risk; i.e., a larger number of banks involved may lower the spread if investors associate a larger number of banks with an increase in the certification of the transaction. Regarding SB transactions, (Vink & Thibeault, 2008) find that whereas credit spread and number of lead managers are significantly, negatively related for MBS, they have an insignificant relationship for ABS and CDOs. Therefore we expect *Number of banks* to have a negative influence on the spread [(Sorge & Gadanecz, 2008), (Nadauld & Weisbach, 2012)].

- Number of bookrunners

The bookrunner is the underwriting institution of the financial instrument; i.e., it has the responsibility of "running" all the process. The number of bookrunners is connected with the number of banks since the number of bookrunners are at least equal to the number of banks involved in the bond issuance. If there is more than one bookrunner involved they are typically called joint bookrunners. We expect that the influence of this variable on the *credit spread* is the same as predicted for the *number of banks*.

- Bookrunner Participation

Is the part of the financial instrument that the bookrunners keeps to themselves. If the bond is considered of low risk, the bookrunner will have the tendency to keep the most part to him, if not we will try to "sell" as much as possible to other banks in an attentive to lower its risk. We expect that the higher the participation, the lower the risk.

- Loan to Value

The *Loan to value* ratio represents the ratio between the tranche size and the transaction size. To calculate the ratio we divided manually the tranche size over the transaction. If the transaction only contains one tranche the value is 100%. In order to calculate the ratio we used the methodology proposed by (Vink & Thibeault, 2008). For BB and CB, we expect that *credit spread* and *loan to value* will have a significant positive relationship, suggesting that lenders associate an increase in the loan to value ratio with a significant increase of credit risk. On the contrary, we expect that *credit spread* and *loan to value* have a significant negative relationship for SB issues; i.e., and if the loan to value is higher, we will expect a lower credit spread. In securitization transactions several credit enhancement mechanisms are implemented to improve the *credit rating* of the issued securities and reduce the risks transferred to investors. One mechanism is the creation of a credit risk mitigation device by subordination of tranches with lower size; such that those lower tranches provide credit support to the most senior tranche.

- Tranche size

The *tranche size* represents the amount of the tranche in euros. (Sorge & Gadanez, 2008) find a negative coefficient on bond *tranche size*. Referring to SB, (Maris & Segal, 2002) study the determinants of *credit spread* on CMBS and find that *tranche size* influence negatively the CMBS *credit spread*. Similarly, (Firla-Cuchra, 2005), (Vink & Thibeault, 2008), and (Buscaino, Caselli, Corielli, & Gatti, 2012) find a negative impact of *tranche size* on the spread. We expect that the higher the *tranche size*, the lower the spread.

- Number of tranches

Represents the *number of tranches* per transaction. SB issues are usually divided into one or more tranches. The same happens with several BB and some CB issues in our sample. For each transaction we computed manually the variable *number of tranches*. For BB and CB issues, it is feasible to associate risk with the *number of tranches*. Riskier transactions might imply a higher number of tranches since each investor is available to constitute a lower share in its portfolio and thus a positive coefficient is expected. For SB, the *number of tranches* allows us to analyze the impact of tranching on the *credit spread*. As referred by (Vink & Thibeault, 2008), “[T]ranching could allow the issuer to take advantage of market factors such as greater investor sophistication and heterogeneous screening skills related to asymmetric information.” (Firla-Cuchra & Jenkinson, 2006) find a significant and negative relationship between the *number of tranches* and the *credit spread* (launch spread). Thus, a negative coefficient between spread and *number of tranches* is expected for SB.

- Fixed Rate

Fixed rate is a dummy variable set equal to 1 if the bond has a fixed rate and zero otherwise. With fixed interest rate, the interests do not fluctuate and are typically protected to avoid the risk of rising interest rates. We expect borrowers to raise funds at a higher spread through fixed priced issues than through floating priced issues. For this reason, a positive sign is expected for a fixed rate issue. Empirically, (Sorge & Gadanecz, 2008) find a significant discount in the pricing of floating rate bonds. They assert that this can reflect the insurance which fixed rate offers against future interest rate fluctuations (Vink & Thibeault, 2008).

- Currency risk

Currency risk is a dummy variable set equal to one for bonds that are denominated in a currency different from the currency of the banks' home country and zero otherwise. We should expect issues exposed to currency risk to have higher credit spreads than issues not exposed. (Vink & Thibault, 2008) find that SB issues exposed to currency risk have higher spreads than other issues not exposed to.

- Callable

Callable is a dummy variable set equal to one if the bond has a call option and zero otherwise. A callable bond is a bond that can be redeemed by the issuer at some point before the bond reaches its date of maturity. The call price will usually exceed the par or issue price; i.e., usually there are substantial call premiums. Thus, a positive sign is expected for a callable bond as the issuer has an option, for which it pays in the form of a higher credit spread. (Fabozzi & Kothari, 2007)

- Crisis

Crisis is a dummy variable equal to one if the issue date belongs to the crisis period and zero otherwise. We consider a pre-crisis period from January 1, 2000 through to September 14th, 2008, and a crisis period from September 15th (Lehman Brothers' bankruptcy filing date), through to December 31st, 2011. A positive coefficient is expected since the 2007/2008 financial crisis has resulted in a number of bank bailouts and business failures, a decline in consumer wealth, and a downturn in economic activity. During this period two other dates will be examined: (i) May 7, 2009 - announcement of the first ECB Covered Bond

Purchase Programme; and (ii) May 2, 2010, which was the day of the official request of financial aid by Greece, representing for many investigators the beginning of the Sovereign Debt Crisis (Carbó-Valverde, Rosen, & Rodríguez-Fernández, 2011). For example, (Prokopczuk, B. Siewert, & Vonhoff, 2012) show that, in general, CB average yield spread increased more than 100 bps during the financial crisis.

- Country CDS

*Country CDS*¹³ means the sovereign CDS at the time of issuance. Sovereign CDS contracts are insurance contracts that allow investors to buy protection against the event of default or debt restructuring (Longstaff, Pan, Pedersen, & Singleton, 2011). We use sovereign CDS spreads with a five year maturity since they are the most liquid and account for a large proportion of the sovereign CDS Market (Remolona, Scatigna, & Wu, 2007). Again, as for country rating, we expect that country CDS and credit spreads will have a significantly positively relationship for all the bond types [(Alter & Schuler, 2012), (Acharya, Drechsler, & Schnabl, 2014)].

- Yield Country

The 10yrs government yields are commonly used in empirical investigation (Gómez-Puig, Sosvilla-Rivero, & K.Singh, 2014). We expect that an increase on the yields, derived from an increase on the credit risk (Barrios, Iversen, Lewandowska, & Setzer, 2009), will result on an increase of the spreads paid by banks at issuance.

¹³ Credit Default Swap is a contract that provides insurance against the risk of default by a particular entity. (Hull J. C., 2012)

- AAA_pre_crisis

This variable is a dummy set equal to one if the country has a triple A rating during the pre-crisis period and zero otherwise.

- AAA_crisis

This variable is a dummy set equal to one if the country rating has triple A rating during the crisis period and zero otherwise. This dummy variable intends to prove that Western European countries with a triple A rating gave additional protection to their banks in the period of crisis (Zaghini, 2014).

- Coun_Under_Ass Pre_Crisis

This variable is a dummy set equal to one if the if banks are headquartered in Portugal, Italy, Ireland, Greece and Spain during the pre-crisis period and zero otherwise.

- Count_Under_ASSCrisis

This variable is a dummy set equal to one if banks are headquartered in Portugal, Spain, Greece or Ireland during the crisis period and zero otherwise. It intends to analyze if banks in these countries, who had international financial assistance, were more “punished” during the financial crisis.

- Cash + Securities / Assets

Cash represents money available for use in the normal operations of the bank. It is the most liquid of all of the bank's assets. Securities is computed as the

sum between the following items: reverse repos and cash collateral, trading securities, derivatives, available for sale securities, held to maturity securities, at-equity investments, and other securities. We expect that an increase on the liquidity will result on a risk reduction (Agostino & Mazzuca, 2008).

- Loans/Customer Deposits

This liquidity or funding ratio indicates to what extent the banks relatively illiquid loans are funded by relatively stable customer deposits¹⁴ rather than wholesale or market funding. Ideally this ratio should be 100%. (Altunbas, Manganelli, & Marques-Ibanez, 2011) state that customer deposits provide funding stability and reduces the probability of a bank rescue[(Agostino & Mazzuca, 2008) and (Casu et al. 2013)]. We thus expect a positive relation between this ratio and bond spreads.

- Net Loans/ Total Assets

This liquidity ratio indicates what percentage of the bank's assets is tied up in loans. The higher this ratio the less liquid the bank is. Net loans is computed as residential mortgage loans, plus other mortgage loans, plus other consumer/retail loans, plus corporate and commercial loans, plus other loans, minus reserve against possible losses on impaired or non-performing loans. Our expectation is that a less liquid bank should have its risk increased (Casu et al. 2013). However (Alessandri, Masciantonio, & Zaghini, 2015) show that the different between safe banks and crisis banks does not display different values.

¹⁴ Current accounts, which may or may not be interest bearing, are subject to immediate and unlimited withdrawal at the option of the customer

- Equity / Total Assets

As Equity is a cushion against asset malfunction, this ratio measures the amount of protection afforded to the bank by the Equity they invested in it. The higher this figure the more protection there is. With the increase of this ratio we expect that credit risk to be lower[(Agostino & Mazzuca, 2008), (Caporale, Matousek, & Stewart, 2009), (A. Minton, Stulz, & Williamson, 2005)].

- Total Regulatory Capital Ratio

This ratio is the total capital adequacy ratio under the Basel rules. It measures Tier 1 + Tier 2 capital which includes subordinated debt, hybrid capital, loan loss reserves and the valuation reserves as a percentage of risk weighted assets and off balance sheet risks. We expect the higher the value the lower the solvency risk. (Altunbas, Manganelli, & Marques-Ibanez, 2011) also claims that, in principle, the higher the value of capital reserves, the stronger the buffer to withstand losses. Additionally banks with more capital and thus less leverage, reduces risk-shifting incentives from shareholders towards excessively risky projects at the expense of debt holders (Casu et al. 2013).

- Impaired Loans/Gross Loans

This ratio reflects the loan quality of the bank. Is a measure of the amount of total loans which are impaired or doubtful. We expect that the lower the ratio the higher the bank's asset quality and thus the lower the *credit spread*. [(Casu et al. 2013), (A. Minton, et al 2005)]

- Return on Average Assets (ROAA)

Computed as net income over the total assets, the ROAA is a profitability ratio that allows to compare the efficiency and operational performance of banks. It measures the generated returns by bank's assets. We expect that the more profitable the bank is, the lower the cost of funding. [(Casu et al. 2013), (Alessandri et al. 2015) (Caporale et al. 2009)]

- Return on Average Equity (ROAE)

Computed as the net income over the equity, is also a profitability ratio. The higher the ratio the better, except when a bank is highly leveraged and hence more vulnerable to shocks. [(A. Minton, et al 2005), (Casu et al. 2013), (Alessandri et al. 2015)]

- Total Assets

Total assets ratio is the sum of total current assets, long term receivables, investment in unconsolidated subsidiaries, other investments, net property plant and equipment and other assets. We expect that the higher the total assets ratio, the lower the cost of funding. [(Zaghini, 2014), (Calomiris & Mason, 2003), (Caporale, Matousek, & Stewart, 2009)]. However, (Altunbas, Manganelli, & Marques-Ibanez, 2011) refers that institutions with higher risk exposure have larger size. Hence, the relationship between total assets and *credit spread* cannot be determined based on the existing literature.

Table 5.2 and Table 5.3 presents the description of variables, expected sign and findings following the existing theoretical and empirical literature.

3. UNIVARIATE ANALYSIS

This chapter provides a statistical analysis of Bank Bonds (BB), Covered Bonds (CB), and Securitization Bonds (SB) issued by banks in Western Europe. We start by comparing credit spread and common pricing factors among the three types of bond issues. Then we present the distribution of spreads across time by country of the issuer, deal type, country rating, and considering two sub-periods: pre-crisis and crisis period.

3.1 Descriptive statistics by Bond Type

Table 3.1 presents descriptive statistics for BB, CB and SB issued by Western European banks during the 2000-2011 period. We also conducted bivariate comparisons of the credit spread and pricing characteristics between the three deal types using nonparametric tests – Wilcoxon rank-sum test for continuous variables and Fisher’s exact test for discrete variables. Regarding the credit spread, Table 3.1 shows that the average credit spreads are economically and statistically lower for CB (39.78 bps) than they are for BB (103.78 bps) and SB (149.56 bps). Additionally, the average credit spreads for SB are economically and statistically higher than the credit spreads for BB at the 5% significance level. However, this can reflect the country rating, since CB issuers are, on average, located in countries with higher credit ratings (1.28) than in the case of SB (1.43) and BB (1.88) categories. This is in line with the prediction that countries with higher credit ratings provide additional protection on bank funding costs (Zaghini, 2014). On the contrary, we find that BB issuers are, on average, located in far riskier countries than in the case of SB, which is not reflected in the cost of credit spreads. Still, these Univariate analyses do not allow us to control for other factors that are known to affect the pricing of bonds. Thus, in order to further test

Hypothesis 2 we proceed, in Chapter 4, with a regression analysis that takes micro and macro pricing factors directly into account.

Table 3.1 Descriptive statistics for BB, CB, and SB

<i>Variable of Interest</i>	<i>Deal Type</i>		
	COVERED BONDS (CB)	BANK BONDS (BB)	SECURITIZATION BONDS (SB)
	(N=10 920)	(N=5 695)	(N=245)
Continuous Variables			
Credit Spread [bps]			
Mean	39,78 ^{a,b}	103,78 ^{a,c}	149,56 ^{b,c}
Median	(26,50)	(60,50)	(101,51)
Credit Rating [1-22 weak]			
Mean	1,52 ^{a,b}	4,44 ^{a,c}	4,38 ^{b,c}
Median	(1,00)	(4,00)	(3,00)
Time to Maturity [years]			
Mean	5,46 ^{a,b}	5,78 ^{a,c}	23,45 ^{b,c}
Median	(4,95)	(5,01)	(16,58)
Number of banks			
Mean	1,84 ^{a,b}	3,39 ^{a,c}	2,08 ^{b,c}
Median	(1,00)	(2,00)	(1,00)
Number of bookrunners			
Mean	1,51 ^a	1,75 ^{a,c}	1,34 ^c
Median	(1,00)	(1,00)	(1,00)
Bookrunner Participation			
Mean	67,49% ^{a,b}	33,38% ^{a,c}	44,82% ^{b,c}
Median	(100,00%)	(0,00%)	(0,00%)
Loan to Value			
Mean	99,25% ^{a,b}	96,75% ^{a,c}	42,43% ^{b,c}
Median	(100,00%)	(100,00%)	(25,55%)
Tranche size [Euro million]			
Mean	222,47 ^{a,b}	534,13 ^{a,c}	770,26 ^{b,c}
Median	(73,30)	(300,00)	(408,45)
Number of tranches			
Mean	1,02 ^{a,b}	1,15 ^{a,c}	4,30 ^{b,c}
Median	(1,00)	(1,00)	(4,00)
Country Rating [1-22 weak]			
Mean	1,28 ^{a,b}	1,88 ^{a,c}	1,43 ^{b,c}
Median	(1,00)	(1,00)	(1,00)
Discrete Variables			
Fixed Rate Issue	85,42% ^a (9 328)	53,26% ^{a,b} (3 033)	13,06% ^{a,b} (32)
Currency Risk	5,83% ^a (637)	20,33% ^{a,b} (1 158)	37,96% ^b (93)
Callable	13,93% ^a (1 521)	11,89% ^{a,b} (677)	60,00% ^{a,b} (147)

Notes: In each cell are mean and median (in parentheses) for continuous variables, percent and number (in parentheses) for discrete variables. The tests for similar distributions in bond characteristics across samples are the Wilcoxon rank-sum test for continuous variables and the Fisher's exact test for discrete variables. (a) indicates significant difference at the 1% level between CB sample and BB sample; (b) indicates significant difference at 1% level between CB sample and SB sample; (c) indicates significant difference at 1% level between BB sample and SB sample .

The average *credit rating* for CB sample (1.52) is significantly lower than the *credit rating* for SB (4.38) and BB (4.44) samples. This suggest that both AS and BB are consider more risky than CB and is consistent with the premise that the higher the *credit rating* the lower the cost of funding. A SB of average size matures over just 23.45 years, which is a long period if we compare it with the mean (median) 5.46 (4.95) and 5.78 (5.01) years for CB and BB bonds, respectively. This is a standard asset securitization characteristic, since in SB the maturity of the securities issued typically matches the maturity of the assets used as collateral, which are characterized by longer maturity levels (Vink & Thibeault, 2008).

In the SB sample, the average number of banks participating in an SB issue is 2.08, which is significantly larger than the average of 1.84 for CB but smaller than the average of 3.39 for BB, which suggest that banks wish to increase the number of institutions participating in traditional bank bond issuance in order to increase the certification of the transaction. This is the case because contrary to traditional bank bonds, where the ability of the issuer to generate sufficient cash flows to service the debt determines the risks of the bond issue, in securitization and covered bonds the repayment depends only or primarily on the assets and cash flows pledged as collateral to the issue. Similar findings were obtained for number of bookrunners.

Regarding Bookrunner participation, the three bond types are different debt instruments. In the CB sample, the average number of bookrunners 67% with the median at 100%, which is significantly higher than the average bookrunners participation for SB (45%) and BB (33%). The loan to value ratio is

economically and statistically higher for CB (99.25%) than they are for BB (96.75%) in SB bonds (42.43%). On the contrary, SB, on average, have lower loan to value ratios than BB.

The mean (median) *tranche size* of the sample BB is €534.13 million (€300 million). Compared to the mean (median) *tranche size* of €770.26 million (€408.45 million) for the SB sample, BB tranches are significantly smaller. On the contrary, BB tranches are significantly larger than CB tranches with a mean (median) of €222.47 million (€73.30 million). Similarly, the number of tranches per transaction is higher for SB (4.30) vis-à-vis BB (1.15) and CB (1.02). Taken this results together, we may conclude that in asset securitization banks benefit for tranching off a larger degree.

Regarding discrete variables, we find that a significantly larger fraction of CB are fixed rate (85.42%) compared to BB (53.26%) and SB (13.06%). The incidence of currency risk is significantly lower in the CB sample than in the BB sample. In the BB sample, 20.33% of the issues are subject to currency risk, compared to a mere 5.83% in the CB sample. However, the fraction of SB and BB subject to currency risk in Western Europe do not differ significantly. Finally, the fraction of SB with a call option is 60%, which is significantly higher than the 11.89% and 13.93% observed for BB and CB issues, respectively. The possibility of redeem the bond before its maturity date brings and additional cost and also help to explain why SB have higher credit spreads than BB and CB.

3.2 Credit Spread over time by Issuer Country

In this section we analyze the evolution of credit spread, considering the three types of funding together, between 2000 and 2011 by issuer country; i.e., considering where the banks are headquartered. Figure 3.1 includes the average spreads by year for all bank issuers in each country and Figure 3.2 compares the average spread for banks headquartered in Greece, Ireland, Portugal and Spain. We use this comparison to observe the crisis effects on countries that were financially helped. Table 3.2, figure 3.1 and figure 3.2 show that until 2007 banks benefit of lower funding costs. However, the 2007-2008 financial crisis and the subsequent European sovereign debt crisis increased significantly the credit spreads, especially in countries such as Greece, Portugal and Ireland, which asked for international financial assistance. This shows that the financial crisis was more severe to countries that lost their financial soundness.

Figure 3.1. Credit spread across time by issuer country

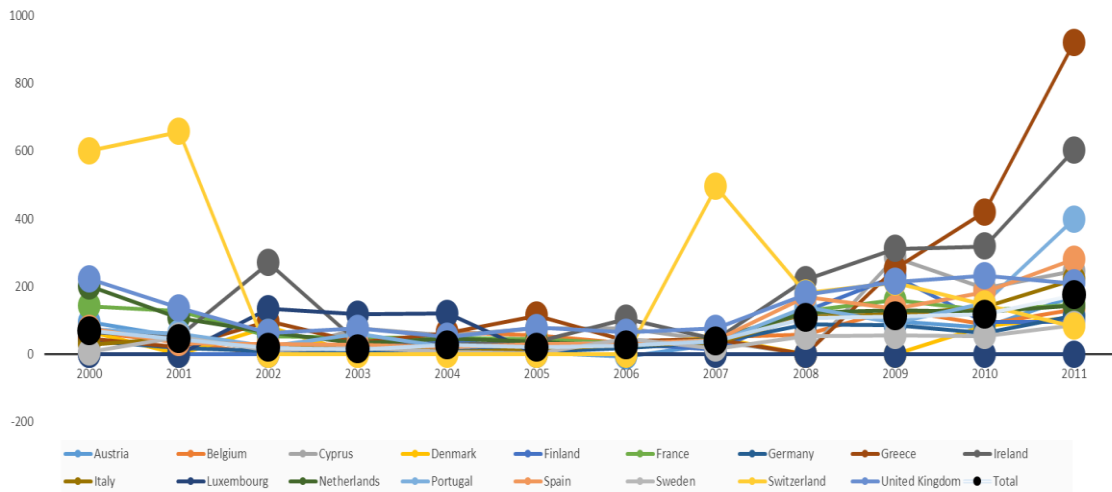


Figure 3.2. Credit spread across time by issuer country (Germany, Greece, Ireland, Portugal & Spain)

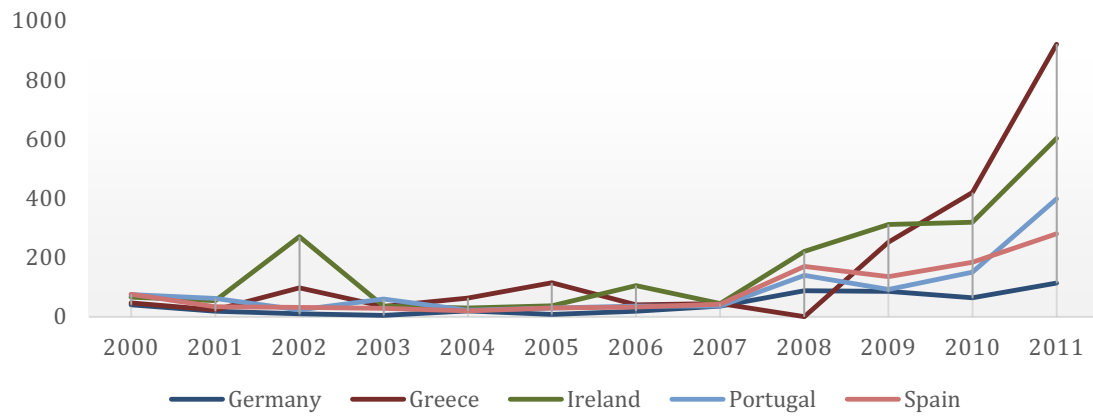


Table 3.2 Credit spread across time by issuer country

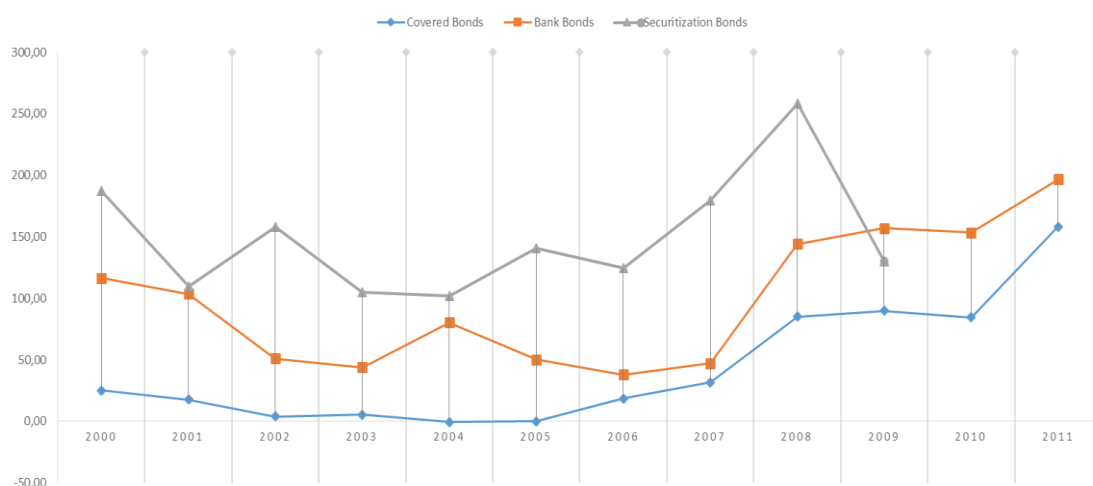
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total	
Austria	95,1 (29,01) 15	51,0 (23,55) 24	18,9 (27,00) 35	17,1 (20,51) 68	13,6 (,60) 43	4,2 (14,30) 87	-6,2 (1,70) 72	30,0 (30,12) 31	134,3 (107,80) 93	97,2 (87,70) 65	79,8 (74,61) 19	173,0 (140,45) 18	51,5 (30,78) 570	
Belgium	64,3 (38,70) 28	37,8 (35,70) 63	-1,6 (9,76) 37	19,3 (8,11) 64	66,0 (17,90) 142	55,2 (11,94) 129	32,4 (21,68) 70	50,2 (29,35) 79	59,2 (58,38) 70	133,7 (103,88) 54	88,7 (87,70) 47	133,2 (124,05) 33	58,8 (34,90) 816	
Cyprus				77,1 (71,76) 3	55,6 (55,61) 1	76,3 (66,48) 3	76,5 (78,23) 3	40,0 (39,96) 2		286,0 (286,00) 1	195,5 (195,48) 2	245,9 (247,41) 3	124,4 (87,57) 18	
Denmark	67,8 (67,80) 2		81,8 (81,81) 1		35,4 (25,65) 3	7,5 (7,48) 2	32,1 (38,60) 4	49,7 (49,70) 1			84,8 (84,80) 1	109,7 (109,65) 2	51,3 (46,44) 16	
Finland				10,7 (12,18) 4	40,0 (32,91) 5	19,6 (18,83) 4	30,3 (26,99) 6	15,4 (16,70) 3	127,3 (113,29) 3	230,5 (182,10) 8	95,4 (93,70) 6	94,5 (90,10) 4	86,6 (66,60) 43	
France	142,5 (48,48) 75	128,3 (48,40) 60	53,2 (42,35) 62	49,7 (33,60) 71	48,0 (35,70) 93	43,5 (33,60) 79	32,6 (31,04) 116	34,6 (30,40) 149	127,8 (125,01) 137	160,2 (141,20) 153	130,4 (113,75) 192	146,8 (125,50) 173	98,9 (71,00) 1360	
Germany	40,4 (30,88) 559	19,0 (24,65) 674	9,6 (16,38) 825	4,8 (11,30) 1 159	19,8 (5,70) 993	8,1 (8,30) 1 006	18,9 (16,20) 710	36,3 (29,20) 585	87,4 (74,95) 770	85,3 (75,80) 1 077	63,5 (54,90) 655	113,9 (108,09) 367	37,7 (26,68) 9 380	
Greece	46,9 (46,90) 1	22,4 (22,38) 1	97,5 (97,84) 6	35,2 (42,38) 4	63,0 (50,71) 10	114,3 (87,53) 4	40,2 (44,35) 15	44,0 (44,31) 9		252,6 (269,86) 12	419,7 (450,81) 13	920,8 (1252,59) 3	181,2 (81,73) 78	
Ireland	65,8 (68,34) 4	54,3 (31,59) 4	270,0 (155,61) 6	35,5 (28,25) 7	29,3 (25,04) 10	37,3 (40,89) 14	105,1 (43,44) 24	44,1 (37,50) 15	220,5 (188,86) 20	311,9 (259,70) 22	318,9 (186,30) 32	602,9 (602,90) 1	178,8 (110,00) 159	
Italy	28,6 (23,59) 169	49,0 (44,10) 77	14,7 (26,15) 58	29,8 (26,69) 92	7,4 (22,98) 124	15,2 (23,70) 127	27,5 (33,63) 140	32,6 (30,10) 157	110,8 (93,90) 197	117,8 (103,90) 129	139,4 (143,79) 72	221,2 (209,90) 97	64,3 (41,50) 1439	
Luxembourg			134,1 (105,35) 4	118,5 (118,50) 2	120,7 (93,75) 4								125,6 (112,10) 10	
Netherlands	201,9 (81,15) 60	108,2 (55,50) 33	65,3 (42,10) 41	33,8 (29,11) 48	46,2 (30,49) 35	37,1 (27,10) 23	24,7 (29,75) 30	45,7 (36,44) 26	123,3 (127,85) 20	130,4 (125,45) 40	124,9 (109,10) 65	143,4 (117,92) 58	101,3 (69,20) 479	
Portugal	74,6 (73,11) 10	61,7 (37,38) 11	22,9 (24,71) 6	59,7 (60,69) 10	22,0 (27,03) 20	28,9 (30,95) 30	35,4 (34,98) 16	35,5 (34,66) 15	139,2 (115,70) 27	92,2 (92,75) 106	150,3 (122,49) 17	398,7 (254,79) 11	89,7 (61,50) 279	
Spain	75,8 (70,90) 33	33,6 (30,40) 30	31,4 (29,96) 28	28,8 (22,43) 61	20,1 (18,86) 66	29,4 (23,42) 94	32,9 (31,89) 155	42,0 (32,15) 102	169,9 (147,70) 77	135,3 (129,80) 190	183,9 (174,50) 180	280,6 (276,10) 182	119,0 (79,76) 1198	
Sweden	6,6 (23,40) 5	52,3 (16,70) 3	11,2 (11,37) 10	19,4 (12,14) 7	6,5 (10,30) 11	3,7 (9,40) 17	46,3 (26,30) 9	16,8 (5,80) 8	53,1 (64,30) 5	55,4 (57,80) 10	54,5 (54,45) 2	86,4 (79,91) 6	27,6 (13,90) 93	
Switzerland	601,0 (340,80) 5	657,7 (463,00) 11							495,4 (495,39) 2	180,3 (173,38) 4	212,0 (222,39) 8	147,0 (144,80) 4	81,9 (81,86) 1	409,1 (293,60) 35
United Kingdom	222,7 (115,91) 48	136,6 (65,00) 37	63,3 (59,19) 48	76,7 (36,90) 71	52,0 (35,02) 92	78,4 (51,37) 98	64,3 (43,05) 81	76,1 (54,36) 63	176,6 (165,25) 66	213,9 (180,65) 110	232,2 (200,80) 93	210,0 (167,74) 80	135,6 (88,69) 887	
Total	69,9 (35,85) 1 014	44,6 (29,90) 1 028	19,2 (20,00) 1 167	14,8 (15,10) 1 671	27,2 (12,56) 1 652	20,1 (13,60) 1 717	26,6 (21,20) 1 451	39,7 (31,11) 1 247	107,5 (85,40) 1 489	112,6 (93,20) 1 985	117,9 (86,79) 1 400	175,2 (147,96) 1 039	63,0 (38,09) 16 860	

Notes: In each cell are mean, median (in parentheses), and number of observations. The credit spread is the bond spread at issue over comparable risk-free government security with a comparable maturity. The line *Total* represents mean, median (in parentheses), and number of observations of the credit spread by year.

3.3 Credit Spread over time by deal type

In this section we analyze the evolution of credit spread between 2000 and 2011 by deal type: Covered Bonds, Bank Bonds and Securitization Bonds. Figure 3.3 helps to prove that the financial crisis (2008) led to an increase of the credit spreads; the Covered Bond Purchase Programme (implemented in 2009) stabilized the credit spreads; but with the onset of the Sovereign Debt crisis (2010), the funding conditions suffered a general deterioration. This also confirms that CB was the safest funding instrument and SB the riskier, a tendency that remained throughout all the years of our sample.

Figure 3.3 Credit Spread over time by deal type



3.4 Spread by Issuer Country and by Bond Type

Table 3.3 and Figure 3.4 show, as we expected, that CB is the financial instrument with the lowest average credit spread, followed by BB and SB. This means that CB are considered to be the safest debt instrument whereas SB the riskier. However, this conclusion does not apply to some of the studied issuer's country. The more visible ones are Cyprus, Greece, Portugal and Spain. Concerning to Cyprus and Greece, despite not having observations for SB, results

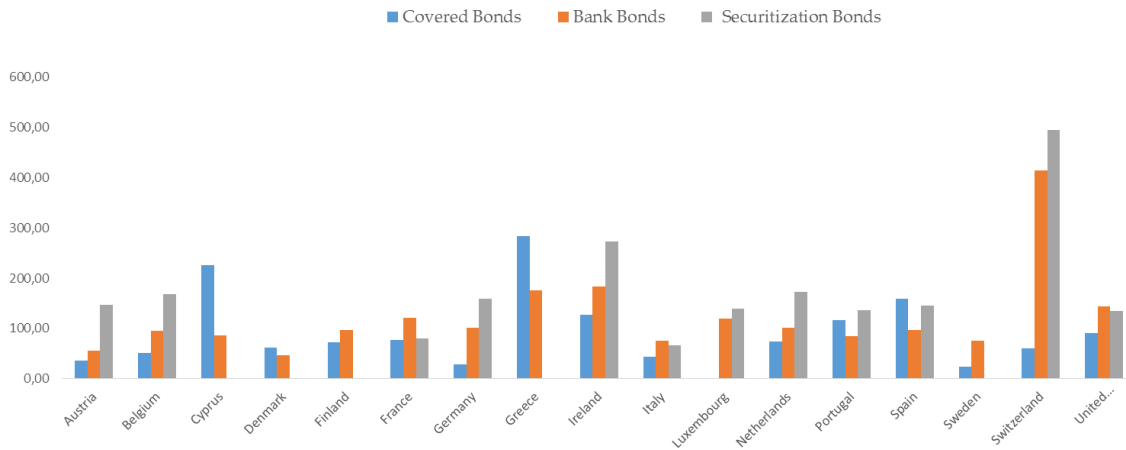
demonstrate that CB have higher credit spreads than BB. Regarding Portugal and Spain, results show that BB have the lowest average credit spread when compared to both SB and CB. This can be explained by the fact that these countries were financial rescued during the European sovereign debt crisis, which lead to a deterioration on their financial soundness; i.e., the quality of the assets used as collateral in CB transactions issued by banks headquartered in Portugal, Spain, Greece and Cyprus were more affected by the financial crisis. Additionally, as pointed out in Table 3.2, after 2008 credit spreads faced by banks when issuing debt instruments increased rapidly in these countries, comparing to countries that were not subject to a financial assistance.

Table 3.3 Credit Spread by Deal Type and Issuer Country

<i>Variable Credit Spread</i>	Covered Bonds	Bank Bonds	Securitization Bonds
Austria	36,26 (32,75) 128	54,86 (29,40) 437	147,52 (116,68) 5
Belgium	51,19 (30,98) 698	94,78 (53,90) 103	167,68 (103,30) 15
Cyprus	225,71 (213,08) 5	85,49 (66,48) 13	
Denmark	61,16 (84,80) 5	46,83 (46,10) 11	
Finland	72,29 (70,00) 17	96,02 (56,82) 26	
France	76,42 (63,20) 664	120,85 (79,21) 687	80,09 (82,53) 9
Germany	27,74 (22,29) 8152	100,94 (61,60) 1164	158,99 (95,75) 64
Greece	283,39 (235,54) 4	175,64 (66,91) 74	
Ireland	127,02 (116,06) 38	183,15 (59,11) 105	273,34 (228,81) 16
Italy	42,97 (25,40) 500	75,98 (51,18) 912	65,67 (69,28) 27
Luxembourg		120,01 (112,50) 7	138,76 (90,43) 3
Netherlands	74,56 (83,70) 46	100,75 (63,20) 413	173,24 (134,51) 20
Portugal	117,06 (113,99) 38	84,34 (48,40) 236	135,87 (119,80) 5
Spain	159,40 (134,00) 413	96,77 (54,30) 769	145,88 (119,09) 16
Sweden	24,33 (13,80) 87	75,35 (58,15) 6	
Switzerland	60,10 (60,10) 1	414,57 (291,70) 32	495,39 (495,39) 2
United Kingdom	89,99 (87,12) 124	143,77 (89,79) 700	134,29 (81,64) 63
Total	39,8 (26,50) 10 920	103,8 (60,50) 5 695	149,6 (101,51) 245

Notes: In each cell are mean, median (in parentheses), and number of observations. The credit spread is the bond spread at issue over comparable risk-free government security with a comparable maturity. Total represents the mean, median (in parentheses), and number of observations for CB, BB and SB

Figure 3.4. Credit Spread by Deal Type and Issuer country



3.5 The impact of the Financial Crisis on BB, SB, and CB Credit Spreads

This section examines whether the 2007-2008 financial crisis and the subsequent European sovereign debt crisis significantly impacted the credit spread of BB, SB, and CB. We therefore considered a pre-crisis period from January 1, 2000 through to September 14, 2008, and a crisis period from September 15, 2008 (the first trading day after Lehman Brothers' bankruptcy filing the day before) through December 31, 2011 and controlled by Country Rating. The evidence presented in Table 3.5. shows that the average credit spread is significantly higher during the crisis period vis-à-vis pre-crisis period for BB, SB, and CB. These results holds even when we split our sample per country rating category.

Table 3.4. The impact of the Financial Crisis on Credit Spreads

Rating	Covered Bonds (CB)		Bank Bonds (BB)		Securitization Bonds (SB)	
	Pre-Crisis	Crisis	Pre-Crisis	Crisis	Pre-Crisis	Crisis
AAA	14,60	89,54	80,75	157,90	158,55	254,76
	(15,30)	(75,93)	(38,67)	(133,20)	(103,26)	(136,72)
	7 084	2 281	2 603	1 253	172	13
AA+	37,18	122,74	47,38	133,22	160,25	80,18
	(17,60)	(111,40)	(28,30)	(125,10)	(103,30)	(110,63)
	611	194	260	206	17	11
AA	3,48	240,57	41,52	267,82	55,81	
	(17,80)	(242,65)	(33,74)	(233,90)	(59,28)	
	187	176	322	125	22	
AA-	0,40	350,88	37,56	267,70	106,53	
	(11,90)	(356,45)	(35,39)	(223,12)	(87,25)	
	137	28	221	35	7	
A+	55,14	123,03	55,81	143,15	149,11	164,93
	(57,20)	(117,27)	(44,15)	(149,40)	(149,11)	(164,93)
	51	136	279	308	1	2
A		236,68	58,61	598,49		
		(213,76)	(45,51)	(584,44)		
		15	46	4		
A-		164,25	46,90	247,99		
		(126,05)	(46,90)	(244,60)		
		9	1	15		
BBB+				336,29		
				(362,40)		
				4		
BBB		277,10				
		(277,10)				
		1				
BBB-		200,85		744,89		
		(200,64)		(661,55)		
		7		4		
BB+		383,83		477,56		
		(383,83)		(455,69)		
		2		7		
B				1 252,71		
				(1252,71)		
				2		
CC		257,00				
		(257,00)				
		1				

Notes: In each cell are mean, median (in parentheses), and number of observations. The credit spread is the bond spread at issue over comparable risk-free government security with a comparable maturity Country rating is the S&P's country credit rating at closing date; the rating is converted as follows: AAA=Aaa=1, AA+=Aa1=2, and so on until D=22. Pre-crisis period:

January 1, 2000 through September 14, 2008; crisis period: September 15, 2008 (Lehman Brothers' bankruptcy filing date) through December 31, 2011.

Figure 3.5. Credit Spread by Country Rating for CB

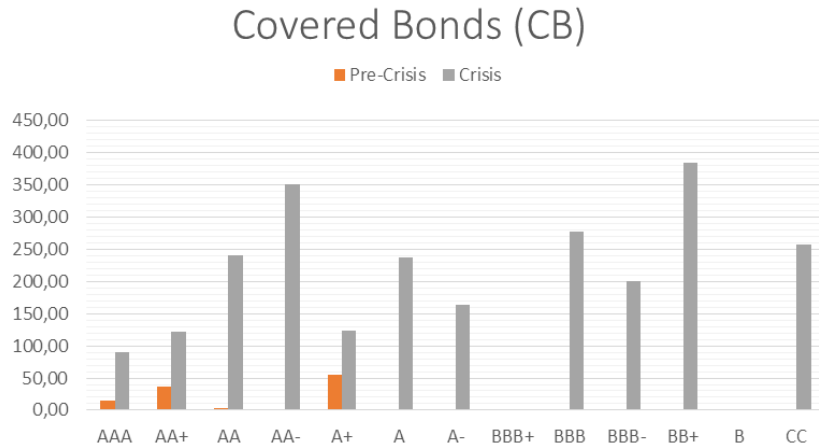


Figure 3.5 shows the evolution of the average credit spreads by country rating for CB. It shows that in period of crisis, the mean spread paid increase in all rating categories and that there are observations for lower rating categories. This is explained by the fact that during the sovereign debt crisis western European countries verified several rating downgrades, which also increased significantly the average spread for each rating category.

Figure 3.6 Spread by Country Rating, before and after crisis, For BB

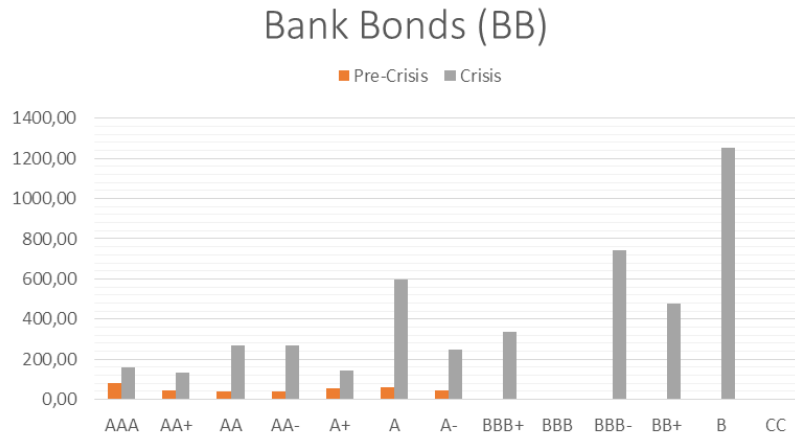


Figure 3.6 presents the average credit spreads by country rating for BB. Similarly to the results presented for covered bonds, this figure shows that in time of crisis countries faced rating downgrades with a significant impact on credit spreads - in pre-crisis period, the lowest rating observed was *A-*, while in crisis period the lowest rating is *B*.

Figure 3.7 Spread by Country Rating, before and after crisis, for SB

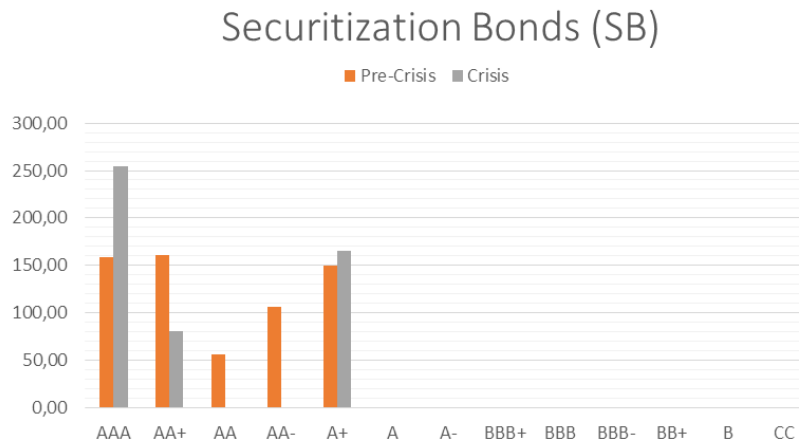


Figure 3.7 shows the average credit spread by country rating for SB. We can observe that SB were issued only in countries with higher ratings. Again, the results are similar to those obtained for both CB and BB.

Overall, we can conclude that the financial crisis and the subsequent sovereign debt crisis conducted to (i) a downgrade in western European

countries credit rating; and (ii) to a deterioration of bank's funding conditions through an increase of bank bond credit spreads.

3.6 Analysis of Covered Bonds (CB), Bank Bonds (BB) and Securitization Bonds (SB).

In this section we describe how the deal types studied on this work are distributed. CB are debt obligations issued by credit institutions and secure on the back of a ring-fence pool of assets referred to as "cover pool" or "cover assets". In this case the classification represents the type of assets that the cover pool has. *Mortgage* represents mortgage loans and *Public* as public sector debt. According to Table 3, although this type of assets are not exclusively, they represent 77% of our sample with a total number of 8 411 issuances. This type of assets are considered to be of high quality. Considering Securitization, the majority bonds are Asset Backed Securities (ABS) followed by Mortgage Backed Securities (MBS), with 66% and 34%, respectively. The main difference between these debt instruments is that while the pool of assets given as collateral to ABS can be a very diverse (e.g., car loans, corporate loans, leases, credit cards, consumer loans), MBS are backed by mortgages only.

Table 3.5 Covered bonds, bonds and securitization classification

	Classification	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total	% Total
Covered Bonds	Mortgage	87	147	176	411	255	230	215	189	392	644	412	274	3 432	31,4%
	Public	240	331	489	643	617	696	489	385	352	489	148	100	4 979	45,6%
	Other Classification	141	120	78	96	94	99	152	143	106	141	156	194	1 520	14%
	Without Classification	80	110	135	132	129	158	44	48	109	27	6	11	989	9%
	Total	548	708	878	1 282	1 095	1 183	900	765	959	1 301	722	579	10 920	100%
Bonds	Corporate Bond-High Yield	4	2		1	3	3		1		2	9	8	33	1%
	Corporate Bond-Investment-Grade	422	285	250	378	516	518	539	461	512	660	669	452	5 662	99%
	Total	426	287	250	379	519	521	539	462	512	662	678	460	5 695	100%
Securitization	Asset-Backed Security	29	7	22	6	33	13	12	14	11	14			161	66%
	Mortgage-Backed Security	11	26	17	4	5			6	7	8			84	34%
	Total	40	33	39	10	38	13	12	20	18	22			245	100%

Notes: This table shows the number of observations by deal type and by their sub-classification

4. REGRESSION ANALYSIS

In this section we subject our samples to OLS regression analysis, with the objective of testing our six hypotheses. As we use a sample of tranche-level observations, we can expect that the standard errors for tranches belonging to the same transaction are correlated with each other. We thus estimate standard errors clustered by transaction. We also adjust for heteroskedasticity using the methodology proposed by Huber (1967) and White (1980). The specification of the initial model is:

$$\begin{aligned}
 \text{Credit Spread}_i = & \alpha + \beta_1 \text{Country Rating}_i + \beta_2 \text{Credit Rating}_i \\
 & + \beta_3 \text{Time to Maturity}_i + \beta_4 \text{Risk Free Rate}_i + \beta_5 \text{eusa5y} - \text{libor3m}_i \\
 & + \beta_6 \text{Volatility}_i + \beta_7 \text{Number of Banks}_i + \beta_8 \text{Number of bookrunners}_i \quad \mathbf{(1)} \\
 & + \beta_9 \text{Bookrunner Participation}_i + \beta_{10} \text{Loan to Value}_i + \beta_{11} \text{Tranche size}_i \\
 & + \beta_{12} \text{Number of tranches}_i + \beta_{13} \text{Fixed Rate}_i + \beta_{14} \text{Currency Risk}_i \\
 & + \beta_{15} \text{Callable}_i + \beta_{16} \text{Crisis}_i + \varepsilon_i
 \end{aligned}$$

Our initial model allows to test hypothesis 1. In order to test hypothesis 2 we include variables *CDS_Country* and *Yield Country*. Variable *CDS_Country* will also be used in testing hypothesis 3. Variable *TripleAAcrisis* will be introduced in our model to test hypothesis 4 and *Coun_Under_AssCrisis* to test hypothesis 5. *CBPP Date* variable will be used to test hypothesis 6. Finally, in conducting robustness checks the following variables will be used: *Cash + Securities / Assets*, *Loans/Customer Deposits*, *Net Loans/ Total Assets*, *Equity / Total Assets*, *Total Regulatory Capital Ratio*, *Impaired Loans/Gross Loans*, *Return on Average Assets (ROAA)*, *Return on Average Equity (ROAE)* and *Total Assets*. The dependent

variable is the ex ante credit spread, in basis points, and independent variables are those presented and described in Table 4.1, which matches variables with corresponding hypotheses.

Table 4.1 Variables used in the Hypotheses

Variable	Hypothesis 1	Hypothesis 2	Hypothesis 3	Hypothesis 4	Hypothesis 5	Hypothesis 6	Robustness Tests
	17	19	16	17	17	4	25
<i>Dependent Variable</i>							
Credit Spread	•	•	•	•	•	•	•
<i>Independent Variables</i>							
<i>Continuous Variables</i>							
Credit Rating	•	•	•	•	•	•	•
Time to Maturity	•	•	•	•	•		•
RiskFreeRate	•	•	•	•	•		•
Eusa5y-libor3m	•	•	•	•	•		•
Volatility	•	•	•	•	•		•
Number of banks	•	•	•	•	•		•
Number of bookrunners	•	•	•	•	•		•
Bookrunner Participation	•	•	•	•	•		•
Loan to Value	•	•	•	•	•		•
Tranche size	•	•	•	•	•		•
Number of tranches	•	•	•	•	•		•
Country Rating	•	•					
CDS_Country		•	•			•	•
Yields Country		•					
<i>Discrete Variables</i>							
Fixed Rate	•	•	•	•	•		•
Currency Risk	•	•	•	•	•		•
Callable	•	•	•	•	•		•
Crisis	•	•					
CBPP Date						•	
AAA_pre_crisis				•			
AAA_crisis				•			
Coun_Under_Ass Pre_Crisis					•		
Coun_Under_AssCrisis					•		
<i>Financial variables</i>							
Cash + Securities /Assets							•
Loans / Customer Deposits							•
Net Loans / Total Assets							•
Equity / Tot Assets							•
Total Regulatory Capital Ratio							•
Impaired Loans/Gross Loans							•
Return on AverageAssets(ROAA)							•
Return on Average Equity(ROAE)							•
TAssets_Millions							•

4.1 Regression Results

4.1.1 The impact of pricing factors on credit spreads

In this section we investigate, for Bank Bonds (BB), Covered Bonds (CB) and Securitization Bonds (SB), the impact of pricing factors on *credit spread*. We

hypothesized (Hypothesis 1) that the impact of pricing factors on credit spread differs significantly between BB, CB and SB. Analyzing table 3.1, we conclude that the Wilcoxon rank-sum test rejects, at 1% significance level, that the credit spread in BB, CB and SB samples has the same distribution.

A Chow test for a structural break is used to investigate whether the credit spreads associated with BB, SB, and CB are influenced differently by common pricing factors. In essence, we are testing whether the pricing factors used in equation (1) are significant in the three types of transactions and, if so, whether they have the same coefficient values. Results are presented in Table 4.2. Hypothesis 1 is accepted because the Chow test statistics in Table 4.2 are all higher than the critical levels. We thus conclude that BB, SB, and CB transactions are distinct financial instruments and thus are financial instruments influenced differently by common pricing factors. Hence, they are not priced in a single integrated market and we cannot estimate the full sample of bonds in a single regression.

Table 4.2 Chow Test for differences on credit spread determinants

Deal Type	Securitization Bonds	Bank Bonds	Covered Bonds
Covered Bond	42,71	97,48	
Bank Bonds	24,97	-	
Securitization Bonds	-	-	

Table 4.3 presents the results of equation (1) for a sample of 16.860 issues, of which 10,920 were classified as CB, 5.695 as BB, and 245 as SB. The variable that represents sovereign risk (country rating) is the S&P's country credit rating at issuance date. Results show that as expected, *Country Rating* is significantly positively related to spread for CB issues, indicating that lending to an issuer located in a country with a rating of BB+ (BB+=11) versus one with a rating of AAA (AAA=1) will increase the credit spread by 126.7 bps. Contrary to what we expected, the influence of *Country Rating* on credit spread is insignificant for BB

and SB. A possible explanation is that for BB and SB, the soundness of countries, where banks are headquartered, expressed by the rating, doesn't have a significant importance leaving that to the bond's characteristics and the ability of banks to fulfill their obligations. The influence of *credit rating* on credit spread is insignificant for CB but positive and significant for BB and SB. Regarding this variable, Table 4.3 shows exactly the results expected; the higher the credit risk of the bond issue the higher the credit spread. A one unit increase in *credit rating* (corresponding to a downgrade from AAA to AA+) is associated with an increase of 12.12 bps and 28.51 bps in BB and SB issues credit spread, respectively. Combining these two findings we conclude that for CB, the country rating is an important spread determinant, which contrasts to BB and SB where country rating is irrelevant, meaning that investors give more relevance to the both issuer and bond characteristics (caught by the bond credit rating). While credit spread and maturity are significantly positively related for CB, they show an insignificant relationship for BB and SB issues. The coefficient value indicates that issuing a CB, with an original maturity one year longer than the mean, increases credit spread by 2.072 bps. The *risk free rate* has an insignificant relationship with SB credit spreads, and unexpectedly, has a significantly positive relationship with BB and CB credit spreads. Meaning that the higher the general level of interest rates the higher the credit spread for both BB and CB. Credit spread and the Euro swap curve slope, represented by the variable *Eusa5y-Libor3m*, are significantly negatively related for three types of bond instruments, meaning a steeper Euro swap curve is associated with lower credit spreads. As expected, credit spread and *Volatility* are significantly positively related for BB, CB, and SB; i.e., an increase in the uncertainty about asset's value increases credit risk and consequently the cost of funding. While credit spread and the *Number of banks* are negatively and significantly related for BB and CB, they have an insignificant relationship with SB issues. A larger number of banks involved lowers the spread

because investors associate a larger number of banks with an increase in the certification of the transaction. .

Table 4.3 Regression Analysis on the impact of the independent variables on the credit spread

<u>Dependent Variable</u>	(1)	(1)	(1)
Credit Spread (bps)	Covered Bonds	Bank Bonds	Securitization Bonds
<u>Independent Variables</u>			
Country Rating	12.67*** (1.017)	2.797 (1.883)	-10.92 (8.257)
Credit Rating	0.501 (0.486)	12.12*** (1.072)	28.51*** (3.642)
Time to Maturity	2.072*** (0.199)	-0.312 (1.055)	-0.0147 (0.626)
RiskFreeRate	624.4*** (114.6)	1152.9*** (294.6)	-113.5 (1223.6)
Eusa5y-libor3m	-0.265*** (0.0172)	-0.221*** (0.0429)	-0.508* (0.199)
Volatility	0.181* (0.0887)	1.066*** (0.240)	3.231* (1.325)
Number of banks	-1.093* (0.472)	-3.137*** (0.599)	-8.963 (9.230)
Number of bookrunners	4.306*** (0.620)	-3.239 (2.118)	27.99 (15.63)
Bookrunner Participation	-4.581* (2.063)	-61.11*** (7.467)	39.52 (22.09)
Loan to Value	-19.40 (36.27)	10.67 (50.06)	43.83 (31.74)
Tranche size	0.00715** (0.00256)	-0.00597 (0.00355)	-0.000703 (0.00262)
Number of tranches	-8.652 (11.39)	45.31** (15.80)	3.936 (4.027)
FixedRate	-45.18*** (2.303)	36.45*** (4.295)	-54.66 (43.50)
Currency Risk	21.69*** (2.929)	39.77*** (4.850)	34.14 (22.87)
Callable	41.65*** (2.426)	31.12*** (6.855)	-38.66 (22.52)
Crisis	119.1*** (2.833)	139.6*** (7.131)	-1.400 (56.04)
Constant	42.88 (47.95)	-83.49 (76.17)	-39.84 (76.40)
Number of Observations			
	10 920	5 695	245
Adjusted R ²			
	0.402	0.304	0.464

Notes: Table 4.3 presents the results of OLS regression analysis of the determinants of Covered Bonds, Bank Bonds and Securitization Bonds credit spread. Credit Spread is computed as the margin yielded (in bases points) by the security at issue above a corresponding currency treasury

benchmark with a comparable maturity. Country Rating is the S&P's country credit rating at closing date; the rating is converted as follows: AAA=Aaa=1, AA+=Aa1=2, and so on until D=22. Credit Rating is the S&P and Moody's rating at bond issuance; the rating is converted as follows: AAA=Aaa=1, AA+=Aa1=2, and so on until D=22. Time to Maturity is the maturity of the financial instrument in years. Risk free rate is the yield on a three-month German Treasury bill. EUSA5y-Libor3M is the difference between the five-year Euro swap rate and the 3-month Libor rate. Volatility is presented by The Chicago Board Options Exchange Volatility Index (VIX). Number of banks is the number of financial institutions participating in the transaction. Number of bookrunners is the number of financial institutions that underwrites the financial instrument. Bookrunner Participation is the percentage of the bond issuance retained by the bookrunner. Loan to value represents the ratio of the tranche size to the transaction size. Tranche size represents the amount of the tranche in euros. Number of tranches is the number of tranches per transaction. Fixed rate equals to 1 if the bond has a fixed coupon rate and 0, otherwise. Currency risk equals 1 for bonds denominated in a different currency than that of the country where the bank is headquartered and 0, otherwise. Callable equal to 1 if the bond can be redeemed before the maturity date and 0, otherwise. Crisis equals 1 if the issue date falls within the crisis period (September 15, 2008 – December 31, 2011) and 0, otherwise (January 1, 2000 – September 14, 2008). ***, ** and * indicates that the reported coefficients are significantly different from zero at the 1%, 5% and 10% levels, respectively. The t-statistics reported in parentheses are based on heteroskedasticity-consistent standard errors clustered by transaction.

On the contrary, the influence of *number of bookrunners* on credit spread is insignificant for BB and SB but positive and significant for CB issues. Regarding CB, the result can be explained by the fact that underwriters may want to scatter the risk, meaning that when the number of bookrunners increases that might indicate that the bond issue is relatively more risky. While credit spread and the *bookrunner participation* are negatively and significantly related for CB and BB, they have an insignificant relationship for SB issues. If we analyze the last three variables, *number of bookrunners*, *number of banks* and *bookrunner participation*, we can conclude that when a particular bond issue has lower risk, banks are more interested in participating and bookrunners want to retain the highest percentage

of the transactions; but if the bond issue has higher risk, bookrunners want to scatter the risk by “hiring” other bookrunners, lowering their participation. Contrary to what expected, the impact of the *loan to value* on bond credit spreads is insignificant. The influence of *tranche size* on credit spread is insignificant for BB and SB but positive and significant for CB (at 5% level). For CB, the results show that the higher the value of the tranche, the higher the default risk. As expected based on empirical literature, spread and *number of tranches* are significantly positively related for BB, but they have an insignificant relationship for both CB and SB. *Fixed rate* behaves differently for the three bond types. As expected based on empirical literature, spread and *fixed rate* are significantly, positively related for BB, but they have an insignificant relationship for SB. Contrary to what expected, credit spread and *fixed rate* have a significant negative relationship for CB. This result can be explained by the fact that in a CB issue underlying assets have usually a fixed rate. That means that issuing bonds with a floating rate demands to close an interest rate derivate (manly an interest rate swap) for which the issuer has to pay a premium. The influence of *currency risk* on credit spread is significant and positive for CB and BB. Such a mismatch in the currency of the issuer’s nationality and the currency of the bond issue significantly increases the rate charged by 21.69 bps and 39.77 bps, respectively. Similarly, *callable* dummy variable has a strong positive relationship with credit spreads for CB and BB. We find that the introduction of a call option in a CB and a BB issue increases the credit spread by 41.65 bps and 31.12 bps, respectively. The 2007-2008 financial crisis and the subsequent European sovereign debt crisis have imposed a significant increase in credit spreads for CB and BB issues. A transaction with the issue date during the crisis period will have a higher average credit spread of 119.1 bps and 139.6 bps for CB and BB issues, respectively. Contrary to expectations, credit spread and *crisis* are insignificantly related for SB. This can be explained by the significant reduction in the number of AS issues

between the pre-crisis and crisis period sub-samples, from 54 to 26 observations (see 4.1.3). The credit crunch precipitated by the subprime mortgage crisis dramatically weakened the market for SB. Additionally, since the Lehman collapse, banks have issued government guaranteed bonds and underwritten their own securitization programs to use them as a guarantee for obtaining resources in the two ECB covered bond purchase programs, initiated during the second half of 2009.

Table 4.4 Standardized coefficients of table 4.3

<u>Dependent Variable</u>	(1)	(1)	(1)
Credit Spread (bps)	Covered Bonds	Bank Bonds	Securitization Bonds
Independent Variables			
Country Rating	0.130*** (1.017)	0.031 (1.883)	-0.060 (8.257)
Credit Rating	0.008 (0.486)	0.194*** (1.072)	0.642*** (3.642)
Time to Maturity	0.095*** (0.199)	-0.010 (1.055)	-0.002 (0.626)
RiskFreeRate	0.100*** (114.6)	0.125*** (294.6)	-0.009 (1223.6)
Eusa5y-libor3m	-0.209*** (0.0172)	-0.109*** (0.0429)	-0.189* (0.199)
Volatility	0.022* (0.0887)	0.080*** (0.240)	0.199* (1.325)
Number of banks	-0.031* (0.472)	-0.076*** (0.599)	-0.080 (9.230)
Number of bookrunners	0.079*** (0.620)	-0.027 (2.118)	0.135 (15.63)
Bookrunner Participation	-0.026* (2.063)	-0.212*** (7.467)	0.124 (22.09)
Loan to Value	-0.016 (36.27)	0.012 (50.06)	0.109 (31.74)
Tranche size	0.037** (0.00256)	-0.031 (0.00355)	-0.009 (0.00262)
Number of tranches	-0.020 (11.39)	0.293** (15.80)	0.067 (4.027)
FixedRate	-0.194*** (2.303)	0.135*** (4.295)	-0.117 (43.50)
Currency Risk	0.062*** (2.929)	0.119*** (4.850)	0.105 (22.87)
Callable	0.175*** (2.426)	0.075*** (6.855)	-0.120 (22.52)
Crisis	0.635*** (2.833)	0.491*** (7.131)	-0.003 (56.04)
Observations	10 920	5 695	245
Adjusted R-squared	0.402	0.304	0.464

Notes: Table 4.4 presents the standardized regress coefficients of regressions presented in table 4.3. Credit Spread is computed as the margin yielded (in bases points) by the security at issue above a corresponding currency treasury benchmark with a comparable maturity. Country Rating is the S&P's country credit rating at closing date; the rating is converted as follows: AAA=Aaa=1, AA+=Aa1=2, and so on until D=22. Credit Rating is the S&P and Moody's rating at

bond issuance; the rating is converted as follows: AAA=Aaa=1, AA+=Aa1=2, and so on until D=22. Time to Maturity is the maturity of the financial instrument in years. Risk free rate is the yield on a three-month German Treasury bill. EUSA5y-Libor3M is the difference between the five-year Euro swap rate and the 3-month Libor rate. Volatility is presented by The Chicago Board Options Exchange Volatility Index (VIX). Number of banks is the number of financial institutions participating in the transaction. Number of bookrunners is the number of financial institutions that underwrites the financial instrument. Bookrunner Participation is the percentage of the bond issuance retained by the bookrunner. Loan to value represents the ratio of the tranche size to the transaction size. Tranche size represents the amount of the tranche in euros. Number of tranches is the number of tranches per transaction. Fixed rate equals to 1 if the bond has a fixed coupon rate and 0, otherwise. Currency risk equals 1 for bonds denominated in a different currency than that of the country where the bank is headquartered and 0, otherwise. Callable equal to 1 if the bond can be redeemed before the maturity date and 0, otherwise. Crisis equals 1 if the issue date falls within the crisis period (September 15, 2008 – December 31, 2011) and 0, otherwise (January 1, 2000 – September 14, 2008). ***, ** and * indicates that the reported coefficients are significantly different from zero at the 1%, 5% and 10% levels, respectively. The t-statistics reported in parentheses are based on heteroskedasticity-consistent standard errors clustered by transaction.

Table 4.4 presents the standardized coefficients of regressions presented in table 4.3. This procedure is important because it compares the strength of the coefficients in affecting the dependent variable. Taking the example of Maturity in CB, the beta coefficient is 0.095. This means that an increase of one unit in the maturity standard deviation leads to an increase of 0.095 in the credit spread standard deviation. Thus, we must conclude that beta coefficients with higher absolute values will have a higher impact in the credit spread standard deviation. Regarding CB, beta coefficients with relatively higher values are *Crisis* (0.635), *EUSA5y-Libor3M* (-0.209), *Fixed Rate* (-0.194), *Callable* (0.175), and *Country Rating* (0.130). These results show that the financial crisis has the highest impact in CB credit spreads. The same conclusion can be reached for BB, since *Crisis* also has the highest absolute value (0.491). Credit Ratings are the most important determinants of BB and SB credit spreads. Our findings are in line with previous

empirical studies, which find rating to be one of the most important determinants of BB and SB bond credit spreads. Regarding SB, our findings also support the prediction that investors might base their investment decision almost exclusively on rating. Finally, results show that pricing factors affect differently the credit spreads on their statically relevance and importance.

4.1.2 Sovereign risk and bank risk

In this section we study the relationship between bank risk and sovereign risk, after controlling for micro and macro pricing factors. In hypothesis 2 we argue that the sovereign risk has a significant positive impact on bank risk, after controlling for other micro and macro pricing factors. Table 4.5 presents regression analyses for the three bond types, using the 3 proxies selected for sovereign risk:

- **Country Rating:** represents the S&P country credit rating at the time of issuance. It assumes value 1 if the rating is AAA, 2 for AA+/Aa1 and so on until 22 for D (default). The higher the value of the variable the lower the soundness of a country.
- **Country's Credit Default Swaps (CDS):** is the value paid by an investor to prevent an event of default by the country. For example, to secure one million euros of public debt, the investor must pay a CDS premium of 50 basis points. This means that he has to pay a premium in an amount of five thousand euros. So the higher the probability of default, the higher the premium.
- **Government Yield:** is the expected return of an investor on a government bond, assuming that the investor will keep the bond on the portfolio till the maturity date. If the credit risk of a country is affected, investors will require a higher return, leading to yield increase.

Analyzing the regression results for country rating, we find that country rating is significantly positively related to spread for CB and BB, indicating that lending to a bank issuer located in a country with a rating of BB+ (BB+=11) versus one with a rating of AAA (AAA=1) will increase the credit spread by 136.4 bps and 60.6 bps for CB and BB, respectively. However, the influence of country rating on credit spread is insignificant for SB issuers. This insignificant relationship can be explained by the fact that contrary to BB, in which issuers typically specify the amount of debt they are seeking, and their creditworthiness becomes the main determinant of credit spreads, in asset securitization transactions the source of cash flows is the SPV's assets. SB are arranged by investment banks with the main goal of coming up with the most efficient mix of maturities, spreads, tranches, warranties, and other credit enhancement mechanisms to manage what lenders perceive to be the risk and the probability of default. Because a financial institution's credit rating often correlates to its country's sovereign debt rating (Zaghini, 2014), a bank sponsor with high-quality assets located in riskier countries stand to gain the most in credit rating improvement through securitization and thus is more likely to finance with SB than with BB.

Observing the standardized coefficients presented in table 4.6, we find that, despite being statistically significant, country rating is not one of the variables with the highest impact on CB (0.148) and BB (0.081) credit spreads.

As for country rating, we find that *CDS_country* is significantly positively related to spread for CB and BB. This suggests that an increase in country CDS by 100 bps will increase the required credit spread by 36.3 bps and 54.7 bps for CB and BB, respectively. Table 4.6 shows that country CDS is one of the most important variables in determining the credit spread for CB and the variable that impacts the most BB credit spreads.

Similar findings were obtained when using the yield on a government bond with a comparable maturity as a proxy for sovereign risk; i.e., the impact of yield country on credit spread is significant and positive for CB and BB, suggesting that an increase in government bond yields by 100 bps will increase the required credit spread by 30.14 bps and 50.36 bps for CB and BB, respectively. Observing the standardized coefficients presented on table 4.6, government bond yields is also one of the most important variable on determining the credit spread.

Overall we conclude that sovereign risk, using the Country rating, CDS or Government Yields, positively impacts the bank risk and that CDS are the sovereign risk proxy with higher influence, since it presents the higher standardized coefficient.

Table 4.5 Regression analysis by sovereign risk variable

Dependent Variable Credit Spread (bps)	Sovereign Risk Variable								
	Country Rating			Country CDS			Government Yields		
	Covered Bonds	Bank Bonds	Securitization Bonds	Covered Bonds	Bank Bonds	Securitization Bonds	Covered Bonds	Bank Bonds	Securitization Bonds
Independent Variables									
Credit Rating	0.900 (0.562)	13.73*** (1.229)	21.12* (7.901)	0.245 (0.586)	11.94*** (0.982)	20.82* (7.819)	1.083 (0.600)	12.84*** (0.972)	20.37** (7.457)
Time to Maturity	1.804*** (0.233)	0.210 (1.665)	0.124 (0.407)	1.932*** (0.230)	0.415 (1.674)	0.126 (0.389)	1.790*** (0.230)	0.421 (1.626)	0.135 (0.420)
Risk Free Rate	-132.0 (181.9)	-921.4* (455.8)	828.0 (3716.2)	839.5*** (208.4)	61.52 (424.3)	722.3 (3226.8)	-1729.1*** (237.2)	-4387.6*** (531.7)	8962.2 (12464.6)
Eusa5y-libor3m	-0.310*** (0.0273)	-0.409*** (0.0713)	-0.599 (0.394)	-0.163*** (0.0333)	-0.249*** (0.0682)	-0.610 (0.345)	-0.496*** (0.0314)	-0.813*** (0.0791)	0.415 (1.524)
volatility	0.587*** (0.128)	0.948** (0.363)	3.698 (1.853)	0.860*** (0.129)	1.043** (0.356)	4.213 (2.242)	-0.0316 (0.130)	-0.452 (0.388)	6.740 (5.027)
number of banks	-2.855*** (0.624)	-1.847* (0.751)	-19.36 (15.89)	-0.919 (0.662)	-0.954 (0.687)	-18.06 (15.05)	-1.912*** (0.564)	-1.028 (0.709)	-15.22 (16.22)
number of bookrunners	5.505*** (1.164)	-1.511 (2.509)	44.28* (18.38)	4.390*** (1.166)	-1.575 (2.425)	42.45* (18.41)	6.522*** (1.131)	-1.737 (2.390)	45.12* (18.61)
Bookrunner Participation	-20.07*** (3.961)	-59.41*** (9.771)	100.6** (32.65)	-18.67*** (3.758)	-57.99*** (9.830)	107.7** (38.39)	-15.71*** (3.838)	-56.31*** (9.610)	121.8* (49.22)
Loan to Value	-30.36 (40.54)	5.641 (56.78)	56.55 (70.47)	-39.09 (39.66)	3.472 (56.63)	57.35 (69.60)	-33.95 (40.35)	9.846 (54.99)	52.32 (65.07)
Tranche size	0.00667 (0.00347)	-0.00118 (0.00454)	-0.00268 (0.00297)	-0.00361 (0.00348)	-0.00947* (0.00453)	-0.00418 (0.00490)	0.000322 (0.00306)	-0.00655 (0.00439)	-0.00296 (0.00279)
Number of tranches	-12.60 (12.24)	46.25** (17.53)	0.0687 (6.943)	-15.39 (2.662)	43.50* (4.781)	-0.918 (8.918)	-14.73 (12.20)	44.63* (17.44)	-6.612 (13.57)
Fixed Rate	-47.21*** (2.648)	13.85** (4.935)	-149.9* (59.35)	-44.89*** (2.662)	17.01*** (4.781)	-149.0* (57.68)	-46.21*** (2.664)	14.57** (4.752)	-154.5* (63.08)
Currency Risk	26.24*** (3.338)	40.91*** (6.538)	112.0 (67.51)	25.14*** (3.308)	46.11*** (6.489)	109.0 (65.16)	39.08*** (3.721)	44.73*** (6.520)	78.88 (94.54)
Callable	45.94*** (3.049)	34.09*** (9.927)	-80.63* (31.18)	42.77*** (3.083)	24.17** (9.184)	-75.30** (27.37)	42.23*** (3.027)	24.63** (9.061)	-66.70 (34.70)
Crisis	99.42*** (3.500)	118.3*** (9.115)	-42.92 (67.86)	83.54*** (4.683)	75.24*** (8.806)	-19.27 (90.29)	101.0*** (3.384)	96.97*** (8.589)	-15.72 (80.25)
Country Rating	13.64*** (1.106)	6.057** (2.020)	-4.160 (13.48)						
CDS_Country				0.363*** (0.0568)	0.547*** (0.0426)	-0.514 (0.834)			
Yield Country							30.14*** (2.714)	50.36*** (4.417)	-103.5 (132.4)
Constant	90.47 (53.54)	-28.69 (94.06)	-19.45 (133.0)	73.32 (52.32)	-45.93 (94.56)	-28.02 (125.3)	56.67 (53.30)	-66.57 (91.63)	53.49 (98.03)
Observations	7 718	3 682	80	7 718	3 682	80	7 718	3 682	80
Adjusted R-squared	0.435	0.423	0.491	0.476	0.515	0.495	0.462	0.504	0.508

Notes: Table 4.5 presents the results of OLS regression analysis of the determinants of Covered Bonds, Bonds and Securitization credit spreads by Sovereign Risk Variable. Credit Spread is computed as the margin yielded (in bases points) by the security at issue above a corresponding currency treasury benchmark with a comparable maturity. Credit Rating is the S&P and Moody's rating at bond issuance; the rating is converted as follows: AAA=Aaa=1, AA+=Aaa1=2, and so on until D=22. Time to Maturity is the maturity of the financial instrument in years. Risk free rate is the yield on a three-month German Treasury bill. EUSA5y-Libor3M is the difference between the five-year Euro swap rate and the 3-month Libor rate. Volatility is presented by The Chicago Board Options Exchange Volatility Index (VIX). Number of banks is the number of financial institutions that participates in the transaction. The bookrunner is the number of financial institutions that underwrites the financial instrument. Bookrunner Participation is the part of the financial instrument that the bookrunner kept. Loan to value represents the ratio between tranche size and

the transaction value. Tranche size represents the amount of the tranche in euros. Number of tranches is the number of tranches per transaction. Fixed rate equals to 1 if the bond has a fixed coupon rate and 0, otherwise. Currency risk equals 1 for bonds denominated in a different currency than that of the country where the bank is headquartered and 0, otherwise. Callable equal to 1 if the bond can be redeemed before the maturity date and 0, otherwise. Crisis equals 1 if the issue date falls within the crisis period (September 15, 2008 – December 31, 2011) and 0, otherwise (January 1, 2000 – September 14, 2008). Country rating is the S&P's country credit rating at closing date; the rating is converted as follows: AAA=Aaa=1, AA+=Aa1=2, and so on until D=22. CDS_Country is the CDS paid at time of issuance by country. Yield Country is the Yield of the country at time of issuance. ***, ** and * indicates that the reported coefficients are significantly different from zero at the 1%, 5% and 10% levels, respectively. The t-statistics reported in parentheses are based on heteroskedasticity-consistent standard errors clustered by transaction. The database only includes observations with CDS values.

Table 4.6 Standardized regress coefficients of table 4.5

Dependent Variable Credit Spread (bps)	Sovereign Risk Variable								
	Country Rating			Country CDS			Government Yields		
	Covered Bonds	Bank Bonds	Securitization Bonds	Covered Bonds	Bank Bonds	Securitization Bonds	Covered Bonds	Bank Bonds	Securitization Bonds
Independent Variables									
Credit Rating	0.014 (0.562)	0.231*** (1.229)	0.469* (7.901)	0.004 (0.586)	0.201*** (0.982)	0.463* (7.819)	0.017 (0.600)	0.216*** (0.972)	0.453** (7.457)
Time to Maturity	0.079*** (0.233)	0.007 (1.665)	0.016 (0.407)	0.084*** (0.230)	0.014 (1.674)	0.017 (0.389)	0.078*** (0.230)	0.014 (1.626)	0.018 (0.420)
Risk Free Rate	-0.018 (181.9)	-0.096* (455.8)	0.060 (3716.2)	0.116*** (208.4)	0.006 (424.3)	0.052 (3226.8)	-0.240*** (237.2)	-0.459*** (531.7)	0.651 (12464.6)
Eusa5y-libor3m (bps)	-0.241*** (0.0273)	-0.223*** (0.0713)	-0.269 (0.394)	-0.126*** (0.0333)	-0.136*** (0.0682)	-0.274 (0.345)	-0.386*** (0.0314)	-0.443*** (0.0791)	0.186 (1.524)
volatility	0.072*** (0.128)	0.084** (0.363)	0.325 (1.853)	0.106*** (0.129)	0.093** (0.356)	0.371 (2.242)	-0.004 (0.130)	-0.040 (0.388)	0.593 (5.027)
number of banks	-0.072*** (0.624)	-0.042* (0.751)	-0.176 (15.89)	-0.023 (0.662)	-0.022 (0.687)	-0.164 (15.05)	-0.048*** (0.564)	-0.024 (0.709)	-0.138 (16.22)
number of bookrunners	0.083*** (1.164)	-0.015 (2.509)	0.278* (18.38)	0.066*** (1.166)	-0.015 (2.425)	0.266* (18.41)	0.098*** (1.131)	-0.017 (2.390)	0.283* (18.61)
Bookrunner Participation	-0.081*** (3.961)	-0.227*** (9.771)	0.315** (32.65)	-0.076*** (3.758)	-0.222*** (9.830)	0.338** (38.39)	-0.064*** (3.838)	-0.215*** (9.610)	0.382* (49.22)
Loan to Value	-0.026 (40.54)	0.007 (56.78)	0.140 (70.47)	-0.033 (39.66)	0.004 (56.63)	0.142 (69.60)	-0.029 (40.35)	0.013 (54.99)	0.129 (65.07)
Tranche size	0.032 (0.00347)	-0.007 (0.00454)	-0.054 (6.943)	-0.017 (0.00348)	-0.054* (0.00453)	-0.084 (0.00490)	0.002 (0.00306)	-0.037 (0.00439)	-0.060 (0.00279)
Number of tranches	-0.031 (12.24)	0.366** (17.53)	0.001 (6.943)	-0.037 (11.91)	0.344* (18.00)	-0.015 (8.918)	-0.036 (12.20)	0.353* (17.44)	-0.110 (13.57)
Fixed Rate	-0.198*** (2.648)	0.053** (4.935)	-0.326* (59.35)	-0.189*** (2.662)	0.066*** (4.781)	-0.323* (57.68)	-0.194*** (2.664)	0.056** (4.752)	-0.335* (63.08)
Currency Risk	0.072*** (3.338)	0.106*** (6.538)	0.223 (67.51)	0.069*** (3.308)	0.120*** (6.489)	0.217 (65.16)	0.107*** (3.721)	0.116*** (6.520)	0.157 (94.54)
Callable	0.182*** (3.049)	0.077*** (9.927)	-0.253* (31.18)	0.169*** (3.083)	0.055** (9.184)	-0.236** (27.37)	0.167*** (3.027)	0.056** (9.061)	-0.209 (34.70)
Crisis	0.545*** (3.500)	0.459*** (9.115)	-0.127 (67.86)	0.458*** (4.683)	0.292*** (8.806)	-0.057 (90.29)	0.554*** (3.384)	0.376*** (8.589)	-0.046 (80.25)
Country Rating	0.148*** (1.106)	0.081** (2.020)	-0.029 (13.48)						
CDS_Country				0.307*** (0.0568)	0.376*** (0.0426)	-0.130 (0.834)			
Yield Country							0.248*** (2.714)	0.342*** (4.417)	-0.212 (132.4)
Observations	7 718	3 682	80	7 718	3 682	80	7 718	3 682	80
Adjusted R-squared	0.435	0.423	0.491	0.476	0.515	0.495	0.462	0.504	0.508

Notes: Table 4.6 presents the standardized regress coefficients of the regression presented in table 4.5. Credit Spread is computed as the margin yielded (in bases points) by the security at issue above a corresponding currency treasury benchmark with a comparable maturity. Credit Rating is the S&P and Moody's rating at bond issuance; the rating is converted as follows: AAA=Aaa=1, AA+=Aa1=2, and so on until D=22. Time to Maturity is the maturity of the financial instrument in years. Risk free rate is the yield on a three-month German Treasury bill. EUSA5y-Libor3M is the difference between the five-year Euro swap rate and the 3-month Libor rate. Volatility is presented by The Chicago Board Options Exchange Volatility Index (VIX). Number of banks is the number of financial institutions that participates in the transaction. The bookrunner is the number of financial institutions that underwrites the financial instrument. Bookrunner Participation is the part of the financial instrument that the bookrunner kept. Loan to value represents the ratio between tranche size and the transaction value. Tranche size represents the amount of the tranche in euros. Number of tranches is the number of tranches per transaction. Fixed rate equals to 1 if the bond has a fixed coupon rate and 0, otherwise. Currency risk equals

1 for bonds denominated in a different currency than that of the country where the bank is headquartered and 0, otherwise. Callable equal to 1 if the bond can be redeemed before the maturity date and 0, otherwise. Crisis equals 1 if the issue date falls within the crisis period (September 15, 2008 – December 31, 2011) and 0, otherwise (January 1, 2000 – September 14, 2008). Country Rating is the S&P's country credit rating at closing date; the rating is converted as follows: AAA=Aaa=1, AA+=Aa1=2, and so on until D=22. CDS_Country is the CDS paid at time of issuance by country. Yield Country is the Yield of the country at time of issuance. ***, ** and * indicates that the reported coefficients are significantly different from zero at the 1%, 5% and 10% levels, respectively. The t-statistics reported in parentheses are based on heteroskedasticity-consistent standard errors clustered by transaction. The database only includes observations with CDS values.

4.1.3 The 2007-2008 financial crisis and the impacted of sovereign risk on bank risk

Based on regression results presented in previous sections we find that the 2007-2008 financial crisis and the subsequent European sovereign debt crisis have imposed a significant increase in credit spreads for CB and BB, but the relationship between spreads and *crisis* is insignificant for SB. Additionally, we find that crisis variable is the most important variable in determining the credit spread when using credit rating as a proxy for sovereign risk. In hypothesis 3 we argue that the 2007-2008 financial crisis increased the impact of sovereign risk on bank risk. In order to investigate further the relationship between sovereign risk and bank risk, namely if the 2007-2008 financial crisis and the subsequent European sovereign debt crisis increased the impact of sovereign risk on bank risk we split our samples into a pre-crisis period from January 1, 2000 to September 14, 2008, and a crisis period from September 15, 2008 (Lehman Brothers' bankruptcy filing date) through December 31, 2011. Additionally, we want to investigate further the impact of the 2007-2008 financial crisis and the subsequent European sovereign debt crisis on SF and SDF credit spreads and pricing processes of CB, BB, and SB.

Table 4.7 presents the results of the regression analyses and Table 4.8 the standardized coefficients. First, we conclude that the impact of sovereign risk on bank bond credit spreads is statistical significant on both periods for CB and BB. Second, *CDS_country* is a variable with a high “weight” in determining CB and BB credit spreads in crisis period; i.e., the results show that CDS acquire a major relevance on determining the CB and BB credit spreads during the crisis, showing the importance of sovereign risk in determining the bank risk. Overall we conclude that the 2007-2008 financial crisis and the subsequent European sovereign debt crisis increased significantly the impact of sovereign risk on bank risk, leading to a tied relation between sovereign and bank risk. We thus accept Hypothesis 3. Our results are in line with (Gómez-Puig, Sosvilla-Rivero, & K.Singh, 2014), who conclude that the linkage between bank risk and sovereign risk tend to strength particularly when a financial crisis emerge.

Table 4.7 Regression analysis on the impact of the financial crisis

<i>Dependent Variable</i> <i>Credit Spread (bps)</i>	Variable of risk Measure of Country: CDS_Country					
	Covered Bonds Pre-Crisis	Covered Bonds Crisis	Bank Bonds Pre-Crisis	Bank Bonds Crisis	Securitization Bonds Pre-Crisis	Securitization Bonds Crisis
Independent Variables						
CDS_Country	0.872*** (0.189)	0.321*** (0.0598)	0.881** (0.309)	0.526*** (0.0429)	8.385 (5.109)	-7.092** (2.182)
Credit Rating	2.036** (0.746)	-0.564 (0.757)	3.722** (1.310)	17.05*** (1.361)	28.64* (10.49)	9.611* (3.738)
Time to Maturity	2.936*** (0.289)	-0.388 (0.383)	-3.936 (3.157)	3.410** (1.063)	-1.177 (0.998)	-7.986 (3.960)
Risk Free Rate	1780.7*** (200.8)	-1283.8* (516.5)	-411.4 (494.2)	-1473.0* (613.9)	-11704.1 (8377.6)	-79106.5 (49505.8)
Eusa5y-libor3m	-0.0381 (0.0305)	-0.384*** (0.0697)	-0.313*** (0.0763)	-0.126 (0.0758)	-0.861 (0.449)	0.987 (2.060)
Volatility	0.681** (0.218)	0.408 (0.230)	1.920 (1.041)	1.995*** (0.334)	-0.452 (3.615)	65.48* (23.12)
Number of banks	1.194* (0.600)	-3.089** (1.090)	-1.468* (0.679)	-1.271 (0.793)	-40.31 (21.11)	216.8 (144.5)
Number of bookrunners	4.093** (1.394)	1.721 (2.459)	-6.621* (3.168)	2.082 (2.424)	88.08* (34.10)	0 (.)
Bookrunner Participation	-9.240* (4.022)	-25.27*** (7.470)	-51.23*** (14.87)	-70.22*** (7.902)	74.83* (32.03)	1672.0* (623.8)
Loan to Value	-33.93 (40.85)	-96.63 (81.14)	35.79 (71.89)	-66.73 (46.53)	31.87 (98.74)	2.932 (40.90)
Tranche size	-0.00976*** (0.00257)	0.0135* (0.00685)	-0.0114 (0.00604)	-0.00439 (0.00396)	-0.0419** (0.0123)	-0.0325*** (0.00779)
Number of tranches	-16.09 (11.83)	-30.04 (23.10)	52.79** (19.85)	6.077 (8.522)	38.09 (23.77)	-53.90 (76.91)
Fixed Rate	-53.83*** (3.700)	-28.65*** (3.293)	5.132 (7.113)	8.563 (4.923)	-81.66 (58.81)	-760.4** (219.0)
Currency Risk	30.66*** (4.144)	7.792 (5.320)	28.54** (10.96)	44.52*** (7.390)	202.8* (81.83)	667.3* (276.3)
Callable	48.47*** (3.201)	2.179 (8.615)	34.24* (13.35)	64.78*** (19.63)	-127.4 (80.28)	262.4* (116.4)
Constant	22.40 (53.98)	301.3** (105.9)	-9.290 (145.7)	71.59 (54.55)	204.0 (138.5)	-2601.7* (1183.8)
Observations	4 878	2 840	1 737	1 945	54	26
Adjusted R-squared	0.245	0.439	0.474	0.466	0.481	0.877

Notes: Table 4.7 presents the results of OLS regression analysis of the determinants of Covered Bonds, Bonds and Securitization credit spreads before and after crisis. Credit Spread is computed as the margin yielded (in bases points) by the security at issue above a corresponding currency treasury benchmark with a comparable maturity. CDS_Country is the CDS paid at time of issuance by country. Credit Rating is the S&P and Moody's rating at bond issuance; the rating is converted as follows: AAA=Aaa=1, AA+=Aa1=2, and so on until D=22. Time to Maturity is the maturity of the financial instrument in years. Risk free rate is the yield on a three-month German Treasury bill. EUSA5y-Libor3M is the difference between the five-year Euro swap rate and the 3-month Libor rate. Volatility is presented by The Chicago Board Options Exchange Volatility Index (VIX). Number of banks is the number of financial institutions that participates in the

transaction. The bookrunner is the number of financial institutions that underwrites the financial instrument. Bookrunner Participation is the part of the financial instrument that the bookrunner kept. Loan to value represents the ratio between tranche size and the transaction value. Tranche size represents the amount of the tranche in euros. Number of tranches is the number of tranches per transaction. Fixed rate equals to 1 if the bond has a fixed coupon rate and 0, otherwise. Currency risk equals 1 for bonds denominated in a different currency than that of the country where the bank is headquartered and 0, otherwise. Callable equal to 1 if the bond can be redeemed before the maturity date and 0, otherwise. ***, ** and * indicates that the reported coefficients are significantly different from zero at the 1%, 5% and 10% levels, respectively. The t-statistics reported in parentheses are based on heteroskedasticity-consistent standard errors clustered by transaction.

Table 4.8 Standardized coefficients of regressions presented on table 4.7

Variable of risk Measure of Country: CDS_Country						
Dependent Variable	Covered Bonds Pre-Crisis	Covered Bonds Crisis	Bank Bonds Pre-Crisis	Bank Bonds Crisis	Securitization Bonds Pre-Crisis	Securitization Bonds Crisis
<i>Credit Spread (bps)</i>						
Independent Variables						
CDS_Country	0.050*** (0.189)	0.421*** (0.0598)	0.075** (0.309)	0.425*** (0.0429)	0.611 (5.109)	-1.402** (2.182)
Credit Rating	0.029** (0.746)	-0.013 (0.757)	0.068** (1.310)	0.315*** (1.361)	0.648* (10.49)	0.214* (3.738)
Time to Maturity	0.161*** (0.289)	-0.017 (0.383)	-0.163 (3.157)	0.111** (1.063)	-0.190 (0.998)	-0.645 (3.960)
Risk Free Rate	0.195*** (200.8)	-0.093* (516.5)	-0.034 (494.2)	-0.061* (613.9)	-0.683 (8377.6)	-2.541 (49505.8)
Eusa5y-libor3m	-0.029 (0.0305)	-0.341*** (0.0697)	-0.169*** (0.0763)	-0.065 (0.0758)	-0.346 (0.449)	0.487 (2.060)
Volatility	0.044** (0.218)	0.064 (0.230)	0.088 (1.041)	0.190*** (0.334)	-0.015 (3.615)	5.681* (23.12)
Number of banks	0.038* (0.600)	-0.078** (1.090)	-0.036* (0.679)	-0.032 (0.793)	-0.418 (21.11)	1.036 (144.5)
Number of bookrunners	0.073** (1.394)	0.028 (2.459)	-0.065* (3.168)	0.023 (2.424)	0.636* (34.10)	0.000 (.)
Bookrunner Participation	-0.042* (4.022)	-0.121*** (7.470)	-0.232*** (14.87)	-0.269*** (7.902)	0.256* (32.03)	3.325* (623.8)
Loan to Value	-0.041 (40.85)	-0.047 (81.14)	0.064 (71.89)	-0.077 (46.53)	0.089 (98.74)	0.006 (40.90)
Tranche size	-0.056*** (0.00257)	0.071* (0.00685)	-0.066 (0.00604)	-0.029 (0.00396)	-0.306** (0.0123)	-0.952*** (0.00779)
Number of tranches	-0.055 (11.83)	-0.046 (23.10)	0.683** (19.85)	0.028 (8.522)	0.806 (23.77)	-0.187 (76.91)
Fixed Rate	-0.266*** (3.700)	-0.135*** (3.293)	0.024 (7.113)	0.030 (4.923)	-0.202 (58.81)	-1.339** (219.0)
Currency Risk	0.106*** (4.144)	0.021 (5.320)	0.071** (10.96)	0.133*** (7.390)	0.502* (81.83)	0.707* (276.3)
Callable	0.265*** (3.201)	0.005 (8.615)	0.121* (13.35)	0.094*** (19.63)	-0.439 (80.28)	0.723* (116.4)
Observations	4 878	2 840	1 737	1 945	54	26
Adjusted R-squared	0.245	0.439	0.474	0.466	0.481	0.877

Notes: Table 4.8 presents the standardized coefficients of the regression presented in table 5.7. CDS_Country is the CDS paid at time of issuance by country .Credit Spread is computed as the margin yielded (in bases points) by the security at issue above a corresponding currency treasury benchmark with a comparable maturity. Credit Rating is the S&P and Moody's rating at bond issuance; the rating is converted as follows: AAA=Aaa=1, AA+=Aa1=2, and so on until D=22. Time to Maturity is the maturity of the financial instrument in years. Risk free rate is the yield on a three-month German Treasury bill. EUSA5y-Libor3M is the difference between the five-year Euro swap rate and the 3-month Libor rate. Volatility is presented by The Chicago Board Options Exchange Volatility Index (VIX). Number of banks is the number of financial institutions that participates in the transaction. The bookrunner is the number of financial institutions that underwrites the financial instrument. Bookrunner Participation is the part of the financial

instrument that the bookrunner kept. Loan to value represents the ratio between tranche size and the transaction value. Tranche size represents the amount of the tranche in euros. Number of tranches is the number of tranches per transaction. Fixed rate equals to 1 if the bond has a fixed coupon rate and 0, otherwise Currency risk equals 1 for bonds denominated in a different currency than that of the country where the bank is headquartered and 0, otherwise. Callable equal to 1 if the bond can be redeemed before the maturity date and 0, otherwise. ***, ** and * indicates that the reported coefficients are significantly different from zero at the 1%, 5% and 10% levels, respectively. The t-statistics reported in parentheses are based on heteroskedasticity-consistent standard errors clustered by transaction.

4.1.4 Countries with Triple A and banks funding conditions.

In hypothesis 4 we point out that Countries with Triple A rating provided a safety net during the 2007-2008 financial crisis on “their” banks funding conditions. In this section we thus study if a safety net was provided by countries with triple A rating to “their” banks during the crisis period. Table 4.9 shows the results of estimating a model in which we include two dummy variables: *AAA_pre_crisis*, equal to one if the country where the bank is headquartered has a Triple A rating in pre-crisis period and 0 otherwise; and *AAA_crisis*, equal to one if the country where the bank is headquartered has a Triple A rating in crisis period. Results presented in table 4.9 show that before the beginning of the crisis, banks headquartered in countries with triple A rating paid, on average, less 11.53 bps when issuing CB. Surprisingly, banks headquartered in countries with a triple A rating paid, on average, more 30.42 bps when issuing BB. With the unwind of the financial crisis, for CB, countries with triple A continued to provide an implicit support because “their banks” paid, on average, less 75.35 bps. For BB the results show that in period of crisis, banks paid less 40.31 bps when they are located in a country with triple A rating. These results

corroborates our hypothesis: banks located in countries with a triple A rating paid a lower average spread during the crisis period. Similar results were obtained by (Zaghini, 2014).

Table 4.9 Regression analysis on the effect of Triple A countries during the financial crisis

Dependent Variable	Covered Bonds	Bank Bonds
Credit Spread (bps)		
Independent Variables		
Credit Rating	1.744*** (0.477)	14.14*** (1.186)
Time to Maturity	2.048*** (0.197)	-0.238 (1.035)
Risk Free Rate	692.1*** (111.7)	1283.5*** (299.2)
Eusa5y-libor3m	-0.251*** (0.0167)	-0.225*** (0.0435)
Volatility	0.251** (0.0880)	1.042*** (0.241)
Number of banks	-0.283 (0.479)	-3.092*** (0.600)
Number of bookrunners	3.651*** (0.621)	-3.874 (2.085)
Bookrunner Participation	-2.024 (2.037)	-60.28*** (7.429)
Loan to Value	-29.59 (35.22)	15.76 (49.07)
Tranche size	0.00366 (0.00263)	-0.00497 (0.00372)
Number of tranches	-13.22 (11.26)	44.41** (15.66)
Fixed Rate	-44.00*** (2.296)	34.71*** (4.200)
Currency Risk	22.32*** (2.924)	38.16*** (4.746)
Callable	40.11*** (2.432)	28.60*** (6.703)
AAA_pre_crisis	-11.53*** (3.295)	30.42*** (3.560)
AAA_crisis	-75.35*** (4.551)	-40.31*** (7.156)
Crisis	172.2*** (5.871)	190.9*** (10.25)
Constant	74.65 (46.88)	-114.7 (75.10)
Number of Observations	10 920	5 695
Adjusted R-squared	0.421	0.317

Notes: Table 4.9 presents the results of OLS regression analysis of the determinants of Covered Bonds, Bonds and Securitization credit spreads. Credit Spread is computed as the margin yielded (in bases points) by the security at issue above a corresponding currency treasury benchmark

with a comparable maturity. Credit Rating is the S&P and Moody's rating at bond issuance; the rating is converted as follows: AAA=Aaa=1, AA+=Aa1=2, and so on until D=22. Time to Maturity is the maturity of the financial instrument in years. Risk free rate is the yield on a three-month German Treasury bill. EUSA5y-Libor3M is the difference between the five-year Euro swap rate and the 3-month Libor rate. Volatility is presented by The Chicago Board Options Exchange Volatility Index (VIX). Number of banks is the number of financial institutions that participates in the transaction. The Number of bookrunners is the number of financial institutions that underwrites the financial instrument. Bookrunner Participation is the part of the financial instrument that the bookrunner kept. Loan to value represents the ratio between tranche size and the transaction value. Tranche size represents the amount of the tranche in euros. Number of tranches is the number of tranches per transaction. Fixed rate equals to 1 if the bond has a fixed coupon rate and 0, otherwise Currency risk equals 1 for bonds denominated in a different currency than that of the country where the bank is headquartered and 0, otherwise. Callable equal to 1 if the bond can be redeemed before the maturity date and 0, otherwise. AAA_pre_crisis is a dummy variable that interacts Country Rating with Crisis. It has value 1 if the country had a triple A rating in the period of pre-crisis (from 1st January 2000 until 15th September 2008) and 0 otherwise. AAA_crisis is a dummy variable that interacts Country Rating with Crisis. It has value 1 if the country had a triple A rating in the period of crisis (after 15th September 2008 until 31th December 2011) and 0 otherwise. Crisis equals 1 if the issue date falls within the crisis period (September 15, 2008 – December 31, 2011) and 0, otherwise (January 1, 2000 – September 14, 2008) ***, ** and * indicates that the reported coefficients are significantly different from zero at the 1%, 5% and 10% levels, respectively. The t-statistics reported in parentheses are based on heteroskedasticity-consistent standard errors clustered by transaction.

4.1.5 Countries with international finance assistance and banks funding conditions

This section examines if banks headquartered in countries that had international finance assistance during the European sovereign debt crisis verified a significant change on their funding conditions of. In hypothesis 5 we argue that countries that had international finance assistance witnessed a deterioration on “their” banks funding conditions. In order to test this hypothesis we add to our base model the following two dummy variables:

Coun_Under_AssPre_Crisis, equal to 1 if banks are headquartered in Portugal, Ireland, Italy, Greece and Spain (PIIGS) in the pre-crisis period and 0, otherwise; and *Coun_Under_AssCrisis*, equal to 1 if banks are headquartered in Portugal, Ireland, Italy, Greece and Spain (PIIGS) in the crisis period and 0, otherwise. Results in Table 4.10 show that for CB that *Coun_Under_AssPre_Crisis* variable is not statistical significant, providing evidence that before the financial crisis, banks headquartered in PIIGS shown no sign of deterioration on their funding conditions. For BB, and with an unexpected sign, banks face, on average, lower spreads (the variable is associated with a 31.91 bps drop in spreads). With the dawn of the financial crisis, results show that the crisis period deteriorate the funding conditions for banks headquartered on PIIGS. On average, they paid a 94.93 bps and 41.44 bps higher spreads when issuing CB and BB, respectively. Again, we corroborate the idea that the soundness of a country is an important determinant of the banks' cost of funding, especially on crisis period. We thus corroborate hypothesis five.

Table 4.10 Regression analysis on the effect of countries under financial assistance during the financial crisis

Dependent Variable	Covered Bonds	Bank Bonds
Credit Spread (bps)		
Independent Variables		
Credit Rating	1.723*** (0.477)	14.25*** (1.190)
Time to Maturity	2.294*** (0.199)	-0.267 (1.029)
Risk Free Rate	762.2*** (109.9)	1252.3*** (296.3)
eusa5y-libor3m	-0.241*** (0.0164)	-0.239*** (0.0427)
Volatility	0.255** (0.0858)	0.903*** (0.240)
Number of banks	0.318 (0.468)	-3.397*** (0.622)
Number of bookrunners	3.308*** (0.614)	-3.081 (2.043)
Bookrunner Participation	-0.808 (2.014)	-60.38*** (7.367)
Loan to Value	-25.07 (36.50)	13.53 (48.58)
Tranche size	0.000949 (0.00259)	-0.00350 (0.00385)
Number of tranches	-8.778 (11.73)	43.80** (15.57)
Fixed Rate	-44.75*** (2.330)	32.51*** (4.068)
Currency Risk	22.32*** (2.926)	37.78*** (4.759)
Callable	39.14*** (2.439)	28.98*** (6.658)
Coun_Under_Ass Pre_Crisis	1.616 (2.460)	-31.91*** (3.574)
Coun_Under_AssCrisis	94.93*** (4.873)	41.44*** (7.253)
Crisis	108.0*** (2.738)	118.9*** (6.901)
Constant	51.19 (48.43)	-74.14 (74.53)
Observations	10 920	5 695
Adjusted R-squared	0.430	0.318

Notes: Table 4.10 presents the results of OLS regression analysis of the determinants of Covered Bonds, Bonds and Securitization credit spreads. Credit Spread is computed as the margin yielded (in bases points) by the security at issue above a corresponding currency treasury benchmark

with a comparable maturity. Credit Rating is the S&P and Moody's rating at bond issuance; the rating is converted as follows: AAA=Aaa=1, AA+=Aa1=2, and so on until D=22. Time to Maturity is the maturity of the financial instrument in years. Risk free rate is the yield on a three-month German Treasury bill. EUSA5y-Libor3M is the difference between the five-year Euro swap rate and the 3-month Libor rate. Volatility is presented by The Chicago Board Options Exchange Volatility Index (VIX). Number of banks is the number of financial institutions that participates in the transaction. The Number of bookrunners is the number of financial institutions that underwrites the financial instrument. Bookrunner Participation is the part of the financial instrument that the bookrunner kept. Loan to value represents the ratio between tranche size and the transaction value. Tranche size represents the amount of the tranche in euros. Number of tranches is the number of tranches per transaction. Fixed rate equals to 1 if the bond has a fixed coupon rate and 0, otherwise. Currency risk equals 1 for bonds denominated in a different currency than that of the country where the bank is headquartered and 0, otherwise. Callable equal to 1 if the bond can be redeemed before the maturity date and 0, otherwise. Coun_Under_Ass_Pre_Crisis is an interaction dummy between Coun_Under_ASS and Crisis. It equals 1 if the issuer bank is headquartered in Portugal, Italy, Ireland, Greece and Spain, and the bond issue belongs to the pre-crisis period (from 1st January 2000 until 15th September 2008) and 0 otherwise. Coun_Under_AssCrisis is an interaction dummy between Coun_Under_ASS and Crisis. It equals 1 if the issuer bank is headquartered in Portugal Italy, Ireland, Greece and Spain, and the bond issue belongs to the crisis period (September 15, 2008 – December 31, 2011) and 0, otherwise. Crisis equals 1 if the issue date falls within the crisis period (September 15, 2008 – December 31, 2011) and 0, otherwise (January 1, 2000 – September 14, 2008). ***, ** and * indicates that the reported coefficients are significantly different from zero at the 1%, 5% and 10% levels, respectively. The t-statistics reported in parentheses are based on heteroskedasticity-consistent standard errors clustered by transaction.

4.1.6 The impact of the first Covered Bond Purchase Programme (CBBP)

In hypothesis 6 we argue that the first Covered Bond Purchase Programme (CBBP) had the desired effect by the monetary authorities. In this section we thus investigate the impact of the first Covered Bond Purchase Programme (CBPP) on bank bond credit spreads. Easing funding conditions for credit institutions and

enterprises was one of the major objectives that the monetary institutions had with this programme. In order to implement this analysis, we defined a window of observations which starts after the dawn of the financial crisis – September 15, 2008 – and ends in the beginning of the European sovereign debt crisis – May 2, 2010. Between these two dates, as presented in Figure 4.1, we have the announcement of the CBPP – May 7, 2009.

Figure 4.1 Period of Analysis CBPP1



Notes: Our observations start at January 1, 2000 and ends at December 31, 2011. As the financial crisis started at September 15, 2008, we defined a window of observations that starts at September 15, 2008 and ends at May 2, 2010 to capture the effect of the Covered Bond Purchase Programme

Analyzing table 4.11 where we compare the mean and median spreads, through the period of analysis, we first conclude that before the financial crisis (Pre-crisis) the average credit spreads were lower. Then, with the unwind of the financial crisis, spreads increased considerably for the three funding forms as a consequence of the significant deterioration on the funding conditions. After the implementation of the first Covered Bond Purchase Programme, announced in May 7, 2009, on average the spreads fallen for CB, BB and SB. Despite the average credit spreads did not return to the values observed during the pre-crisis period, the rising tendency fade away. This might mean that the CBPP was in fact a successful monetary instrument because it reduced the costs of funding and restored confidence. However, a major problem disrupted in 2010. The sovereign crisis imploded after the request made by Greek authorities for financial

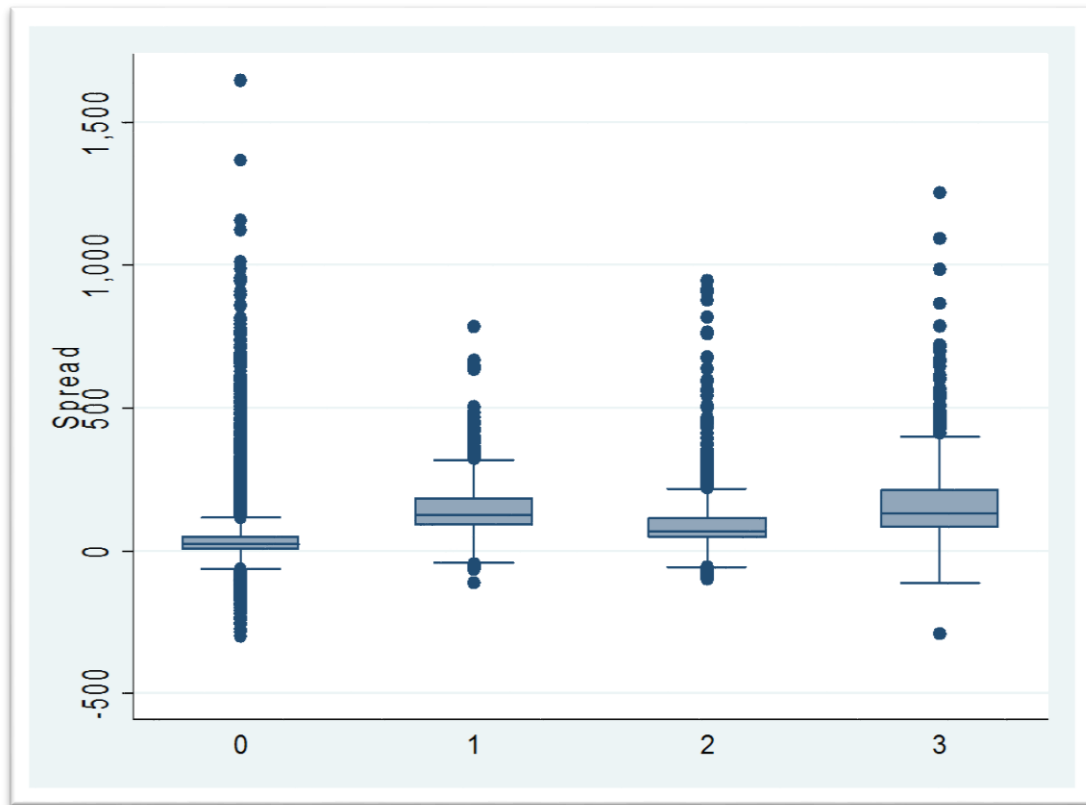
assistance, the starting point for the so-called sovereign debt crisis in the Eurozone, fact that still remains.

Table 4.11 Credit spread values during different periods of analysis

Variable : Credit Spread	Covered Bonds	Banks Bonds	Securitization Bonds
<i>Periods of Analysis</i>			
<u>Pre - Crisis</u> ⁰	16,07 ^{a,b} (15,40) 8 070	70,34 ^{a,c} (37,50) 3 732	146,66 ^{b,c} (93,00) 219
<u>At Crisis before CBPP</u> ¹	128,51 ^a (108,95) 688	173,98 ^a (160,44) 454	245,78 (210,06) 11
<u>After CBPP before Sovereign Crisis</u> ²	68,69 ^{a,b} (58,35) 1 228	143,97 ^a (113,00) 641	121,34 ^b (112,53) 15
<u>Sovereign Crisis</u> ³	141,25 ^a (112,86) 934	181,16 ^a (152,30) 868	
<u>Total</u>	39,78 (26,50) 10 920	103,78 (60,50) 5 695	149,56 (101,51) 245

Notes: Each cell contains means, parenthetic medians and number of observations for credit spreads in four periods: *0* - January 1, 2000 through September 15, 2008; *1* - September 16, 2008 through May 7, 2009; *2* - May 8, 2009 through May 2, 2010; *3* - May 3, 2010 through December 31, 2011. We test for similar distributions in credit spread across samples via the Wilcoxon rank-sum test. Credit Spread is computed as the margin yielded (in bases points) by the security at issue above a corresponding currency treasury benchmark with a comparable maturity. *a* denotes statistical difference at the 1% level between 'Covered Bonds' and 'Bank Bonds' samples; *b* denotes statistical difference at the 1% level between 'Covered Bonds' and 'Securitization Bonds' samples; and *c* denotes statistical difference at the 1% level between 'Bank Bonds' and 'Securitization Bonds' samples.

Figure 4.2 Graphic presentation of the spread evolution through the periods



Notes 0 - January 1, 2000 through September 15, 2008; 1 - September 16, 2008 through May 7, 2009; 2 - May 8, 2009 through May 2, 2010; 3 - May 3, 2010 through December 31, 2011

Table 4.12 Regression analysis on the effect of covered bond purchase programme

Dependent Variable	CBPProgramme
Credit Spread (bps)	<i>N</i> = (3 015)
Independent Variables	
CDS_Country	0.502*** (0.0332)
Credit Rating	10.19*** (0.716)
CBBP Date	-39.81*** (3.367)
Constant	81.04*** (3.905)
Observations	3 015
Adjusted R-squared	0.203

Notes: Table 4.12 presents the results of OLS regression analysis of the determinants of credit spreads during between 15th September of 2008 (onset Financial Crisis) and 2nd May of 2010 (onset Sovereign Debt Crisis). Credit Spread is computed as the margin yielded (in bases points) by the security at issue above a corresponding currency treasury benchmark with a comparable maturity. Credit Rating is the S&P and Moody's rating at bond issuance; the rating is converted as follows: AAA=Aaa=1, AA+=Aa1=2, and so on until D=22. CDS_Country is the CDS paid at time of issuance by country. Yield Country is the Yield of the country at time of issuance. CBPP equal to 1 if issuance is after 07th May of 2009 and 0 otherwise. ***, ** and * indicates that the reported coefficients are significantly different from zero at the 1%, 5% and 10% levels, respectively. The t-statistics reported in parentheses.

Table 4.12 presents the regression analysis of the impact of the first CBPP programme on the credit spreads of our sample. We use *CBPP Date* as a dummy variable, set equal to 1 if de CB issuance date belongs to periods 2 and 0, otherwise. The time period is presented in Figure 4.1. Our findings shows that the implementation of the CBPP impacts significantly the pricing of bonds, decreasing the average credit spread by 39.81 bps. We thus accepts Hypothesis

6, since the implementation of the CBPP reduced, on average, the credit spreads and contributed to an easing of financial institutions funding conditions.

4.1.7 Robustness tests

To validate the main results presented, we introduced banks financial characteristics (ratios) reflecting liquidity, regulatory capital, asset quality and performance. For liquidity we use Cash plus Securities over Assets, Loans over Customer Deposits and Net Loans over Total Assets. Regulatory capital will be studied using Equity over Total Assets and Total Regulatory Capital Ratio. Impaired Loans over Gross Loans measures the asset quality, *Return on Average Assets (ROAA)* and *Return on Average Equity (ROAE)* measure the bank performance. Total assets reflects the size of the bank.

(Calomiris & Mason, 2003) define some criterions about banks' insolvency. According to basic finance, the probability of a bank becomes insolvent depends on three factors: (i) asset risk, (ii) leverage; and (iii) liquidity of assets in relation to liabilities. Following this idea, we can assume that any ratio that increases asset risk or leverage causes insolvency problems leading to an increase of the funding costs. Liquidity of assets in relation to liabilities is also an important variable because if assets are less liquid that might mean a liquidity problem, which leads to an increase in funding costs.

Overall we conclude that banks with higher liquidity, better asset quality and financial performance are able to reduce their funding costs.

Table 4.13 presents our results when we include banks' characteristics as additional regressors. Because of the reduced number of observation in SB, we will focus our analysis on BB and CB.

Starting with liquidity ratios, Cash plus Securities over Assets is statistical significant (10% level) for CB and insignificant for BB. The sign presented for CB

is the expected one since a bank with a higher liquidity level is expected to have a lower cost of funding. The impact of Loans over Customer Deposits on CB spreads is insignificant for CB but significant and negative for BB. The sign for BB were not expected as (Altunbas, Manganeli, & Marques-Ibanez, 2011) states that customer deposits provides funding stability and reduces the probability of a bank rescue. On the other hand, (Agostino & Mazzuca, 2008) suggests that the reduction of funds raised through deposits can increase profitability, leading to better performances and consequently to more “safe” banks. As we expected, Net Loans over Total Assets and credit spreads have a significantly positively relationship for CB: i.e., a higher ratio would cause liquidity problems and consequently higher funding costs. This can also lead to a leverage¹⁵ problem because as it occurs in investment banks such as Lehman Brothers, during the financial crisis, they had huge sums of loans but all from borrowed money and not by their own. The impact of the ratio Equity over total assets on credit spread is significant and negative for BB only (10% level), which suggests that institutions with higher capacity of absorbing unexpected losses in assets are consider to be safest than banks with lower equity buffer. The total Regulatory Capital Ratio is significant and positive at the level of 10% for BB. Thus, contrary to what we expected the higher the ratio, the higher the funding costs. This result is quit counterintuitive since it suggests that banks with less regulatory capital divided by risk weighted assets pay lower spreads. As expected, Impaired Loans over Gross Loans ratio and credit spread have a significant positive relationship for CB, meaning that the banks with a higher level of impaired loans on total loans face higher funding costs. Regarding bank performance, both *Return on Average Assets (ROAA)* and *Return on Average Equity (ROAE)* have an insignificant relationship with bank bond credit spreads.

¹⁵ We consider that a bank is high levered when the total assets are financed, in majority, by borrowed capital and not by the banks' capital.

Finally, bank size, represented by the total assets, and credit spread have an insignificant relationship for both CB and BB. Our results do not corroborate those of (Calomiris & Mason, 2003), which states that larger banks are able to diversify their loan portfolios and thus reduce asset risk and, consequently, default risk. Similarly, (Zaghini, 2014) shows evidence consistent with the too-big-to-fail (TBTF) hypothesis: an increase in the total assets of a bank reduces, on average, the spread paid.

Table 4.13 Regression Analysis on the impact of the independent variables on the credit spread using Financial Ratios

Dependent Variable	Covered Bonds	Bank Bonds	Securitization Bonds
Credit Spread (bps)			
Independent Variables			
CDS_Country	0.272*** (0.0668)	0.516*** (0.0559)	
Credit Rating	-0.956 (0.965)	16.88*** (2.333)	6.001*** (0.196)
Time to Maturity	1.295** (0.404)	7.235*** (1.240)	
Risk Free Rate	228.7 (360.0)	57.40 (703.9)	
Eusa5y-libor3m	-0.273*** (0.0517)	-0.352*** (0.0978)	-1.341** (0.120)
Volatility	0.712*** (0.213)	0.417 (0.416)	
Number of banks	-0.852 (0.849)	-2.596** (0.858)	
Number of bookrunners	4.067*** (1.193)	10.31** (3.596)	
Bookrunner Participation	-8.116 (5.148)	-33.73*** (9.113)	
Loan to Value	22.14 (40.57)	-35.29 (64.02)	-93.94 (43.02)
Tranche size	-0.00339 (0.00475)	-0.000622 (0.00437)	-0.00116 (0.000846)
Number of tranches	1.389 (12.80)	26.13 (29.16)	
Fixed Rate	-28.92*** (2.792)	-4.353 (5.440)	
Currency Risk	28.69*** (4.078)	29.91*** (7.857)	
Callable	22.19*** (6.059)	7.300 (13.52)	
Crisis	81.10*** (5.911)	88.12*** (18.37)	
Cash + Securities /Assets	-50.35* (22.45)	1.567 (40.24)	5.43e-08 (0.0000406)
Loans / Customer Deposits	1.279 (0.797)	-7.694*** (1.534)	
Net Loans / Total Assets	3855.6** (1362.7)	2223.4 (2531.7)	
Equity / Tot Assets	131.3 (152.6)	-502.1* (235.2)	
Total Regulatory Capital Ratio	2.386 (54.87)	330.4* (157.0)	
Impaired Loans/Gross Loans	-64.48 (65.28)	381.8** (139.0)	
Return on Average Assets(ROAA)	804.9 (471.9)	-614.3 (1695.5)	
Return on Average Equity(ROAE)	-12.79 (8.460)	-16.11 (52.86)	
TAssets_Millions	0.00000666 (0.00000505)	0.0000160 (0.0000102)	
Constant	1.314 (54.79)	-71.19 (96.44)	384.3*** (8.600)
Observations	3 031	1 425	7
Adjusted R-squared	0.516	0.566	0.980

Notes: Table 4.13 presents the results of OLS regression analysis of the determinants of Covered Bonds, Bonds and Securitization credit spreads. Credit Spread is computed as the margin yielded (in bases points) by the security at issue above a corresponding currency treasury benchmark with a comparable maturity. CDS_Country is the CDS paid at time of issuance by country. Credit Rating is the S&P and Moody's rating at bond issuance; the rating is converted as follows: AAA=Aaa=1, AA+=Aa1=2, and so on until D=22. Time to Maturity is the maturity of the financial instrument in years. Risk free rate is the yield on a three-month German Treasury bill. EUSA5y-Libor3M is the difference between the five-year Euro swap rate and the 3-month Libor rate. Volatility is presented by The Chicago Board Options Exchange Volatility Index (VIX). Number of banks is the number of financial institutions that participates in the transaction. The Number of bookrunners is the number of financial institutions that underwrites the financial instrument. Bookrunner Participation is the part of the financial instrument that the bookrunner kept. Loan to value represents the ratio between tranche size and the transaction value. Tranche size represents the amount of the tranche in euros. Number of tranches is the number of tranches per transaction. Fixed rate equals to 1 if the bond has a fixed coupon rate and 0, otherwise. Currency risk equals 1 for bonds denominated in a different currency than that of the country where the bank is headquartered and 0, otherwise. Callable equal to 1 if the bond can be redeemed before the maturity date and 0, otherwise. Crisis equals 1 if the issue date falls within the crisis period (September 15, 2008 – December 31, 2011) and 0, otherwise (January 1, 2000 – September 14, 2008). Cash + Securities /Assets is the ratio between Cash plus Securities, that represents the total cash available, and the total assets, Loans / Customer Deposits represents the relation between the Loans and the Customer Deposits, Net Loans / Total Assets are the percentage of loans in the Total Assets, Equity / Tot Assets is the ratio between Value of equity and Total Assets, Total Regulatory Capital Ratio is the total capital adequacy under Basel rules, Impaired Loans/Gross Loans represents total impaired loans divided by the total gross loans, Return on Average Assets(ROAA) is equal to the net profit divided by the Total Assets, Return on Average Equity(ROAE) is the net profit divided by the total amount of Equity, TAssets_Millions are the total assets presented in balance. ***, ** and * indicates that the reported coefficients are significantly different from zero at the 1%, 5% and 10% levels, respectively. The t-statistics reported in parentheses are based on heteroskedasticity-consistent standard errors clustered by transaction

5. CONCLUSION

Since the first signs of the subprime crisis in the beginning of 2007 that researchers has been looking more closely to the relationship between Banking and Sovereign risk. Following the bankruptcy of Lehman Brothers, the world assisted to the biggest financial crisis since 1929. This dissertation looks closely the role played by the sovereign risk on banking risk, using a sample of 10,920 Covered Bonds, 5,695 bank bonds and 245 securitization bonds issued during the 2000-2011 period.

We conclude that the common pricing factors impact differently the three different bond types. Additionally, we found that the impact of sovereign risk on bank risk is significant and positive. Results show that sovereign risk, in fact, has a major role in determining bank risk and that in crisis periods this connection tends to strengthen. Our results are in line with those of (Gómez-Puig, Sosvilla-Rivero, & K.Singh, 2014).

In line with (Zaghini, 2014) findings, our results show that countries with better ratings provided a safety net for “their banks”, allowing them to borrow with lower funding costs. Additionally, our results show that on average banks from Portugal, Italy, Ireland, Greece and Spain, countries with international financial assistance, supported relatively higher costs of funding during the crisis period.

Regarding the role of the first Covered Bonds Purchase Programme (CBPP) issued by the European Central Bank in an attempt to minimize the effects of the financial crisis, our results show that after the crisis break, spread increased sharply, but with the implementation of the CBPP the average credit spread decreased significantly for covered bonds, bank bonds and even for securitization bonds. This was a quite short-term effect because in 2010, with the appearance of the Sovereign Debt Crisis, the growing trend started again.

With this work, we believe that we did a major contribution to a better understanding between the sovereign and banking risk. In a time where the public debt (high ratios) of countries is at the center of the concerns, we prove that the sovereign risk is an important variable for the funding conditions of the financial system. This relationship is even more important in times of financial distress. Ultimately countries with financial soundness and ready to support any financial distress is an important fact to a healthy financial system. That is why public governors should adopt measures to strengthen the financial health of the country because in the end, the system credibility will rely on it.

With the beginning of the financial crisis, and especially with the Sovereign Debt crisis, European Central Bank has adopted quantitative easing programmes such as the Second and Third Covered bond purchase programmes (CBPP 2) & (CBPP3), Securities Markets Programme, asset-backed securities purchase programme (ABSPP), public sector purchase programme (PSPP) which are clearly subjects for future research. Meanwhile studying the relationship in other countries, or introducing other macro variables such as Gross Domestic Product (GDP) and inflation rate, or even the most recent financial events such as bail-ins¹⁶ and negative interest rates, are also important subjects deserving future research.

¹⁶ The directive 2014/59/EU of 15 of May 2014 refers that in order to ensure that the financial stability could not be affected by financial institutions point (67) says that “The bail-in tool achieves that objective by ensuring that shareholders and creditors of the failing institution suffer appropriate losses and bear an appropriate part of the costs arising from the failure of the institution”.

References

- (ECBC), E. C. (2014). *European Covered Bond Fact Book 2014 edition*.
- A. Minton, B., Stulz, R., & Williamson, R. (2005). *How Much Do Banks Use Credit Derivatives To Reduce Risk? National Bureau Of Economic Research*. National Bureau Of Economic Research.
- Acharya, V., Drechsler, I., & Schnabl, P. (2014). *A Pyrrhic Victory? Bank Bailouts and Sovereign Credit Risk*. National Bureau Of Economic Research.
- Affinito, M., & Tagliaferri, E. (2010). *Why do (or did) banks securitize their loans? Evidence from Italy*. Banca D'Italia.
- Afonso, A., Arghyrou, M. G., & Kontonikas, A. (2015). *The determinants of sovereign bond yield spreads in the EMU*. European Central Bank (ECB).
- Agostino, M., & Mazzuca, M. (2008). *Why do Banks Securitise: Evidence from Italy*. Department of Economics and Statistics, University of Calabria.
- Alessandri, P., Masciantonio, S., & Zaghini, A. (2015). *Tracking banks' systemic importance before and after crisis*. Banca D'Italia.
- Alter, A., & Schuler, Y. S. (2012). *Credit Spread Interdependencies of European States and Banks during the Financial Crisis*. University of Konstanz.
- Altunbas, Y., Manganelli, S., & Marques-Ibanez, D. (2011). *Bank Risk During The Financial Crisis - Do Business Models Matter. .* European Central Bank.
- Arezki, R., Candelon, B., & Sy, A. (2011). *Sovereign Rating News and Financial Markets Spillovers: Evidence from the European Debt Crisis*. CESIFO Working Paper N^o. 3411.
- Attinasi, M.-G., Checherita, C., & Nickel, C. (2009). *What explains the surge in euro area sovereign spreads during the financial crisis of 2007-09? European Central Bank*.

- Barrios, S., Iversen, P., Lewandowska, M., & Setzer, R. (2009). *Determinants of intra-euro area government bond spreads during the financial crisis*. European Commission.
- Beau, E., Hill, J., Hussain, T., & Nixon, D. (2014). *Bank funding costs: what are they, what determines them and why do they matter*. Bank of England, Quarterly Bulletin 2014 Q4 .
- Beirne, J., Dalitz, L., & Ejsing, J. (2011). *The Impact of the Eurosystem's Covered Bond Purchase Programme on the Primary and Secondary Markets*. Frankfurt, Germany: European Central Bank.
- Buscaino, V., Caselli, S., Corielli, F., & Gatti, S. (2012). *Project Finance Collateralised Debt Obligations: An Empirical Analysis of Spread Determinants*. *European Financial Management* 18, 950-969.
- Buscaino, V., Caselli, S., Corielli, F., & S., G. (2012). *Project Finance Collateralised Debt Obligations: An Empirical Analysis of Spread Determinants*. *European Financial Management* 18: 950-969.
- Calomiris, C. W., & Mason, J. R. (2003). *Fundamentals, Panics, and Bank Distress During the Depression*. *The American Economic Review*.
- Cantor, R., & Packer, F. (1996). *Determinants and Impact of Sovereign Credit Ratings*. *Frbny Economic Policy Review*.
- Caporale, G. M., Matousek, R., & Stewart, C. (2009). *Rating Assignments: Lessons from International Banks*. Berlin: Deutsches Institut für Wirtschaftsforschung.
- Carbó-Valverde, S., Rosen, R. J., & Rodríguez-Fernández, F. (2011). *Are Covered Bonds a Substitute for Mortgage-Backed Securities?* Federal Reserve Bank of Chicago.
- Caselli, S., Gandolfi, G., & Soana, M. G. (2016). *The Impact of Sovereign Rating News on European Banks*. *European Financial Management*, Vol. 22, No. 1, 2016, 142–167.

- Casu, B., Clare, A., Sarkisyan, A., & Thomas, S. (2013). *Securitization and Bank Performance*. Ohio State University: Journal of Money, Credit and Banking.
- Collin-Dufresne, P., Goldstein, R. S., & Martin, J. S. (2001). *The Determinants of Credit Spread Changes*. *The Journal of Finance*, Vol. 56, No. 6. (Dec., 2001), pp. 2177-2207.
- Daniels, K. D., Ejara, D. D., & Vijayakumar, J. (2010). *Debt Maturity, Credit Risk, and Information Asymmetry: The Case of Municipal Bonds*. The Eastern Finance Association.
- Davidson, A. A., Wolff, L., & A., C. (2003). *Securitization: Structuring and Investment Analysis*. Wiley Finance.
- Duffie, D., & Singleton, K. (2001). *Modeling Term Structures of Defaultable Bonds*. ECB. (2010). *Monthly Bulletin, August*.
- Eichengreen, B., & Mody, A. (1998). *Interest rates in the north and capital flows to the south: is there a missing link?* *Journal of International Finance* 1, 35-57.
- Estrella, A., & Schich, S. (2012). *Sovereign and Banking Sector Debt: Interconnections through Guarantees*. OECD Journal: Financial Market Trends.
- Fabozzi, F. J., & Kothari, V. (2007). *Securitization: The Tool of Financial Transformation*. Yale ICF Working Paper No. 0707.
- Firla-Cuchra, M. (2005). *Explaining Launch Spreads on Structured Bonds*, Working Paper. Oxford University.
- Firla-Cuchra, M., & Jenkinson, T. (2006). *Why are securitization issues tranching?* Working Paper, Oxford University.
- Fons, J. (1987). *The default premium and corporate bond experience*. *Journal of Finance*, Vol. 42, No. 1, pp. 81-97.

- Gabbi, G., & Sironi, A. (2005). Which Factors Affect Corporate Bonds Pricing? Empirical Evidence from Eurobonds Primary Market Spreads. *The European Journal of Finance*.
- Gatti, S., Kleimeier, S., Megginson, W., & Steffanoni, A. (2013). *Arranger Certification in Project Finance*. *Financial Management* 42: 1-40.
- Gerlach, S., Schulz, A., & Wolff, G. B. (2010). *Banking and Sovereign risk in the euro area*. Deutsche Bundesbank.
- Gómez-Puig, M., Sosvilla-Rivero, S., & K.Singh, M. (2014). *Sovereign and banks in the euro area: a tale of two crises*. Barcelona: Economic Theory Department .
- Grande, G., Levy, A., Panetta, F., & Zaghini, A. (2011). *Public Guarantees On Bank Bonds : Effectiveness And Distortions*. *OECD Journal : Financial Market Trends*.
- He, J., Hu, W., & Lang, L. (2000). *Credit spread curves and credit ratings*. Chinese University of Hong Kong working paper.
- Helwege, J., & Turner, C. (1999). *The slope of the credit yield curve for speculative-grade issuers*. *Journal of Finance*, Vol. 54, No. 5, pp. 1869-1884.
- Hu, J., & Cantor, R. (2006). *The Relationship between Issuance Spreads and Credit Performance of Structured Finance Securities*. *Journal of Fixed Income* 16, 5-20.
- Huber, P. (1967). *The Behavior of Maximum Likelihood Estimates under Nonstandard Conditions*, in *Proceedings of the Fifth Berkeley Symposium on Mathematical Statistics and Probability* 1, 221-233. Berkeley, CA: University of California Press.
- Hull, J. C. (2012). *Options, Futures and Other Derivatives - Eight Edition*. Pearson Education Limited.
- Hull, J., Predescu, M., & White, A. (2004). *The relationship between credit default swap spreads, bond yields, and credit rating announcements*. *Journal of Banking & Finance* 28 (2004) 2789–2811.

- Jacobs, M. J., Karagozoglu, A. K., & M., P. (2010). *Measuring Credit Risk - CDS Spreads vs. Credit Ratings*. FMA Meetings in New York.
- Jones, E., Mason, S., & Rosenfeld, E. (1984). *Contingent Claims Analysis of Corporate Capital Structures*. An Empirical Investigation, *Journal of Finance* 39, 611-625.
- Kamin, S. B., & Von Kleist, K. (1999). *The Evolution And Determinants Of Emerging Market Credit Spreads In The 1990s*. International Finance Discussion Papers.
- Kaufman, G. G. (2013). *Too Big To Fail In Banking: What Does It Mean?* . LSE Financial Markets Group Special Paper Series.
- Krishnamurthy, A., & Muir, T. (2015). *Credit Spreads and the Severity of Financial Crises*. Stanford Graduate School of Business and Yale School of Management.
- Labonte, M. (2015). *Systemically Important or "Too Big to Fail" Financial Institutions*. Congressional Research Service, 7-5700.
- Longstaff, F. A., & Schwartz, E. (1995). *A simple approach to valuing risky fixed and floating rate debt*. *Journal of Finance* 50(3), 789–821.
- Longstaff, F. A., Pan, J., Pedersen, L. H., & Singleton, K. J. (2011). *How Sovereign Is Sovereign Credit Risk?* . *American Economic Journal: Macroeconomics*, 3(2): 75-103.
- Maris, S., & Segal, W. (2002). *Analysis of Yield Spreads on Commercial Mortgage-Backed Securities*. *Journal of Real Estate Research* 23, 235-252.
- Nadauld, T., & Weisbach, M. (2012). *Did securitization affect the cost of corporate debt?* *Journal of Financial Economics* 105, 332-352.
- Panetta, F. (2011). *The impact of sovereign credit risk on bank funding conditions*. Bank for International Settlements.
- Pinto, J. F. (2013). *A Theoretical and Empirical Analysis of Structured Finance*. Porto.

- Pinto, J. M., & Santos, M. C. (September 2015). *Debt Financing Choices: Theory and Evidence from Europe*. Porto: School of Economics and Management Catholic University of Portugal.
- Prokopczuk, M., B. Siewert, J., & Vonhoff, V. (2012). *Credit Risk in Covered Bonds*.
- Remolona, E., Scatigna, M., & Wu, E. (2007). *Interpreting sovereign spreads*. BIS Quarterly Review, March. .
- S., G., Kleimeier, S., Megginson, W., & Steffanoni, A. (2013). *Arranger Certification in Project Finance*. *Financial Management* 42: 1-40.
- Sarig, O., & Warga, A. (1989). *Some Empirical Estimates of the Risk Structure of Interest Rates*. *Journal of Finance* 44, 1351-1360.
- Schich, S., & Lindh, S. (2012). *Implicit Guarantees for Bank Debt: Where Do We Stand?* OECD Journal: Financial Market Trends Volume 2012 Issue 1.
- Sorge, M., & Gadanez, B. (2008). *The Term Structure of Credit Spreads in Project Finance*. *International Journal of Finance and Economics* 13, 68-81.
- Szczerbowicz, U. (2014). *The ECB's Unconventional Monetary Policies: Have they lowered market borrowing costs for banks and governments?* RIETI Discussion Paper Series 14-E-008.
- Thau, A. (2011). *The Bond Book - Third Edition*. McGraw-Hill.
- Vink, D., & Thibeault, A. E. (2008). *ABS, MBS and CDO Compared: An Empirical Analysis*. Nyenrode Business Universiteit.
- White, H. (1980). *A Heteroskedasticity-consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity*. *Econometrica* 48, 817-830.
- Zaghini, A. (2014). *Bank Bonds: Size, Systemic Relevance and the Sovereign*. Center for Financial Studies.
- Zähres, M. (2012). *Capital market bank funding*. Deutsche Bank AG, DB Research.
- Zhu, H. (2004). *An empirical comparison of credit spreads between the bond market and the credit default swap market*.

Table 5.1 – Rating Scale

Fitch	S&P	Moody's	Rating grade description (Moody's)	
AAA	AAA	Aaa	Investment grade	Minimal credit risk
AA+	AA+	Aa1		Very low credit risk
AA	AA	Aa2		
AA-	AA-	Aa3		Low credit risk
A+	A+	A1		
A	A	A2		
A-	A-	A3		
BBB+	BBB+	Baa1	Moderate credit risk	
BBB	BBB	Baa2		
BBB-	BBB-	Baa3		
BB+	BB+	Ba1	Speculative grade	Substantial credit risk
BB	BB	Ba2		
BB-	BB-	Ba3		
B+	B+	B1		High credit risk
B	B	B2		
B-	B-	B3		
CCC+	CCC+	Caa1		Very high credit risk
CCC	CCC	Caa2		
CCC-	CCC-	Caa3		
CC	CC	Ca		In or near default, with possibility of recovery
C	C			
DDD	SD	C	In default, with little chance of recovery	
DD	D			
D				

Notes: Represents the rating scale of the 3 most known rating agencies. In our work we only use the S&P one.

Table 5.2 Variables Description, related Empirical Literature, Expected Sign and Findings (1)

Variable	Description	Empirical Literature	Expected Sign			Findings			
			Covered Bonds	Bonds	Securitization	Hypotheses	Covered Bonds	Bonds	Securitization
Dependent Variable Credit Spread	Credit Spread is computed as the margin yielded (in bases points) by the security at issue above a corresponding currency treasury benchmark with a comparable maturity								
Independent Variables Continuous Variables									
Country Rating	is the S&P's country credit rating at dosing date; the rating is converted as follows: AAA=Aaa=1, AA+=Aa1=2, and so on until D=22	Andrea Zaghini (2014) Caporale, Matousek, & Stewart (2009) Arezki, Candelon, & Sy, (2011)	+	+	+	1	+	I	I
Credit Rating	Credit Rating is the S&P and Moody's rating at bond issuance; the rating is converted as follows: AAA=Aaa=1, AA+=Aa1=2, and so on until D=22	Andrea Zaghini (2014) Gatti et al. (2013) Vink & Thibault (2008) Gabbi & Sironi, (2005) Sorge & Gadanez (2008) Zähres (2012)	+	+	+	1	I	+	+
Time to Maturity	Is the maturity of the financial instrument in years.	Jones, Mason, & Rosenfeld, (1984) Sarig & Warga, (1989) He, Hu, & Lang, 2000 Duffie & Singleton, (2001) Sorge & Gadanez, (2008) Eichengreen & Mody, (1998) Kamin & Von Kleist, (1999) Collin-Dufresne, Goldstein, & Martin, (2001) Longstaff, Pan, Pedersen, & Sorge & Gadanez, (2008) Hu & Cantor, (2006)	?	?	?	1	+	I	I
RiskFreeRate	Is the yield on a three-month German Treasury bill	Eichengreen & Mody, (1998) Kamin & Von Kleist, (1999) Collin-Dufresne, Goldstein, & Martin, (2001) Longstaff, Pan, Pedersen, & Sorge & Gadanez, (2008) Hu & Cantor, (2006)	-	-	-	1	+	+	I
Eusa5y-libor3m	Is the difference between the five-year Euro swap rate and the 3-month Libor rate	Sorge & Gadanez, (2008) Hu & Cantor, (2006)	+	+	+	1	-	-	-
Volatility	is presented by The Chicago Board Options Exchange Volatility Index (VIX)	Fabozzi and Kothari (2007) Davidson, Wolff, & A., (2003) Pinto J. F., (2013) Collin-Dufresne, Goldstein, & Martin, (2001)	+	+	+	1	+	+	+
Number of banks	is the number of financial institutions participating in the transaction	Vink & Thibault (2008) Sorge & Gadanez, (2008) Nadauld & Weisbach (2012)	-	-	-	1	-	-	I
Number of bookrunners	Number of financial institutions that underwrites the financial instrument	Vink & Thibault (2008)	-	-	-	1	+	I	I
Bookrunner Participation	is the percentage of the bond issuance retained by the bookrunner	Vink & Thibault (2008)	-	-	-	1	-	-	I
Loan to Value	represents the ratio of the tranche size to the transaction size	Vink & Thibault (2008)	+	+	-	1	I	I	I
Tranche size	Represents the amount of the tranche in euros	Vink & Thibault (2008) Sorge & Gadanez, (2008) Firla-Cuchra, (2005) Buscaino, Caselli, Corielli, & Gatti, (2012) Maris & Segal, (2002)	-	-	-	1	+	I	I
Number of tranches	is the number of tranches per transaction	Vink & Thibault (2008) Firla-Cuchra and Jenkinson (2006)	+	+	-	1	I	+	I
CDS_Country	is the CDS paid at time of issuance by country	Acharya, Drechsler, & Schnabl (2014) Alter & Schuler, (2012) Longstaff, Pan, Pedersen, & Singleton, (2011) Remolona, Scatigna, & Wu, 2007	+	+	+	2	+	+	I
Yields Country	Yield of the country at time of issuance	(Gómez-Puig, Sosvilla-Rivero, & K.Singh, (2014) Barrios, Iversen, Lewandowska, & Setzer, (2009)	+	+	+	2	+	+	I
Discrete Variables									
Fixed Rate	equals to 1 if the bond has a fixed coupon rate and 0, otherwise	Vink & Thibault (2008) Sorge & Gadanez, (2008)	+	+	+	1	-	+	I
Currency Risk	equals 1 for bonds denominated in a different currency than that of the country where the bank is headquartered and 0, otherwise.	Andrea Zaghini (2014) Vink & Thibault (2008)	+	+	+	1	+	+	I
Callable	equal to 1 if the bond can be redeemed before the maturity date and 0, otherwise	Fabozzi & Kothari, (2007)	+	+	+	1	+	+	I
Crisis	equals 1 if the issue date falls within the crisis period (September 15, 2008 – December 31, 2011) and 0, otherwise (January 1, 2000 – September 14, 2008)	Carbó-Valverde, Rosen, & Rodríguez-Fernández (2011) Prokopczuk, B. Sievert, & Vonhoff, 2012)	+	+	+	1	+	+	I
AAA_pre_crisis	It has value 1 if the country had a triple A rating in the period of pre-crisis (from 1st January 2000 until 15th September 2008) and 0 otherwise		-	-	NA	4	+	+	NA
AAA_crisis	It has value 1 if the country had a triple A rating in the period of crisis (after 15th September 2008 until 31th December 2011) and 0 otherwise	Andrea Zaghini (2014)	-	-	NA	4	-	-	NA
Coun_Under_Ass_Pre_Crisis	It equals 1 if the issuer bank is headquartered in Portugal, Italy, Ireland, Greece and Spain, and the bond issue belongs to the pre-crisis period (from 1st January 2000 until 15th September 2008) and 0 otherwise		?	?	NA	5	I	-	NA
Coun_Under_AssCrisis	It equals 1 if the issuer bank is headquartered in Portugal Italy, Ireland, Greece and Spain, and the bond issue belongs to the crisis period (September 15, 2008 – December 31, 2011) and 0, otherwise		+	+	NA	5	+	+	NA

(Continued)

Table 5.3 Variables Description, related Empirical Literature, Expected Sign and Findings (2)

(Continued)

Variable	Description	Empirical Literature	Expected Sign				Findings		
			Covered Bonds	Bonds	Securitization	Hypotheses	Covered Bonds	Bonds	Securitization
Financial variables									
Cash + Securities / Assets	Ratio between Cash plus Securities, that represents the total cash available, and the total assets	Agostino and Mazzuca (2008)	-	-	NA	Robustness test	-	I	I
Loans/Customer Deposits	Represents the relation between the Loans and the Customer Deposits	Agostino and Mazzuca (2008) Casu, Clare, Sarkisyan, & Thomas, (2013) Altunbas, Manganeli, & Marques-Ibanez, (2011)	+	+	NA	Robustness test	I	-	I
Net Loans/ Total Assets	Percentage of loans in the Total Assets	Alessandri, Masciantonio, & Zaghini, (2015) Casu, Clare, Sarkisyan, & Thomas, (2013)	?	?	NA	Robustness test	+	I	I
Equity / Total Assets	Ratio between Value of equity and Total Assets	Agostino & Mazzuca, (2008) Caporale, Matousek, & Stewart (2009) A. Minton, Stulz, & Williamson (2005)	-	-	NA	Robustness test	I	-	I
Total Regulatory Capital Ratio	The total capital adequacy under Basel rules	Altunbas, Manganeli, & Marques-Ibanez, (2011) Casu, Clare, Sarkisyan, & Thomas, (2013)	-	-	NA	Robustness test	I	+	I
Impaired Loans/Gross Loans	Represents total impaired loans divided by the total gross loans	Casu, Clare, Sarkisyan, & Thomas, (2013) A. Minton, Stulz, & Williamson, (2005)	+	+	NA	Robustness test	I	+	I
Return on Average Assets (ROAA)	Ratio between net profit divided by the Total Assets	Alessandri, Masciantonio, & Zaghini, (2015) Casu, Clare, Sarkisyan, & Thomas, (2013) Caporale, Matousek, & Stewart (2009)	-	-	NA	Robustness test	I	I	I
Return on Average Equity(ROAE)	Net profit divided by the total amount of Equity	A. Minton, Stulz, & Williamson, (2005) Casu, Clare, Sarkisyan, & Thomas, (2013) Alessandri, Masciantonio, & Zaghini, (2015)	-	-	NA	Robustness test	I	I	I
Total Assets	The total assets presented in balance	Andrea Zaghini (2014); Agostino and Mazzuca (2008) Calomiris & Mason (2003) Caporale, Matousek, & Stewart, (2009) Altunbas, Manganeli, & Marques-Ibanez, (2011)	?	?	NA	Robustness test	I	I	I

The characters expressed on the *Expected Sign* and *Finding* columns have the following impact on the credit spread: - = negative impact | + = positive impact | I = insignificant impact | ? = sign cannot be clearly determined | NA = information not available