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Key words: debt pricing; asset securitization; covered bonds; financial crisis; quantitative easing
JEL classification: F34; G01; G12; G21; G24

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1. Introduction

The transition from the traditional originate-to-hold model to the originate-to-distribute model, as well as its reliance on credit markets as a continuing source of credit, has been blamed by academics and practitioners for the 2007-2008 financial crisis [Brunnermeier (2009), Keys *et al.* (2010), Demyanyk and Van Hemert (2011), Purnanandam (2011)]. If the originator does not hold the credit it originates, but distributes the loan and its risks to other entities through asset securitization (AS), the incentive of the originator to monitor the credit granting process is reduced. Although recent studies point out that securitization played a relevant role in allowing financial institutions to solve liquidity and funding problems in the post-crisis period--namely as an active tool used to access various lending schemes by central banks [Altunbas *et al.* (2009), Cardone-Riportella *et al.* (2010)]--, with the financial crisis several complex structured products like synthetic CDOs and squared CDOs may have disappeared forever.

The reduction in the number of AS transactions after the beginning of the 2007-2008 financial crisis was accompanied by a growing demand for covered bonds (CB), a funding instrument that has been used in European countries for over a century.[1] In fact, the European market for CB has significantly grown in recent years, particularly when markets began to view AS instruments somewhat suspiciously and at the same time when liquidity in the markets was scarce, making it an important source of financing (or refinancing) for the European banking system. According to ECB (2008), CB have important features, from the perspective of financial stability, proving to be relatively resilient during the 2007-2008 financial crisis, principally when compared with AS. Moreover, CB are subject to tight regulatory control and are subject to preferential treatment under Basel III and Solvency II, which has increased its importance as a refinancing vehicle for European banks. This has led to several authors [Lucas *et al.* (2008), Bernanke (2009), Surti (2010), Carbó-Valverde *et al.* (2013)] proposing CB as a promising alternative to AS.

AS and CB are economically significant financial market segments. According to the Association for Financial Markets, the volume of securitized assets in Western Europe grew from €78.2 billion in 2000 to €753.9 billion in 2008, an increase of 864.1%. With the 2007-2008 financial crisis, the volume of AS bonds decreased significantly to €377.8 billion in 2009, a decline of 49.9% from 2008. In 2015, a total of €196.1 billion of securitized products were issued in Western Europe.[2] According to Packer *et al.* (2007) CB issuance in Europe increased significantly from less than €100 billion in the mid-1990s to €350 billion

[1] CB are a European product par excellence, which are more than 240 years old--in the 19th century, nearly every European country had a CB system--playing a fundamental role in bank funding as a competitive capital market instrument of long-term funding for mortgage or public-sector loans. For further development see, e.g., Packer *et al.* (2007), ECB (2008), Schwarcz (2011), Prokopczuk *et al.* (2013) and ECBC (2016).

[2] In the U.S., after a sharp decrease of 61.2% between 2007 (€2,404.9 billion) and 2008 (€933.6 billion), the volume of securitization products grew to €1,615.4 billion in 2015, an increase of 73.0%. There has essentially been no CB issuance by U.S. banks in the 2000-2012 period: €4 billion in 2006 and €8.86 billion in 2007.

in 2006. In 2010, for the first time ever CB issuance exceeded the issuance of senior unsecured bonds in the Euro market with a total issuance of €599.2 billion, decreasing to €497.2 billion in 2015.[3] The development of the European market for CB was significantly increased by the ECB's extraordinary action implementing two Covered Bond Purchase Programmes in 2009 and 2011 (CBPP1 and CBPP2),[4] and announcing more recently (September 2014) the third Covered Bond Purchase Programme (CBPP3).[5]

CB are hybrid financial debt instruments with characteristics of both senior bonds and AS bonds--asset-backed securities (ABS) and mortgage-backed securities (MBS)--issued specifically by banks. The benefits of CB are similar to those of AS; both can access low-cost capital market funding with a low-level of risk for their investors, and both can be used to regenerate lending markets. Schwarcz (2011) emphasizes that CB should be viewed as a financing tool that belongs, as does AS, to structured finance: AS and CB are processes whereby financial assets are pooled together, with their cash flows, and converted into negotiable securities to be placed in the market. Although in a traditional AS transaction the assets are transferred to a vehicle company created for this purpose through a true sale, in a CB cover-pool assets remain on the originator's balance sheet and investors have a priority claim against the collateral assets in case of default by the originators.

Considering that CB and AS transactions have significant similarities and the fact that during the 2007-2008 financial crisis and the subsequent European sovereign debt crisis the ECB relied on both instruments--three Covered Bond Purchase Programmes (2009, 2011 and 2014) and one Asset Backed-Securities Purchase Programme (2014)--as a way to restore bank funding, enhancing the transmission of monetary policy and providing further monetary policy accommodation, we would like to raise two questions: (Q.1) *How do common pricing characteristics compare between AS and CB?* And (Q.2) *to what extent are AS and CB priced by common factors?*

Compared to traditional securitization, CB have a dual protection nature since they are backed by a pool of specific underlying assets (such as high-grade mortgages or public sector debt), in addition to the issuer's creditworthiness. Additionally, AS tranches carry large systematic risks. Considering that credit ratings ignore systematic risks and are constructed to reflect only physical default probabilities (S&P) or expected losses (Moody's), securitized assets are expected to offer higher yields than similarly rated bonds [Hu and Cantor (2006), Coval *et al.* (2009), Wojtowicz (2014)]. Finally, CB are not subject to prepayment

[3] Source: European Covered Bond Council (ECBC); www.ecbc.eu.
[4] CBPP1 was announced on 7 May 2009, under which the Eurosystem made outright purchases of CB to the nominal value of €60 billion from 6 July 2009 to the end of June 2010. On October 6, 2011 the ECB announced CBPP2 of €40 billion in favor of euro-denominated CB in both primary and secondary markets.
[5] CBPP3 was originally scheduled until October 2016. Between 2014 and 2016 it was embedded in a broader asset purchase programme, including asset backed-securities, public sector bonds, and corporate sector bonds. In December 2015, CBPP3 was extended to March 2017 and in November 2016 to the end of 2017.

risk and non-performing loans are replaced in the cover pool. Thus, CB have an associated lower risk when compared with AS bonds [Schwarcz (2011), Szczerbowicz (2015)]. If CB are less risky than AS bonds, then the rates charged on AS bonds should be higher than the rates charged on CB. This raises a third question: (Q.3) *Is the credit spread on AS bonds significantly higher than the credit spread on CB?*

Western European countries experienced two recent crises, the 2007-2008 financial crisis and the subsequent European sovereign debt crisis. Given that the 2007-2008 financial crisis has somewhat tarnished the previously prevailing positive image of AS, as a process to help remedy deficiencies in financial markets, arising from incomplete capital allocation [Brunnermeier (2009), Shin (2009)], we cannot rule out that a flight to quality might have left many investors and intermediaries in the Western European countries credit-rationed. As a result, CB are being presented as the answer to securitization's imperfections and we can verify a substitution effect between the use of AS and CB in the crisis period. Thus, issuers and investors might have also changed their attitude towards these debt instruments in terms of pricing and compensation. This brings to light one additional question: (Q.4) *Are the credit spread and pricing processes of AS and CB significantly affected by the 2007-2008 financial crisis and the subsequent European sovereign debt crisis?*

According to Beirne *et al.* (2011), the CBPP1 led to a narrowing of CB spreads, which is consistent with the ECB objective of promoting the ongoing decline in money market term rates. Similar results were presented by Szczerbowicz (2015) for CBPP2. However, Schuller (2013) points out that the overall effect of CBPP2 on the spreads was a sharp difference between core Europe and distressed European countries, where the primary market virtually ran dry. Similarly, Gürtler and Neelmeier (2016) find that while CBPP1 lowered the risk premiums of public CB, they do not verify a similar effect for CBPP2. Considering this empirical puzzle regarding CPPB2 and that CB purchase programmes may have had an impact on the AS spread itself, we would like to raise one final question: (Q.5) *What was the impact of the ECB's covered bond purchase programmes on CB and AS bond credit spreads?*

To the best of our knowledge, no empirical study comparing the characteristics and pricing processes of AS and CB has been published yet. Furthermore, the Western Market is, after the U.S. market, one of the largest markets for AS but it has been neglected by the existing literature. Similarly, despite the rise in importance of CB in Europe, they have not received significant attention--in fact, the main sources of market information have been yearly surveys by the European Covered Bond Council and research by rating agencies. We compile a large sample of 6,191 AS bonds and 11,471 CB issued by Western European banks between January 1, 2000 and October 31, 2012 to use in this study. There are few studies available that compare the influence of the determinants of AS and CB pricing factors and its influence on credit spreads. Thus, we consider this study an important contribution to literature research in this specific area, and in general to the literature on risk premia in bond markets, mainly by presenting a detailed analysis of

the influences of bond-specific factors, macro variables and exogenous events such as the collapse of Lehman Brothers on September 15, 2008 and the downgrade of Greece on April 24, 2010 on bond spreads. In addition, we contribute to the literature on the pricing of CB by studying CB backed by public loans and mortgages separately. Finally, our paper sheds some light on the puzzling role of the ECB's CBPP2 concerning CB spreads.

We find that most of the common pricing characteristics in fact differ significantly, not only between AS and CB issues but also between ABS and public CB (PCB) and MBS and mortgage CB (MCB). Univariate analysis also shows a clear substitution effect between the two types of bonds in the crisis period and that the financial crisis increased AS bonds and CB credit spreads significantly: the average credit spread is economically and statistically higher for AS bonds (127.8 bps *versus* 75.7 bps) and CB issues (77.8 bps *versus* 18.3 bps) during the crisis period.

Loan pricing regression analyses reveal that AS and CB issues are not priced in a single integrated debt market. Moreover, even ABS and PCB, as well as MBS and MCB are debt instruments influenced differently by common pricing factors. Considering AS and CB transactions as a whole, our results indicate that while in the pre-crisis period, AS bond credit spreads are higher than those of CB, in crisis period AS bonds have on average a 24.9 bps lower credit spread than CB. However, when we compare AS bonds with CB considering the bond collateral--public loans (ABS and PCB) or mortgages (MBS and MCB)--we find that credit spreads are significantly higher for ABS than for PCB in both pre- and crisis periods. Considering MBS *versus* MCB, our results indicate that while in pre-crisis period MBS have higher credit spreads, whereas in the crisis period we find that MCB are associated with higher credit spreads than MBS. Therefore, we do not corroborate the hypothesis raised by CB literature [Packer *et al.* (2007), Schwarcz (2011), Szczerbowicz (2015)] that the credit spread on CB is lower than the credit spread on otherwise comparable bond issues for AS and CB backed by mortgages during the crisis period. Similar results were obtained when we use the weighted average spread (WAS) instead of the credit spread to compare the cost of funding between AS and CB.

Our results show that CB credit spreads are driven by collateral type: MCB have higher credit spreads than PCB. In line with previous empirical studies, we find rating to be the most important determinant of AS bond credit spreads at the time of issuance, which supports the prediction that investors might have based their investment decision almost exclusively on rating during the pre-crisis period. Regarding CB, we show that bond issues specific effects--bond maturity, number of participating banks and type of interest rate --, macroeconomic factors--country risk, the level of interest rates, the slope of the yield curve and market volatility--and exogenous events--financial crisis, sovereign debt crisis, and the ECB's CBPP--are relevant drivers for credit spreads.

Regarding the long-term effects of the ECB's CBPP on CB credit spreads, we find, in line with Beirne *et al.* (2011) and Szczerbowicz (2015) that the first CBPP led to a narrowing of MCB credit spreads

in the Euro area. However, contrary to the results presented by Gürtler and Neelmeier (2016), we find that CBPP1 has an insignificant impact on PCB credit spread. For CBPP2, contrary to Szczerbowicz (2015) but in parallel with Gürtler and Neelmeier (2016), we find that the effect of the second CBPP--we find a significant positive relationship between the second CBPP and credit spreads for PCB and that the programme has an insignificant impact on MCB credit spread--is not consistent with the ECB's objective of promoting the easing of funding conditions for credit institutions and enterprises. Finally, we find that the ECB's CBPP2 fed through into ABS prices: despite the fact that CBPP2 does not have an impact on MBS credit spreads, this programme led to the narrowing of ABS credit spreads issued by euro area banks, especially those located in Portugal, Ireland, Italy, Greece and Spain.

This paper is organized as follows. Section 2 reviews the literature. Section 3 describes DCM Analytics and Datastream databases used in this study, as well as the basic characteristics for the samples of AS *versus* CB. This section also compares the financial characteristics of AS issues with the sample of CB, and studies the impact of the financial crisis on credit spreads and pricing factors. Section 4 examines the determinants of credit spreads for AS and CB issues. We begin by presenting the methodology and analyzing the extent to which both debt issues are priced by common factors, followed by the regression results. Section 5 provides robustness checks using alternative and rearranged variables. In this section, we also conduct tests for potential endogeneity effects. Section 6 concludes the study.

2. Literature review

2.1. The financial economics of asset securitization and covered bonds

AS refers to a process by which an entity pools its interest into identifiable future cash flows, transfers the claims on those future cash flows to another entity created for the sole purpose of holding those financial claims--a Special Purpose Vehicle (SPV)--, and then issues negotiable securities. AS bonds are issued as subordinated, negotiable contingent claims (tranches) with varying seniority and maturity, backed by the credit payment performance of securitized assets.[6]

CB have a long history in European debt markets and have been replacing AS bonds since 2009. According to the ECB (2008), 'covered bonds are dual-recourse bonds, with a claim on both the issuer and a cover pool of high-quality collateral (which the issuer is required to maintain), issued under specific covered bond legislation (or contracts which emulate this)'. Concerning CB, the cover-pool of assets usually remain on the issuer's balance sheet and are 'ring-fenced' to give bondholders greater protection in

[6] For further details see, *e.g.*, Roever and Fabozzi (2003), Jobst (2007), Gorton and Metrick (2013), Pinto and Alves (2016) and references therein.

the event of bankruptcy.[7] As with AS, the structure and regulation of CB vary across countries. Structured CB are an example of a type of bond from the standard legislative CB. Structured CB are very similar to the AS technique as such transactions involve the use of an SPV that buys the cover-pool assets. However, even in a structured CB, bondholders have a residual claim on the bank issuer.

According to Schwarcz (2011), the most important similarity between CB and AS transactions is that both endeavor for bankruptcy remoteness; i.e., both transactions are structured in order to protect investors in the event of an issuer's bankruptcy. Additionally, in both transactions after bondholders are paid in full, any residual value from the asset pool is returned for the benefit of other creditors. There are, however, important differences between CB and AS [Packer *et al.* (2007)]. First, although in a traditional securitization transaction the assets are transferred to an SPV created for this purpose through a true sale, in a CB cover-pool assets remain on the originator's balance sheet. Second, CB investors have a full recourse right in case of a default by the originators. Thus, the financial institution issuing these securities, not only is responsible for its repayment, but it is also responsible for maintaining sufficient assets on its balance sheet in order to meet investor's needs. On the contrary, in an AS transaction, the source of repayments/funds shifts from the cash flows of the issuer/sponsor to the cash flows generated by the SPV's assets and/or a third party that guarantees the payments whenever cash flows become insufficient. If the assets are not sufficient to remunerate investors then junior tranches with low underlying credit ratings are the first to absorb the initial credit losses, protecting senior classes of potential losses through a subordination credit enhancement mechanism. In short, while an AS transaction is implemented as non-recourse financing (off-balance sheet financing), CB have full recourse to the issuer in the event of collateral deficiency (on-balance sheet financing). Third, while in AS--ABS and MBS--the pool of assets is fixed or static, the cover pools are usually dynamic, requiring the covered bond issuer to continually segregate new assets as needed to maintain overcollateralization. Fourth, contrary to AS bonds, CB are not pass-through structures, as concerning CB it is not mandatory to have an exact match between the cash inflows from the underlying cover-pool assets and the cash outflows to repay the investors. Finally, another important difference is related to regulation; while CB issuances are subject to financial supervision, AS activity has been mostly beyond the directly regulated segments of the financial system.

Existing literature presents the following main reasons for a bank corporation to issue both AS [Jones (2000), Fabozzi *et al.* (2006), Jobst (2006), Loutskina and Strahan (2009), Cardone-Riportella *et al.* (2010), Casu *et al.* (2013) and Pinto and Alves (2016)] and CB [Packer *et al.* (2007), Surti (2010), Beirne

[7] Ring-fencing here means that in a standard (legislative) CB transaction the cover-pool assets are segregated in order to protect them from claims of the issuer's bankruptcy. In structured transactions, ring-fencing means, as for securitization, that the cover-pool assets are sold to a bankruptcy-remote SPV. See Packer *et al*. (2007) and Schwarcz (2011) for a distinction between structured and legislative CB regimes.

et al. (2011), Schwarcz (2011), Carbó-Valverde *et al.* (2013)] to: (*i*) increase liquidity and diversify funding sources; (*ii*) reduce the cost of funding; and (*iii*) improve the bank's ability to manage funding and interest rate risk. However, and contrary to securitization, CB do not allow banks to transfer credit risk; obtain new profit opportunities, by recognizing accounting gains when the market value of the loans exceeds their book value; and to benefit from regulatory capital arbitrage by reducing risk-weighted assets, since cover-pool assets remain on the issuer's balance-sheet [Carlstrom and Samolyk (1995), Jagtiani *et al.* (1995), Calomiris and Mason (2004), Ambrose *et al.* (2005), Chiesa (2008), Affinito and Tagliaferri (2010)].

Despite the above-mentioned advantages, securitization also has shortcomings. Cardone-Riportella *et al.* (2010) and Jobst (2006) point out that AS transactions are fairly complex and involve a significant amount of due diligence, negotiation, and legal procedures. Additionally, there is a broad consensus about the important role played by AS in the development and propagation of the 2007-2008 financial crisis [Brunnermeier (2009), Shin (2009), Demyanyk and Van Hemert (2011), Purnanandam (2011)]. Gorton (2009) presents asymmetric information problems as the major problem behind complex structures, which imposes a substantial agency cost on efficient AS transactions. Regarding CB, notwithstanding the benefits of CB when compared to AS, there are concerns that a high amount of bank assets, which are pledged to special creditors, and therefore would not be available in case of bank insolvency, would make banks more vulnerable in case of market turmoil and lead to further destabilization of the system. This idea is corroborated by Schwarcz (2011), who argues that CB are more likely to harm 'non-adjusting creditors'. While in securitization the segregated pool of assets is typically fixed, allocating risk to all stakeholders, in CB the asset pool is dynamic requiring the issuer to continue to segregate assets as needed to repay the CB, in order of priority, *vis-à-vis* unsecured creditors. Additionally, funding loans via CB involves a greater outlay of capital by the issuer relative to the originate-to-distribute model, which, in turn, will lead to higher private borrowing costs.

2.2 The determinants of credit spreads for asset securitization and covered bonds

The existing literature on the pricing determinants of AS and CB is still very scant when compared with the large number of empirical studies available on the pricing of corporate bonds. Researchers [e.g., Collin-Dufrense *et al.* (2001), Elton *et al.* (2001), Campbell and Taksler (2003), Longstaff *et al.* (2005), Chen *et al.* (2007), Bao *et al.* (2011), Flannery *et al.* (2012)] find that several factors are important determinants of corporate bond credit spreads, like credit rating, maturity, liquidity, systematic risk, incomplete accounting information, leverage and taxes. Market variables, like the level of interest rates, the slope of the yield curve, and market volatility, also have a significant impact on spreads.

Referring to AS bonds, Rothberg *et al.* (1989) document that liquidity, credit risk, interest rate volatility and the term structure of interest rates affect the pricing of pass-through securities significantly. Maris and Segal (2002) and Hu and Cantor (2006) compare AS with corporate bond credit spreads and

document relatively higher credit spreads for AS securities. On the contrary, Pinto *et al.* (2017) find, using a European sample of AS and corporate bonds closed between 2000 and 2016, that ABS and MBS, but not CDOs, have lower credit spreads than corporate bonds. Maris and Segal (2002) study the determinants of spread for commercial mortgage-backed securities (CMBS) and find that default probability, tranche size, transaction size and year of issuance influence spreads. An *et al.* (2011) show that the default risk, the interest rate volatility, the slope of the yield curve, and the property-type composition of the underlying asset pool have a significant impact on CMBS spreads. Ammer and Clinton (2004) argue that credit rating is the most important pricing factor for this asset class at issue. This idea is corroborated by Hu and Cantor (2006), Vink and Thibeault (2008), and Buscaino *et al.* (2012). Vink and Thibeault (2008) examine how common pricing factors compare for ABS, MBS and CDO and find that they are influenced differently by common pricing factors.

Academic literature on CB has focused mainly on the German covered bond market, due to its size and importance. Koziol and Sauerbier (2007) and Kempf *et al.* (2012) argue that German CB spreads are determined by liquidity only. Schäfer and Hochstein (1999) and Birkmeyer and Herbert (2002) show that variables such as the outstanding amount and credit rating affect jumbo CB credit spreads. In addition, Breger and Stovel (2004) find that while liquidity affects German CB credit spreads significantly, rating differences between AAA and AA are not significant. Prokopczuk *et al.* (2013) show that liquidity, credit quality of the cover-pool assets and whether they are covered by public sector or mortgage loans are important determinants of CB yield spreads issued by German banks.

There are only two empirical papers which aim to study the determinants of CB spreads in international CB markets. Prokopczuk and Vonhoff (2012) demonstrate that developments in the real estate sector and legislative frameworks explain the pricing of mortgage CB during the financial crisis. Authors also demonstrate that country-specific differences exist and liquidity is an important determinant of mortgage CB credit spreads in both pre-crisis and crisis periods. Gürtler and Neelmeier (2016) study the factors which influence risk premiums of public CB. In line with Beirne *et al.* (2011) and Prokopczuk and Vonhoff (2012), they find that whereas a higher interest rate level and a positive development of the stock market lead to lower risk premiums, high stock market volatility leads to higher risk premiums. Moreover, the development of real estate prices also influences risk premiums of public CB and both the financial crisis and the sovereign debt crisis increased public CB credit spreads significantly. Finally, authors find mixed effects regarding the impact of ECB's CBPP on credit spreads: while the CBPP1 lowers risk premiums, the CBPP2 does not influence public CB spreads significantly.

3. Sample selection and descriptive statistics

3.1. Sample selection

Our sample consists of individual bond issues extracted from the DCM Analytics database. The DCM Analytics database (formerly Bondware database) is compiled by Dealogic and offers comprehensive information about public debt securities issued in relation to the debt capital markets. This database contains detailed historical information on virtually the entire population of bond securities issued in international capital markets and provides information on the micro characteristics of the bond offers (e.g., transaction and tranche size, maturity, currency, pricing, rating, type of interest rate) and of the issuers (e.g., name, nationality, industry sector). To select our samples of AS and CB issues, we extracted bonds issued by banks between January 1, 2000 and October 31, 2012. We explicitly chose October 31, 2012 as the end of our sample period as it corresponds to the end of the ECB's CBPP2.

Although the database extracted from DCM Analytics contains information on several types of bonds, we include only those with a "covered bond", "asset-backed security", and "mortgage-backed security" deal-type code. In CB, the cover-pool assets were primarily high-quality mortgage loans--mortgage covered bonds (MCB)--and public sector debt--public covered bonds (PCB)--, whereas in asset securitization securities could be backed by consumer-backed products--asset-backed securities (ABS)--, by mortgages--mortgage-backed securities (MBS)--, and by debt obligations such as investment-grade and high-yield corporate bonds, emerging market bonds, MBS, ABS, bank loans, and other CDO--collateralized debt obligations (CDO). In order to compare AS with CB, we exclude CDOs and include ABS backed only by public sector loans and mortgages. Synthetic securitizations, through which banks transfer credit risk to third parties using credit derivatives or credit linked notes without removing the underlying portfolio of assets from the issuers' balance sheet, are excluded from our sample. We exclude bond issues which have a "Non-US Agency" deal-type code, "corporate bond investment-grade", and "corporate bond high-yield". Perpetual bonds and bonds with additional features such as step-up, caps, or floors are also excluded from the database. We include bond tranches classified either as fixed rate bonds (with coupon rate information) or variable rate bonds (with both spread and index information). For variable rate bonds, only those quoted on the following indices are included: Euribor, Euro Libor, USD Libor, and GBP Libor. We also require that the issuer country is in Western Europe and that the tranche size (in Euro millions) is available. Finally, in order to take possible outliers into account we winsorize the data for transaction size and credit spread at the 1% and the 99%.

After applying these screens, we are able to examine a total of 17,662 bonds (worth €4,730.9 billion) issued by Western European banks located in 17 different countries.[8] Our sample contains information on 6,191 AS issues worth €2,046.4 billion, of which 718 issues worth €174.8 billion have an

[8] Western Europe includes in our database Austria, Belgium, Cyprus, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Slovak Republic, Slovenia, Spain, Switzerland and the United Kingdom.

ABS deal type code and 5,473 issues worth €1,871.6 billion have a MBS deal type code; and 11,471 CB issues worth €2,684.5 billion, of which 6,292 issues worth €1,349.8 billion are PCB and 5,179 issues worth €1,334.7 billion are MCB. As the unit of observation is a single bond issue, multiple issues from the same transaction appear as separate observations in our database. We verify with Dealogic that our AS sample refers to securities sold to investors by bankruptcy-remote SPVs.

In section 4, the credit spread on AS and CB issues is modeled as a function of microeconomic variables as well as macroeconomic conditions--the level of interest rates, market volatility, and the slope of the Euro yield curve. The data on macroeconomic variables are obtained from Datastream. We link the macroeconomic variables and the microeconomic information contained in the DCM Analytics database through the issue date. The main problem in choosing a set of variables for each type of issue is the requirement that each set must be meaningful for AS and CB. Several variables are available for the two types of bonds, which allows us to directly compare the main pricing factors for AS and CB issues.

3.2. Univariate analysis

In the univariate analysis, we examine and compare credit spread and common pricing factors not only among the two financing instrument types, but also among sub-categories that are directly comparable: ABS with PCB and MBS with MCB. The purpose is to provide insight into the common pricing characteristics associated with AS and CB. Table 1 presents basic characteristics for the sample of AS and CB while Table 2 provides *t-tests* and *Fisher's exact tests* comparing the values of each variable in the AS bond sample with the corresponding values in the CB sample; the values of each variable in the ABS sample with the corresponding values in the PCB sample; and the values of each variable in the MBS sample with the corresponding values in the MCB sample. Almost all of the pair-wise comparisons indicate statistically significant differences between the common pricing variables associated with AS and CB issues, as well as with ABS and PCB and MBS and MCB.

****** Insert Tables 1 and 2 about here ******

Credit spread corresponds to the price for the risk associated with the bond instrument at the date of issuance and is defined as the margin yielded by the security at the date of issuance above a corresponding currency treasury benchmark with a comparable maturity. Regarding the relative pricing of AS *versus* CB issues, Tables 1 and 2 show that the average credit spreads are economically and statistically higher for AS bonds (85.8 bps) than they are for CB (34.8 bps) at the 5% significance level. Similarly, ABS (109.8 bps) and MBS (82.6 bps) have higher average credit spreads than PCB (24.7 bps) and MCB (47.0 bps), respectively. 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 answer Q.3 we proceed, in section 4, with a regression analysis that takes micro and macro pricing factors directly into account.

Credit rating evaluates the capacity of the bank issuer to repay interest and principal on time as promised. We use a rating classification scheme based on 22 rating scales for two rating agencies. Bond ratings are thus based on the S&P and Moody's rating at the time of issuing the bond, and converted as follows: AAA=Aaa=1, AA+=Aa1=2, and so on until D=22. Country risk is approximated by Standard & Poor's country credit rating at the time of issuance. Similarly, this variable measures from 1 for the countries with the lowest risk (AAA=1) to 22 for the countries of highest risk (D=22). Other measures of country risk are available and have been used in other studies, such as the monthly data compiled by the International Country Risk Guide (ICRG) or the country risk rank provided by Euromoney magazine. The use of S&P's country rating is justified, as pointed out by Erb *et al.* (1996), by its strong correlation with these alternative measures. Average credit ratings for CB (1.5) issues are significantly better than for AS bonds (4.5). This may suggest that AS transactions are riskier than CB. However, this can also reflect the country rating, since AS bank issuers are, on average, located in far riskier countries than in CB. Still, despite the average country rating for ABS issuers (1.4), which is significantly higher than the corresponding value for PCB (1.1), the average country rating for MBS (1.3) is lower than the one for MCB (1.4). This result coupled with the fact that average credit ratings for MBS (4.4) are significantly worse than for MCB (1.8) may indicate that mortgages included in the MCB cover-pool are of better quality (have lower credit risk) than those selected for including in the MBS pool of assets. This is in line with one of the benefits of CB which is most often referred to: concerning CB, the cover-pool assets remain on the originator's balance sheet, issuers have an incentive to maintain high quality assets on their balance sheets, giving a positive signal to the markets.

The observed level of management fees and the number of participating banks also provide indirect evidence that MBS are relatively riskier than MCB. The average level of management fees for MBS (20.6 bps) is significantly higher than the level for MCB (11.2 bps). The average number of banks participating in an MBS transaction is 3.1 and is significantly larger than the average of 1.9 for MCB. These findings suggest that the originator wishes to increase the number of underwriting institutions participating in a MBS transaction in order to spread risks. These findings can also be explained by the fact that MBS (€1,663.6 million) transactions are significantly larger than MCB transactions (€260.1 million).

While the average tranche size exhibited by ABS bonds does not differ significantly at the 5% significance level from the average tranche size exhibited by PCB issues, the average tranche size for MBS (€342.0 million) is relatively large when compared to the €257.7 million for MCB.

Most of the remaining variables detailed in Tables 1 and 2 clearly suggest that AS and CB issues are fundamentally different financial instruments. While U.K. borrowers only represent 1.1% of the CB issues, they account for 45.1% of the AS bonds--a similar pattern is found when comparing ABS and MBS with PCB and MCB, respectively. On the contrary, German borrowers represent 78.2% and 10.3% of the

CB and AS issues, respectively. A significantly larger number of tranches per transaction are issued in an AS transaction. In a typical AS transaction, the average number of tranches per transaction is 4.9, which is larger than the average number of 1.0 for CB. Finally, the average tranche-to-transaction ratio for AS bonds (21.5%) is significantly lower than the tranche-to-transaction ratio for CB (99.2%). Thus, we can conclude that AS transactions may benefit from tranching to a larger degree and that CB transactions have typically one tranche per transaction only. Additionally, since in AS the pool of assets is static, this allows issuers to create a broader set of tranches that are backed by the pool, which allows bonds to differ in the timing and security of payment. An AS tranche of an average size matures in 33.5 years, which is a long period if we compare it with the average 5.4 years for CB. Similarly, ABS (25.2) and MBS (34.6) have higher average maturities than PCB (5.3) and MCB (5.5). This can be explained by the fact that contrary to CB, AS bonds have a pass-through nature that leads to maturity being virtually the same as that of the underlying pool of assets. In line with Packer *et al.* (2007) we find that unlike AS bonds, which tend to have floating rates and early repayments, CB generally pay fixed rates and have bullet maturities. Finally, only a small percentage of CB (5.2%) have currency risk, which reflects the importance of the euro-denominated CB market. However, this important difference comes from the fact that a significant percentage of MBS (21.2%) are issued with currency risk when compared with MCB (5.3%)--currency risk does not differ significantly between ABS and PCB.

In summary, we find that most of the common pricing characteristics in fact differ significantly, not only between AS and CB issues but also between ABS and PCB and MBS and MCB. Table 2 shows that all pair-wise comparisons indicate statistically significant differences in value, with the exception of tranche size, number of banks, management fee and currency risk between ABS and PCB. Considering the financial instruments studied as a whole, we document that the transaction structures differ between the two types of bond issues, as well as other important univariate differences, namely: (*i*) AS average credit spreads are significantly higher than those of CB issues; (*ii*) both ABS and MBS have a significantly larger average transaction size than do PCB and MCB issues and AS transactions are issued with a significantly higher number of tranches, which have, on average, a lower credit rating *vis-à-vis* bonds belonging to PCB or MCB; (*iii*) AS bonds have much longer average maturity and are more likely to be arranged for U.K. borrowers than CB issues, which are more likely to be issued by banks located in Germany; (*iv*) MBS may be considered relatively riskier because both the average level of management fee and the average number of banks participating are substantially larger than the averages for MCB; (*v*) MBS are much more likely to be subject to currency risk and bank issuers are, on average, located in less riskier countries than in MCB; and (*vi*) CB issues are more likely to have a fixed rather than a floating rate.

We will examine bond pricing to a greater extent in section 4, when we employ an OLS regression to determine what factors influence the credit spreads of AS and CB transactions. However, our results

indicate that the common pricing characteristics differ significantly in value between the two types of bond issues. Therefore, we would expect the impact on pricing to be bond-specific.

3.3. The impact of the financial crisis on credit spreads and pricing factors

To answer Q.4, in this section we examine whether the 2007-2008 financial crisis and the subsequent European sovereign debt crisis significantly impacted the credit spread of AS and CB issues. We therefore investigate whether our univariate results are robust over time considering 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 the Lehman Brothers' bankruptcy filing the day before) through to October 31, 2012. The first and significant conclusion that can be drawn from the analysis of Table 3 is that while the MCB market during the crisis period remained active--2,165 bonds issued in the crisis period versus 3,014 in the pre-crisis period, a reduction of 28.2%--, there is a significant reduction of MBS issuance between the two periods (reduction of 78.4%). This result may be explained by the ECB's CB purchase programmes. Additionally, the ABS market contracted less than the MBS market.

****** Insert Table 3 about here ******

Panel A of Table 3 provides *z-statistics* (Wilcoxon *z-test*) and almost all of the pair-wise comparisons indicate that equality of means for continuous variables can be rejected for AS and CB issues. There are three exceptions for CB issues: *transaction size*, *tranche size* and *maturity*. However, when we divide AS and CB samples considering whether the cover-pool assets are public loans or mortgages, we find that while the equality of means can be rejected for all MBS and MCB, *credit rating* and *country risk* variables do not differ significantly between pre-crisis and crisis periods for ABS. Similarly, the equality of means cannot be rejected for PCB *credit rating*. Similar findings are presented in Panel B of Table 3 for categorical (dummy) variables regarding AS and CB, which strongly support that the proportions of tranches differ significantly in the pre-crisis *versus* crisis period. For both ABS and PCB, we find that the proportions of tranches do not differ significantly between the two sub-samples pre- and post-crisis for *currency risk* and *U.K. borrowers*. Similar results were obtained for *fixed rate* only in MBS. The evidence strongly supports the assumption that the average credit spread is significantly higher for AS bonds (127.8 bps *versus* 75.7 bps) and CB issues (77.8 bps *versus* 18.3) during the crisis period. These results hold for MBS, PCB and MCB but not for ABS: ABS average credit spread is lower during the crisis period. Thus, we can conclude that the crisis has a significant impact on AS and CB credit spreads. These simple analyses, however, do not allow us to control for other micro and macro pricing factors. We thus proceed, in Section 4, with regression analyses where we are able to take these factors directly into account. Contrary to AS bonds (ABS and MBS) and MCB, the average maturities, transaction sizes, and tranche sizes of PCB have significantly reduced during the crisis period. This can be explained by the European sovereign debt crisis that led to a significant deterioration in the financing conditions of state-owned enterprises.

Taking the remaining variables, we are able to document the following important findings: (*i*) MBS and MCB issues have a significantly better credit rating during the crisis period when compared with the pre-crisis period; (*ii*) during the crisis period, with the exception of ABS, bonds in Western Europe are issued by banks located in far riskier countries, which can be explained by the European sovereign debt crisis; (*iii*) both AS and CB issues have a lower average number of tranches and thus a higher tranche-to-transaction ratio during the crisis period than during the pre-crisis period, with MBS verifying a significant increase from 19.2% to 28.2%; (*iv*) while during the crisis period the number of banks involved in both AS and PCB decreased significantly, the opposite was found for MCB; and (*v*) during the crisis period while U.K. banks increased their use of MCB and reduced the use of MBS, German banks reduced the use of all bond types.

4. Determinants of credit spreads for AS and CB issues

In this section, we subject the various samples to an OLS regression analysis, with four objectives. First, we wish to determine which of the variables have a significant and independent effect on credit spreads once the effects of other variables are accounted for (Q.2). Thus, we start our analysis by determining if AS and CB are priced in the same way, which is the equivalent to testing whether AS and CB issues are priced in segmented or integrated debt markets. Second, we aim to determine whether AS (ABS and MBS) bonds are more or less expensive than CB (PCB and MCB), after controlling for other micro and macro pricing factors (Q.3). We then try to determine whether the 2007-2008 financial crisis and the subsequent European sovereign debt crisis impacts AS and CB credit spreads significantly--again, after controlling for other micro and macro pricing factors (Q.4). Finally, the impact of the ECB's CBPP2 is particularly puzzling, so we analyze the pricing of our cross-section dataset of bond issues within a multivariate regression framework, focusing on the relationship between credit spread and the ECB's CBPP1 and CBPP2, while controlling for other relevant micro and macro risk factors that also affect the credit spread (Q.5).

We estimate the determinants of bond pricing using the model described in equation (1). The dependent variable is the credit spread, in basis points, and the independent variables are those presented and described in Table 4, which gives an overview of the variables and their expected sign, taking into consideration the existing empirical literature.

****** Insert Table 4 about here ******

We employ OLS regression techniques and adjust for heteroskedasticity. As the unit of observation is the bond tranche and due to time varying risk premia, we estimated standard errors clustered by both transaction and year. The specification of the initial model is:

$$
\begin{aligned}
Credit\ spread_i = {} & \alpha + \beta_1 Log\ \ transaction\ \ size_i + \beta_2 Tranche\ \ to\ transaction_i + \beta_3 Maturity_i \\
& + \beta_4\ Number\ of\ banks_i + \beta_5\ Country\ risk_i + \beta_6\ Fixed\ rate_i + \beta_7\ Currency\ risk_i \\
& + \beta_8\ Callable_i + \beta_9\ Risk\ \ free\ \ rate_i + \beta_{10}\ EUSA5y - Libor3m_i + \beta_{11} Volatility_i \\
& + \beta_{12}\ Crisis_i + \beta_{13}\ U.K.\ borrowers_i + \beta_{14}\ Rating * rated_i + \beta_{15}\ Rated_i\ + \varepsilon_i
\end{aligned}
\tag{1}
$$

A Chow test for a structural break is used to investigate whether the credit spreads associated with AS and CB issues are influenced differently by common pricing factors (Q.2). In essence, we are testing whether the pricing factors used in equation (1) are significant in both AS and CB transactions and, if so, whether they have the same coefficient values. Considering that the Chow test statistic (93.1) is higher than the critical level, we conclude that AS and CB issues are distinct financial instruments. Even when we compare ABS with PCB (Chow test statistic of 48.1) and MBS with MCB (Chow test statistic of 65.9) our results indicate that the two bond types 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 in order to examine the individual impact of each pricing factor on credit spreads (see section 4.2).

4.1. Do AS bonds have higher spreads than CB?

The literature suggests that one core reason for a bank to use securitization is the reduction in funding costs. Finnerty (1988), Caselli and Gatti (2005) and Fabozzi *et al.* (2006), among others, point out that making use of a transaction that is specifically structured using an SPV and is secured by ring-fencing assets producing cash flows solely for supporting the transaction coupled with credit enhancement mechanisms like subordination and overcollateralization, reduces the cost of funding by allowing the issuer to obtain better credit ratings than it would by issuing senior unsecured debt. The same intuition is presented by Rosenthal and Ocampo (1988), Jones (2000), Roever and Fabozzi (2003) and Jobst (2006): securitization offers a low cost and credible way for information about the firm's receivables to be produced and provided to investors. Regarding CB, Packer *et al.* (2007) and Bertalot (2014) show that CB, like AS bonds, have significant lower spreads than senior, unsecured bonds, which can be explained by the dual protection nature that combines the obligation of the issuer with the added protection of dedicated collateral. However, to our knowledge, no empirical study comparing AS and CB spreads on an individual basis has yet been published.

There are two important differences that should be stressed when directly comparing CB with AS. First, concerning AS the bank no longer bears the risk of the loans as they are transferred to an SPV, in relation to CB the covered pool is constantly adjusted to maintain the pool size. Due to this, more information about the contents of the pool of assets is available for asset securities investors than for CB investors and thus securitization transactions reduce information asymmetries. However, one potential problem of AS is that the issuer bank may know more about the credit risk of borrowers than investors do.

This may give banks an incentive to have loans in the asset pool which are more risk prone than investors perceive, which increases the risk of agency problems such as moral hazard. As an alternative, CB limit this problem as the bank must transfer a replacement loan from its general portfolio to the mortgage pool if a loan defaults.

The existing literature on CB [Packer *et al.* (2007), Schwarcz (2011), Bertalot (2014), Szczerbowicz (2015)] present CB as less risky than AS bonds. In addition, Hu and Cantor (2006) and Coval *et al.* (2009) argue that securitized assets are expected to offer higher yields than similarly rated corporate bonds since AS bonds carry large systematic risks. In order to examine whether the credit spreads on AS bonds are higher than the credit spreads on comparable CB we use equation (1) and create one dummy variable set equal to 1 if the tranche is an AS bond (*AS*), and 0 otherwise. Furthermore, so as to directly compare AS and CB with the same collateral, we also include two dummy variables set equal to 1 if the tranche is an ABS (*ABS*) or a MBS (*MBS*), and 0 otherwise. Finally, we control for country and year fixed effects.

Column 1 of Table 5 reports estimates of this equation for a sample of 6,191 AS bonds and 11,471 CB issues. The results suggest that, controlling for credit rating, AS bonds in Western Europe are associated with higher spreads since the AS dummy variable is associated with a statistically significant 21.4 bps increase in credit spreads. In order to check whether this finding is robust over time, we estimate model [1] for pre-crisis and crisis periods. Columns 2 and 3 of Table 5 show that while AS bond credit spreads are higher than those of CB credit spreads in the pre-crisis period (model [1a]), we find the opposite for the crisis period (model [1b]): the *AS* dummy variable is associated with a statistically significant 24.9 bps drop in credit spreads. Therefore, considering AS and CB transactions as a whole, we corroborate the hypothesis raised by existing literature [Hu and Cantor (2006), Coval *et al.* (2009), Schwarcz (2011), Szczerbowicz (2015)] that the credit spread on CB is lower than the credit spread on AS bonds for the pre-crisis period only.

****** Insert Table 5 about here ******

However, as our bonds are backed by different loan types, we re-estimated model [1] for two sub-samples created according to whether the bond collateral consist of public loans--ABS or PCB--or mortgages--MBS and MCB. Columns 4 and 7 of Table 5 report regression results where dummy variables *ABS* and *MBS*--set equal to 1 if the tranche is an ABS or a MBS, respectively, and 0 otherwise--are included as additional variables. The results suggest that *ABS* and *MBS* dummy variables are associated with statistically significant 37.2 bps and 26.0 bps increases in credit spreads in models [2] and [3], respectively, meaning that both ABS and MBS have higher spreads than CB with identical credit ratings.

In order to verify if these results are robust over time, we re-estimate models [2] and [3] for pre-crisis and crisis periods. We find that during the pre-crisis period credit spreads are significantly higher for ABS and MBS than for PCB and MCB. Considering the crisis period, our results indicate that while ABS credit spreads

are significantly higher than PCB credit spreads, contrary to what we expected--as during the crisis period the ECB implemented two CB purchase programmes (CBPP1 and CBPP2)--MBS have lower credit spreads than MCB: the *MBS* dummy variable is associated with a significant 45.2 bps drop in credit spreads. Therefore, we corroborate the hypothesis raised by CB literature [Schwarcz (2011), Bertalot (2014), Szczerbowicz (2015)] that the credit spread on CB is lower than the credit spread on bond issues with similar credit ratings for AS and CB backed by public sector loans and mortgages during the pre-crisis period and for ABS and PCB during the crisis period. Our results are also in line with the predictions of Hu and Cantor (2006) and Coval *et al.* (2009), who argue that securitized assets are expected to offer higher yields than similarly rated bonds since ABS and MBS carry large systematic risks. AS transforms pools of assets into securitized tranches characterized by different risk-return profiles; i.e., ABS or MBS are created based on a diversified collateral portfolio, which makes it possible to generate large volumes of highly rated AAA and AA tranches from lower rated collateral. For example, an AAA rated tranche backed by diversified consumer-backed products, basket with a subordination of 30% will only incur losses if 50% of corporates default (assuming 40% recoveries); i.e., an extreme systemic event. Considering that credit ratings ignore systematic risks and are constructed to reflect only physical default probabilities (S&P) or expected losses (Moody's) [Wojtowicz (2014), *Cornaggia et al.* (2016)], investors should require higher yields when investing in AS bonds to compensate the larger systematic risks.

Our results for MBS and MCB may reflect that in the crisis period mortgages included in the cover-pool assets might be of less quality than those transferred via true sale to an SPV and given as a guarantee to investors in an AS transaction. This may also reflect the fact that MCB rating increases--via overcollateralization, liquidity risks, quality of the cover-pool assets and, sometimes, subordination--are much harder to achieve compared with securitization transactions due to the fact that the covered bond rating cannot be entirely detached from the rating of the bond issuer themselves.

Finally, we check the robustness of our results by replacing the credit spread by the weighted average spread (WAS)--calculated as the weighted average between the tranche spread and its weight in the transaction size--as our dependent variable (see section 5.1) and our results remains largely the same.

4.2. Determinants of credit spreads

Table 6 presents the results of estimating equation (1) using a sample of 6,191 AS bonds and 11,471 CB. We start by examining if there are significant differences in credit spreads between ABS and MBS and between PCB and MCB. Columns 1 and 4 of Table 6 report regression results of estimating models [4] and [5], where dummy variables MBS and MCB are included as additional regressors. The results suggest, contrary to what we expected, that (*i*) credit spreads in Western Europe do not differ significantly between ABS and MBS, holding other factors constant; and (*ii*) MCB have higher credit spreads than PCB. Considering that MBS and MCB are secured by the collateral of specified real estate property, we would

expect the credit spreads of bonds backed by mortgages to be lower than ABS and PCB credit spreads. These findings can be explained by the fact that, as shown in Table 1, MCB have a higher credit risk than PCB. Thus, considering that banks issuing PCB are located in countries with lower sovereign risk than banks that rely more on MCB issuance, the implicit government guarantee provided to PCB allows such banks to issue bonds with a lower credit spread.

Then, a Chow test is used to investigate whether the credit spreads associated with each sub-category of AS bonds--ABS and MBS--and CB--PCB and MCB--are influenced differently by common pricing factors. Considering that the Chow test statistics are higher than the critical levels--17.5 for ABS *versus* MBS and 22.9 for PCB *versus* MCB--, we conclude that ABS and MBS are debt instruments influenced differently by common pricing factors and that PCB and MCB are priced differently by micro and macro characteristics. We thus analyze the pricing of AS and CB separately for each bond sub-category, comparing the results presented in models [4a], [4b], [5a], and [5b].

The second line of Table 6 details the influence of *log transaction size* on credit spread, which is insignificant for ABS and PCB but negative and significant for MBS. On the contrary, credit spread and transaction size have a significant positive relationship for MCB. For MBS, this can be explained by the fact that larger issues are likely to be associated with less uncertainty and to have more public information available about them than smaller offerings. Regarding MCB, larger issues means higher asset pools on the balance sheet since the financial institution issuing these securities is responsible for maintaining sufficient assets on its balance sheet in order to meet investor's needs.

Tranche to transaction ratio behaves differently for AS bonds--ABS and MBS--and PCB than for MCB. As we expected based on empirical literature, spread and tranche to transaction ratio have a significant and positive relationship for MCB. The influence of *tranche to transaction* on credit spread for ABS and MBS is insignificant, suggesting that lenders do not associate an increase in tranche to transaction ratio with a significant reduction of credit risk.

While credit spread and *maturity* are significantly positively related for PCB issues--in line with the intuition that lenders should get a higher remuneration for being exposed to risk for a longer period of time--, they show an insignificant relationship for AS bonds and a significant negative relationship for MCB. The coefficient value indicates that issuing a bond, with an original maturity one year longer than the mean, increases the credit spread by 1.2 bps for PCB but decreases the credit spread by 0.5 bps for MCB. For structured finance transactions, like project finance and leveraged buy-outs, the empirical results reported in other studies suggest a non-linear term structure of credit spreads--hump-shaped for project finance loans [Sorge and Gadanecz (2008] and convex for leveraged buy-out loans [Pinto *et al.* (2017)]--, so we augment our baseline multiple regression with non-linear maturity components. Results (not reported) show, as we expected, that for CB a linear positive relationship between spread and maturity

remains very significant. For AS, non-linear maturity terms have an insignificant impact on credit spreads, which can be easily explained by the fact that the maturity of the securities issued in an AS transaction typically matches the maturity of the assets used as collateral.

The variable *number of banks* behaves differently for CB (PCB and MCB) compared to AS (ABS and MBS). While credit spread and the number of banks are positively and significantly related for PCB and MCB, they have an insignificant relationship for ABS and MBS. The need for a larger number of banks in arranging a CB transaction may possibly be associated with an increase in risk and thus an extra premium is demanded. *Country risk* is significantly positively related to spread for MCB, indicating that lending to a bank 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 133.9 bps. Contrary to what we expected, credit spread and country risk have a significant negative relationship for bonds backed by public loans. This might be explained by the fact that banks located in countries with higher sovereign risk have to implement additional credit enhancement mechanisms (e.g., subordination and overcollateralization) to increase bond credit ratings and thus reduce credit spreads. As we expected, ABS and MBS on average do not have to pay an extra risk premium on fixed coupon rate issues in comparison with floating rate issues. Similarly, the impact of *fixed rate* on credit spreads is significant and positive for both PCB and MCB. This can be explained by the fact that while in AS bonds, coupons are mainly floating-rate, while CB coupons are predominantly fixed-rate (see Table 1).

The influence of *currency risk* on credit spread is insignificant for ABS and PCB but negative and significant for bonds backed by mortgages. Such a mismatch in the currency where the deal is carried out and the currency where the CB is issued decreases the rate charged significantly by 14.0 bps and 6.8 bps for MBS and MCB, respectively. This can be explained by the European sovereign debt crisis that led to a euro devaluation. The introduction of a call option in an ABS issue increases the credit spread by 33.0 bps. These values can be understood as the premium that an ABS issuer has to pay to retain the right to redeem the bonds at some point before the bond reaches its date of maturity. However, the impact of *callable* on MBS, as well as on both PCB and MCB credit spreads is insignificant. As we expected, *U.K. borrowers* raise funds at a higher spread compared to borrowers from continental Europe in the MCB market. In addition, similarly to existing empirical studies, the U.K. borrowers' dummy variable has an insignificant relationship with ABS spreads. However, U.K. borrowers and credit spread have a significant positive relationship for MBS.

The 2007-2008 financial *crisis* and the subsequent European sovereign debt crisis have imposed a significant increase in credit spreads for MBS and CB issues. A transaction with the issue date or active date during the crisis period will have a higher average credit spread of 78.0 bps for MBS and 60.1 bps and 68.8 bps for PCB and MCB, respectively. Moreover, contrary to our expectations, credit spread and *crisis* are insignificantly related for ABS. This can be explained by the significant reduction in the number of

ABS issues between the sub-samples of the pre-crisis and crisis period, from 489 to 229 observations (see Table 3). The credit crunch precipitated by the subprime mortgage crisis dramatically weakened the market for AS bonds and led to only the good transactions (with better quality collateral) and then less risk, being placed on the market. We believe that an analysis of the impact of the 2007-2008 financial crisis and the subsequent European sovereign debt crisis on AS bond credit spreads presents an important opportunity for future research, mainly considering a broader dataset including ABS purchased by the ECB under the current ABS purchase programme, expected to be active till the end of 2017. The impact of the financial crisis on credit spread and pricing processes for ABS, MBS, PCB and MCB will be analyzed further in section 4.3.

The *-risk-free rate* has an insignificant relationship with AS bond credit spreads, but a significantly positive relationship with CB credit spreads. Our findings for MCB diverge from those of Prokopczuk and Vonhoff (2012), who find for a sample of MCB issued by banks located in France, Germany, Spain, and the U.K that the risk-free rate has a significant negative impact on the pricing of bonds. Contrary to the results presented by Hu and Cantor (2006) and Sorge and Gadanecz (2008), credit spread and the slope of the Euro swap curve, *EUSA5y-Libor3M*, have an insignificant relationship for AS. As expected, the relationship between credit spreads and the slope of the Euro swap curve is significantly negative for PCB and MCB, meaning a steeper Euro swap curve is associated with lower credit spreads. The variable *volatility* behaves differently for AS bonds than for CB. Credit spread and volatility are significantly positively related for PCB and MCB, but have an insignificant relationship for ABS and MBS. Our results for CB are in line with those of Prokopczuk and Vonhoff (2012), who found a significant and positive relationship for MCB, but different from those of Gürtler and Neelmeier (2016), who present an insignificant relationship between market volatility and credit spreads. Regarding AS, our results corroborate those presented by Pinto *et al.* (2017).

Regarding the impact of credit risk on credit spreads, Table 6 shows the exact 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 15.9 bps, 16.8 bps, 1.8 bps and 1.4 bps in ABS, MBS, PCB and MCB credit spread, respectively. Our findings are in line with previous empirical studies, which find *rating* to be one of the most important determinants of AS bond credit spreads, and also support the prediction that investors might base their investment decision almost exclusively on rating. As we expected, AS rated tranches have lower credit spreads than non-rated ones. Regarding CB, while there is a significant negative relationship between the *rated* variable and PCB credit spreads, the *rated* variable does not impact on MCB credit spreads significantly. Our results are in line with Prokopczuk *et al.* (2013) for MCB issued in the crisis period and with Gürtler and Neelmeier (2016) for PCB issued by euro area banks for the *rating*rated* variable but not for the *rated* variable. Regarding MCB,

our results are in line with Prokopczuk *et al.* (2013) for specific sample periods--if the bond has credit rating, it does not affect CB credit spreads in the crisis period. For PCB, our results are in line with Gürtler and Neelmeier (2016) concerning the impact of credit rating on credit spread but diverge concerning the impact of the *rated* variable: non-rated PCB credit spreads do not differ significantly from those with credit rating.

4.3. The impact of the financial crisis on PCB and MCB pricing processes

Based on regression results presented in Section 4.2, we find that the 2007-2008 financial crisis and the subsequent European sovereign debt crisis have imposed a significant increase in credit spreads for MBS, PCB, and MCB, but the relationship between spreads and crisis is insignificant for ABS. To examine the impact of the 2007-2008 financial crisis and the subsequent European sovereign debt crisis on AS and CB pricing processes (Q.4) 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 to October 31, 2012.

Model [4a] in Table 7 shows (comparing results for pre-crisis *versus* crisis period) that the coefficient of the *rating*rated* remains significantly positively related to credit spread. The coefficients of *maturity*, *currency risk*, *risk-free rate*, *U.K. borrowers* and *rated* become insignificant, while the coefficients of *fixed rate* and *EUSA5y-Libor3M* become significantly negatively related to credit spread. Thus, we conclude that the slope of the yield curve, which reflects the expectations of interest rate evolution in the future, affects the credit spread significantly. As expected, a positive slope reflects expectations of improved economic conditions and, consequently, lenders require lower credit spreads. A change in coefficient signs takes place for *country risk* and *callable* variables, which become significantly negatively related to credit spread. One could interpret this significant negative relationship between country risk and credit spread as evidence that in the crisis period only transactions with better quality collateral--or those with additional credit enhancement like further subordination and/or with a monoline guarantee--issued by banks located in countries with worse ratings than were accepted by the market. Finally, the introduction of a call option signals to the market that the transaction is of a higher quality, as it allows the SPV to repurchase the issued bonds in the future.

****** Insert Table 7 about here ******

For MBS (model [4b] for pre-crisis and crisis sub-samples), while the coefficients of *log transaction size*, *rating*rated* and *rated* remain significantly related to credit spread, the coefficient of *volatility* becomes insignificant. We find that in the crisis period the tranche to transaction size has a significantly negative impact on credit spread, suggesting that lenders associate an increase in tranche to transaction ratio with a significant reduction of credit risk. This is in line with Diamond (1993), Winton (1995), and Glaeser and Kallal (1997), who argue that bank issuers exploit market factors to their advantage

by issuing different classes of securities--tranching--with different degrees of seniority. In an AS transaction, bonds are pooled into classes, each one representing a degree of subordination. Senior classes are larger and have absolute priority in the cash flows concerning subordinate ones, which are the more junior classes. Finally, the significant positive relationship between country risk and credit spread during the crisis period is not a surprise, as rating agencies downgraded sovereign ratings from several Western European countries (e.g., Belgium, Greece, Ireland, Italy, Portugal, and Spain).

Regarding PCB, model [5a] in Table 7 shows that the coefficients of *fixed rate* and *volatility* remain significantly positively related to credit spread, while the coefficient of *EUSA5y-Libor3M* remains significantly negatively related to credit spread. The coefficients on *currency risk*, *rating*rated* and *rated* become insignificant. The insignificance of *rated*rating* and *rated* variables can be explained by the fact that almost all PCB were issued with a rating and more than 90% of PCB have a rating classification of A+. It is important to notice that under CBPP1 and CBPP2 minimum requirements concerning credit ratings were established in order for a CB to be eligible. In addition, we find that the coefficient of a *number of banks* becomes significantly positively related to credit spread, which means that a higher number of banks involved may mean a higher level of risk associated with the transaction. Finally, a change in coefficient signs takes place for three variables. The *log transaction size*, *maturity* and *risk-free rate* variables become significantly negatively related to credit spread. One could interpret this significant negative relationship between transaction size and credit spread as evidence of a positive price liquidity effect related to the size of the entire issue. The change in sign for maturity can be explained by the two ECB's CB purchase programmes implemented in 2009 and 2011. Finally, the change in sign for the level of interest rates can be explained by the European sovereign debt crisis: it is expected that during a period of crisis the increase in the level of interest rates will mean an economic recovery and, as such, spreads will decrease.

For MCB (model [5b] for pre-crisis and crisis sub-samples), the coefficients of a *number of banks* (with a significant increase in the coefficient value), *fixed rate* and *EUSA5y-Libor3M* remain statistically significant. While the coefficients of *risk-free rate*, *volatility*, *U.K. borrowers* and *rated* variables become insignificant, the *log transaction size*, *country risk*, and *rating*rated* variables become significantly positively related to credit spread. Thus, we can identify a change in the type of factors that explain MCB credit spreads, from macroeconomic factors (the level of interest rates and market volatility) to default factors (country risk and credit rating). The significant positive relationship between country risk and credit spread during the crisis period can be explained by the sovereign debt crisis. Additionally, almost all MCB were issued with a rating during this period as the ECB only purchases rated CB under CBPP1 and CBPP2. The positive impact of transaction size on credit spread in crisis period can be explained by a liquidity shortfall in financial markets. The critical phase of the 2007-2008 financial crisis manifested a shortage of liquidity, which was reflected in a fall in asset prices below their long-run fundamental price and a

deterioration in external financing conditions. Finally, the insignificant relationship between macroeconomic variables *risk-free rate* and *volatility* and credit spread during the crisis period can be explained by the ECB's CB purchase programmes, implemented as a way to restore bank funding, enhancing the transmission of monetary policy and providing further monetary policy accommodation.

Based on our regression analyses, we find evidence that the 2007-2008 financial crisis and the subsequent European sovereign debt crisis does have a significant impact on both AS (ABS and MBS) and CB (PCB and MCB) pricing processes. Thus, the financial crisis substantially influenced the explanatory power of the regressions, as well as the coefficients of the macro and micro pricing factors (in sign and in significance). We corroborate our findings using a Chow test for a structural break, finding that the independent variables have different impacts on ABS, MBS, PCB and MCB credit spreads in the pre-crisis period *vis-à-vis* the crisis period.

4.4. The impact of CBPP1 and CBPP2 on bond credit spreads

When debt capital markets were recovering from the 2007-2008 financial crisis, the European sovereign debt crisis began. Contrary to the first crisis, which affected financial markets globally, the latter occurred only in the euro zone, more specifically in some euro area countries. This again led to a lack of investor confidence and, consequently, a possible increase in risk premiums during this period. In addition, because of the significant increase in the sovereign risk of some Eurozone countries (e.g., Portugal, Ireland, Italy, Greece and Spain) and taking into account the significant relationship between bank risk and sovereign risk, AS and CB credit spreads may have been strongly affected during this period.

During these crises, the ECB announced two covered bond purchase programmes (CBPP) with similar objectives. The first CBPP (CBPP1) with the objective of supporting 'a specific financial market segment that is important for the funding of banks and that had been particularly affected by the financial crisis' [ECB (2010)]. This programme was announced on May 7, 2009, under which the Eurosystem made outright purchases of CB to the nominal value of €60 billion in both primary and secondary markets--from 6 July 2009 to the end of June 2010. The second CBPP (CBPP2) was implemented with the objective of contributing to '(a) easing funding conditions for credit institutions and enterprises and (b) to encouraging credit institutions to maintain and expand their lending to customers' [ECB (2012)]. The CBPP2 was announced on October 6, 2011, under which €40 billion in favor of euro-denominated CB in both primary and secondary markets could be purchased.

In order to investigate the long-term effects of the ECB's CBPP on CB credit spreads, controlling for the two referred crises, we use equation (1) and create the following four dummy variables: (*i*) *CBPP1* set equal to 1 if the CB issue date belongs to the announcement and implementation of the first CBPP (from May 7, 2009 through to June 30, 2010), and 0 otherwise; (*ii*) *CBPP2* set equal to 1 if the CB issue date belongs to the announcement and implementation of the second CBPP (from October 6, 2011 through to

October 31, 2012), and 0 otherwise; (*iii*) *financial crisis* set equal to 1 if the CB issue date belongs to the 2007-2008 financial crisis (from September 15, 2008--Lehman Brothers' bankruptcy filing date--through to April 23, 2010), and 0 otherwise; and (*iv*) *sovereign crisis* set equal to 1 if the CB issue date belongs to the European sovereign debt crisis (from April 24, 2010--downgrade of Greece sovereign credit rating, which triggered broad market turmoil--through to October 31, 2012), and 0 otherwise. Considering that the CBPP2 had a broader objective other than to merely support a specific financial market segment, we also implement the same methodology to examine the effects of the CB purchase programmes on AS bond credit spreads.

Table 8 reports regression results where the previously referred dummy variables were included as additional regressors in the models to test for the presence of any effect of the ECB's CBPP on CB and AS credit spreads. Column 1 of Table 8 reports estimates for a sample of 11,471 CB issued by Western European banks between January 1, 2000 and October 31, 2012. As we expected, the results suggest that both the financial crisis and the sovereign debt crisis increased CB credit spreads significantly, since both dummy variables are associated with statistically significant 73.8 bps and 76.3 bps increases in credit spreads, respectively. Results also show that while the first CBPP had a reducing effect on Western European CB credit spreads of 14.1 bps, the second CBPP is associated with a significant 10.0 bps increase in CB credit spreads. In order to check whether these findings are robust for Eurozone *versus* U.K. banks and for PCB *versus* MCB, we re-estimate model [6] for CB issued by banks located in Eurozone countries (model [7]) and then for two sub-samples created according to whether the cover pool contains public loans (PCB) or mortgages (MCB)--models [7a] and [7b]. Columns 2 to 4 of Table 8 show that while the CBPP1 has been effective in meeting ECB objectives by lowering credit spreads of CB issued by Eurozone banks, particularly for MCB, the CBPP2 has not contributed to easing funding conditions for Euro area banks since the credit spread and CBPP2 dummy have an insignificant (MCB) or a significant positive (PCB) relationship. Finally, our results show that U.K. banks face similar spreads when issuing CB to banks located in continental Europe.

****** Insert Table 8 about here ******

Our findings are similar to those presented by Beirne *et al.* (2011) and Szczerbowicz (2015) for the impact of CBPP1 on MCB credit spread: the first CBPP led to a narrowing of MCB credit spreads in the Euro area. Contrary to the results presented by Gürtler and Neelmeier (2016), we find that CBPP1 has an insignificant impact on PCB credit spread. For CBPP2, contrary to Szczerbowicz (2015) but in line with Gürtler and Neelmeier (2016), we find a significant positive relationship between the second CBPP and credit spreads for PCB. In addition, we find that CBPP2 has an insignificant impact on MCB credit spread. Thus, our results regarding the second CBPP are not consistent with the ECB objective of promoting the easing of funding conditions for credit institutions and enterprises. These findings can be explained by the

fact that in the second programme the demand was significantly lower than the announced amount; whereas the planned amount was completely exhausted during the first programme, during the second programme the total amount of purchased CB only reached €16.4 billion of the €40 billion announced by the ECB. In December 2011, the ECB announced the three year jumbo Longer-Term Refinancing Operations (LTROs) and settled its first tranche, with the second tranche being settled in March 2012, which had a longer impact on the euro-denominated CB market with a significant decrease of public issuance in 2011 and 2012.

Regarding AS bonds--models [8a] and [8b] for ABS and MBS, respectively--we find that the CBPP1 does not contribute to a credit spread reduction for both ABS and MBS issued by banks located in the Euro area. However, despite the insignificant impact of CBPP2 on MBS credit spreads, this programme led to a narrowing of ABS credit spreads in the Euro area, which is in line with the ECB objective of easing funding conditions for credit institutions. We thus find, for ABS, that the ECB CB purchases fed through into other asset prices.

5. Robustness checks

5.1. Do AS transactions have a lower cost of funding than CB transactions?

The existing literature on AS [Finnerty (1988), Caselli and Gatti (2005), Fabozzi *et al.* (2006), Jobst (2006)] presents the reduction in funding costs as one core reason for a bank using securitization. On the other hand, Packer *et al.* (2007), Schwarcz (2011), Bertalot (2014) and Szczerbowicz (2015) present CB as less risky than AS bonds. So far (section 4.1), we find that during the pre-crisis period credit spreads are significantly higher for ABS and MBS than for PCB and MCB. Considering the crisis period, our results indicate that while ABS credit spreads are significantly higher than PCB credit spreads, MBS have lower credit spreads than MCB.

AS transforms pools of assets into securitized tranches--tranching--characterized by different risk-return properties. Relying on different credit enhancement mechanisms, AS allows for achieving credit quality improvement. Most of the credit risk is thus concentrated in the first-loss equity tranche, which also provides the highest coupon. Essentially, in AS and contrary to CB, which are typically based on the issuance of a single tranche per transaction (see Table 1), the cost of funding is determined by the combination of the different tranches. Therefore, to analyze if CB have a lower cost of funding than AS we need to compare the total cost of funding for the whole transaction. We then use the weighted average spread (WAS)--calculated as the weighted average between the tranche spread and its weight in the transaction size--as a measure of the total cost of funding.

We examine if CB transactions have a lower cost of funding than AS transactions using the model described in equation (2) and create three dummy variables set equal to 1 if the transaction is an AS transaction (*AS*), an ABS transaction (*ABS*) and a MBS transaction (*MBS*), and 0 otherwise. The dependent variable is the WAS, in basis points, and the independent variables are those presented and described in

Table 4. We employ OLS regression techniques and adjust for heteroskedasticity. Due to time varying risk premia, we estimated standard errors clustered by year.

$$\begin{aligned} WAS_i = {} & \alpha + \beta_1 \, Log\ transaction\ size_i + \beta_2 \, Number\ of\ banks_i + \beta_3 \, Country\ risk_i \\ & + \beta_4 \, Currency\ risk_i + \beta_5 Risk\ \ free\ \ rate_i + \beta_6 \, EUSA5y - Libor3m_i \\ & + \beta_7 \, Volatility_i + \beta_8 \, Crisis_i + \beta_9 \, U.K.borrowers_i + \varepsilon_i \end{aligned} \quad (2)$$

Table 9 reports estimates of this equation for a sample of 1,031 AS transactions, of which 168 transactions have an ABS deal type code and 863 have a MBS deal type code, and 11,377 CB transactions, of which 6,244 transactions have a PCB deal type code and 5,133 transactions a MCB deal type code. Our results, using WAS as a measure of the entire cost of funding, corroborate our previous results when comparing MBS with MCB in both pre- and crisis periods: while MBS transactions have higher WAS than MCB transactions in the pre-crisis period, MBS transactions are associated with a statistically significant WAS decrease of 31.6 bps in the crisis period. Regarding ABS and PCB, results presented in section 4.1 seem to be robust for the pre-crisis period since we find that ABS have higher WAS than PCB. However, WAS for ABS transactions do not differ significantly from that of PCB transactions during the crisis period. Therefore, we corroborate the hypothesis raised by CB literature that the funding cost on CB is lower than the funding cost on comparable AS transactions during the crisis period only.

****** Insert Table 9 about here ******

5.2. Further analyzes on the impact of the ECB's CBPPs on bond credit spreads

Prokopczuk and Vonhoff (2012) and Gürtler and Neelmeier (2016) show that the country in which a CB is issued influences risk premiums. Specifically, Gürtler and Neelmeier (2016) present significant pricing differences between PCB issued in Germany *vis-à-vis* Non-Germany countries. Although we attempt to account for this using several country-specific variables, it might be useful to further split the dataset with regard to country. As CB issued by German banks constitute the majority of the dataset and because the impact on CB credit spreads of the two CBPP by the ECB may have a differential impact on different countries belonging to the euro area, we check the robustness of our results obtained by splitting both PCB and MCB into CB issued by German banks and CB issued by Non-German banks. In addition, considering that the European sovereign debt crisis has significantly affected Portugal, Ireland, Italy, Greece and Spain, we also examine the impact of the ECB's CBPP on CB credit spreads issued by banks located in these countries. Finally, once the ECB CB purchases fed through into ABS credit spreads, we extend these analyses to ABS. The results are shown in Table 10.

****** Insert Table 10 about here ******

Our results show that the first CBPP had a reducing effect on MCB credit spreads only, with a higher impact for MCB issued by banks located in Portugal, Ireland, Italy, Greece and Spain (model [7b]).

Comparing Tables 8 and 10, the results are similar: the CBPP1 did not lead to a narrowing of PCB credit spreads and the CBPP2 dummy has an insignificant (PCB and MCB issued by banks located in Portugal, Ireland, Italy, Greece and Spain and MCB issued by non-German banks) or a significant positive (PCB issued by both German and non-German banks and MCB issued by German banks) impact on CB credit spreads. Again, we find that while the CBPP1 does not impact ABS credit spreads, the CBPP2 reduces ABS credit spreads significantly for tranches issued by non-German banks, especially for those located in Portugal, Ireland, Italy, Greece and Spain. Altogether, our results obtained in section 4.4 hold for the different country-level sub-samples.

5.3. Additional sensitivity tests

We perform a number of additional robustness checks regarding the pricing of ABS, MBS, PCB and MCB. First, we check whether our results are affected by potential endogeneity of maturity choice. This could be the case if riskier borrowers are only able to issue shorter maturity bonds. We reject the null of no endogeneity of maturity for MCB only. Using *tranche size* and *number of tranches* as instrumental variables, we obtained consistent estimates of the coefficients, which confirm our main results reported in Table 6. Second, our models [4b], [5a] and [5b] are re-estimated after adding the *management fees* variable. We find an insignificant relationship with credit spreads for MBS, PCB and MCB. Additionally, we also replace the country risk with the Euromoney country risk scores. Finally, we divided maturity into two variables, 'high maturity' and 'low maturity', as suggested by Vink and Thibault (2008). Our estimates remain unchanged when we adjust the S&P's rating scale and use the Euromoney country risk scores, and appear robust to the inclusion of rearranged variables controlling for specific contractual features of bond issues. Overall, these additional sensitivity tests further confirm the robustness of our results regarding the pricing of AS and CB.

6. Summary and conclusions

We give the first detailed comparative analysis of credit spreads and pricing processes of AS *versus* CB transactions using a large cross-section of bonds issued by Western European banks between January 1, 2000 and October 31, 2012. We show that not only AS and CB are priced differently by common pricing factors but also that asset-backed securities (ABS) backed by public loans and public CB (PCB) as well as mortgage-backed securities (MBS) and mortgage CB (MCB) are not priced in integrated bond markets. Our results also demonstrate that: (*i*) during the pre-crisis period, credit spreads are significantly higher for ABS than for PCB as well as for MBS *vis-à-vis* MCB; and (*ii*) in the crisis period, while ABS have higher spreads than PCB, MBS are associated with a significant 45.2 reduction in spreads *vis-à-vis* MCB.

Our results are particularly relevant for issuing banks, investors and for monetary policy reasons, since we show that both AS and CB credit spreads are driven by collateral type and while in AS credit

rating is the most important determinant of credit spreads, in CB not only issue specific effects, but also macroeconomic factors and exogenous events are relevant drivers for credit spreads. We show that the 2007-2008 financial crisis and the subsequent European sovereign debt crisis both had a significantly increasing effect on CB credit spreads. Regarding the impact of the first and second covered bond purchase programmes (CBPP1 and CBPP2) by the ECB, the effects are mixed. While the first programme led to lower MCB credit spreads; the second programme did not reach the ECB's desired objectives: we find an insignificant or a significant positive relationship between the second CBPP and credit spreads for both MCB and PCB. Finally, we find that the CBPP2 reduces ABS credit spreads significantly for tranches issued by non-Germany banks, namely those located in Portugal, Ireland, Italy, Greece and Spain.

The period of financial crisis was marked by the sharp reduction in securitization operations and the increase in CB issues. At the basis of this difference is the launch of the two CBPP by the ECB in 2009 and 2011, which indicates that CB were in fact a substitute for AS. Despite the fact that CB are commonly presented as avoiding moral hazard problems raised by AS, because issuers often retain ownership of the cover-pool assets, securitization transactions can be, and increasingly are after recent legislative changes in the U.S. and Europe--e.g., the US's Dodd-Frank Act, the Financial Accounting Standards Board amendments (FAS 166 and 167) and the joint work between the BoE and the ECB identifying the impediments that may be preventing the emergence of a healthy securitization market in Europe and suggesting policy options aimed at mitigating them--, on-balance sheet. These changes require originators to retain a minimum amount of recourse, thereby keeping 'skin in the game' to minimize moral hazard. Additionally, in Europe banks typically buy the first loss tranche and retain the servicing obligations for securitized assets, thereby exposing them to the increased collection costs associated with defaults. Thus, both AS and CB constitute efficient secured funding alternatives available to financial institutions to obtain stable medium and long-term funding at competitive prices and to diversify funding sources in Europe. In taking both instruments together, banks have powerful instruments to effectively manage liquidity risk while transferring risks to investors through global capital markets.

On January 22, 2015, the ECB launched its expanded Asset Purchase Programme (APP), a package consisting of the third CBPP (CBPP3), the Asset-Backed Securities Purchase Programme (ABSPP), the Public Sector Purchase Programme (PSPP) and the Corporate Sector Purchase Programme (CSPP). Monthly purchases in public and private sector securities amount to €80 billion on average--with the main goal of addressing the risks of a too prolonged period of low inflation in the Eurozone--and are intended to be carried out until the end of 2017. Answering our research questions including data of ABS and CB issued under the ECB expanded APP is an important avenue for further research. Further research could also explore how AS and CB changed the way banks manage their funding and liquidity and how these changes have in turn altered the traditional links between bank liquidity, cost of funds, and loan supply.

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Table 1: Univariate statistics - pricing features associated with AS bonds and CB compared

Variable of interest	Type of bond issue						Variable of interest	Type of bond issue					
	AS Full Sample	ABS	MBS	CB Full Sample	PCB	MCB		AS Full Sample	ABS	MBS	CB Full Sample	PCB	MCB
Univariate analysis - continuous variables													
Credit spread (bps)							**Tranche to transaction (%)**						
Number	6,191	718	5,473	11,471	6,292	5,179	Number	6,191	718	5,473	11,471	6,292	5,179
Mean	85.8	109.8	82.6	34.8	24.7	47.0	Mean	21.5%	26.9%	20.8%	99.2%	99.3%	99.2%
Median	45.3	58	45.0	24.0	19.9	32.5	Median	7.6%	13.0%	7.0%	100.0%	100.0%	100.0%
Std. Dev.	123.9	187.1	112.7	61.4	51.4	69.8	Std. Dev.	29.0%	29.6%	28.9%	6.8%	6.7%	7.0%
Transaction Size (€ million)							**Number of banks**						
Number	1,401	201	1,200	11,384	6,248	5,136	Number	6,191	718	5,473	11,471	6,292	5,179
Mean	1,556.4	916.4	1,663.6	236.2	216.5	260.1	Mean	2.9	2.0	3.1	1.9	1.9	1.9
Median	826.9	568.7	862.7	80.0	100.0	50.0	Median	2.0	2.0	2.0	1.0	1.0	1.0
Std. Dev.	2,681.1	1,058.4	2,850.6	463.7	437.9	492.3	Std. Dev.	2.3	1.4	2.3	2.4	2.4	2.3
Tranche size (€ million)							**Number of tranches**						
Number	6,191	718	5,473	11,471	6,292	5,179	Number	1,401	201	1,200	11,384	6,248	5,136
Mean	330.5	243.4	342.0	234.0	214.5	257.7	Mean	4.9	3.8	5.0	1.0	1.0	1.0
Median	64.7	64.4	64.7	80.0	100.0	50.0	Median	4.0	3.0	4.0	1.0	1.0	1.0
Std. Dev.	967.8	497.2	1,013	445.6	418.0	476.0	Std. Dev.	3.4	2.1	3.5	0.1	0.1	0.1
Credit rating [1-22 weak]							**Country risk [1-22 weak]**						
Number	5,757	656	5,101	10,364	5,842	4,522	Number	6,191	718	5,473	11,471	6,292	5,179
Mean	4.5	5.4	4.4	1.5	1.4	1.8	Mean	1.3	1.4	1.3	1.2	1.1	1.4
Median	3.0	5.0	3.0	1.0	1.0	1.0	Median	1.0	1.0	1.0	1.0	1.0	1.0
Std. Dev.	4.0	4.7	3.9	1.5	1.3	1.7	Std. Dev.	0.9	1.1	0.8	0.9	0.5	1.2
Maturity (years)							**Management fee (bps)**						
Number	6,191	718	5,473	11,471	6,292	5,179	Number	155	13	142	656	483	173
Mean	33.5	25.2	34.6	5.4	5.3	5.5	Mean	20.5	19.8	20.6	9.6	9.0	11.2
Median	35.3	28.9	36.5	4.9	4.9	5.0	Median	13.5	10.0	13.5	8.0	8.0	10.0
Std. Dev.	15.8	13.5	15.8	3.8	3.8	3.9	Std. Dev.	25.1	25.6	25.1	6.0	5.3	7.3
Univariate analysis - dummy variables													
Fixed rate							**Currency Risk**						
N. of issues with data available	6,191	718	5,473	11,471	6,292	5,179	N. of issues with data available	6,191	718	5,473	11,471	6,292	5,179
N. of issues with dummy=1	129	54	75	9,771	5,450	4,321	N. of issues with dummy=1	1,189	28	1,161	592	315	277
% of total available data	2.1%	7.5%	1.4%	85.2%	86.6%	83.4%	% of total available data	19.2%	3.9%	21.2%	5.2%	5.0%	5.3%
U.K. borrowers							**German borrowers**						
N. of issues with data available	6,191	718	5,473	11,471	6,292	5,179	N. of issues with data available	6,191	718	5,473	11,471	6,292	5,179
N. of issues with dummy=1	2,790	48	2,742	123	36	87	N. of issues with dummy=1	639	191	448	8,969	5,668	3,301
% of total available data	45.1%	6.7%	50.1%	1.1%	0.6%	1.7%	% of total available data	10.3%	26.6%	8.2%	78.2%	90.1%	63.7%

This Table reports summary statistics for a sample of asset securitization (AS) bonds and corporate bond (CB) issues closed between January 1, 2000 and October 31, 2012. Information on AS and CB issues was obtained from DCM Analytics. For a definition of the variables, see Table 4.

Table 2: Tests of significance for the difference in values among AS and CB issues

Variable of interest	Type of bond issue		
	AS vs CB	**ABS vs PCB**	**MBS vs MCB**
Continuous variables: two-sample t-tests assuming unequal variances			
Credit spread (bps)	30.44	12.13	19.75
Credit Rating [1-22 weak]	54.18	21.92	43.59
Maturity (years)	137.39	39.31	132.00
Tranche to transaction (%)	-15.52	-65.30	-14.04
Country risk [1-22 weak]	2.71	6.90	-7.08
Transaction size (€ million)	18.40	9.35	17.00
Tranche size (€ million)	7.43	1.50#	5.54
Number of tranches	42.70	18.64	39.72
Number of banks	28.57	1.51#	25.77
Management fees (bps)	5.38	1.51#	4.32
Dummy variables: Fisher's exact test (p-values)			
Fixed rate	0.000	0.000	0.000
Currency Risk	0.000	0.234*	0.000
U.K. borrowers	0.000	0.000	0.000
German borrowers	0.000	0.000	0.000

Table 2 provides *t-tests* for continuous variables and *Fisher's exact tests* for dummy variables comparing the values of each variable in the asset securitization (AS) bonds sample with the corresponding values in the covered bonds (CB) sample; the values of each variable in the asset backed-securities (ABS) sample with the corresponding values in the public corporate bonds (PCB) sample; and the values of each variable in the mortgage backed-securities (MBS) sample with the corresponding values in the mortgage covered bonds (MCB) sample. For continuous variables, # indicates that the values do not differ significantly between the two bond issues at the 5% significance level. For dummy variables, * indicates that the proportion of tranches for which dummy = 1 does not differ significantly between the issue class. For a definition of the variables, see Table 4.

Table 3: The impact of the financial crisis on the characteristics of AS and CB tranches

Panel A: The impact of the financial crisis on the characteristics of AS and CB tranches - continuous variables

Variable of interest	AS Full Sample				ABS				MBS				CB Full Sample				PCB				MCB			
	N	Mean	Median	Wilcoxon z-test	N	Mean	Median	Wilcoxon z-test	N	Mean	Median	Wilcoxon z-test	N	Mean	Median	Wilcoxon z-test	N	Mean	Median	Wilcoxon z-test	N	Mean	Median	Wilcoxon z-test
Credit spread (bps)																								
pre-crisis	4999	75.7	40.0	**-20.24** ***	489	114.5	50.0	**-2.64** ***	4510	71.5	37.0	**-20.06** ***	8,303	18.3	17.0	**-56.20** ***	5,289	17.8	16.8	**-31.86** ***	3,014	19.3	17.6	**-42.07** ***
crisis	1192	127.8	100.0		229	99.7	70.0		963	134.5	100.0		3,168	77.8	67.4		1,003	61.3	60.0		2,165	85.4	72.0	
Transaction size (€ millions)																								
pre-crisis	1039	1,269.5	756.1	**-6.72** ***	125	790.8	500.0	**-2.84** ***	914	1334.9	796.2	**-6.87** ***	8,227	215.9	100.0	**1.36**	5,249	222.7	100.0	**7.96** ***	2,978	203.8	50.0	**-4.76** ***
crisis	362	2,379.9	1,117.6		76	1,123.1	900.0		286	2713.8	1259.3		3,157	289.1	50.0		999	183.9	50.0		2,158	337.8	75.0	
Tranche size (€ millions)																								
pre-crisis	4999	244.7	51.2	**-18.77** ***	489	194.2	41.6	**-7.13** ***	4510	250.2	52.2	**-17.79** ***	8,303	213.4	100.0	**1.21**	5,289	220.5	100.0	**7.81** ***	3,014	201.0	50.0	**-4.82** ***
crisis	1192	690.5	242.0		229	348.4	167.5		963	771.9	264.7		3,168	288.1	50		1,003	183.2	50		2,165	336.7	77.2	
Number of tranches																								
pre-crisis	1039	5.2	5.0	**7.94** ***	125	4.1	4.0	**2.67** ***	914	5.4	5.0	**7.01** ***	8,227	1.0	1.0	**3.16** ***	5,249	1.0	1.0	**1.76** *	2,978	1.0	1.0	**3.16** ***
crisis	362	3.8	3.0		76	3.3	3.0		286	3.9	3.0		3,157	1.0	1.0		999	1.0	1.0		2,158	1.0	1.0	
Credit rating [1-22 weak]																								
pre-crisis	4,731	4.7	3.0	**10.36** ***	445	5.3	5.0	**0.48**	4286	4.6	3.0	**11.99** ***	7,332	1.5	1.0	**1.99** **	4,880	1.4	1.0	**0.57**	2,452	1.9	1.0	**9.37** ***
crisis	1,026	3.7	1.0		211	5.6	5.0		815	3.2	1.0		3,032	1.6	1.0		962	1.3	1.0		2,070	1.7	1.0	
Maturity (years)																								
pre-crisis	4999	31.3	33.3	**-20.14** ***	489	23.3	24.0	**-5.04** ***	4510	32.2	33.6	**-22.43** ***	8,303	5.4	5.0	**0.08**	5,289	5.3	5.0	**3.63** ***	3,014	5.4	4.9	**-2.06** **
crisis	1192	42.6	42.0		229	29.4	32.7		963	45.7	42.7		3,168	5.4	4.9		1,003	5.0	4.0		2,165	5.5	5.0	
Tranche to transaction (%)																								
pre-crisis	4999	19.8%	6.6%	**-11.88** ***	489	24.9%	12.0%	**-2.94** ***	4510	19.2%	6.1%	**-10.72** ***	8,303	99.0%	100.0%	**-4.45** ***	5,289	99.2%	100.0%	**-2.10** **	3,014	98.8%	100.0%	**-4.65** ***
crisis	1192	28.8%	14.0%		229	31.1%	14.6%		963	28.2%	13.8%		3,168	99.7%	100.0%		1,003	99.6%	100.0%		2,165	99.7%	100.0%	
Country risk [1-22 weak]																								
pre-crisis	4999	1.2	1.0	**-5.66** ***	489	1.3	1.0	**0.17**	4510	1.2	1.0	**-6.24** ***	8,303	1.1	1.0	**-13.69** ***	5,289	1.1	1.0	**-11.58** ***	3,014	1.3	1.0	**-4.01** ***
crisis	1192	1.4	1.0		229	1.4	1.0		963	1.4	1.0		3,168	1.5	1.0		1,003	1.3	1.0		2,165	1.6	1.0	
Number of banks																								
pre-crisis	4999	3.2	2.0	**23.02** ***	489	2.3	2.0	**12.55** ***	4510	3.3	3.0	**18.88** ***	8,303	1.9	1.0	**-6.78** ***	5,289	1.9	1.0	**2.84** ***	3,014	1.8	1.0	**-8.78** ***
crisis	1192	1.8	1.0		229	1.2	1.0		963	2.0	1.0		3,168	1.9	1.0		1,003	1.5	1.0		2,165	2.0	1.0	

Panel B: The impact of the financial crisis on the characteristics of AS and CB tranches - dummy variables

Variable of interest	AS Full Sample				ABS				MBS				CB Full Sample				PCB				MCB			
	N	N (d=1)	% of total	Fisher's exact test	N	N (d=1)	% of total	Fisher's exact test	N	N (d=1)	% of total	Fisher's exact test	N	N (d=1)	% of total	Fisher's exact test	N	N (d=1)	% of total	Fisher's exact test	N	N (d=1)	% of total	Fisher's exact test
Panel B: dummy variables																								
Fixed rate																								
pre-crisis	4999	117	2.3%	**0.003** *	489	50	10.2%	**0.000** *	4510	67	1.5%	**0.127**	8303	7,306	88.0%	**0.000** *	5289	4,639	87.7%	**0.000** *	3014	2,667	88.5%	**0.000** *
crisis	1192	4	0.3%		229	4	1.7%		963	8	0.8%		3168	2,465	77.8%		1003	811	80.9%		2165	1,654	76.4%	
Currency risk																								
pre-crisis	4999	1073	21.5%	**0.000** *	489	25	5.1%	**0.013**	4510	1048	23.2%	**0.000** *	8,303	370	4.5%	**0.000** *	5,289	254	4.8%	**0.097**	3,014	116	3.8%	**0.000** *
crisis	1192	116	9.7%		229	3	1.3%		963	113	11.7%		3,168	222	7.0%		1,003	61	6.1%		2,165	161	7.4%	
U.K. borrowers																								
pre-crisis	4999	2413	48.3%	**0.000** *	489	25	5.1%	**0.016**	4510	2388	52.9%	**0.000** *	8,303	40	0.5%	**0.000** *	5,289	35	0.7%	**0.023**	3,014	5	0.2%	**0.000** *
crisis	1192	377	31.6%		229	23	10.0%		963	354	36.8%		3,168	83	2.6%		1,003	1	0.1%		2,165	82	3.8%	
German borrowers																								
pre-crisis	4999	598	12.0%	**0.000** *	489	155	31.7%	**0.000** *	4510	443	9.8%	**0.000** *	8,303	7,007	84.4%	**0.000** *	5,289	4,862	91.9%	**0.000** *	3,014	2,145	71.2%	**0.000** *
crisis	1192	41	3.4%		229	36	15.7%		963	5	0.5%		3,168	1,962	61.9%		1,003	806	80.4%		2,165	1,156	53.4%	

This table reports statistics for characteristics of AS and CB tranches which are separated into two sub-samples: pre-crisis period (from January 1, 2000 through to September 14, 2008) and crisis period (from September 15, 2008 through to October 31, 2012). AS sample is divided into two sub-samples created considering whether bonds are asset-backed securities (ABS) or mortgage-backed securities (MCB)CB sample is divided into two sub-samples created considering whether the cover-pool assets includes public loans (PCB) or mortgages (MCB). In Panel A, ***, **, * indicate that equality of means can be rejected at the 1%, 5%, and 10% significance level, respectively. In Panel B, * indicates that there is a statistically significant relationship between the dummy variable and the financial crisis. For a definition of the variables, see Table 4.

Table 4: Definition of variables, expected sign, and findings

Variable	Description	Empirical Literature	Expected Sign				Findings			
			ABS	MBS	PCB	MCB	ABS	MBS	PCB	MCB
Dependent Variable										
Credit spread	Spread at issue over comparable risk-free government security with a comparable maturity.									
Independent Variables										
Microeconomic independent variables										
Log transaction size	Natural log of the bond transaction size. Transaction size is converted into Euro millions when necessary.	Vink and Thibeault (2008) | Prokopczuk and Vonhoff (2012) | Prokopczuk et al. (2013) | Gürtler and Neelmeier (2016) | Pinto et al. (2017) |	-/I	-/I	-/I	-/I	I	-	?	+/I
Tranche to transaction	Ratio of the tranche size to the transaction size of a given bond issue.	Vink and Thibeault (2008) | Pinto et al. (2017) |	-/I	-/I	+	+	I	?	I	+/I
Maturity	Maturity of a bond, in years.	Vink and Thibeault (2008) | Sorge and Gadanecz (2008) | Prokopczuk et al. (2013) | Gürtler and Neelmeier (2016) | Pinto et al. (2017) |	I	-/I	+	+	I	I	+	-/I
Number of banks	The number of financial institutions participating in the bond issuance.	Sorge and Gadanecz (2008) | Vink and Thibeault (2008) | Pinto et al. (2017) |	-/I	-	+	+	I	I	+	+
Rated	Dummy equal to 1 if the bond has a credit rating from S&P or Moody's and 0 otherwise.	Elton et al. (2001) | Ammer and Clinton (2004) | Firla-Cuchra (2005) | Hu and Cantor (2006) | Vink and Thibeault (2008) | ECB (2008) | Sorge and Gadanecz (2008) | ECBC (2009) | Buscaino et al. (2012) | Prokopczuk and Vonhoff (2012) | Prokopczuk et al. (2013) | Gürtler and Neelmeier (2016) | Pinto et al. (2017) |	-	-	?	?	-	-	-	+/I
Rating*rated	The interaction between rated and credit rating. Credit reating 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.		+	+	+	+	+	+	+	+/I
Fixed rate	Dummy equal to 1 if a loan or bond is fixed price and 0 otherwise.	Vink and Thibeault (2008) | Pinto et al. (2017) |	+/I	+/I	+	+	-/I	I	+	+
Currency risk	Dummy equal to 1 for bonds that are denominated in a currency different from the currency in the deal's nationality.	Vink and Thibeault (2008) | Pinto et al. (2017) |	+/I	+/I	+	+	-/I	?	+/I	?
Callable	Dummy equal to 1 if the bond has a call option and 0 otherwise.	Fabozzi et al. (2006) | Kothari (2006) | Pinto et al. (2017) |	I	I	+	+	?	I	I	I
U.K. borrowers	Dummy equal to 1 if the bank issuer is located in the U.K. and 0 otherwise.	Prokopczuk and Vonhoff (2012) | Pinto et al. (2017) |	?	?	+/I	+/I	+/I	+/I	I	?

(Continued)

Table 4: Definition of variables, expected sign, and findings

(continued)

Variable	Description	Empirical Literature	Expected Sign				Findings			
			ABS	MBS	PCB	MCB	ABS	MBS	PCB	MCB
Independent variables:										
Macroeconomic independent variables										
Country risk	S&P's country credit rating at close. The rating is converted as follows: AAA=1, AA+=2, and so on until D=22.	Erb et al. (1996) | ECBC (2014) | Gürtler and Neelmeier (2016) |	I	I	+/I	+/I	?	?	-/I	+/I
Risk free rate	The yield on a 3-month German Treasury bill at the time of signing the loan or issuing the bonds - a proxy for the general level of interest rates.	Eichengreen and Mody (1998) | Prokopczuk and Vonhoff (2012) | Pinto et al. (2017) |	-/I	-/I	-	-	-/I	I	+	+/I
EUSA5y-Libor3M	The slope of the Euro swap curve, obtained as the difference between the five-year Euro swap rate and the 3-month Libor rate.	Hu and Cantor (2006) | Sorge and Gadanecz (2008) | Pinto et al. (2017) |	-/I	-/I	-	-	-/I	I	-	-
Volatility	The Chicago Board Options Exchange Volatility Index (VIX). VIX reflects a market estimate of future volatility.	Gürtler and Neelmeier (2016) | Pinto et al. (2017) |	+	+	I	+/I	I	+/I	+	+/I
Crisis	Dummy equal to 1 if the issue date belongs to the crisis period and 0 otherwise. The pre-crisis period includes loans and bonds closed between January 1, 2000 and September 14, 2008; the crisis period includes loans and bonds closed between September 15, 2008 (Lehman Brothers' bankruptcy filing date) and October 31, 2012.	Brunnermeier (2009) | Benmelech and Dlugosz (2009) | Shin (2009) | Prokopczuk and Vonhoff (2012) | Prokopczuk et al. (2013) | Gürtler and Neelmeier (2016) | Pinto et al. (2017) |	+	+	+	+	I	+	+	+
CBPP1	Dummy equal to 1 if the bond was issued during the first European Covered Bond Purchase Programme (from May 7, 2009 through June 30, 2010) and 0 otherwise.	Packer et al. (2007) | ECB (2008) | ECBC (2009) | ECBC (2011) | Beirne et al. (2011) | Carbó-Valverde et al. (2013) | Schuller (2013) | Szczerbowicz (2015) | Gürtler and Neelmeier (2016) |	?	?	-	-	I	+	I	-
CBPP2	Dummy equal to 1 if the bond was issued during the second European Covered Bond Purchase Programme (from October 6, 2011 through October 31, 2012) and 0 otherwise.		?	?	?	?	-	I	+	+/I
Financial crisis	Dummy equal to 1 if the issue date belongs to the 2007-2008 financial crisis (from September 15, 2008 through April 23, 2010) and 0 otherwise.	Beirne et al. (2011) | Prokopczuk et al. (2013) | Schuller (2013) |	+	+	+	+	I	I	+	+
Sovereign crisis	Dummy equal to 1 if the issue date belongs to the European sovereign debt crisis (from April 24, 2010 through December 31, 2011) and 0 otherwise.	Beirne et al. (2011) | Prokopczuk et al. (2013) | Schuller (2013) |	+	+	+	+	?	+	+	+

The following characters mean: – = negative impact on the credit spread | + = positive impact on the credit spread | I = insignificant impact on the credit spread | ? = sign cannot be clearly determined | NA = information about this variable is not available.

Table 5: Regression analyses of the cost of funding: credit spreads

Dependent variable: Credit spread (bps)	**[1]** **All bonds**	**[1a]** **All Bonds | pre-crisis period**	**[1b]** **All Bonds | crisis period**	**[2]** **ABS and PCB**	**[2a]** **ABS and PCB | pre-crisis period**	**[2b]** **ABS and PCB | crisis period**	**[3]** **MBS and MCB**	**[3a]** **MBS and MCB | pre-crisis period**	**[3b]** **MBS and MCB| crisis period**
Independent variables:									
Intercept	109.99 ***	120.50 ***	139.34 **	120.35 ***	84.36 ***	126.68 ***	60.11	58.99 ***	165.88 ***
	(0.000)	(0.000)	(0.029)	(0.001)	(0.000)	(0.008)	(0.361)	(0.002)	(0.000)
Log transaction size	0.13	-0.76	-0.98	1.95	5.72 ***	-4.24 **	-1.18	-5.23 ***	-0.58
	(0.874)	(0.401)	(0.527)	(0.168)	(0.003)	(0.018)	(0.247)	(0.000)	(0.779)
Tranche to transaction	-21.58 ***	-6.47	-57.49 ***	-64.40 ***	-60.06 ***	-62.64 ***	-10.20 **	4.48	-55.46 ***
	(0.000)	(0.222)	(0.000)	(0.000)	(0.003)	(0.002)	(0.033)	(0.346)	(0.000)
Maturity	-0.20	-0.23 *	-0.09	-0.22	0.60 *	-1.83 ***	-0.13	-0.10	0.19
	(0.190)	(0.079)	(0.803)	(0.446)	(0.055)	(0.000)	(0.384)	(0.306)	(0.669)
Number of banks	1.86 ***	1.29 ***	7.58 ***	1.61 ***	0.69 **	5.63 ***	1.73 ***	1.36 ***	7.31 ***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.021)	(0.000)	(0.001)	(0.002)	(0.000)
Country risk	6.46 **	-3.43	9.45 ***	-4.58	4.36	-11.17 **	8.30 ***	-8.73	11.11 ***
	(0.033)	(0.406)	(0.004)	(0.327)	(0.403)	(0.023)	(0.008)	(0.121)	(0.001)
Fixed rate	11.92 ***	6.36 *	16.54 ***	11.31 ***	4.24	24.10 **	16.30 ***	7.88	17.73 ***
	(0.000)	(0.072)	(0.000)	(0.006)	(0.360)	(0.016)	(0.000)	(0.231)	(0.001)
Currency risk	-16.48 ***	-16.66 ***	-8.59	1.48	1.64	-10.80	-20.12 ***	-20.49 ***	-8.44
	(0.000)	(0.000)	(0.140)	(0.768)	(0.769)	(0.174)	(0.000)	(0.000)	(0.250)
Callable	1.33	1.01	-0.53	5.51	12.29 **	-8.12	-0.76	-3.53	2.59
	(0.625)	(0.725)	(0.940)	(0.257)	(0.046)	(0.451)	(0.801)	(0.166)	(0.739)
Risk free rate	-0.069 **	-0.079 **	-0.016	-0.056	-0.084	0.011	-0.078 **	-0.077 *	-0.051
	(0.017)	(0.028)	(0.773)	(0.189)	(0.138)	(0.838)	(0.035)	(0.055)	(0.471)
EUSA5y-Libor3M	-0.19 ***	-0.16 ***	-0.28 ***	-0.16 ***	-0.16 ***	-0.25 ***	-0.19 ***	-0.16 ***	-0.27 ***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.004)	(0.005)	(0.000)	(0.002)	(0.000)
Volatility	0.18	0.46 **	-0.33	0.26	0.05	0.19	0.29	0.86 ***	-0.33
	(0.232)	(0.011)	(0.336)	(0.139)	(0.778)	(0.645)	(0.197)	(0.003)	(0.393)
Crisis	-3.12			-4.80			-8.71		
	(0.789)			(0.814)			(0.487)		
U.K. borrowers	-16.00 ***	-40.30 ***	49.65	-10.63	-21.94	12.56	88.42	-0.74	32.36 ***
	(0.008)	(0.000)	(0.392)	(0.414)	(0.159)	(0.702)	(0.152)	(0.944)	(0.006)
Rating*rated	12.83 ***	14.56 ***	7.60 ***	8.47 ***	10.09 ***	6.13	14.41 ***	15.96 ***	8.43 ***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Rated	-39.75 ***	-40.53 ***	-37.66 ***	-28.70 ***	-34.22	-18.18	-48.24 ***	-48.68 ***	-45.41 ***
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.350)	(0.000)	(0.000)	(0.001)
AS	21.44 ***	39.24 ***	-24.90 *						
	(0.000)	(0.000)	(0.080)						
ABS				37.23 ***	29.98 **	56.25 ***			
				(0.001)	(0.021)	(0.001)			
MBS							25.99 ***	47.75 ***	-45.23 ***
							(0.000)	(0.000)	(0.010)
Country fixed effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Year fixed effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Number of observations	17,662	13,302	4,360	7,010	5,778	1,232	10,652	7,524	3,128
Adjusted R^2	0.33	0.34	0.26	0.23	0.22	0.19	0.37	0.42	0.29

Table 5 presents the results of an OLS regression analysis of the determinants of bond credit spreads for: (*i*) a sample of 6,191 asset securitization (AS) bonds and 11,471 covered bonds (CB)--model [1]; (*ii*) a sample of 718 asset-backed securities (ABS) and 6,292 public covered bonds (PCB)--model [2]; and (*iii*) a sample of 5,473 mortgage-backed securities (MBS) and 5,179 mortgage covered bonds (MCB)--model [3]. Modes are re-estimated according to whether bonds are issued in the pre-crisis period--between January 1, 2000 and September 14, 2008--or in the crisis period--between September 15, 2008 (Lehman Brothers' bankruptcy filing date) and October 31, 2012. AS is equal to 1 if the bond is an AS bond and 0 if the bond is a CB issue. ABS is equal to 1 if the bond is an ABS and 0 if the bond is a PCB. MBS is equal to 1 if the bond is a MBS and 0 if the bond is a MCB. For a definition of the remaining variables, see Table 4. For each independent variable, the first row reports the estimated coefficient and the second row reports the *p*-value. Coefficients were estimated based on heteroskedasticity-consistent standard errors clustered by year and transaction. We controlled for country and year fixed-effects. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Table 6: Regression analyses of the determinants of credit spreads

Dependent variable:	**[4]**	**[4a]**	**[4b]**	**[5]**	**[5a]**	**[5b]**
Credit spread (bps)	**AS bonds**	**ABS**	**MBS**	**CB**	**PCB**	**MCB**
Independent variables:						
Intercept	175.83 ***	190.17 *	150.31 ***	-53.18	-16.73	-55.65 ***
	(0.000)	(0.058)	(0.000)	(0.307)	(0.329)	(0.002)
Log transaction size	-10.10 ***	6.82	-12.12 ***	2.17 ***	0.63	2.42 ***
	(0.000)	(0.569)	(0.000)	(0.000)	(0.299)	(0.003)
Tranche to transaction	-1.32	7.51	1.50	23.83 **	-4.46	38.04 ***
	(0.808)	(0.726)	(0.780)	(0.034)	(0.773)	(0.000)
Maturity	0.17	-0.37	0.20	0.47 **	1.16 ***	-0.51 **
	(0.318)	(0.637)	(0.249)	(0.014)	(0.000)	(0.049)
Number of banks	0.17	-0.51	0.20	1.24 ***	0.71 ***	2.15 ***
	(0.817)	(0.862)	(0.788)	(0.000)	(0.001)	(0.000)
Country risk	0.35	-14.25 **	7.44	11.16 ***	-10.91 *	13.39 ***
	(0.975)	(0.023)	(0.487)	(0.000)	(0.056)	(0.000)
Fixed rate	-12.15	-66.93	1.60	14.91 ***	18.12 ***	16.59 ***
	(0.607)	(0.149)	(0.956)	(0.000)	(0.000)	(0.000)
Currency risk	-17.78 ***	-48.54	-14.04 ***	-2.65	4.21	-6.84 *
	(0.000)	(0.231)	(0.000)	(0.232)	(0.124)	(0.059)
Callable	6.97 *	32.98 **	3.45	3.50	-1.10	5.54
	(0.093)	(0.041)	(0.350)	(0.154)	(0.714)	(0.192)
Risk free rate	-0.007	-0.11	0.01	0.05 ***	0.06 ***	0.03 **
	(0.839)	(0.356)	(0.624)	(0.000)	(0.000)	(0.036)
EUSA5y-Libor3M	-0.07	-0.15	-0.05	-0.10 ***	-0.09 ***	-0.14 ***
	(0.301)	(0.517)	(0.407)	(0.000)	(0.000)	(0.000)
Volatility	0.23	0.86	0.19	0.27 ***	0.48 ***	0.20 *
	(0.338)	(0.220)	(0.476)	(0.000)	(0.000)	(0.057)
Crisis	58.53 ***	-53.53	78.00 ***	68.81 ***	60.08 ***	68.77 ***
	(0.000)	(0.182)	(0.000)	(0.000)	(0.000)	(0.000)
U.K. borrowers	21.80 *	44.78	23.04 *	38.18	1.76	55.83 ***
	(0.067)	(0.344)	(0.074)	(0.446)	(0.751)	(0.000)
Rating*rated	16.34 ***	15.85 ***	16.81 ***	1.80 ***	1.77 ***	1.37 **
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.030)
Rated	-115.53 ***	-166.35 **	-105.06 ***	-0.86	-5.96 ***	2.31
	(0.000)	(0.017)	(0.000)	(0.664)	(0.008)	(0.443)
MBS	-10.82					
	(0.249)					
MCB				5.12 ***		
				(0.000)		
Country fixed effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Number of observations	6,191	718	5,473	11,471	6,292	5,179
Adjusted R^2	0.35	0.23	0.41	0.27	0.17	0.34

Table 6 presents the results of an OLS regression analysis of the determinants of bond credit spreads for: (*i*) a sample of 6,191 asset securitization (AS) bonds--model [4]--and 11,471 covered bonds (CB)--model [5]; (*ii*) a sample of 718 asset-backed securities (ABS) and 5,473 mortgage-backed securities (MBS)--models [4a] and [4b]; and (*iii*) a sample of 6,292 public covered bonds (PCB) and 5,179 mortgage covered bonds (MCB)--models [5a] and [5b]. MBS is equal to 1 if the bond is a MBS and 0 if the bond is an ABS. MCB is equal to 1 if the bond is a MCB and 0 if the bond is a PCB. For a definition of the remaining variables, see Table 4. For each independent variable, the first row reports the estimated coefficient and the second row reports the *p*-value. Coefficients were estimated based on heteroskedasticity-consistent standard errors clustered by year and transaction. We controlled for country fixed-effects. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Table 7: Regression analyses of the determinants of credit spreads--the impact of the financial crisis

Dependent variable: Credit spread (bps)	**[4a] ABS | pre-crisis period**	**[4a] ABS | crisis period**	**[4b] MBS | pre-crisis period**	**[4b] MBS | crisis period**	**[5a] PCB | pre-crisis period**	**[5a] PCB | crisis period**	**[5b] MCB | pre-crisis period**	**[5b] MCB | crisis period**
Independent variables:								
Intercept	-132.37	223.44 ***	246.71 ***	265.07 ***	8.00	182.75 **	-12.83	50.22
	(0.294)	(0.010)	(0.001)	(0.001)	(0.803)	(0.020)	(0.183)	(0.478)
Log transaction size	24.44	4.06	-11.54 ***	-18.84 **	1.70 ***	-3.45 **	-0.61	3.13 **
	(0.141)	(0.652)	(0.000)	(0.014)	(0.010)	(0.026)	(0.592)	(0.025)
Tranche to transaction	1.16	30.50	15.81 ***	-39.20 ***	-6.98	68.72	9.25	19.42
	(0.973)	(0.465)	(0.003)	(0.004)	(0.612)	(0.378)	(0.111)	(0.606)
Maturity	1.72 *	-1.41	0.01	0.50	1.52 ***	-1.85 ***	0.16	-0.52
	(0.072)	(0.403)	(0.916)	(0.451)	(0.000)	(0.000)	(0.637)	(0.224)
Number of banks	-2.45	-6.92	-0.16	3.16	0.24	4.29 ***	1.75 ***	6.04 ***
	(0.528)	(0.513)	(0.785)	(0.488)	(0.191)	(0.001)	(0.000)	(0.000)
Country risk	43.90 *	-14.80 **	-28.92 ***	15.59 **	-11.88	-10.77	1.72	9.55 ***
	(0.061)	(0.011)	(0.004)	(0.045)	(0.219)	(0.155)	(0.654)	(0.004)
Fixed rate	-34.10	-390.62 **	5.18	-37.50	12.67 ***	37.19 ***	10.02 **	17.03 ***
	(0.495)	(0.046)	(0.864)	(0.494)	(0.000)	(0.000)	(0.015)	(0.000)
Currency risk	-78.68 *	40.95	-16.61 ***	23.87 *	7.00 **	-4.58	10.76 **	-21.84 ***
	(0.081)	(0.246)	(0.000)	(0.068)	(0.015)	(0.468)	(0.019)	(0.000)
Callable	63.94 ***	-62.26 ***	-1.49	14.61	0.17	11.38	1.24	1.57
	(0.008)	(0.004)	(0.584)	(0.161)	(0.956)	(0.414)	(0.797)	(0.873)
Risk free rate	-0.41 *	0.01	0.00	-0.10	0.07 ***	-0.10 **	0.06 ***	-0.05
	(0.065)	(0.902)	(0.913)	(0.225)	(0.000)	(0.019)	(0.000)	(0.124)
EUSA5y-Libor3M	-0.27	-0.31 *	-0.11	-0.08	-0.10 ***	-0.19 ***	-0.11 ***	-0.17 ***
	(0.570)	(0.083)	(0.141)	(0.496)	(0.000)	(0.000)	(0.000)	(0.000)
Volatility	0.91	-0.28	2.74 ***	-0.16	0.53 ***	0.49 ***	0.27 **	0.26
	(0.558)	(0.674)	(0.000)	(0.767)	(0.000)	(0.010)	(0.034)	(0.103)
U.K. borrowers	284.20 **	70.63	-64.66	10.74	-30.63		-35.33 ***	38.95
	(0.036)	(0.119)	(0.108)	(0.729)	(0.122)		(0.000)	(0.480)
Rating*rated	19.97 ***	10.39 ***	18.30 ***	13.16 ***	1.96 ***	1.86	0.50	2.93 **
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.228)	(0.353)	(0.013)
Rated	-231.05 **	-124.70	-113.47 ***	-76.65 ***	-6.80 ***	1.07	6.32 **	-0.01
	(0.023)	(0.124)	(0.000)	(0.001)	(0.004)	(0.858)	(0.045)	(0.998)
Country fixed effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Number of observations	489	229	4,510	963	5,289	1,003	3,014	2,165
Adjusted R^2	0.30	0.31	0.49	0.38	0.08	0.19	0.07	0.26

Table 7 presents the results of an OLS regression analysis of the determinants of credit spreads for asset-backed securities (ABS), mortgage-backed securities (MBS), public covered bonds (PCB) and mortgage covered bonds (MCB) sub-samples created by considering a pre-crisis period from January 1, 2000 through to September 14, 2008, and a crisis period from September 15, 2008 (Lehman Brothers' bankruptcy filing date) through to December 31, 2011. For a definition of the variables, see Table 4. For each independent variable, the first row reports the estimated coefficient and the second row reports the *p*-value. Coefficients were estimated based on heteroskedasticity-consistent standard errors clustered by year and transaction. We controlled for country fixed-effects. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Table 8: The impact of the ECB's CBPP on AS and CB credit spreads

Dependent variable: Credit spread (bps)	**[6]** **CB | Western Europe**	**[7]** **CB | Eurozone**	**[7a]** **PCB | Eurozone**	**[7b]** **MCB | Eurozone**	**[8a]** **ABS | Eurozone**	**[8b]** **MBS | Eurozone**
Independent variables:						
Intercept	-49.43	-64.36 ***	-9.90	-73.74 ***	296.93 **	163.11 ***
	(0.329)	(0.000)	(0.580)	(0.000)	(0.017)	(0.003)
Log transaction size	1.71 ***	1.73 ***	0.38	1.98 **	10.41	-3.56
	(0.001)	(0.001)	(0.537)	(0.018)	(0.388)	(0.287)
Tranche to transaction	24.18 **	21.96 *	-7.54	42.38 ***	-6.32	3.20
	(0.029)	(0.053)	(0.645)	(0.000)	(0.780)	(0.604)
Maturity	0.45 **	0.45 **	1.12 ***	-0.54 **	-0.87	-0.01
	(0.020)	(0.021)	(0.000)	(0.040)	(0.320)	(0.962)
Number of banks	1.31 ***	1.38 ***	0.72 ***	2.33 ***	-1.74	0.32
	(0.000)	(0.000)	(0.000)	(0.000)	(0.581)	(0.794)
Country risk	8.77 ***	9.44 ***	-16.75 ***	12.40 ***	-2.97	-3.76
	(0.002)	(0.001)	(0.004)	(0.000)	(0.785)	(0.789)
Fixed rate	15.70 ***	15.40 ***	18.89 ***	15.38 ***	-82.46	-41.08
	(0.000)	(0.000)	(0.000)	(0.000)	(0.176)	(0.371)
Currency risk	-3.13	0.18	3.82	-3.82	-61.71	-7.89
	(0.154)	(0.935)	(0.145)	(0.326)	(0.178)	(0.436)
Callable	2.63	3.10	-1.64	6.68	38.54 **	8.82
	(0.286)	(0.209)	(0.585)	(0.118)	(0.033)	(0.114)
Risk free rate	0.07 ***	0.07 ***	0.07 ***	0.05 ***	-0.25	-0.06
	(0.000)	(0.000)	(0.000)	(0.001)	(0.145)	(0.265)
EUSA5y-Libor3M	-0.06 ***	-0.06 ***	-0.07 ***	-0.07 ***	-0.37	-0.16
	(0.000)	(0.000)	(0.000)	(0.000)	(0.303)	(0.138)
Volatility	0.29 ***	0.26 ***	0.52 ***	0.14	-0.06	1.47 ***
	(0.000)	(0.000)	(0.000)	(0.234)	(0.957)	(0.005)
U.K. borrowers	26.39					
	(0.587)					
Rating*rated	1.75 ***	1.90 ***	1.64 ***	1.63 **	15.68 ***	17.20 ***
	(0.000)	(0.000)	(0.000)	(0.011)	(0.000)	(0.000)
Rated	0.45	0.18	-5.12 **	3.58	-190.51 **	-153.83 ***
	(0.822)	(0.927)	(0.023)	(0.245)	(0.011)	(0.000)
CBPP1	-14.14 ***	-15.28 ***	-3.40	-21.76 ***	-11.67	75.93 ***
	(0.000)	(0.000)	(0.362)	(0.000)	(0.760)	(0.004)
CBPP2	10.03 **	7.43	33.73 ***	-1.51	-112.72 *	9.43
	(0.033)	(0.127)	(0.001)	(0.784)	(0.094)	(0.796)
MCB	4.96 ***	4.61 ***				
	(0.000)	(0.000)				
Financial crisis	73.82 ***	75.46 ***	59.74 ***	80.57 ***	-50.61	-23.98
	(0.000)	(0.000)	(0.000)	(0.000)	(0.259)	(0.336)
Sovereign crisis	76.30 ***	75.09 ***	60.84 ***	77.89 ***	-55.99	81.94 ***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.356)	(0.001)
Country fixed effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Number of observations	11,471	11,346	6,254	5,092	670	2,731
Adjusted R^2	0.28	0.26	0.17	0.33	0.25	0.40

Table 8 presents the results of an OLS regression analysis of the determinants of bond credit spreads for: (*i*) sample of 11,471 CB--model [6]; (*ii*) a sub-sample of 11,348 CB issued by banks located in the Eurozone--model [7]; (*iii*) two sub-samples of 6,256 public covered bonds (PCB) and 5,092 mortgage covered bonds (MCB) issued by banks located in the Eurozone--models [7a] and [7b]; and (*iv*) two sub-samples of 670 asset-backed securities (ABS) and 2,731 mortgage-backed securities (MBS) issued by banks located in the Eurozone--models [8a] and [8b]. CBPP1 is equal to 1 if the CB issue date belongs to the announcement and implementation of the first CBPP (from May 7, 2009 through June 30, 2010), and 0 otherwise. CBPP2 is equal to 1 if the CB issue date belongs to the announcement and implementation of the second CBPP (from October 6, 2011 through to October 31, 2012), and 0 otherwise. Financial crisis is equal to 1 if the CB issue date belongs to the 2007-2008 financial crisis (from September 15, 2008--Lehman Brothers' bankruptcy filing date--through to April 23, 2010), and 0 otherwise. Sovereign crisis set equal to 1 if the CB issue date belongs to the European sovereign debt crisis (from April 24, 2010--downgrade of Greece sovereign credit rating, which triggered broad market turmoil--through to October 31, 2012), and 0 otherwise. For a definition of the remaining variables, see Table 4. For each independent variable, the first row reports the estimated coefficient and the

second row reports the *p*-value. Coefficients were estimated based on heteroskedasticity-consistent standard errors clustered by year and transaction. We controlled for country fixed-effects. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Table 9: Regression analyses of the cost of funding: weighted average spreads (WAS)

Dependent variable: WAS (bps)	**[9]** **All bonds**	**[9a]** **All Bonds | pre-crisis period**	**[9b]** **All Bonds | crisis period**	**[10]** **ABS and PCB**	**[10a]** **ABS and PCB | pre-crisis period**	**[10b]** **ABS and PCB | crisis period**	**[11]** **MBS and MCB**	**[11a]** **MBS and MCB | pre-crisis period**	**[11b]** **MBS and MCB| crisis period**
Independent variables:									
Intercept	29.56	11.01	119.67 *	54.41 **	50.00	36.40	43.08	-0.22	38.99
	(0.394)	(0.319)	(0.072)	(0.027)	(0.142)	(0.191)	(0.211)	(0.984)	(0.589)
Log transaction size	-0.14	-0.67	-0.27	-0.56	0.33	-3.88	0.18	-2.34 **	1.31
	(0.883)	(0.410)	(0.835)	(0.521)	(0.703)	(0.166)	(0.914)	(0.040)	(0.506)
Number of banks	2.36 ***	1.44 ***	7.89 ***	1.40 ***	0.73 **	6.89 **	3.54 ***	2.48 ***	7.43 ***
	(0.003)	(0.000)	(0.008)	(0.007)	(0.016)	(0.028)	(0.002)	(0.003)	(0.005)
Country risk	11.21 **	-4.58	9.81	-9.31	-11.64	-11.18	13.86 **	-2.27	11.89
	(0.034)	(0.451)	(0.169)	(0.144)	(0.398)	(0.243)	(0.015)	(0.674)	(0.131)
Currency risk	-6.49	1.30	-24.38 ***	-6.56	-0.18	-21.91 *	-6.17	0.62	-24.73 ***
	(0.256)	(0.748)	(0.001)	(0.328)	(0.976)	(0.095)	(0.274)	(0.835)	(0.010)
Risk free rate	0.019	0.018	0.062	0.003	0.013	0.005	0.030	0.020	0.060
	(0.525)	(0.469)	(0.479)	(0.933)	(0.732)	(0.934)	(0.401)	(0.625)	(0.368)
EUSA5y-Libor3M	-0.14 **	-0.10 ***	-0.20	-0.14 ***	-0.12 ***	-0.18 *	-0.14 *	-0.08	-0.23
	(0.017)	(0.003)	(0.143)	(0.001)	(0.006)	(0.071)	(0.065)	(0.204)	(0.109)
Volatility	0.22	0.05	0.17	0.27	-0.013	0.54	0.32	0.15	0.15
	(0.469)	(0.849)	(0.682)	(0.275)	(0.966)	(0.137)	(0.368)	(0.570)	(0.768)
Crisis	19.99 *			20.52 ***			14.51		
	(0.093)			(0.006)			(0.299)		
U.K. borrowers	17.31	-3.25	19.45	22.84 **	18.07 *	68.38	42.56	4.39 **	39.68
	(0.570)	(0.427)	(0.650)	(0.029)	(0.051)	(0.362)	(0.176)	(0.034)	(0.404)
AS	6.44	31.89 ***	-26.80 **						
	(0.512)	(0.000)	(0.014)						
ABS				32.26 **	48.43 ***	2.76			
				(0.011)	(0.003)	(0.860)			
MBS							1.09	32.85 ***	-31.56 **
							-0.92	(0.000)	(0.013)
Country fixed effects	*Yes*	*Yes*	*Yes*	*Yes*	*Ýes*	*Yes*	*Yes*	*Yes*	*Yes*
Year fixed effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Number of observations	12,408	8,994	3,414	6,412	5,352	1,060	5,996	3,642	2,354
Adjusted R^2	0.26	0.09	0.19	0.16	0.08	0.13	0.31	0.10	0.24

Table 9 presents the results of an OLS regression analysis of the determinants of bond weighted average spreads (WAS) for: (i) a sample of 1,031 asset securitization (AS) transactions and 11,377 covered bond (CB) transactions--model [9]; (ii) a sample of 168 asset-backed securities (ABS) transactions and 6,244 public covered bond (PCB) transactions--model [10]; and (iii) a sample of 863 mortgage-backed securities (MBS) transactions and 5,133 mortgage covered bond (MCB) transactions--model [11]. Modes are re-estimated according to whether bonds are issued in the pre-crisis period--between January 1, 2000 and September 14, 2008--or in the crisis period--between September 15, 2008 (Lehman Brothers' bankruptcy filing date) and October 31, 2012. AS is equal to 1 if the bond is an AS bond and 0 if the bond is a CB issue. ABS is equal to 1 if the bond is an ABS and 0 if the bond is a PCB. MBS is equal to 1 if the bond is a MBS and 0 if the bond is a MCB. For a definition of the remaining variables, see Table 4. For each independent variable, the first row reports the estimated coefficient and the second row reports the *p*-value. Coefficients were estimated based on heteroskedasticity-consistent standard errors clustered by year. We controlled for country and year fixed-effects. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Table 10: Robustness checks: the impact of the ECB's CBPP on AS bond and CB credit spreads

Dependent variable: Credit spread (bps)	**[7a] PCB | Euro Non-Germany**	**[7a] PCB | Euro Germany**	**[7a] PCB | Portugal, Ireland, Italy, Greece and Spain**	**[7b] MCB | Euro Non-Germany**	**[7b] MCB | Euro Germany**	**[7b] MCB | Portugal, Ireland, Italy, Greece and Spain**	**[8a] ABS | Euro Non-Germany**	**[8a] ABS | Euro Germany**	**[8a] ABS | Portugal, Ireland, Italy, Greece and Spain**
Independent variables:									
Intercept	-48.54	-16.38	-57.03	-45.29	-40.72 ***	-36.62	36.74	536.77 **	71.18 **
	(0.125)	(0.422)	(0.373)	(0.104)	(0.000)	(0.408)	(0.440)	(0.049)	(0.041)
Log transaction size	-2.33	0.69	-6.47	5.78 ***	-1.20	1.35	-12.47 **	36.77 *	-0.40
	(0.429)	(0.247)	(0.149)	(0.001)	(0.155)	(0.635)	(0.024)	(0.062)	(0.916)
Tranche to transaction	13.90	-13.27	45.14	49.36 ***	2.74	41.73 **	10.11	-42.15	5.93
	(0.508)	(0.513)	(0.184)	(0.001)	(0.719)	(0.012)	(0.400)	(0.718)	(0.565)
Maturity	0.53	1.21 ***	1.81	-0.62	0.12	-2.06 ***	-0.16	4.54	-0.29
	(0.376)	(0.000)	(0.179)	(0.104)	(0.655)	(0.007)	(0.705)	(0.189)	(0.424)
Number of banks	2.81 ***	0.34 *	5.58 ***	3.28 ***	1.92 ***	6.34 ***	-2.03	-32.99	-2.85 *
	(0.000)	(0.073)	(0.003)	(0.000)	(0.000)	(0.000)	(0.273)	(0.104)	(0.059)
Country risk	-23.36 ***		-22.13 **	6.40 *		5.59	-5.38		6.33
	(0.000)		(0.041)	(0.068)		(0.276)	(0.272)		(0.313)
Fixed rate	11.54	19.69 ***	-10.48	-12.93 **	34.06 ***	-40.13 ***	-48.56	-231.42	-40.78
	(0.112)	(0.000)	(0.441)	(0.026)	(0.000)	(0.000)	(0.117)	(0.124)	(0.274)
Currency risk	-2.08	5.43 *	-22.20	-10.04 **	6.73	0.79	-59.94	-7.34	
	(0.706)	(0.087)	(0.250)	(0.031)	(0.275)	(0.968)	(0.375)	(0.916)	
Callable	27.84	-2.38	31.23	-5.51	-1.82	-9.71	8.14	46.02	11.80 **
	(0.115)	(0.430)	(0.197)	(0.510)	(0.716)	(0.372)	(0.248)	(0.281)	(0.045)
Risk free rate	0.09 ***	0.07 ***	0.15 *	-0.03	0.06 ***	0.06	0.08	-0.89 **	0.03
	(0.009)	(0.000)	(0.057)	(0.234)	(0.000)	(0.137)	(0.170)	(0.044)	(0.483)
EUSA5y-Libor3M	0.01	-0.08 ***	0.14	-0.13 ***	-0.08 ***	0.02	0.11	-0.80	-0.06
	(0.899)	(0.000)	(0.139)	(0.008)	(0.000)	(0.743)	(0.289)	(0.212)	(0.394)
Volatility	0.59	0.53 ***	1.38 *	-0.27	0.41 ***	-0.97 ***	1.55 ***	9.46 **	0.47
	(0.114)	(0.000)	(0.099)	(0.276)	(0.001)	(0.007)	(0.003)	(0.046)	(0.305)
U.K. borrowers	2.77			48.74 ***			99.58 ***		
	(0.654)			(0.000)			(0.001)		
Rating*rated	8.68 **	1.43 ***	8.10 *	3.34	0.66	4.65 *	13.16 ***	29.36 ***	12.55 ***
	(0.029)	(0.000)	(0.098)	(0.125)	(0.194)	(0.072)	(0.000)	(0.000)	(0.000)
Rated	17.78	-5.84 ***	49.19	-7.23	8.23 ***	-11.66	-33.38	-526.81 **	-64.29 ***
	(0.193)	(0.010)	(0.144)	(0.411)	(0.009)	(0.302)	(0.146)	(0.016)	(0.000)
CBPP1	9.99	-3.73	59.59 *	-38.40 ***	-8.71 **	-52.89 ***	24.56	-253.04	22.30
	(0.581)	(0.300)	(0.087)	(0.000)	(0.014)	(0.000)	(0.197)	(0.537)	(0.161)
CBPP2	52.00 **	33.35 ***	62.37	-7.67	17.14 ***	-26.07	-71.09 ***	-58.61	-168.19 ***
	(0.019)	(0.000)	(0.208)	(0.381)	(0.001)	(0.276)	(0.001)	(0.274)	(0.000)
Financial crisis	35.31	61.28 ***	2.72	91.16 ***	66.76 ***	123.84 ***	-31.59 *	-423.49	-4.64
	(0.123)	(0.000)	(0.944)	(0.000)	(0.000)	(0.000)	(0.084)	(0.110)	(0.710)
Sovereign crisis	73.02 ***	55.44 ***	78.78 **	87.08 ***	56.98 ***	133.06 ***	32.73	-406.06 **	40.78 ***
	(0.000)	(0.000)	(0.014)	(0.000)	(0.000)	(0.000)	(0.148)	(0.024)	(0.004)
Country fixed effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Number of observations	624	5,668	263	1,878	3,301	946	527	191	442
Adjusted R^2	0.17	0.18	0.05	0.39	0.27	0.43	0.49	0.25	0.56

Table 10 presents the results of an OLS regression analysis of the determinants of bond credit spreads for : (*i*) three sub-samples of 624 PCB issued by Non-German banks, 5,668 PCB issued by German banks, and 263 PCB issued by banks located in Portugal, Ireland, Italy, Greece and Spain--columns 1 to 3; (*ii*) three sub-samples of 1,878 MCB issued by Non-German banks, 3,301 MCB issued by German banks, and 946 MCB issued by banks located in Portugal, Ireland, Italy, Greece and Spain--columns 4 to 6; and (*iii*) three sub-samples of 527 ABS issued by Non-German banks, 191 ABS issued by German banks, and 442 ABS issued by banks located in Portugal, Ireland, Italy, Greece and Spain--columns 7 to 9. CBPP1 is equal to 1 if the CB issue date belongs to the announcement and implementation of the first CBPP (from May 7, 2009 through June 30, 2010), and 0 otherwise. CBPP2 is equal to 1 if the CB issue date belongs to the announcement and implementation of the second CBPP (from October 6, 2011 through October 31, 2012), and 0 otherwise. Financial crisis is equal to 1 if the CB issue date belongs to the 2007-2008 financial crisis (from September 15, 2008--Lehman Brothers' bankruptcy filing date—through to April 23, 2010), and 0 otherwise. Sovereign crisis set equal to 1 if the CB issue date belongs to the European sovereign debt crisis (from April 24, 2010--downgrade of Greece sovereign credit rating, which triggered broad market turmoil--through to October 31, 2012), and 0 otherwise. For a definition of the remaining variables, see Table 4. For each independent variable, the first row reports the estimated coefficient and the second row reports the *p*-value. Coefficients were estimated based on heteroskedasticity-consistent standard errors clustered by year and transaction. We controlled for country fixed-effects. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.