Risk Premia in Covered Bond Markets

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Abstract

In this paper, we empirically explore risk premia in mortgage covered bond markets. Using a large panel data set of covered bond asset swap spreads, we study the impact of different legal and economic environments. Conducting an in-depth analysis of this market, we find significant but small differences between countries during normal market periods. However, these differences are much stronger during times of economic crisis. Moreover, we find that developments in the real estate market are of relatively little importance during stable market periods. During economic distress, however, these have been of high importance for explaining risk premia in covered bond markets.

JEL classification: G12, G15, G21

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I Introduction

In the background of the recent financial crisis, covered bonds have been heavily discussed as a promising alternative to mortgage-backed securities (MBS) and as a new source for US mortgage funding.[1] In particular, Bernanke (2009) points out that *"covered bonds do help to resolve some of the difficulties associated with the originate-to-distribute model."* Considering the current developments in financial regulation, Basel III treats covered bonds in a favorable way in terms of the Liquidity Coverage Ratio (as "highly liquid" level 2 assets) and the Net Stable Funding Ratio (as "very liquid" assets). Moreover, Solvency II assigns covered bonds a preferential status in terms of their solvency charges. Thus, the importance of covered bonds as a funding instrument will likely increase further.

In Europe, covered bonds have already been an important refinancing vehicle for decades. Starting with the development of the German covered bond in the 18th century, more and more countries have launched covered bond legislation over recent years. With an outstanding volume of EUR 2.39 trillion, covered bonds are now the primary source of mortgage funding for European banks, and the European covered bond market is one of the biggest bond markets in the world.[2] In addition, the importance of the European covered bond market was particularly stressed during the recent financial crisis. Even though their value was less affected than that of MBS, the European Central Bank (ECB) announced the launch of a EUR 60 billion covered bond purchase program in May 2009. Thereby, the ECB emphasized that a functioning covered bond market is essential for the stability of the European

[1] See Lucas et al. (2008), Biswas et al. (2010) and Carbo-Valverde et al. (2011).
[2] ECBC (2010), p. 69.

financial system.[3]

In contrast to MBS, covered bonds are dual-recourse bonds with (i) a claim on the issuer and (ii) a claim on an underlying cover pool in case of the issuer's default. Compared to MBS, this recourse leads to a less complete credit risk transfer and is the most important distinction from asset-backed securities. Moreover, the typical market regulation further enhances the quality of covered bonds: covered bonds do not contain prepayment risk, the cover assets are liable to strict legal requirements and remain on the issuer's balance sheet, and the dynamic cover pool is actively managed, i.e. non-performing cover loans have to be replaced. Due to these security mechanisms, covered bonds are often regarded to be similar quality to government bonds. During the recent financial crisis and in some countries, however, covered bonds exhibited considerable risk premia compared to government bonds.

The purpose of this study is a detailed analysis of covered bond risk premia and their driving factors. More specifically, we contribute to the existing literature by being the first to thoroughly investigate individual risk premia in the European covered bond market. We investigate asset swap spreads of individual covered bonds in the biggest issuer countries, France, Germany, Spain and the UK. These four markets account for 56 % of the international mortgage covered bond market. Recent studies of covered bond markets restrict their analysis to a comparison of country-specific average yield spreads.[4] This approach, however, does not account for issuer-specific effects and does not reveal whether different risk premia are due to regulatory differences between countries or differences of individual bonds. In contrast, we

[3]For a detailed analysis of the covered bond purchase program see Beirne et al. (2011).
[4]See Volk & Hillenbrand (2006) or Packer et al. (2007).

conduct an in-depth analysis considering individual characteristics of covered bonds such as their liquidity and rating. Thereby, we obtain a clean separation between the different risk factors. Moreover, we consider macroeconomic factors that account for the variation of asset swap premia over time. We show that country-specific differences exist, but are much less pronounced when incorporating other effects such as developments in the real estate market. Finally, in a separate examination, we analyze the impact of the recent financial crisis on the pricing of covered bonds. We find that the quality of the cover pool is of little importance during normal market conditions, but particularly relevant in turbulent times.

The remainder of this paper is organized as follows. Section II discusses relevant literature. Section III describes the institutional details of the European covered bond market. In Section IV, we describe the data, our methodology and present the empirical results. Section V summarizes and concludes.

II Literature

It is surprising that, despite its systemic importance, the covered bond market is not well researched and lacks academic literature. Most existing research has been conducted by fixed income departments of major European banks or published by national and international covered bond associations. Some studies, such as Packer et al. (2007) and Avesani et al. (2007), are written as policy papers of international organizations.

Extant literature on covered bonds primarily investigates German covered bonds (Pfandbriefe). Schäfer & Hochstein (1999), Birkmeyer & Herbert (2002) and Breger

& Stovel (2004) analyze yield differences for Pfandbriefe, and show that mortgage Pfandbriefe trade at a premium compared to public Pfandbriefe and less liquid traditional Pfandbriefe trade at a premium compared to Jumbo Pfandbriefe.

Koziol & Sauerbier (2007) and Kempf et al. (2012) opine that yield differences between Pfandbriefe and German government bonds (Bunds) can solely be ascribed to liquidity differences. Using this approach, they derive a term structure of illiquidity premia.

All the aforementioned studies are restricted to the German covered bond market. This approach has the advantage that the regulatory environment is uniform for all issues. Cross-country differences, however, cannot be investigated. To the best of our knowledge, there exist only three studies that investigate the covered bond markets across countries. Volk & Hillenbrand (2006) conduct a pure cross-sectional analysis on one arbitrary day (15 April 2006) and find differences in the pricing of covered bonds by nationality of issuer. Packer et al. (2007) argue that these differences are only weakly related to differences in the respective legislative frameworks. Recently, Bujalance & Ferreira (2010) analyze dynamic relationships between covered bond spreads in France, Germany and Spain. In contrast to our study, these studies only consider country-specific average covered bond spreads and, hence, do not control for individual bond characteristics.

In more general terms, our study is also related to studies in the corporate bond market such as Collin-Dufresne et al. (2001), Elton et al. (2001), Campbell & Taksler (2003), Houweling et al. (2005), Chen et al. (2007) and van Landschoot (2008). These studies analyze unsecured corporate bonds that are not backed by collateral

and often suffer from a considerable heterogeneity of bond characteristics. The issuers may also strongly differ in terms of risk even within a rating class. In contrast, due to its high level of standardization, the covered bond market has a higher level of homogeneity and it is relatively easy to isolate different risk components.

III The European Covered Bond Market

We briefly review the most important features of the European covered bond market.[5] A short overview of the country specific details of covered bond markets considered in our study can be found in the Appendix. Although covered bonds usually have several common characteristics, no global convention formally defining covered bonds exists.[6] In Europe, however, the EU Directive on Undertakings for Collective Investment in Transferable Securities (UCITS Article 52(4)) provides a formal definitions and minimal requirements for covered bonds.[7] In the following, we highlight the most common features.

Covered bonds are issued by financial institutions and typically have fixed coupon payments and a principal payment at maturity. They are dual-recourse bonds with (i) a priority claim on the issuer and (ii) a claim on an underlying cover pool of high-quality collateral in case of a default. If the collateral were insufficient, the covered bond holder would have an equivalent claim on the bank's assets as other unsecured creditors. Covered bonds are issued under a covered bond legislation

[5] A detailed description of the European covered bond market can be found, e.g. in Packer et al. (2007), Cross (2008) and ECB (2008).

[6] See, e.g. Schwarcz (2011) on legal aspects of covered bonds.

[7] See ECBC (2010). Note that this Article was known as UCITS Article 22(4) until it was revised following the recast of EU Directive 85/611 under Directive 2009/65 on 13 July 2009.

(which may differ according to the issuers' country) or under certain contractual provisions. The on-balance-sheet collateral consists of first-rank mortgage loans or high-quality public debt. Depending on the covered bond legislation, the issuer has to hold the respective cover pools separately. In recent years, the share of mortgage loans has increased steadily whereas public-sector loans have become less important. The loan-to-value ratio for mortgage loans may not exceed between 60% and 80%, depending on the country's legislation. For both types of covered bonds, the collateral's value always has to be higher than the nominal value of the outstanding covered bonds of an issuer.

An important criterion to distinguish between covered bonds is whether they belong to the Jumbo segment or not. Jumbo covered bonds have their origin in the Pfandbriefe market and were developed in 1995 in order to increase market liquidity. They are exchange traded fixed rate bullet bonds with a minimum issue size of EUR 1 billion. Moreover, minimum requirements for market making have to be fulfilled. Nowadays, Jumbo covered bonds represent approximately half of the total market. After sovereign government bonds, Jumbo covered bonds are the second most liquid European bond market.[8]

In this study, we restrict our analysis to Jumbo mortgage covered bonds as mortgage covered bonds are the major segment of the covered bond market. In Germany, the share of public covered bonds is steadily decreasing over time. In other countries, only a few public covered bonds compared to mortgage covered bonds are outstanding. The restriction to the Jumbo market is due to sufficient

[8]ECB (2008), p. 10.

liquidity compared to smaller issues and, thus, higher data quality.

IV Covered Bond Spreads

A Yield Data Description

The sample period in our study is 1 January 2000 to 6 May 2009. The end is chosen for a specific reason. On 7 May 2009 the ECB announced its decision to intervene in the European covered bond market through outright purchases of covered bonds.[9] These purchases took place over a period of about one year and officially ended on 21 April 2010. As we do not have detailed information about which bonds and to what extent the ECB actually purchased, we do not consider this period in the analysis. Moreover, it was impossible to identify whether and how the results were driven by the ECB's actions or for other reasons.

We consider all bonds included in the iBoxx Covered Bond Index over the sample period. All bonds that meet the following selection criteria become automatically a member of this index.[10] First, the covered bond must fulfill the criteria specified in UCITS 52(4). Second, all bonds must have a remaining time-to-maturity of at least one year. Third, only fixed rate bonds whose cash flows are known in advance are considered. Fourth, the bonds must be denominated in euros with a minimum amount outstanding of EUR 1 billion. We restrict our analysis to the four major European economies in which covered bonds are issued on a regular basis, i.e. France, Germany, Spain and the UK. Only UK bonds that are denominated in euros

[9] See Beirne et al. (2011).
[10] See also www.markit.com.

are included. We obtain weekly (Wednesday) asset swap spreads calculated above six-month Euribor and bond specific information, such as coupon, time-to-maturity, bid–ask spread and rating from Bloomberg. Multi-debt issues are excluded from the analysis. To take potential outliers into account, we winsorize the data at the 0.5 % and 99.5 % level.

The time period analyzed in this paper consists of two distinct periods. The first period ranges from 1 January 2000 to 31 May 2007. We refer to this time as the *normal period*. The recent financial crisis had its beginning in the middle of 2007. We therefore denote the time from 1 June 2007 to 6 May 2009 as *crisis period*.

The final data set consists of 233 different bonds issued by 47 different banks and a total of 42,083 observations. Table 1 displays the number of yield spread observations by country, sample period and time-to-maturity. Several points are worth noticing. First, one can observe that the Spanish covered bond market has grown to be the largest over time, followed by the German market. Most bonds have a maturity below 12 years with a relatively equal distribution between short (less than five years) and medium term (five to 12 years). Table 2 reports the average yield spreads by country, sample period and time-to-maturity. Overall, without taking any further bond or issuer characteristics into account, UK bonds exhibited the highest average spread. Interestingly, however, the average UK spread during the normal period was even lower than the average German spread. Yield spreads during the crisis period are, as expected, much higher than during normal market conditions. The breakdown by maturities reveals quite distinct shapes of the maturity structure across countries.

B Methodology

To explore the determinants of covered bond spreads we run a series of regressions with the spread as dependent variable. As explanatory variables we employ several bond-specific and country-specific factors varying cross-sectionally and/or through time. We run pooled OLS regressions. Since we work with panel data it is important to account for dependencies in the cross-section and the time series dimension to avoid biased standard errors. Therefore, we follow Thompson (2011) and adjust the standard errors by clustering across time and bonds. Two-dimensional clustering is also recommended by Petersen (2009) who conducts extensive simulation experiments comparing several methods to compute standard errors for panel data sets. He finds that two-dimensional clustering produces unbiased standard errors if there are sufficient number of clusters in each dimension. This is clearly fulfilled in our case.

C Explanatory Variables

The following explanatory variables are employed. First, we use a set of bond-specific variables to control for tax effects, liquidity and credit risk. Bonds with higher coupons are taxed more during their life than bonds with lower coupons (Elton et al., 2001). Therefore, we use the coupon rate as explanatory variable to capture this effect. To control for liquidity effects cross-sectionally and over time, we use the issue size and the bid–ask spread. Bonds with larger issue size and lower bid–ask spreads are usually considered more liquid (Amihud & Mendelson, 1991 and Amihud et al., 2005).

In order to capture differences in credit risk we use the bond's rating as a proxy for this factor. Alternatively, one could use the rating of the issuer, but as the issuing mortgage banks are often unrated, we decided to use the bond rating instead. Clearly, ratings are known to be sticky as they are not often revised. Therefore, the rating captures cross-sectional differences much better than changes over time. Most bonds are rated AAA, AA or A (according to S&P's classification). To capture the bond rating effect we include a dummy variable if the bond is rated as AA or A, which reflects the difference relative to AAA.[11] For about 10 % of all observations we could not obtain a rating history either because these bonds have not been rated or this information is not available. Thus we include another dummy variable for unrated bonds.

To be able to investigate country-specific differences we include dummy variables for bonds issued in France, the UK, and Spain. Hence, Germany is serving as the benchmark. Any significant differences between countries after controlling for tax, liquidity and credit risk effects are likely due to differences in legislation and the regulation of the respective covered bond market.

How do covered bond spreads depend on the macroeconomy? In order to investigate this question we include a number of macroeconomic variables. First, we include the interest rate level approximated by the six-month Euribor rate.[12] As pointed out by Longstaff & Schwartz (1995) and Campbell & Taksler (2003), the risk-free interest rate is expected to have a negative effect on bond yields as a higher

[11] We group the two rating classes together as only less than 1 % of the bonds are rated A.

[12] Although the six-month Euribor rate might be considered not to be entirely risk-free, it is the reference rate of the asset swap spread used in this study. As a robustness check we have repeated the analysis using one-year German treasury as the risk-free rate. No significant chances were observed.

risk-neutral drift reduces the probability of the issuer's default and thus increases the bond price.

To capture the economic conditions that may either effect the value of the cover pool or the probability of default of the issuer, we include three country specific variables. First, we calculate the return of the country's residential property prices over the preceding 12 months based on the property price statistics published by the Bank for International Settlement (BIS). The BIS does not collect this data itself but obtains them from the relevant national source, i.e. the National Institute of Statistics and Economic Studies for France, the Deutsche Bundesbank for Germany, the Banco de Españia for Spain, and the Office for National Statistics for the UK. This data is only available on a quarterly basis for France, Spain, and UK and only on an annual basis for Germany.[13] Consequently, we are only able to update the real estate return information on an quarterly (annual) basis.[14] An alternative were to interpolate the data but this would clearly create a forward looking bias. We expect the country's real estate return to be negatively correlated with the covered bond yield spread as a decrease in property prices decreases the value of the cover pool and, thus, increases potential losses in case of issuer default.

Second, we calculate the preceding 12 months' equity return of each country's major equity index, i.e. the CAC 40, the DAX 30, the IBEX 35 and the FTSE 100. As argued by Collin-Dufresne et al. (2001), equity index returns can be considered to reflect changes in the business climate and the overall risk of defaults. We therefore

[13] All returns are annualized to make them comparable.

[14] To check the robustness of results with respect to the difference in observation frequencies we have repeated the analysis using monthly yield spread observations yielding qualitatively identical results.

expect a negative relationship between equity returns and covered bond spreads.

The previous two country-specific variables are both backward looking whereas bond yields are forward looking. Therefore, we include the implied equity index volatility level of each market as a third country-specific macroeconomic variable. For France, Germany and the UK, these implied volatility indices are rightly available from the countries' main exchanges. For the IBEX, no volatility index is calculated by the Bolsa de Madrid. However, Gonzalez-Perez & Novales (2011) compute this index up to February 2008.[15] To complete the series we use the implied volatility of the closest to maturity at-the-money IBEX futures option thereafter. Implied volatility is an indicator of economic uncertainty and risk. We therefore expect a positive relationship with the covered bond spread.

D Results: Normal Period

Table 3 reports regression results using bond-specific variables and country dummies only. To facilitate the discussion of results, we label the regressions from A to E. Regressions A–C separately include tax and liquidity, credit risk and country dummies, respectively. Regression D includes all bond-specific variables whereas regression E adds the country-specific dummy variables.

We can observe that coupon and bid–ask spread are significant with the expected sign while amount is not significant. The latter can be explained by the fact that we only consider the Jumbo market segment with mandatory market making where all issues are of large size. Hence, the overall liquidity is high and differences in the

[15]We thank Alfonso Novales for sharing these data with us.

outstanding amounts do not play a major role. A substantial fraction of 7 % of the variation in yield spreads is explained by these variables. On the other hand, bond rating and country can only explain 2 % and 3 %, respectively. The AA/A rating dummy is not significant in regression B, but becomes so in regression D when liquidity and tax variables are included, indicating that the latter are important control variables. Moreover, the joined (adjusted) R^2 is now at 11 %. Regression E shows that the country of issuance remains significant (except for the UK) after controlling for tax, liquidity and credit risk. Assuming that the control variables for these effects are not systematically biased, we can draw two conclusions. First, the covered bond legislation in Spain appears to be less strict, which can explain the additional yield spread of 2.2bp. Second, in France, market participants seem to consider a direct or indirect governmental intervention in case of payment difficulties as more likely, which might explain the –2.7bp spread of the French bonds compared to the German benchmark. Overall, country differences appear to be small during normal periods.

Table 4 presents the results of the regressions including economic variables. Regression F adds the six-month Euribor to the previous specifications. Regressions G to I additionally include the country-specific real estate return, equity return and implied volatility, respectively. Finally, regression J includes all variables together.

Several points are worth noticing. First, although the coefficient of the interest rate level is highly significant and negative as expected, the R^2 increases only to 17 % (regression F). Interestingly, the developments in the country-specific real estate markets seem to have no significant influence on the covered bond yields. It seems

that market participants are not concerned with developments in the value of the cover pool. Contrarily, equity market returns and implied equity volatilities have significant impact (regressions G–I). Equity bear markets (regression H) and higher uncertainty (proxied by implied equity volatility, regression I) are associated with lower covered bond prices and higher yields. Most noticeably, the R^2 makes a fairly big jump to 32 % and 35 %, respectively. As it is well known that equity returns and volatility are negatively correlated, one might suspect that inclusion of both together does not increase explanatory power. On the other hand, our return variable is backward looking whereas implied volatility is a forward looking measure. The final specification (regression J) shows that both can be used in tandem to increase the R^2 further, to more than 36 %. Real estate return remains insignificant. Interestingly, even after including the country-specific economic variables, the country dummies remain significant reflecting the impact of the regulatory environment. Moreover, the UK dummy changes its sign when including country-specific macroeconomic variables.

E Results: Crisis Period

Table 5 presents the results using bond-specific variables and country dummies during the crisis period. The first point to note is that coupon size is not significant anymore. One possible explanation is that investors care about tax issues during normal times (as coupon has been significant before) but are less concerned about taxes during crisis times. The second interesting point to observe from regression A is the fact that the R^2 doubles. The bid–ask spread now captures 15 % of the

variation in yield spreads, suggesting that investors are highly concerned about liquidity.

The rating coefficients in regression B are both negative and significant. This is rather counterintuitive, but by looking at regression D we immediately see that this is a consequence of not controlling for liquidity. The coefficient for non-rated bonds remains negative and significant. It seems that a substantial number of these bonds were issues of such high quality that a rating has not been necessary. However, the number of non-rated bonds has substantially decreased over time so that the estimate is based on less than 5 % of the data and should therefore not be over-interpreted.[16]

Regression C reports the country dummy regressions without controlling for liquidity, tax and credit risk whereas regression E includes those variables. In contrast to the normal period we can observe much more pronounced differences between countries. Country dummies alone explain 16 % of yield spread variation; together with the bond-specific variables the R^2 increases to 26 %. UK bonds now trade at a premium of more than 50bp, Spanish bonds at a premium of around 15bp, and French bonds at par relative to German bonds.

Table 6 reports the regression results during the crisis period including country-specific economic variables. The inclusion of the interest rate level raises the R^2 to 65 % (regression F). Even more interesting, however, is the fact that the inclusion of country-specific real estate returns raises the explanatory power up to 80 % (regression G). The coefficient is not only significant, but of substantial size. This is in sharp contrast to the results for the normal period. We interpret this

[16] As a robustness check, we have repeated the analysis eliminating the non-rated bonds from our sample, which did not yield significant changes for the remaining results.

observation as evidence that market participants become more concerned about developments of the cover pool during crisis periods. Hence, market participants account for the fact that the probability of having to rely on the cover pool, i.e. a default of the issuer, becomes more likely.

Regression H shows that equity return remains significantly negative but that the coefficient has increased by a factor of five. However, it is still almost ten times smaller than the real estate return coefficient (both return variables are measured in annual terms). When adding volatility alone (regression I), the coefficient is still positive and significant, however, together with equity return it loses it significance, which might be partly a technical effect due to an increased correlation between the two variables. In the full specification (regression J), the explanatory power is high at 83 %. The tax variable, coupon, remains insignificant, which reinforces the previous finding that tax concerns seem to be of little relevance during the crisis. The differences between countries captured by the country dummy variables are high and significant reinforcing the fact that – controlling for other factors – country-specific legislation is an important factor during periods of economic distress.

F Robustness Checks

To check the robustness of results, we have performed several additional analyses:

(i) Due to the lower frequency of real estate return observations, the use of weekly data might be an issue (although we cluster standard errors by time). Therefore, we have repeated the analysis using monthly data.

(ii) Winsorizing the data at the 0.5 % and 99.5 % level is to some extent arbitrary.

We have therefore repeated the analysis winsorizing at the 2.5 % and 97.5 % level.

(iii) In the main study, we have used six-month Euribor as the variable describing the interest rate level (mainly because asset swap spreads are quoted with respect to this rate). As Euribor is not entirely risk free, we have repeated the analysis using the one-year German Bund rate instead.

(iv) The starting point of the financial crisis is not well defined. We have therefore shifted the split point by two months.

None of these analyses yielded significantly different results not altering our main findings.

V Summary and Conclusions

In this paper, we conduct a detailed analysis of covered bond yield spreads. Our study yields several interesting findings. First, we demonstrate that developments in the real estate sector and, thus, the value of the cover pool are of minor relevance for the pricing of mortgage covered bonds during stable market conditions but become highly relevant during periods of economic distress. This makes intuitive sense, as the likelihood of the issuers' default is higher and thus the value of the cover pool of great importance. This finding also shows the important distinction between covered bonds and MBS, which are more dependent on the development of the underlying portfolio. Second, after controlling for tax, liquidity and credit risk effects, a significant difference can be attributed to the legislative framework. During normal times the size of this difference is small, but becomes much larger during crises. Third, general country-specific market conditions proxied by equity market

performance are always relevant and explain a substantial fraction of variation in spreads. During crises, however, developments in the real estate market are much more important. Fourth, tax effects are only relevant in normal market periods and fifth, liquidity is always an important factor, especially in turbulent times.

Overall, we can conclude that covered bond yield spreads are not very much impacted by the quality of the cover assets and the legislative framework during stable market periods. However, these factors gain highly significant importance during economic turbulences.

Covered bonds are often regarded as an effective refinancing vehicle for banks and therefore considered to increase economic stability during times of crisis. However, we have found that this is highly dependent on the respective regulatory framework. The German and French covered bond legislation should be considered exemplary and may serve as blue print for covered bond legislation in other countries.

A Appendix

This appendix provides institutional details of the four major covered bond markets considered in this study.

France: French covered bonds, *obligations foncières*, are issued by special purpose banks called Sociétés de Crédit Foncier (SCF). These banks are subsidiaries of universal banks and up to now four French banks have set up an SCF. In principal, the legal framework is based on the German Pfandbriefe law. The minimum overcollateralization has to be 2 %. The maximum loan-to-value ratio for private mortgage loans is 80 %, and 60 % for institutional loans. Hybrid cover pools with public loans are theoretically possible, but not prevailing. A liquidity buffer for 180 days is required. Since the legal framework in France is at least as restrictive as in Germany and the special purpose bank principle additionally enhances the credit quality, we expect, compared to other countries, very low spreads for bonds issued under French law.

Germany: The German *Pfandbriefe* are the oldest covered bond securities in Europe (and worldwide). Pfandbriefe were first issued after the Prussian war in 1769. They are issued by universal banks with a special Pfandbriefe license as specified in the Pfandbriefe Act. In contrast to many other countries, the cover pool remains in the ownership of the issuer, but is declared separately. In case of a default, Pfandbriefe investors have a priority claim on the cover pool and a publicly appointed cover pool administrator salvages the assets. The cover pool assets must fulfill a minimum overcollateralization of 2% in terms of present values and the loan-to-value

ratio must not exceed 60 %. A liquidity buffer for 180 days is required. Due to the long history without a single Pfandbriefe default, the low loan-to-value ratio and the strict regulation, Pfandbriefe are considered to be the typical benchmark for covered bonds and are therefore expected to have a low spreads.

Spain: The Spanish *Cédulas* are issued by universal banks. No specific issuing license is required. The cover pool assets remain in the ownership of the issuer and are not disclosed separately. Hence, even though covered bond investors have a priority claim on the cover pool, a clear separation of the assets is difficult to achieve. In contrast, the minimum overcollateralization of 25% is quite high. The maximum loan-to-value ratio for private mortgage loans is 80%, and 60% for institutional loans. In contrast to France and Germany, there are no liquidity buffers required. The less restrictive framework and the absence of the special bank principle should lead to higher spreads compared to other countries. The advantage of a higher required overcollateralization may also be offset by a Spanish real estate market being much more volatile.

United Kingdom: The British covered bond market is the youngest market considered. The first covered bond was issued by HBOS Treasury Services in 2003. Issuers are universal banks who have to obtain a special covered bond license. The regulatory framework is similar to France and Germany but, in contrast, the cover pool is transferred to a special purpose vehicle. Moreover, there is no fixed minimum overcollateralization. This is justified by the regulator by saying that in practice overcollateralization is driven by rating agency requirements and is usually

significantly above the minimum requirements in those jurisdictions with specified overcollateralization levels.[17] As it is not obvious whether the market shares this argument and prefers a rating driven regulation, we have no clear expectation of the resulting spread differences.

[17] See HM-Treasury (2011).

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Table 1: **Number of Covered Bond Yield Spread Observations**

This table reports the number of weekly observed covered bond yield spreads in basis points by country, subperiod and time-to-maturity. All bonds are denominated in euros.

	UK	France	Germany	Spain	Total
Total	5,347	5,096	14,804	16,836	42,083
Panel A: Breakdown by Period, All Maturities					
Normal Period	2,170	2,921	10,909	9,095	25,095
Crisis Period	3,177	2,175	3,895	7,741	16,988
Panel B: Breakdown by Maturities, Entire Sample Periods					
Short ($<$ 5 years)	2,026	2,722	9,441	5,424	19,613
Medium (5–12 years)	2,419	2,326	5,363	8,980	19,088
Long (12–30 years)	902	48	0	2,432	3,382

Table 2: **Average Covered Bond Yield Spreads**

This table reports the average weekly observed covered bond yield spreads in basis points by country, subperiod and time to maturity. All bonds are denominated in euros.

	UK	France	Germany	Spain	Total
Total	47.8	12.1	5.3	24.9	19.3
Panel A: Breakdown by Period, All Maturities					
Normal Period	2.2	0.5	2.4	4.7	3.0
Crisis Period	78.9	27.6	13.3	48.5	43.4
Panel B: Breakdown by Maturities, Entire Sample Period					
Short (< 5 years)	52.5	14.9	4.6	23.1	16.1
Medium (5–12 years)	48.8	8.7	6.5	24.7	20.7
Long (12–30 years)	34.6	9.1	-	29.6	30.6

Table 3: **Bond-specific Variables**

This table shows the results of panel data regressions of covered bond asset swap spreads against the variables listed below for the normal period; p-values are in parenthesis.

	A	B	C	D	E
Intercept	–7.23 (0.00)	2.12 (0.00)	2.44 (0.00)	–10.25 (0.00)	–11.20 (0.00)
Coupon	1.66 (0.00)			1.89 (0.00)	2.19 (0.00)
Amount	0.52 (0.36)			0.69 (0.18)	0.60 (0.12)
Bid–ask	0.26 (0.00)			0.30 (0.00)	0.24 (0.01)
AA/A dummy		1.01 (0.15)		2.01(0.00)	1.50 (0.01)
NR dummy		3.75 (0.00)		4.89 (0.00)	4.97 (0.00)
France dummy			–1.91 (0.05)		–2.65 (0.00)
UK dummy			–0.22 (0.82)		–0.46 (0.59)
Spain dummy			2.29 (0.00)		2.15 (0.00)
Real Estate					
Equity					
Volatility					
Euribor					
R squared	0.07	0.02	0.03	0.11	0.14

Table 4: **Bond-specific and Economic Variables**

This table shows the results of panel data regressions of covered bond asset swap spreads against the variables listed below for the normal period; p-values are in parenthesis

	F	G	H	I	J
Intercept	–3.74 (0.06)	–3.84 (0.05)	1.77 (0.39)	–7.51 (0.00)	–4.23 (0.04)
Coupon	2.14 (0.00)	2.11 (0.00)	1.12 (0.00)	0.95 (0.00)	0.87 (0.00)
Amount	0.50 (0.22)	0.52 (0.21)	0.32 (0.41)	0.30 (0.44)	0.29 (0.46)
Bid–ask	0.26 (0.00)	0.26 (0.00)	0.30 (0.00)	0.30 (0.00)	0.31 (0.00)
AA/A dummy	0.75 (0.24)	0.79 (0.22)	1.10 (0.06)	1.04 (0.08)	1.11 (0.06)
NR dummy	4.13 (0.00)	4.15 (0.00)	4.01 (0.00)	3.97 (0.00)	3.97 (0.00)
France dummy	–3.19 (0.00)	–4.18 (0.00)	–3.10 (0.00)	–1.87 (0.01)	–2.37 (0.02)
UK dummy	–0.19 (0.84)	–0.94 (0.50)	0.07 (0.94)	3.22 (0.00)	2.23 (0.06)
Spain dummy	1.98 (0.00)	0.93 (0.54)	3.09 (0.00)	4.52 (0.00)	4.07 (0.00)
Real Estate		9.99 (0.36)			1.66 (0.84)
Equity			–16.26 (0.00)		–6.56 (0.00)
Volatility				0.44 (0.00)	0.31 (0.00)
Euribor	–2.30 (0.00)	–2.20 (0.00)	–2.27 (0.00)	–2.64 (0.00)	–2.52 (0.00)
R squared	0.17	0.18	0.32	0.35	0.36

Table 5: **Bond-specific Variables during Crisis**

This table shows the results of panel data regressions of covered bond asset swap spreads against the variables listed below for the crisis period; p-values are in parenthesis.

	A	B	C	D	E
Intercept	18.23 (0.19)	47.78 (0.00)	13.27 (0.00)	21.60 (0.13)	3.26 (0.73)
Coupon	1.19 (0.67)			1.34 (0.64)	1.85 (0.39)
Amount	–2.90 (0.38)			–3.99 (0.24)	–4.49 (0.04)
Bid–ask	1.54 (0.00)			1.49 (0.00)	1.38 (0.00)
AA/A dummy		–16.29 (0.00)		–1.11 (0.81)	10.83 (0.03)
NR dummy		–32.84 (0.00)		–20.57 (0.00)	–12.88 (0.02)
France dummy			14.28 (0.00)		1.14 (0.80)
UK dummy			65.61 (0.00)		53.07 (0.00)
Spain dummy			35.26 (0.00)		14.56 (0.00)
Real estate					
Equity					
Volatility					
Euribor					
R squared	0.15	0.03	0.16	0.16	0.26

Table 6: **Bond-specific and Economic Variables during Crisis**

This table shows the results of panel data regressions of covered bond asset swap spreads against the variables listed below for the crisis period; p-values are in parenthesis.

	F	G	H	I	J
Intercept	133.45 (0.00)	75.61 (0.00)	89.04 (0.00)	84.20 (0.00)	61.12 (0.00)
Coupon	1.72 (0.32)	1.80 (0.23)	1.47 (0.31)	1.63 (0.30)	1.63 (0.24)
Amount	–4.36 (0.01)	–4.23 (0.01)	–3.96 (0.01)	-4.21 (0.01)	–4.01 (0.01)
Bid-ask	0.94 (0.00)	0.45 (0.00)	0.45 (0.00)	0.72 (0.00)	0.25 (0.00)
AA/A dummy	10.19 (0.00)	8.04 (0.01)	12.91 (0.00)	10.87 (0.00)	10.10 (0.00)
NR dummy	–3.59 (0.43)	2.31 (0.37)	4.85 (0.12)	0.96 (0.80)	6.29 (0.00)
France dummy	5.25 (0.15)	16.34 (0.00)	2.96 (0.37)	8.91 (0.01)	12.65 (0.00)
UK dummy	59.86 (0.00)	72.54 (0.00)	65.56 (0.00)	64.57 (0.00)	73.53 (0.00)
Spain dummy	22.56 (0.00)	35.07 (0.00)	28.52 (0.00)	27.17 (0.00)	36.26 (0.00)
Real estate		–736.10 (0.00)			–601.07 (0.00)
Equity			–80.17 (0.00)		–50.59 (0.00)
Volatility				1.10 (0.00)	–0.06 (0.39)
Euribor	–30.69 (0.00)	–15.46 (0.00)	–22.08 (0.00)	–26.95 (0.00)	–13.05 (0.00)
R squared	0.65	0.80	0.75	0.70	0.83