Credit Risk in Covered Bonds

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Abstract

Covered bonds are a promising alternative for prime mortgage securitization. In this paper, we explore risk premia in the covered bond market and particularly investigate whether and how credit risk is priced. In extant literature, yield spreads between high-quality covered bonds and government bonds are often interpreted as pure liquidity premia. In contrast, we show that although liquidity is important, it is not the exclusive risk factor. Using a hand-collected data set of cover pool information, we find that the credit quality of the cover assets is an important determinant of covered bond yield spreads. This effect is particular strong in times of financial turmoil and has a significant influence on the issuer's refinancing cost.

JEL classification: G01; G12; G21

Keywords: Covered Bonds; Credit Risk; Cover Pool; Financial Crisis; Pfandbrief

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I Introduction

Covered bonds are debt securities backed by a cover pool of mortgages or public-sector loans serving as collateral. Compared to other securitized assets, such as ABS or CDOs, they were significantly less affected during the recent financial crisis. Due to their special structure, covered bonds do not suffer from the same moral hazard problems, which are widely accepted as one of the causes of the subprime crisis.[1] Since they are subject to tight regulatory control, the market was not subject to the same extreme lack of confidence, which arguably caused severe problems in other asset-backed and mortgage-backed securities markets. This has led to much discussion about covered bonds as a promising alternative for mortgage securitization.[2] Moreover, covered bonds are subject to preferred treatment under new regulatory frameworks such as Basel III and Solvency II and will therefore gain importance as a refinancing vehicle for financial institutions.

In comparison to ABS transactions, the structure of a typical covered bond is fundamentally different: (i) a covered bond is a claim on the issuer, and the cover loans remain on the issuer's balance sheet instead of being transferred to a special purpose vehicle; (ii) the coupon and redemption payments are agreed on in advance and the investor does not bear any prepayment risks; (iii) the direct access to the cover pool is only necessary if the issuer defaults on its liabilities; (iv) there are very strict legal requirements with regard to the allowed pool assets and their valuation; (v) pool borrowers are liable with all of their assets and not only with the underlying cover pool.

Covered bonds are often seen as close substitutes for high-quality government bonds. Due to their security mechanisms and the high quality of their collateral, they have often been considered virtually default-free in the past. Therefore, the yield spread with respect

[1] See Bernanke (2009) who points out that *"covered bonds do help to resolve some of the difficulties associated with the originate-to-distribute model."*

[2] See, e.g., Lucas et al. (2008) and Bernanke (2009).

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to government securities has often been interpreted as pure liquidity premium (see, e.g., Koziol and Sauerbier, 2007 and Kempf et al., 2012).

The purpose of this study is an in-depth analysis of the covered bond market. In particular we investigate whether and, if yes, to what extent, credit risk is priced in covered bonds. To do this, we use an ideally suited data set from the German covered bond market. Since 2005 issuers of covered bonds in Germany have been required to disclose detailed information about the underlying cover pool. Using this hand-collected data set we are able to examine which fraction of yield spreads is driven by liquidity, the creditworthiness of the issuer, the type of collateral, and the quality of the underlying cover pool.

Our contribution to the literature is threefold. First, in contrast to the assumption of Koziol and Sauerbier (2007) or Kempf et al. (2012), we show that although liquidity is important, it is not the exclusive factor for explaining covered bond yield spreads. Second, in addition to previous studies on covered bonds such as Birkmeyer and Herbert (2002) and Breger and Stovel (2004), we analyze individual spreads in different periods of time and explicitly account for the issuers' default risk. Third, using our hand-collected data set, we are the first to study the impact of cover pool quality on the prices of covered bonds. As such, we also contribute to the literature on the relation of common knowledge and market confidence (Morris and Shin, 2012).

The main results of our study are as follows. First, we show that not only liquidity, but also issuer-specific effects, especially the quality of the cover pool, are relevant drivers for yield spreads between covered bonds and German government bonds. Second, yield spreads between individual covered bonds are mainly driven by their relative liquidity and whether they are covered by public-sector or mortgage loans. Liquidity proves to have an important effect and accounts for up to 80 bp of the yield spread. However, our empirical

results suggest that investors demand an additional default risk premium depending on the quality of the cover pool assets.[3] During the recent sovereign crisis, each percentage point of cover pool assets originating from a GIPSI[4] country, leads to an average increase of 1.22 bp for the yield spread.

Our study is particularly related to the literature on covered bonds, and in general to the literature on risk premia in bond markets. Due to its size and importance, most previous research has focused on the German covered bond market (also known as the *Pfandbrief* market). Bühler and Hies (1998) and Jobst (2006) investigate the spread dynamics of German covered bonds, but do not come up with an explanation for the yield differences. Koziol and Sauerbier (2007) and Kempf et al. (2012) argue that German covered bonds can be considered as default-free and that yield differences with government bonds have to be ascribed to liquidity only. Schäfer and Hochstein (1999) and Birkmeyer and Herbert (2002) investigate yield differences in the market for jumbo covered bonds and relate them to several explanatory variables such as the outstanding amount and rating. Whereas Schäfer and Hochstein (1999) conclude that the jumbo covered bond market is rather homogenous, Birkmeyer and Herbert (2002) find higher yields for covered bonds issued by mortgage banks relative to public banks. Breger and Stovel (2004) study the effect of credit risk and liquidity in the market for traditional and jumbo covered bonds. The authors find a significant liquidity premium of 15 bp between traditional and jumbo covered bonds whereas rating differences between AAA and AA are not significant. Studying the European covered bond market, Prokopczuk and Vonhoff (2012) show that country-specific differences exist and developments in the real estate market explain a

[3]This finding is also related to Gefang et al. (2011), who show that long-term LIBOR–OIS spreads during the recent crisis were associated with both credit and liquidity risk. For example, we find that the granularity of the cover pool has a significant impact on the yield spread.

[4]This acronym refers to Greece, Italy, Portugal, Spain, and Ireland.

major fraction of covered bond spreads during the financial crisis.[5]

The remainder of this paper is structured as follows. In Section II, we provide institutional details of the covered bond market. Section III describes the methodology of our analysis and presents the data of our study. In Section IV, we provide and discuss the empirical results. Section V provides a brief summary and concludes.

II Details of the German Covered Bond Market

This section reviews the most important features and the regulatory background of the German covered bond (*Pfandbrief*) market. The legal basis for a covered bond issuance is the Covered Bond Act (*Pfandbrief* Act) of 2005 that replaced the Public Covered Bond Act and the Mortgage Bank Act dating back to 1900. Until 2005, covered bond issuers had to be specialized banks, but nowadays every wholesale bank is allowed to apply for a covered bond license. The Covered Bond Act sets restrictive requirements such that covered bonds are highly standardized and investors can easily assess their quality. Beyond the general banking supervision under the terms of the German Banking Act, covered bond issuers are permanently supervised by an independent trustee appointed by the German financial supervisory authority (BaFin). This strong regulation is set up to ensure timely payment and remoteness in the case of bankruptcy.

Covered bonds are *dual recourse bonds* with (i) a claim on the issuer and (ii) a priority claim on an underlying asset pool in case of a default. The cover pool is kept on the issuer's balance sheet and is only separated in the case of the issuer's default. Cover pools mainly consist of high-quality public-sector or first-rank residential and commercial

[5]More generally, our paper is also related to a large number of studies that investigate risk premia in the corporate bond market. These studies, such as Collin-Dufresne et al. (2001), Longstaff et al. (2005), Chen et al. (2007), and De Jong and Driessen (2007), mostly study unsecured bonds that are not backed by collateral.

mortgage loans.[6] Covered bonds backed by loans to public-sector entities are called *public covered bonds* and those backed by mortgage loans are referred to as *mortgage covered bonds*. It is important to note that every issuer has only one cover pool for each covered bond segment. Hence, every public covered bond of an issuer is backed by the same issuer-specific public cover pool and every mortgage covered bond by the same issuer-specific mortgage cover pool. The German Covered Bond Act sets conservative guidelines for the quality, the size, and the valuation of the cover assets as well as for its supervision to ensure timely payments in case of an issuer's default. Moreover, covered bonds are not subject to prepayment risk, and matured or defaulted loans in the cover pool have to be replaced with new ones. The issuer also has to assure that the present value of the cover pool assets always exceeds the present value of the outstanding covered bonds by at least 2 %. These dynamic features of the cover pool further ensure a sustainably high collateral value for the covered bond.

Public covered bonds are issued on loans to the federal government, the federal state governments, local authorities, and public-sector institutions in the European Economic Area, Switzerland, the US, Canada, and Japan. Loans to German public agencies or public banks that are guaranteed by these bodies are also eligible for the cover pool. It is noteworthy that the withdrawal of public-sector guarantees for state banks and for debt issued by savings banks in 2005 has led to a shrinking supply of public-sector collateral and, therefore, public covered bond issues.[7] *Mortgage covered bonds* are covered by first-rank mortgage loans fully collateralized by real estate properties in the European Economic Area, Switzerland, the US, Canada, and Japan. The underlying properties may be residential, commercial, or both. The loan-to-value ratio of each underlying loan

[6] Moreover, covered bonds on ship and airplane loans exist, but only account for a small fraction of the market.

[7] See, e.g., ECB (2008), p. 10.

must not exceed 60 % and is subject to permanent supervision. Compared to covered bond legislation in other countries or mortgage-backed securities, the maximum loan-to-value ratio required for covered bonds is very conservative. For the purpose of liquidity management, maturity-matching between cover assets and outstanding covered bonds, and currency hedging, it is allowed to include specified claims against qualified banks as well as derivatives.

In the event of an issuer's insolvency, covered bond holders have preferential claims on the cover assets. The cover pools are separated from the issuer's assets and managed by an independent trustee on behalf of the covered bond holders. They are not included in the insolvency proceedings until the covered bond creditors are fully redeemed. Alternatively, another covered bond issuer may take over the cover assets and serve the payments in a timely manner. An early repayment of the covered bond is supposed to be avoided. These arrangements make sure that covered bond holders are protected against insolvency caused outside the issuer's covered bond operations and that the covered bond payments occur on time.

An important segment is the market for *jumbo covered bonds*. This segment is defined by minimum standards agreed on by the issuing banks. It was introduced in 1995 in order to increase the liquidity of large issues. Jumbo covered bonds are required to be plain vanilla bearer bonds with fixed coupon payments, a bullet payment at maturity, and without embedded options. The minimal issue size is EUR 1 billion. Moreover, they have to be listed at an exchange, and at least five market makers have to continuously provide price quotes for a trading volume of up to EUR 15 million. In addition, the quoted bid–ask spread is not allowed to exceed a maturity-dependent boundary. These standards significantly enhance the liquidity in this segment, and jumbo covered bonds are very actively traded. Smaller and less liquid issues in either bearer or registered form

are commonly referred to as *traditional covered bonds*.

III Data and Methodology

III.1 Bond Prices and Yield Spreads

We consider all public and mortgage covered bonds outstanding between January 2006 and December 2011 with fixed coupon and without embedded options that have been issued by a German bank. We focus on the German market after 2005 as only for this market and this time period is detailed information on cover pool compositions available. Our total sample consists of 8,535 covered bonds issued by 105 different banks. We exclude all bonds that do not have at least one price quote during the sample period or for which the prices exceed reasonable bounds.[8] Since trading close to maturity is particularly thin and small pricing errors translate into relatively large annualized yield errors, we exclude all bonds with less than six months to maturity. We first obtain weekly price data (Wednesday) from Bloomberg. Due to marginal trading on exchanges, Bloomberg is the most reliable source available, since prices are provided by at least five contributors.[9] Bloomberg prices are quoted on a three-day settlement basis, and we compute accrued interest using the respective day count fraction.

Cover pool information is published on a quarterly basis (see Section III.3). Therefore, we compute quarterly yield spreads as the average of the weekly yield spreads during the six weeks following the record date of the cover pool. This period is the usual time by which nearly all issuers have published their reports. The calculation of the average yield spread during this period is considered as a trade-off between using the

[8] We exclude price quotes below 1% and above 500% that are apparently due to data errors.

[9] Approximately 60 %–70 % of the market volume is traded over the phone and most of the remaining part on electronic trading platforms.

yield spread precisely at the record date or using the yield spread after six weeks when the information is actually available to all market participants. As the cover pool composition for a single issuer remains relatively constant over time, this assumption is not likely to distort our results. In total, our final main data set consists of 1,224 outstanding covered bonds with available price data and 7,132 quarterly yield spreads.[10]

To gain insight into the behavior of risk premia in covered bonds during the recent financial turmoil, we divide our sample period into four sub-sample periods. The first sub-sample period is referred to as *pre-crisis* and covers the time span prior to the recent financial crisis. It ranges from January 2006 until June 2007. The second sub-sample period lasts from July 2007 until 14 September 2008 and is considered the *subprime crisis*. The third sub-sample period starts after the collapse of Lehman Brothers on 15 September 2008, when market participants became more aware of the risks in the banking sector. We refer to this period as the *banking crisis*. Finally, the fourth sub-sample period begins on 1 July 2010, which is when it became apparent to market participants that the first Greek rescue package would not be sufficient. We denote this period as the *sovereign crisis*. Our sample ends in December 2011. As we work with quarterly data, the time spans of our sub-periods are rather short. However, in the main part of our study we are mostly interested in the cross-sectional characteristics of covered bonds.

Table 1 presents summary information of the data. Panel A shows that traditional covered bonds account for the major part of the number of issues in the covered bond market. Jumbo and traditional issues differ considerably in terms of their outstanding amount, which is approximately ten times higher for jumbo covered bonds, and the jumbo covered bonds in our sample appear to have a slightly longer time to maturity on average.

[10]Note that we use quarterly data in the main part of the study as the cover pool information used in the next section is only available at this frequency. However, as a robustness check, we have repeated the analysis not relying on cover pool information using weekly data, yielding very similar results.

Due to the higher liquidity in the jumbo segment, it is not surprising that the number of price observations per bond for jumbos exceeds the number for traditional covered bonds.

Panel B of Table 1 shows the distribution of covered bond issues with respect to the issuer rating classes. Issues are grouped into the classes according to their issuers' long-term credit rating. We calculate this rating as the average rating from the three major rating agencies Fitch, Moody's, and Standard & Poor's. Covered bond issuers are mainly rated AA and A and the rating classes are similarly distributed in each of the covered bond segments. As no issuer is rated AAA during the three crisis periods and the number of issuers rated BB is rather small, we consider only the three different rating segments AAA/AA, A, and BBB/BB for our empirical study.

In the main part of the paper, we work with the yield spreads relative to public jumbo covered bonds as they are considered the safest and most liquid instruments in the covered bond market. This approach facilitates identifying risk premia *within* the covered bond market that are not driven by factors that affect the covered bond market as a whole. In the preliminary analysis, we also consider spreads relative to German government bonds (*Bunds*). For yield spreads relative to *Bunds*, we use Nelson and Siegel (1987) term structure estimates provided by the Deutsche Bundesbank. For public-sector jumbo covered bonds we follow the same methodology.[11]

To avoid distortions due to maturity, coupon, or taxation effects as in the case of simply comparing yields-to-maturity of duration-matched bonds, we define the yield spread of an individual covered as follows: first, we calculate a theoretical bond price as the bond's cash flows discounted with the benchmark yield curve. Second, given the theoretical and the actual bond price, we compute the theoretical and the observed

[11]The Nelson and Siegel (1987) method is widely used in fixed-income markets, see, e.g., Coroneo et al. (2011) for a description of its advantageous features. We use the package developed in Ferstl and Hayden (2010).

yield-to-maturity. The yield spread is the difference between the actually observed yield and the theoretical yield.

III.2 Explanatory Variables

We relate the obtained yield spreads to the following explanatory variables that capture the different risk factors within the covered bond market. These factors should, at least partially, account for the yield differences between particular issues.

First, we compare the yield spread between mortgage and public jumbos by introducing a mortgage jumbo dummy variable. At least before the advent of the European sovereign debt crisis, covered bonds backed by mortgages were considered to be riskier than those backed by high-quality public-sector debt. Therefore, we expect mortgage jumbos to (initially) trade at a credit risk yield premium compared to public jumbos. Second, we introduce a dummy for public traditional covered bonds. By definition, jumbos are more liquid in terms of outstanding volume, a maximal bid–ask spread, and the vested market-making, among others. Hence, public traditional covered bonds should trade at a liquidity yield premium compared to public jumbo covered bonds. Third, a dummy for traditional mortgage covered bonds measures the joint effect of liquidity and credit risk. For the sovereign bond market, Favero et al. (2010) find yield differences increasing in both liquidity and credit risk with an interaction term of the opposite sign. Moreover, Bühler and Trapp (2010) find a negative correlation between liquidity and credit risk for high-quality AAA-rated corporate bonds. As the covered bond market is comparable to the European sovereign bond market and to high-quality corporate bonds in terms of liquidity and credit risk, it is reasonable to expect a similar result. Hence, we expect a positive yield premium that is smaller than the sum of the pure liquidity and the pure credit risk premium.

It is straightforward to classify the different bond issues with respect to their rating. The rating mainly measures the quality of the underlying cover pool. For a strong rating, it has to be highly plausible that the payments can be made by the underlying cover pool even if the issuer defaults. At the outset, covered bond ratings were independent from the general financial strength of the issuer, but nowadays rating agencies also consider the issuer rating to compute a limit for the highest possible rating.[12] As covered bonds are backed by the cover pool, however, their rating exceeds or is at least equal to the issuer's long-term credit rating.

Even though covered bonds are backed by high-quality cover pools that may guarantee the payments after an issuer's default, the issuer rating may also have an impact on their relative pricing. We use the long-term issuer credit rating from the three major rating agencies Fitch, Moody's, and Standard & Poor's, and calculate an average rating. In general a better long-term issuer credit rating should lead to a lower yield spread.[13]

Issuers also differ by the type of institution. Covered bonds issued by state banks until July 2005 are guaranteed by the German federal states through a so-called "guarantor liability mechanism." Although there is no longer an explicit guarantee, state banks are still considered to be backed and eventually rescued by the state. We therefore expect state banks' covered bonds to trade at a yield discount relative to comparable bonds of other issuers.[14]

Typical proxies for the liquidity of a fixed-income security are trading activity, the

[12]Standard & Poor's were the last to consider the issuer's rating when they changed their rating methodology at the end of 2009.

[13]Instead of using only the rating categories, the use of the issuers' CDS spreads would be a meaningful alternative. Unfortunately, CDS spreads are not available for most of the issuers.

[14]In a previous version of this paper we have also investigated the question of whether the there was a structural break in July 2005 due to the abolition of the explicit guarantee of state banks. However, we could not find any evidence supporting this hypothesis.

bid–ask spread, the proportion of zero-return days, the outstanding amount, and the age. For our data set, only the last two proxies are available. A higher outstanding amount signals a higher liquidity and, therefore, should lead to a lower yield spread. Moreover, trading directly after the issuance date is usually more active and diminishes as the security ages. Therefore, the liquidity premium and, thus, the yield spread should be positively related to the age of a covered bond. To account for differences in the maturity spectrum of the covered bond, we standardize the liquidity measure and use the relative age, i.e., the age divided by the initial time to maturity.[15] The full regression model we estimate for each sample bond i with yield spread $y_{i,t}$ at date t reads

$$\begin{aligned} y_{i,t} &= \alpha + \beta_1\, JumboMortgage_{i,t} + \beta_2\, TraditionalPublic_{i,t} + \beta_3\, TraditionalMortage_{i,t} \\ &+ \beta_4\, AA\,BondRating_{i,t} + \beta_5\, NoBondRating_{i,t} + \beta_6\, AA/A\,IssuerRating_{i,t} \\ &+ \beta_7\, BBB/BB\,IssuerRating_{i,t} + \beta_8\, NoIssuerRating_{i,t} + \beta_9\, RelativeAge_{i,t} \\ &+ \beta_{10}\, IssueSize_{i,t} + \beta_{11}\, Landesbank + \varepsilon_{i,t} \end{aligned} \tag{1}$$

III.3 Cover Pool Information

Since 31 December 2005, issuers have been required to publish details of their cover pool composition to enhance the transparency of the covered bond market in Germany (§ 28 Covered Bond Act). The reporting dates for these publications are quarterly: 31 March, 30 June, 30 September, and 31 December. The reports are usually published on the issuer's website within six weeks after the reporting date. They contain information on the notional and present value outstanding, the degree of overcollateralization, the maturity profile of outstanding bonds and cover loans, a categorization of mortgage cover

[15] The results, however, are robust to using age (in years) instead.

pool by cover loan size, a breakdown of public cover pool by borrower's place of residence, a breakdown of mortgage cover pool by real property location, and property type financed. We collect these data from the issuers' websites or their investor relations department for the time span from December 2005 to December 2011.

Table 2 presents summary statistics of cover pool information. The results show that cover pools differ considerably between different issuers. For public covered bonds, the cover pool's notional values range between EUR 6 million and EUR 91 billion. For mortgage covered bonds, the range lies between EUR 75 million and EUR 54 billion. On average, approximately two-thirds of the total cover pool consists of public-sector loans.

Most of the covered bonds outstanding and cover pool loans have a maturity of 1 to 5 years, with slight differences between the issuers. For public covered bonds, a large fraction of the pool consists of German cover pool assets. For mortgage covered bonds, about half of the bonds are backed by residential German cover loans. The other half are backed by foreign residential and commercial cover pool assets. However, there is a great variety between issuers, and issuers without any German cover pool assets as well as issuers without any foreign cover pool assets both exist.

We define the following variables to capture the different types of risk within the cover pools. These variables are calculated for every issuer and every quarter:

- Overcollateralization: $OC = \frac{\text{cover pool value – total amount outstanding}}{\text{total amount outstanding}}$
- Term transformation: $TRANS = \text{avg. maturity of pool assets – avg. maturity outstanding}$
- Percentage due oustanding: $PBDUE = \frac{\text{amount of bonds due next year}}{\text{total amount outstanding}}$
- Percentage due cover loans: $CLDUE = \frac{\text{amount of cover loans due next year}}{\text{total amount cover loans}}$
- Percentage of German cover pool assets: $GERM = \frac{\text{amount of German cover pool assets}}{\text{total amount cover pool assets}}$

– Percentage of small cover loans: $SMALL = \frac{\text{amount of cover loans} \leq \text{EUR 300,000}}{\text{total amount cover loans}}$

– Percentage of GIPSI cover pool assets: $GIPSI = \frac{\text{amount of GIPSI cover pool assets}}{\text{total amount cover pool assets}}$

Table 3 displays summary statistics of cover pool explanatory variables. The overcollateralization (OC) can be measured on a notional or present value basis. The median OC amounts to 12 % for public and 22.6 % for mortgage covered bonds on a notional basis and is slightly higher in terms of present value. § 4 of the Covered Bond Act requires OC to be at least 2 % on a present value basis, therefore the minimum is always above this value.[16] Maintaining the OC at a higher level than the minimum level is often required by rating agencies for assigning a specific rating. In particular, this requirement is made for mortgage covered bonds, leading to a higher OC on average. In general, however, a higher amount of OC shows a relatively higher amount of assets to guarantee for the outstanding covered bond payments for both public and mortgage covered bonds. Therefore, we expect the yield spread to be negatively related to OC.

The term transformation ($TRANS$) measures the volume-weighted average maturity of cover pool assets versus the outstanding notional. If $TRANS$ is zero, the average maturities coincide. A higher $TRANS$ signals a shorter average maturity of the outstanding bonds, a smaller one signals a shorter average maturity of the cover pool. On average, $TRANS$ is slightly positive for public bonds and slightly negative for mortgage bonds. However, there may be large maturity mismatches since $TRANS$ ranges between -7.5 and 5.9 years. In general, a maturity mismatch may cause several problems. First, the cover pool and the outstanding bonds may react differently to interest rate changes. Second, a shorter maturity of the outstanding bonds may lead to the requirement of

[16]The extreme maximum values are for the bank WestLB, that had already built a large cover pool when it started to issue the first public-sector covered bond under the new Covered Bond Act, and for SachsenLB, with many cover loans, but hardly any mortgage covered bonds outstanding shortly before it was taken over by LBBW.

refinancing for the issuer. In particular, this is important when markets dry up and refinancing is difficult. Third, a shorter maturity of the cover pool may force the issuer to provide additional cover assets. Therefore, a higher *TRANS* as well as a lower *TRANS* may signal higher risks for the covered bond holder and we expect a positive relation between the yield spread and $|TRANS|$.

The interpretation of the percentage of covered bonds and cover loans due the following year (PB_{DUE} and CL_{DUE}), is similar. A higher PB_{DUE} may signal the need for short-term refinancing, a higher CL_{DUE} the necessity to provide additional cover assets. Hence, we expect both variables to be positively related to the yield spread. Table 3 shows meaningful differences between the issuers. On average, PB_{DUE} and CL_{DUE} amount to 16 % to 21 %, but may also be 0 % or more than 90 %. These variables, however, have to be interpreted with care since maturity mismatches can also be compensated by the use of derivatives or other bank assets and liabilities.

The covered bonds considered are mainly backed by German cover assets with median values of 88 % for public and 96 % for mortgage covered bonds. However, the percentage of German cover assets (*GERM*) varies substantially between 8.5 % and 100 %. This variable can have two opposite effects. On the one hand, *GERM* signals lower diversification and, therefore, higher residual risk, which should lead to a higher risk premium. On the other hand, German public-sector debt is considered relatively safe compared to other European countries, and the German real estate market has been shown to be less volatile and less overvalued than the real estate markets of other countries. Therefore, German cover assets can be regarded as less risky, leading to a lower yield spread.

The variable *SMALL* is available onlysfor mortgage covered bonds. It shows the percentage of mortgage cover loans below EUR 300,000. A higher value of *SMALL* means

that the cover pool is more granular and hence, ceteris paribus, less risky. Therefore, we expect the yield spread to be negatively related to *SMALL*.[17]

Finally, Since the end of 2008, banks have to provide more detailed information on the geographical origin of the cover pool assets. This allows us to calculate the variable $GIPSI$, which measures the fraction of cover pool assets originating from Greece, Italy, Portugal, Spain and Ireland. Particularly during the sovereign crisis period, we expect this variable to be positively related to the yield spread.

Summarizing, the full model including cover pool variables is given by

$$\begin{aligned} y_{i,t} &= \alpha + \beta_1 OC_{i,t} + \beta_2 |TRANS|_{i,t} + \beta_3 PBDUE + \beta_4 CLDUE + \beta_5 GERM \\ &+ \beta_6 SMALL + \beta_7 GIPSI + \beta_8 JumboMortgage_{i,t} + \beta_9 TraditionalPublic_{i,t} \\ &+ \beta_{10} TraditionalMortage_{i,t} + \beta_{11} AA\,BondRating_{i,t} + \beta_{12} NoBondRating_{i,t} \\ &+ +\beta_{13} AA/A\,IssuerRating_{i,t} + \beta_{14} BBB/BB\,IssuerRating_{i,t} + \beta_{15} NoIssuerRating_{i,t} \\ &+ \beta_{16} RelativeAge_{i,t} + \beta_{17} IssueSize_{i,t} + \beta_{18} Landesbank + \varepsilon_{i,t} \end{aligned} \tag{2}$$

IV Empirical Results

IV.1 Preliminary Analysis: Average Yield Spreads

In a preliminary analysis, we first investigate the average weekly yield spreads of the different covered bond market segments relative to *Bunds*. Figure 1 shows the average yield spreads of the four market segments. The vertical lines mark the beginning of the *subprime crisis* period, the *banking crisis* period, and the *sovereign crisis*, respectively.

[17] We do not use information on the type of residential versus commercial mortgage, as these are closely related to *SMALL*. Residential mortgages are typically smaller and commercial mortgages often exceed EUR 5 million. Therefore, it is not surprising that the variables are highly correlated with and prone to multicollinearity problems. Analogously, we do not consider information on the percentage of large loans.

In the *pre-crisis* period until June 2007, the average covered bond spread for all segments relative to Bunds is approximately 10 bp with a maximum of up to 30 bp. Surprisingly, periods with average covered bond spreads below zero also exist, showing that covered bonds sometimes even trade at a small yield discount relative to *Bunds*. This result signals the very high quality of covered bonds usually perceived by investors.

However, with the advent of the *subprime crisis* the picture completely changes. Starting in July 2007, the average yield spreads steadily rise to approximately 50 bp until September 2008. Furthermore, during the *banking crisis* period, spreads drastically increase to approximately 120 bp for jumbo and over 150 bp for traditional covered bonds and decrease in mid 2009 to 50 bp and 100 bp, respectively. One can observe a clear gap between the jumbo and the traditional segments. During the subsequent *sovereign crisis*, spreads start to increase again; however, now traditional mortgage bonds remain at similar levels to their jumbo counterparts and only traditional public bonds trade at a yield premium.

These spreads signal the high risk premia demanded by investors during the recent financial turmoil and suggest that, at least during times of financial crises, covered bonds cannot be regarded as close substitutes for *Bunds*. Moreover, this preliminary analysis also supports the partitioning of our sample into a pre-crisis period and separate periods for the *subprime crisis*, the *banking crisis*, and the *sovereign crisis*.

Comparing the covered bond spreads with respect to *Bunds*, however, does not allow the different risk premia contained in the covered bond market to be disentangled. Hence, it is still uncertain whether the strong increase in yield spreads is mainly driven by liquidity or credit risk. We therefore compute the yield spreads relative to public jumbo covered bonds. This approach enables us to isolate the individual risk premia better by comparing covered bonds that differ in only one dimension. Figure 2 shows the average yield spreads

of the remaining three covered bond segments. Some striking yield differences *within* the covered bond market become visible. Additionally to the yield spreads relative to *Bunds*, this figure shows that the yield spreads relative to public jumbo covered bonds behave differently during the *pre-crisis* period, the *subprime crisis*, the *banking crisis* period, and the *sovereign crisis* period. In the *pre-crisis* period, the three average segment yield spreads mostly vary between -5 bp and 10 bp. Whereas mortgage jumbo covered bonds trade at a relatively stable yield spread of 2 bp on average, traditional covered bond yield spreads are more volatile and trade at a premium of 3–5 bp on average. With the beginning of the *subprime crisis*, the average yield spreads increase to 10 bp for mortgage jumbo covered bonds and 20 bp for traditional covered bonds, rising up to 80 bp during the *banking crisis* period. During the *sovereign crisis*, we can observe that both jumbo and traditional mortgage bonds exhibit a negative spread whereas traditional public bonds continue to trade at a premium of 10–25 bp.

Table 4 shows summary statistics of the individual yield spreads relative to the average public jumbo covered bond yield curve for the total sample and the different sub-periods.[18] At most times, mortgage jumbo covered bonds trade at a small premium and traditional covered bonds at a larger premium relative to public jumbo covered bonds. Hence, covered bonds backed by mortgages seem to be considered more risky than those covered by public-sector loans. However, this picture changes during the *sovereign crisis* (Panel D), where one can observe a negative spread for the mortgage jumbo bonds. Thus, it appears that during this period market participants considered the credit risk of public loans higher than that of mortgage loans.

The lower liquidity of traditional covered bonds is priced with 4–6 bp on average

[18]We present statistics for quarterly data at this point as these are used in the subsequent analysis. The summary statistics for weekly data are very similar, and are therefore not reported to save space.

relative to jumbo covered bonds before the crisis. During the crisis sub-periods the average yield spreads significantly increase up to 44 bp for public traditional covered bonds. The effect on the liquidity premia for traditional covered bonds is the largest, but a substantial variation of the credit risk premium for mortgage jumbo covered bonds can also be observed.

Within a specific covered bond segment, however, the yield spreads also vary considerably. During the *pre-crisis* and the *subprime crisis* period, traditional covered bond spreads are much more volatile, with an increasing volatility during the latter period. In the *banking crisis* period and the *sovereign crisis* period, yield spreads fluctuate significantlywithin all covered bonds segments. Even for public jumbo covered bonds the yield spreads vary between -52 bp and 189 bp. This observation shows that it is not sufficient to partition the covered bonds market into the four segments to entirely explain the yield spreads. Further risk factors should be considered. The results clearly show that the covered bonds market cannot be regarded as homogenous, and considerable differences between the covered bond segments as well as between individual covered bonds exist. In the following, we explore the yield spreads in the covered bond market in detail.

IV.2 Analysis of Covered Bond Spreads

We aim to assign the different components of the yield spreads to the explanatory variables introduced in Section III.2 and run pooled regressions. Panel A of Table 5 displays eight regression results for the *pre-crisis* period, which all comprise segment dummies and differ by the inclusion of covered bond rating dummies (Regression B) and issuer rating dummies (Regression C). Regressions D to G further include the bond's relative age and outstanding amount as liquidity proxies as well as a dummy variable for bonds of state banks. Regression H repeats Regression G including time-fixed effects as a robustness

check.

The results show a positive and mostly significant relationship between the yield spreads and the dummies for mortgage and traditional covered bonds. Depending on the inclusion of further explanatory variables, the average credit risk premium for mortgage covered bonds relative to public covered bonds amounts to 1 bp and the average liquidity premium for traditional covered bonds relative to jumbo covered bonds is up to 3 bp. The joint dummy variable approximately equals the sum of the credit risk and the liquidity premium. Altogether, these segment variables already explain some part of the variation in the yield spreads.

As expected, the covered bond rating has a significant influence on the yield spread, and a higher rating leads to a lower spread. The differences are around 2 bp between AA- and AAA-rated bonds. This result provides evidence that investors already value the bond's credit risk during the *pre-crisis* period, when covered bonds are typically considered to be close substitutes to *Bunds*. Surprisingly, the absence of a bond rating does not lead to a higher yield spread. This result, however, may be driven by the fact that the market did not necessarily demand a rating for covered bonds at the beginning of our sample period and, thus, a rating does not signal a higher credit quality per se. The issuer rating is mostly insignificant and the increase in the adjusted R^2 is smaller than observed for the bond ratings. Only the absence of an issuer rating increases the yield spread significantly.

The results also show a significant and positive relation between the yield differences and the liquidity proxies. Besides the premium for traditional covered bonds, a higher relative age and a lower outstanding amount (both signaling a lower liquidity) lead to a significantly higher yield spread. In particular, a covered bond close to maturity on average trades at an additional yield spread of around 7 bp relative to its issuance. Hence,

liquidity seems to be an important priced risk factor even during the *pre-crisis* period.

Overall, the full model (Regression G) explains roughly 19 % of the yield spread variation within the covered bond market. When including time-fixed effects (Regression H), the adjusted R^2 increases to 22 %.

The results for the *subprime crisis* presented in Panel B of Table 5 are similar in terms of sign and significance, but more pronounced. The yield spreads between the segments are higher in absolute terms and the adjusted R^2 for the full model increased to 37.3 % (43.5 % with time-fixed effects). It is important to note that the credit risk premium between mortgage and public covered bonds only increases to 3–5 bp whereas the liquidity premium between traditional and jumbo covered bonds increases considerably to 9–14 bp. In contrast to the results in Panel A, the joint effect is smaller than the sum of the credit risk and the liquidity premium, suggesting a negative correlation between liquidity and credit risk.[19] However, a formal test of this hypothesis did not provide a significant result.

The bond rating variables are insignificant (in the full model), whereas the issuer ratings have negative coefficients, which is counter-intuitive but may indicate that the market did not rely on rating information during the *subprime crisis*. In contrast, the bond's relative age and its outstanding amount have a significant impact similar to the *pre-crisis* period, but larger in absolute values. This result, in conjunction with the higher yield spreads for traditional covered bonds, provides evidence of a considerably higher liquidity premium during the *subprime crisis*. Covered bonds issued by state banks are no longer penalized with a significant yield spread.

The results for the *banking crisis* period are shown in Panel C of Table 5. A large part of the yield spread variation, 26 %, is again explained by the covered bond segments.

[19]This result complements the findings of Favero et al. (2010) for European sovereign bonds and Bühler and Trapp (2010) for high-quality AAA rated corporate bonds that, in contrast to the findings for sub-investment grade bonds, liquidity and credit risk interact negatively in high-quality bond markets.

The remaining part can be explained by the issuer rating dummies, the liquidity proxies and firm-specific effects, leading to an adjusted R^2 of up to 32 % for the full model (34 % with time-fixed effects), which is lower than in Panel B. Moreover, the size of many coefficients, especially the segment dummies, are of much greater size, most notably between traditional and jumbo covered bonds. The average yield spread between these segments is up to 38 bp. The rating variables contribute only very little to explaining the variation of the covered bond yield spreads.

Besides the striking yield difference between traditional and jumbo covered bonds, relative age also has a strong impact of more than 30 bp between recently issued and almost matured covered bonds, which is three times higher than in the previous period. Hence, liquidity seems to be another important factor considered by covered bond investors.

In contrast to the previous results, bonds issued by state banks trade at a yield discount of around 12 bp compared to other covered bonds. This result may indicate that, against the background of the *banking crisis,* a potential governmental rescue is perceived more likely for state banks than for private banks.

Panel D displays the results during the *sovereign crisis* period. Notably, the adjusted R^2 decreases to 18–19 % for the full model. Most interestingly, mortgage bonds now trade at a significant price premium (yield discount) to public bonds. This indicates that the market's perception of the credit risk in mortgage versus public bonds has considerably shifted. Whereas covered bonds backed by public loans were considered less risky at the beginning of our sample period, the *sovereign crisis* increased market participants' awareness of the possibility of public defaults.

In summary, our results show that the covered bond market exhibits considerable heterogeneity, and the risks perceived by investors vary strongly over time. The four

covered bond segments account for a large part of the yield spreads whereas the issuer and bond ratings do not play an important role. Individual bond liquidity is also always an important factor.

IV.3 Detailed Analysis Using Cover Pool Data

Up to this point, we only approximate the cover pool quality by the distinction between mortgage and public-sector cover loans and the covered bond rating. In the following, we explicitly consider the variables related to the quality of the cover pool described in Section III.3.

In a first step, we use the model including the covered bond segments, the issuer rating, and the liquidity proxies as the basic model when measuring the impact of the cover pool variables. That is, we refrain from using the bond rating dummies since we aim to measure the quality of the cover pool directly by using the cover pool variables, defined above. As such, our analysis will also show how well the rating agencies capture the credit risk of individual bonds. As a second analysis, we then include the bond rating dummies in addition to the cover pool variables in order to investigate whether the bond rating adds any additional information.[20]

Table 6 displays the regression results for the *pre-crisis* period (Panel A), the *subprime crisis* (Panel B), the *banking crisis* (Panel C), and the *sovereign crisis* (Panel D). Regression A shows the basic model. Regressions B to G include the six cover pool variables separately (as *SMALL* is only available for mortgage covered bonds, Regression G is based only on this sub-set). Regression H provides the coefficient estimates for the cover pool variables only, whereas Regression I includes the variable *SMALL* but therefore uses only the mortgage bonds in the sample. Regression J is the full model excluding bond

[20]We thank an anonymous referee for suggesting this.

rating information, which is included in Regression K. Regression L repeats regression K for mortgage bonds only, including the variable *SMALL*. Finally, Regression M is identical to the full model K, but includes time-fixed effects as a robustness check.

We first focus our discussion on the full model specification without bond ratings, i.e., Regression J. During the *pre-crisis* period, the impact of all cover pool variables except that of $|TRANS|$ is significant. As expected, a higher OC leads to a lower yield spread. The impact, however, is of moderate economic size given that an OC of 100 % may decrease the yield spread by only 0.89 bp. The variables $PBDUE$ and $CLDUE$ have, as expected, a positive yield impact. A higher fraction of German cover assets leads to a higher yield spread. Thus, covered bond investors seem to price the lower regional diversification within the cover pools. Finally, covered bonds with a more granular portfolio trade at a significant yield discount, signaling the higher value of covered bonds with a diversified underlying cover pool.

However, considering the cover pool variables alone (Regressions H and I), the adjusted R^2 amounts to 1.2 % and 4.6 %, signaling that only a small part of the yield spreads can be explained by the cover pool variables. The explanatory power of the full model is with 18.1 % smaller than the model excluding cover pool variables but including bond rating information, which is 19.2 % (see Table 5, Panel A, Regression G). Both sets of information combined (Regression K), increase the adjusted R^2 further to 20 %.

It is important to note that the sign and significance of the basic model variables do not change when including the cover pool variables. Comparing these results to Panel A of Table 5, we provide evidence that, during the *pre-crisis* period, the covered bond yield spreads are mainly driven by the differences between the four covered bond market segments and their relative liquidity. The additional impact of the quality of the cover pool and the issuer rating is of minor importance.

The results change slightly during the period of the *subprime crisis*. Whereas the four covered bond segments and the liquidity proxies already explain 37.5 % of the variation in the yield spreads, the full model now improves the adjusted R^2 by 1.8 % to 39.3 %. Most interestingly, in contrast to the *pre-crisis* period, the cover pool variables are now able to explain a greater fraction of the variation in yield spreads than the bond ratings, which can be seen from comparing the adjusted R^2 of the full model (Regression J) with the model excluding the cover pool variables but including bond ratings (Table 5, Panel B, Regression G), i.e. 39.3 % vs. 37.3 %. The inclusion of both information sets only increases the R^2 to 39.4 % (Regression K) which provides evidence that, during times of crisis, covered bond investors rely more on cover pool information than on bond ratings.

The impact of the individual cover pool variables is similar to the *pre-crisis* period. The fraction of German cover pool assets, $GERM$, has a significant negative impact. This result suggests that investors prefer the high quality and lower volatility of German cover assets to international diversification of the cover pool during times of financial turmoil. Moreover, a more granular cover pool as measured with $SMALL$ and, equivalently, a higher fraction of residential mortgages has a negative impact on the yield spread. Thus, covered bond investors prefer cover pools that are less volatile and less dependent on contemporaneous economic conditions.

The observed trend continues when investigating the *banking crisis* period. Panel C of Table 6 provides evidence that investors evaluate the cover pool quality in detail. The adjusted R^2 substantially increases with the inclusion of the cover pool variables (32.0 % vs. 36.3 %). Again, the bond rating variables add almost no additional explanatory power.

It is noteworthy that the overcollateralization (OC) does not have a significant impact during the *banking crisis* period. Moreover, the impact is economically very small

in the *pre-crisis* and *subprime* periods. Hence, investors do not seem to take the amount of *OC* into account when pricing covered bonds. On the one hand, this result may show that the legal requirement of a minimal *OC* is sufficient and any additional *OC* does not have any impact. On the other hand, *OC* may be regarded as less relevant, since the number may frequently change by the issuance of new covered bonds. Overall, our results show that the general composition of the cover pool is more important than simply the amount of overcollateralization.

The coefficient of *GERM* has now increased by a factor of four, enhancing the fact that investors are more concerned with local default risk than with diversification benefits. This finding is further supported by the results provided by Regression K(GIPSI), which is identical to Regression K but includes the fraction of *GIPSI* loans in the cover pool instead of the fraction of German loans.[21] For every percentage point increase of cover loans in *GIPSI* countries, the covered bond spread increases by 69 bp.[22]

This effect is even further enhanced in the *sovereign crisis* period (Panel D). The coefficient of the *GIPSI* variable almost doubles to 1.22 bp. The explanatory power of the cover pool variables is strong, as can be seen by comparing the R^2 of Regression J (25.2 %) with that of Regression G in Table 5, Panel D (17.5 %). The marginal increase provided by the bond rating variables is, again, small.

Altogether, the results provide strong evidence that despite the strong legal requirements, the characteristics of the cover pool have a significant impact on the prices of covered bonds. This is especially true for the composition of the cover pool, and less for its overall size (overcollateralization). Whereas investors do consider the quality of the cover pool assets less during normal market periods, they rely heavily on them during

[21] The variable *GIPSI* is available only from December 2008 onwards, and is thus not included in Panel A and B.

[22] We do not include both variables simultaneously, due to the high correlation between them.

times of economic distress.

V Summary and Conclusion

In this paper we investigate the existence of credit risk premia in covered bond markets. In contrast to previous studies, we find that liquidity is not the exclusive driver of yield spreads between German covered bonds and government bonds but that the quality of the cover pool assets is also of high relevance. Therefore, our results show that the presumption of a homogenous German covered bond market cannot be sustained.

In general, the impact of the cover pool quality is relatively small during normal market conditions. Hence, our results provide evidence that the strict regulation of German covered bonds ensures the overall high quality of the cover pool. During the recent times of economic distress, however, risk factors such as the term transformation between covered bonds and their cover pool, the fraction of German cover assets, and the fraction of *GIPSI* cover assets show a significant impact on the yield spreads. Therefore, the mandatory publications according to the Covered Bond Act seem to be less important during normal market times, but provide additional value in times of financial turmoil. Morris and Shin (2012) show that the existence of common knowledge can prevent the collapse of market liquidity when new information is introduced into the market. As such, the requirement to publish cover pool data may help to create a "level playing field" for investors with varying degrees of information.

Altogether, we have found that differences in credit risk have a significant impact on the valuation of covered bonds. The understanding of the different risk premia within the covered bond market is important for investors, issuers, and regulators. Investors are mainly interested in accurately knowing about the risks inherent in the covered bond

market during different market environments. Issuers need to know the perceived risk factors priced by investors to design an optimal covered bond issuance. As the covered bond market is of systemic importance for the European banking system, regulators are concerned about the issuers' long-term ability to meet their obligations. Moreover, it is important for regulators from other countries to be informed about the main risk factors when setting up a legal framework for covered bonds.

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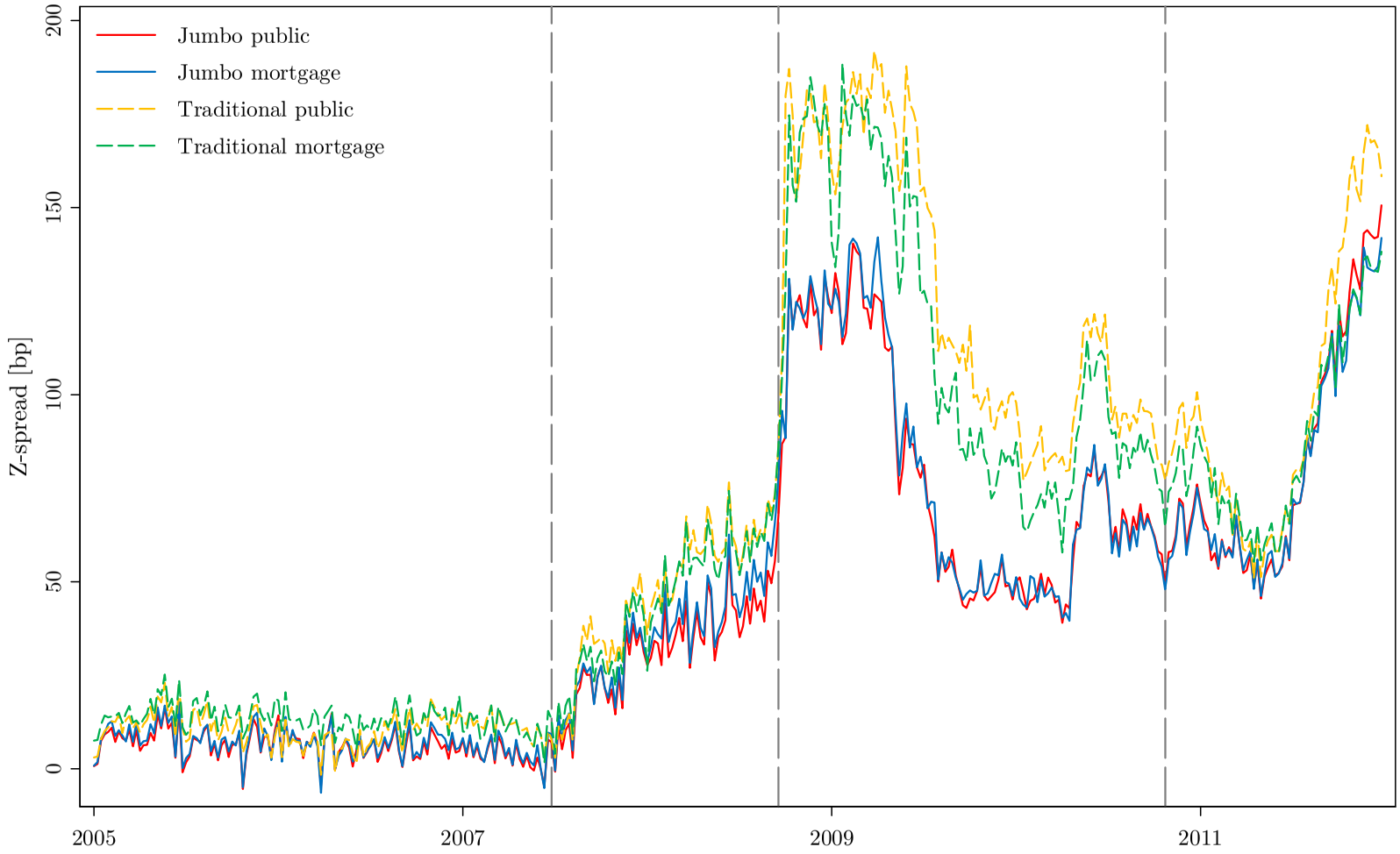

Figure 1: Yield Spreads Relative to German Bunds

This figure shows the average yield spreads of the four covered bond segments relative to the term structure of German *Bunds* in basis points. The average yield spreads are calculated on a weekly basis for the time period from January 2006 until December 2011.

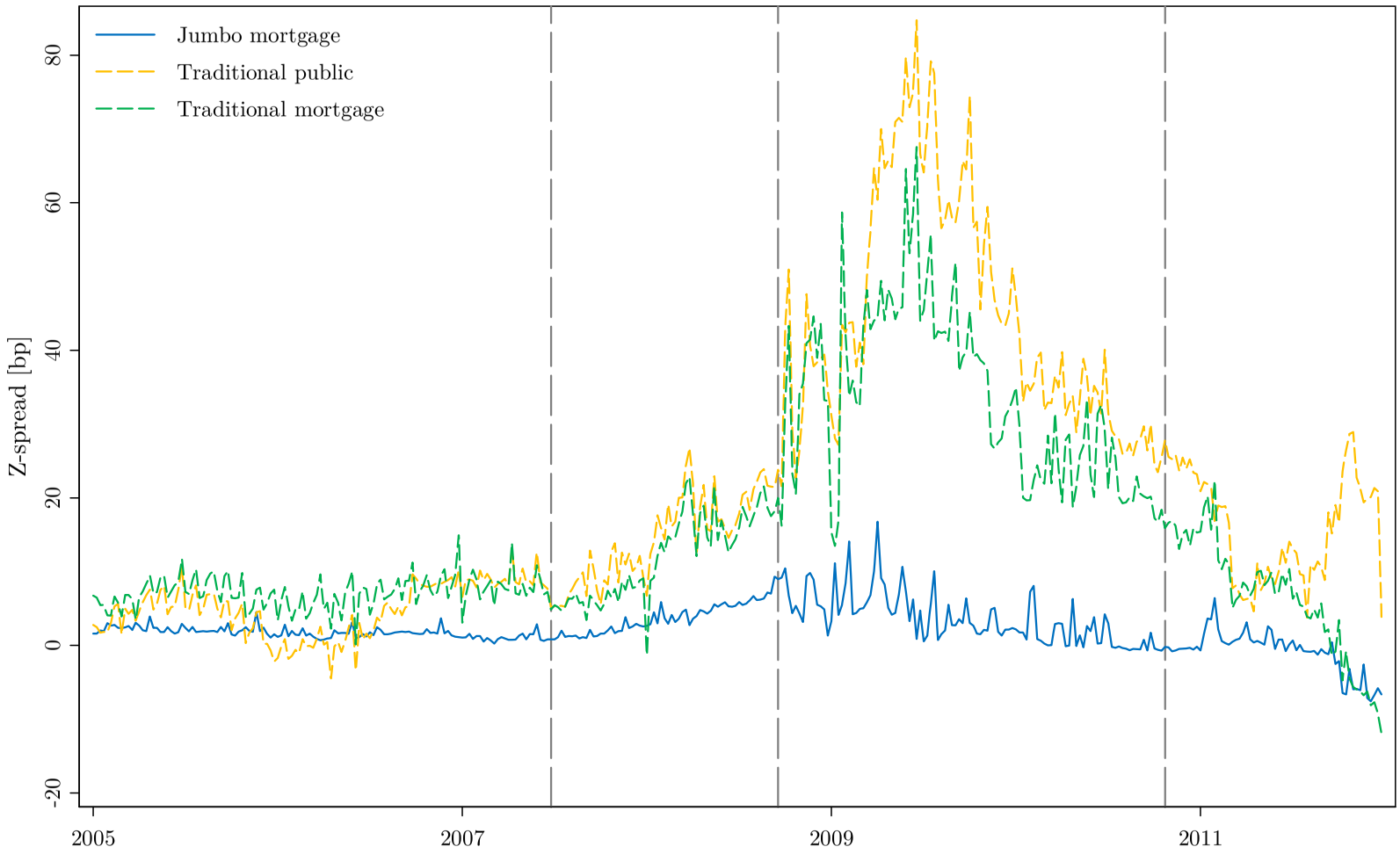

Figure 2: Yield Spreads Relative to Public Jumbo Covered Bonds

This figure shows the average yield spreads of three covered bond segments relative to the term structure of public jumbo covered bonds in basis points. The average yield spreads are calculated on a weekly basis for the time period from January 2006 until December 2011.

Table 1: Summary Information of the Data Set

This table shows summary information of the covered bonds considered in our study. Panel A breaks down the statistics by the market segment, Panel B by the average long-term issuer credit rating of Fitch, Moody's, and Standard & Poor's. A single issue is unambiguously assigned to a market segment and may be allocated repeatedly for a specific issuer rating due to rating changes. The data on the outstanding amount are averaged across the different issues from the same segment, the data on the time to maturity across the different issues from the same segment and across time. The number of quarterly observations is the number of bond prices of the respective issues during the four subperiods and the whole sample period from January 2006 to December 2011. The four sub-periods range from January 2006 to June 2007 (pre-crisis), from July 2007 to September 2008 (subprime crisis), from October 2008 to June 2010 (banking crisis), and from July 2010 to December 2011 (sovereign crisis).

Panel A: Market Segment

Market Segment	# Issues with price availability	Outstanding amount (EUR million)	Time-to-maturity (years) pre-crisis	subprime crisis	banking crisis	sovereign crisis	# Observations pre-crisis	subprime crisis	banking crisis	sovereign crisis	all
Public jumbo	223	1,525	3.39	3.22	3.09	3.02	835	621	726	419	2,601
Mortgage jumbo	77	1,610	4.33	3.63	3.47	3.39	256	208	320	226	1,010
Public traditional	657	220	2.52	1.95	1.74	2.14	817	785	609	199	2,410
Mortgage traditional	267	205	2.55	2.60	2.22	2.96	401	250	260	200	1,111
Overall	1,224	891	3.04	2.65	2.61	2.92	2,309	1,864	1,915	1,044	7,132

Panel B: Issuer Rating

Issuer Rating	# Issues with price availability Public Jumbo	Mortgage Jumbo	Public Traditional	Mortgage Traditional	all	# Observations pre-crisis	subprime crisis	banking crisis	sovereign crisis	all
AAA	0	0	4	0	4	4	0	0	0	4
AA	58	9	338	44	449	469	514	333	174	1,490
A	202	73	360	209	844	1,618	1,267	1,501	783	5,169
BBB	25	5	28	22	80	180	40	22	34	276
BB	5	2	4	5	16	34	21	29	30	114
No Rating	1	0	5	3	9	4	22	30	23	79

Table 2: Summary Statistics of Cover Pool Information

This table reports the summary statistics of the cover pool information according to § 28 Covered Bond Act. Panel A shows the data for public covered bonds, Panel B for mortgage covered bonds. The numbers are calculated from quarterly observations for 40 issuers given in EUR million. The total sample consists of quarterly observations from December 2005 to December 2011 (with the exception of the GIPSI variable, which is available only from December 2008 onwards). The overall statistics are based on the average aggregate number for all issuers published by the Association of German Covered Bond Banks over the sample period.

Panel A: Public Covered Bonds

Variable	Mean	Std. Dev.	Min.	25% Perc.	Median	75% Perc.	Max.	Overall
Notional value cover pool	21,225	22,682	6	3,175	12,212	31,231	91,383	760,721
Notional value outstanding	18,748	20,319	5	2,657	10,904	28,143	87,781	671,912
Present value cover pool	22,379	23,981	6	3,286	12,675	33,616	97,382	802,058
Present value outstanding	19,550	21,179	5	2,738	11,359	29,814	88,902	700,658
Cover loans with maturity up to 1 year	4,975	6,838	0	521	2,393	5,490	37,377	170,149
Cover loans with maturity $>$ 1 year up to 5 years	8,542	9,573	0	1,388	5,311	11,855	40,150	295,227
Cover loans with maturity $>$ 5 years up to 10 years	5,230	5,980	0	982	3,265	7,084	34,105	186,829
Cover loans with maturity $>$ 10 years	3,146	4,015	0	334	1,484	4,292	17,818	108,460
Covered bonds outstanding with maturity up to 1 year	3,912	4,808	0	511	2,244	4,846	24,046	134,738
Covered bonds outstanding with maturity $>$ 1 year up to 5 years	9,202	10,727	0	1,239	5,529	12,530	45,866	323,554
Covered bonds outstanding with maturity $>$ 5 years up to 10 years	3,556	3,799	0	619	2,092	5,699	24,220	124,018
Covered bonds outstanding with maturity $>$ 10 years	2,679	3,289	0	319	1,545	3,229	13,347	89,577
German cover pool assets	16,725	18,955	6	2,757	10,406	22,249	87,158	599,429
Foreign cover pool assets	4,232	7,001	0	275	1,375	4,588	32,882	151,669
GIPSI cover pool assets	1,775	3,151	0	50	394	1,964	15,388	33,445

Table 2 continued.

Panel B: Mortgage Covered Bonds

Variable	Mean	Std. Dev.	Min.	25% Perc.	Median	75% Perc.	Max.	Overall
Notional value cover pool	9,161	12,193	75	1,610	5,302	10,021	54,237	310,727
Notional value outstanding	7,491	10,522	3	873	4,225	8,242	48,165	254,089
Present value cover pool	9,704	12,920	76	1,675	5,643	10,629	58,110	329,160
Present value outstanding	7,816	11,034	3	920	4,367	8,413	51,496	265,128
Cover loans with maturity up to 1 year	2,479	4,787	0	232	819	2,051	27,942	83,798
Cover loans with maturity $>$ 1 year up to 5 years	3,873	5,223	7	535	2,055	4,589	28,096	131,371
Cover loans with maturity $>$ 5 years up to 10 years	2,339	2,506	25	470	1,714	3,166	12,624	79,328
Cover loans with maturity $>$ 10 years	478	570	0	48	216	741	2,370	16,200
Covered bonds outstanding with maturity up to 1 year	1,423	2,154	0	118	556	1,487	12,670	45,303
Covered bonds outstanding with maturity $>$ 1 year up to 5 years	3,922	5,720	0	440	2,132	4,412	31,109	132,555
Covered bonds outstanding with maturity $>$ 5 years up to 10 years	1,754	2,548	0	245	1,009	2,034	16,585	59,492
Covered bonds outstanding with maturity $>$ 10 years	557	740	0	29	220	738	3,021	16,742
Cover loan amount up to EUR 300,000	3,081	5,273	0	143	825	3,441	32,584	103,643
Cover loan amount $>$ EUR 300,000 up to EUR 5 mn	1,881	2,615	0	230	1,052	2,095	14,055	63,287
Cover loan amount $>$ EUR 5 mn	3,710	5,794	0	232	1,626	4,171	28,983	125,830
German cover pool assets (residential)	4,332	6,469	0	503	2,037	4,925	39,147	146,954
German cover pool assets (commercial)	90	246	0	0	0	44	2,391	3,054
Foreign cover pool assets (residential)	2,654	3,560	0	397	1,208	3,608	15,360	90,037
Foreign cover pool assets (commercial)	1,510	3,151	0	0	65	1,172	15,597	51,235
GIPSI cover pool assets	415	1,259	0	0	0	55	5,774	7,893

Table 3: Summary Statistics of Cover Pool Explanatory Variables

This table reports the summary statistics of the cover pool explanatory variables. Panel A shows the data for public covered bonds, Panel B for mortgage covered bonds. The numbers are calculated from quarterly observations for 40 issuers over the sample period December 2005 to December 2011 (with the exception of the GIPSI variable, which is available only from December 2008 onwards).

Panel A: Public Covered Bonds

Variable	Mean	Std. Dev.	Minimum	25%	Median	75%	Maximum
Overcollateralization (notional)	0.2569	0.5549	0.0112	0.0651	0.1195	0.2422	8.3325
Overcollateralization (present value)	0.2905	0.7730	0.0268	0.0853	0.1324	0.2447	14.2728
Average term transformation (years)	0.1563	1.3373	-7.5000	-0.3184	0.3608	0.9419	3.4298
Percentage of bonds due the following year	0.1844	0.1154	0.0000	0.1188	0.1823	0.2422	0.9374
Percentage of cover loans due the following year	0.1969	0.1272	0.0000	0.1088	0.1628	0.2520	0.8317
Percentage German cover pool assets	0.8362	0.1555	0.2831	0.7598	0.8788	0.9624	1.0000
Percentage GIPSI cover pool assets	0.0602	0.0718	0.0000	0.0087	0.0323	0.0811	0.3149

Panel B: Mortgage Covered Bonds

Variable	Mean	Std. Dev.	Minimum	25%	Median	75%	Maximum
Overcollateralization (notional)	1.0142	4.3406	0.0230	0.1308	0.2259	0.5851	61.4231
Overcollateralization (present value)	1.0321	4.0445	0.0406	0.1544	0.2499	0.6551	56.4231
Average term transformation (years)	-0.1189	1.7368	-6.1306	-1.2450	-0.1118	1.1008	5.9299
Percentage of bonds due the following year	0.1626	0.1106	0.0000	0.0882	0.1549	0.2177	0.8216
Percentage of cover loans due the following year	0.2076	0.1415	0.0000	0.1119	0.1629	0.2594	0.7331
Percentage German cover pool assets	0.8606	0.2080	0.0849	0.7739	0.9683	1.0000	1.0000
Percentage GIPSI cover pool assets	0.0166	0.0410	0.0000	0.0000	0.0000	0.0046	0.2153
Percentage of small cover loans	0.3226	0.2979	0.0000	0.0333	0.2834	0.5430	0.9988
Percentage of large cover loans	0.4331	0.2975	0.0000	0.1452	0.4164	0.6963	1.0000
Percentage of residential cover loans	0.4867	0.2821	0.0000	0.2443	0.4478	0.7327	1.0000
Percentage of commercial cover loans	0.5133	0.2821	0.0000	0.2673	0.5522	0.7557	1.0000

Table 4: Descriptive Statistics for Yield Spreads

This table shows the summary statistics for the covered bond yield spreads relative to the term structure of public jumbo covered bonds in basis points. The statistics are based on the equally weighted yield spread observations in the respective covered bond segment and time period (winsorized at the 0.5th and 99.5th percentiles). N is the number of quarterly observations. The sample period is partitioned into the pre-crisis period (January 2006 to June 2007, Panel A), the period of the subprime crisis (July 2007 to September 2008, Panel B), the banking crisis period (September 2008 to June 2010, Panel C), and the sovereign debt crisis (July 2010 to December 2011, Panel D). The full sample (January 2006 to December 2011) is presented in Panel E.

Panel A: Pre-Crisis Period

Segment	Mean	Std. Dev.	Min.	Median	Max.	% > 0	N
Public Jumbo Covered Bonds	0.4	4.1	-9.7	0.0	22.8	49.5%	835
Mortgage Jumbo Covered Bonds	1.2	3.4	-5.1	0.7	22.7	61.3%	256
Public Traditional Covered Bonds	3.6	9.5	-21.6	4.9	23.2	69.9%	817
Mortgage Traditional Covered Bonds	5.7	8.8	-19.3	6.7	23.2	73.8%	401

Panel B: Subprime Crisis

Segment	Mean	Std. Dev.	Min.	Median	Max.	% > 0	N
Public Jumbo Covered Bonds	0.3	4.3	-14.2	0.2	24.6	51.7%	621
Mortgage Jumbo Covered Bonds	3.3	5.0	-6.5	2.4	27.0	74.5%	208
Public Traditional Covered Bonds	14.3	12.8	-34.2	14.4	46.2	89.8%	785
Mortgage Traditional Covered Bonds	11.6	13.7	-34.2	11.8	46.2	86.8%	250

Panel C: Banking Crisis

Segment	Mean	Std. Dev.	Min.	Median	Max.	% > 0	N
Public Jumbo Covered Bonds	0.3	30.3	-52.0	-7.8	189.3	28.9%	726
Mortgage Jumbo Covered Bonds	2.8	26.8	-31.9	-4.2	165.2	35.0%	320
Public Traditional Covered Bonds	44.0	39.6	-52.0	42.7	189.3	87.0%	609
Mortgage Traditional Covered Bonds	30.4	32.2	-31.4	25.3	164.0	85.5%	260

Panel D: Sovereign Debt Crisis

Segment	Mean	Std. Dev.	Min.	Median	Max.	% > 0	N
Public Jumbo Covered Bonds	0.2	25.8	-38.5	-7.1	133.0	40.6%	419
Mortgage Jumbo Covered Bonds	-3.1	16.0	-37.0	-5.6	35.4	40.3%	226
Public Traditional Covered Bonds	16.4	28.4	-37.3	11.3	132.6	72.4%	199
Mortgage Traditional Covered Bonds	5.7	18.8	-38.5	5.9	85.4	62.5%	200

Panel E: Total Sample

Segment	Mean	Std. Dev.	Min.	Median	Max.	% > 0	N
Public Jumbo Covered Bonds	0.3	19.3	-52.0	-0.8	189.3	42.8%	2,601
Mortgage Jumbo Covered Bonds	1.2	17.3	-37.0	0.2	165.2	51.0%	1,010
Public Traditional Covered Bonds	18.3	28.1	-52.0	11.0	189.3	80.9%	2,410
Mortgage Traditional Covered Bonds	12.8	21.8	-38.5	9.9	164.0	77.5%	1,111

Table 5: Determinants of Covered Bonds Yield Spreads

This table reports the estimated coefficients (in bold) and the p-values from the regression of the covered bond yield spreads. The yield spreads are calculated in basis points and winsorized at the 0.5th and 99.5th percentile. The outstanding amount is denoted in EUR billion and the age is given relative to initial maturity. The dummy variables are relative to AAA-rated public jumbo covered bonds issued by AAA-issuers. The p-values are shown below the coefficient estimates and based on standard errors obtained by using the HAC-adjustments of **?** for panel data. *** (**,*) denotes significance at the 1 % (5 %, 10 %) level. N is the number of quarterly observations. The sample consists of observations from January 2006 to June 2007 (Panel A), from July 2007 to September 2008 (Panel B), from September 2008 to June 2010 (Panel C), and from July 2010 to December 2011 (Panel D).

Panel A: Pre-Crisis Period

Regression	A	B	C	D	E	F	G	H
Constant	**0.35*** ** 0.0000	**0.35** ** 0.0260	**-0.08** 0.9730	**-1.79** ** 0.0229	**-1.28** 0.1331	**-2.69** 0.1725	**0.54** 0.5430	**0.39** 0.6943
Jumbo Mortgage	**0.88*** ** 0.0005	**-0.43** 0.3810	**1.03*** ** 0.0003	**2.16*** ** 0.0005	**0.95** ** 0.0187	**2.30*** ** 0.0002	**1.29*** ** 0.0072	**1.00** ** 0.0271
Traditional Public	**3.21** 0.2239	**3.78** 0.1438	**3.31** 0.2144	**1.61** 0.3835	**1.86** 0.2922	**1.97** 0.2983	**2.19** 0.2384	**2.54** 0.2102
Traditional Mortgage	**5.37*** ** 0.0002	**4.33*** ** 0.0075	**5.44*** ** 0.0002	**3.72*** ** 0.0008	**2.60** ** 0.0216	**4.16*** ** 0.0004	**3.16** ** 0.0129	**3.70** ** 0.0157
AA Bond Rating		**2.14** ** 0.0470			**1.89** ** 0.0404		**1.53** * 0.0927	**1.65** * 0.0757
No Bond Rating		**-3.55*** ** 0.0059			**-2.83*** ** 0.0096		**-3.13** ** 0.0130	**-2.76** ** 0.0121
AA/A Issuer Rating			**0.07** 0.9769			**0.24** 0.9142	**-2.36** 0.1511	**-3.59*** ** 0.0044
BBB/BB Issuer Rating			**3.14** 0.2698			**2.96** 0.3018	**0.075** 0.9708	**-0.62** 0.6924
No Issuer Rating			**8.04*** ** 0.0001			**9.43*** ** 0.0013	**9.78*** ** 0.0008	**7.15*** ** 0.0000
Relative Age				**7.46*** ** 0.0016	**6.86*** ** 0.0017	**7.26*** ** 0.0011	**6.72*** ** 0.0012	**6.03*** ** 0.0029
Issue Size				**-1.34*** ** 0.0000	**-1.47*** ** 0.0000	**-1.11*** ** 0.0000	**-1.27*** ** 0.0000	**-1.22*** ** 0.0000
Landesbank				**1.75*** ** 0.0032	**1.69*** ** 0.0015	**2.01*** ** 0.0024	**1.85*** ** 0.0013	**1.47*** ** 0.0008
N	2,309	2,309	2,309	2,309	2,309	2,309	2,309	2,309
Adjusted R^2	7.0%	10.1%	8.5%	16.0%	18.1%	17.2%	19.2%	22.3%

Table 5 continued.

Panel B: Subprime Crisis

Regression	A	B	C	D	E	F	G	H
Constant	**0.30***** 0.0000	**0.52***** 0.0041	**5,37***** 0.0056	**-2.95**** 0.0205	**-2.67**** 0.0144	**1.30*** 0.0863	**1.71**** 0.0199	**-2.45** 0.1214
Jumbo Mortgage	**3.01**** 0.0374	**3.46***** 0.0039	**3.64**** 0.0129	**4.52***** 0.0066	**4.70***** 0.0013	**4.44***** 0.0054	**4.12***** 0.0018	**3.52***** 0.0057
Traditional Public	**13.96***** 0.0062	**14.10***** 0.0060	**12.20**** 0.0155	**9.15**** 0.0139	**9.17**** 0.0139	**8.82**** 0.0164	**8.88**** 0.0166	**8.53**** 0.0224
Traditional Mortgage	**11.28**** 0.0199	**11.54**** 0.0134	**11.13**** 0.0220	**8.04**** 0.0146	**8.08**** 0.0117	**8.11**** 0.0134	**7.89**** 0.0146	**7.27**** 0.0272
AA Bond Rating		**-1.01** 0.4085			**-0.46** 0.6227		**-0.54** 0.6230	**1.49*** 0.0762
No Bond Rating		**-2.70**** 0.0236			**-0.97** 0.2907		**-1.70** 0.1728	**-1.78** 0.1670
A Issuer Rating			**-6.24***** 0.0058			**-4.58***** 0.0025	**-4.70***** 0.0031	**-4.87***** 0.0017
BBB/BB Issuer Rating			**-2.89**** 0.0273			**-2.11**** 0.0169	**-2.19**** 0.0147	**-1.08**** 0.0310
No Issuer Rating			**-4.18**** 0.0363			**-0.33** 0.8572	**1.08** 0.6934	**1.37** 0.6084
Relative Age				**10.90***** 0.0004	**10.76***** 0.0005	**10.32***** 0.0005	**10.18***** 0.0006	**9.71***** 0.0012
Issue Size				**-2.10**** 0.0217	**-2.15**** 0.0157	**-1.87**** 0.0406	**-1.94**** 0.0267	**-1.63**** 0.0422
Landesbank				**3.39*** 0.0766	**3.28*** 0.0719	**1.15** 0.4036	**0.94** 0.4763	**1.19** 0.3618
N	1,864	1,864	1,864	1,864	1,864	1,864	1,864	1,864
Adjusted R^2	28.0%	28.4%	32.7%	35.4%	35.4%	37.2%	37.3%	43.5%

Table 5 continued.

Panel C: Banking Crisis

Regression	A	B	C	D	E	F	G	H
Constant	**0.29****	**0.64**	**-5.12**	**-10.87****	**-9.39****	**-11.41****	**-8.91***	**-7.32**
	0.0202	0.1295	0.1549	0.0204	0.0359	0.0200	0.0523	0.1869
Jumbo Mortgage	**2.51***	**-3.03***	**2.05***	**1.24***	**-3.58***	**0.92**	**-3.75**	**-3.97**
	0.0769	0.0961	0.0796	0.0879	0.0939	0.1850	0.1073	0.1093
Traditional Public	**43.67*****	**43.73*****	**45.29*****	**37.40*****	**38.17*****	**38.03*****	**38.42*****	**38.48*****
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001
Traditional Mortgage	**30.08*****	**28.48*****	**30.85*****	**24.55*****	**23.46*****	**25.00*****	**23.63*****	**24.64*****
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
AA Bond Rating		**12.71****			**10.43***		**10.26***	**10.47***
		0.0455			0.0785		0.0965	0.0853
No Bond Rating		**-6.51***			**-5.02****		**-4.29**	**-4.00**
		0.0501			0.0489		0.1598	0.1661
A Issuer Rating			**6.23**			**0.93**	**-0.44**	**-1.15**
			0.1245			0.7951	0.9076	0.7639
BBB/BB Issuer Rating			**6.45**			**5.08**	**4.08**	**4.34**
			0.2561			0.3543	0.4847	0.4138
No Issuer Rating			**-12.08****			**-14.75****	**-12.78****	**-13.97****
			0.0149			0.0166	0.0344	0.0224
Relative Age				**34.41*****	**31.91*****	**33.83*****	**31.69*****	**30.26*****
				0.0011	0.0011	0.0009	0.0009	0.0006
Issue Size				**-2.79***	**-2.59**	**-2.68***	**-2.49**	**-2.61**
				0.0753	0.1081	0.0832	0.1220	0.1389
Landesbank				**-11.05****	**-11.60****	**-11.25****	**-12.07****	**-12.51****
				0.0403	0.0383	0.0334	0.0359	0.0306
N	1,915	1,915	1,915	1,915	1,915	1,915	1,915	1,915
Adjusted R^2	26.1%	27.3%	26.6%	31.4%	32.2%	31.6%	32.3%	33.6%

Table 5 continued.

Panel D: Sovereign Crisis

Regression	A	B	C	D	E	F	G	H
Constant	**0.16****	**-1.58**	**-5.22***	**1.87**	**0.11**	**0.52**	**-0.03**	**3.77***
	0.0232	0.4264	0.0936	0.2457	0.8699	0.8229	0.9874	0.0577
Jumbo Mortgage	**-3.29**	**-2.11***	**-3.25**	**-6.55**	**-5.09**	**-7.06**	**-5.72***	**-5.37**
	0.1278	0.0775	0.1318	0.1388	0.1046	0.1263	0.0982	0.1212
Traditional Public	**16.25*****	**16.07*****	**18.28*****	**16.40*****	**16.25*****	**20.19*****	**20.27*****	**19.12*****
	0.0021	0.0023	0.0010	0.0047	0.0039	0.0081	0.0044	0.0043
Traditional Mortgage	**5.58**	**4.75**	**3.70**	**4.32**	**4.29**	**2.18**	**2.82**	**3.06**
	0.2970	0.4334	0.4074	0.3070	0.3618	0.5408	0.4873	0.4462
AA Bond Rating		**1.20**			**-0.50**		**-2.45**	**-2.38**
		0.6374			0.7621		0.1290	0.1606
No Bond Rating		**8.06**			**5.61**		**2.86**	**3.18**
		0.3282			0.4124		0.6400	0.6025
A Issuer Rating			**5.33**			**1.01**	**0.44**	**1.11**
			0.1277			0.7412	0.8780	0.6774
BBB/BB Issuer Rating			**22.84*****			**21.51*****	**20.59*****	**20.34*****
			0.0003			0.0029	0.0005	0.0008
No Issuer Rating			**-2.14**			**-10.61**	**-10.81**	**-9.81**
			0.6052			0.1365	0.1214	0.1178
Relative Age				**7.82**	**8.08**	**4.77**	**4.98**	**5.49**
				0.2375	0.2185	0.5227	0.4806	0.4389
Issue Size				**-1.37**	**-1.25**	**-0.04**	**0.21**	**-0.16**
				0.5935	0.6238	0.9883	0.9408	0.9553
Landesbank				**-13.27****	**-12.37****	**-14.86****	**-14.61****	**-14.26****
				0.0482	0.0254	0.0380	0.0192	0.0205
N	1,044	1,044	1,044	1,044	1,044	1,044	1,044	1,044
Adjusted R^2	7.7%	9.1%	11.4%	13.3%	13.9%	17.4%	17.5%	18.9%

Table 6: Impact of Cover Pool Variables

This table reports the estimated coefficients (in bold) and the t-statistics from the regression of the covered bond yield spreads. The yield spreads are calculated in basis points and winsorized at the 0.5th and 99.5th percentile on a weekly basis. The outstanding amount is denoted in EUR billion and the age is given relative to initial maturity. The dummy variables are relative to AAA-rated public jumbo covered bonds issued by AAA/AA-issuers. The p-values are shown below the coefficient estimates and based on standard errors obtained by using the HAC-adjustments of **?**. *** (**,*) denotes the significance at the 1 % (5 %, 10 %) level. N is the number of quarterly observations. The sample consists of observations from January 2006 to June 2007 (Panel A), from July 2007 to September 2008 (Panel B), from September 2008 to June 2010 (Panel C), and from July 2010 to December 2011 (Panel D).

Panel A: Pre-Crisis Period

Regression	A	B	C	D	E	F	G	H	I	J	K	L	M
Constant	**-2.69** 0.2069	**1.65** 0.5480	**-2.60** 0.2420	**-2.61** 0.2078	**-3.08** 0.1581	**-3.61*** 0.0852	**13.74***** 0.0000	**-2.17*** 0.0668	**-5.01*** 0.0587	**0.02** 0.9936	**3.97**** 0.0429		**1.93** 0.3157
OC		**-0.94***** 0.0100						**1.02** 0.1335	**0.22** 0.8391	**-0.89***** 0.0044	**-1.01***** 0.0054	**-0.59** 0.4477	**-0.58**** 0.0375
$\lvert TRANS\rvert$ (years)			**-0.08** 0.6579					**-0.20** 0.3788	**1.84***** 0.0000	**-0.08** 0.5789	**0.09** 0.4757	**1.69***** 0.0025	**0.00** 0.9889
PBDUE				**6.02***** 0.0067				**9.01**** 0.0332	**6.49**** 0.0222	**6.64***** 0.0079	**3.91**** 0.0263	**-4.87** 0.1014	**5.05**** 0.0194
CLDUE					**1.92*** 0.0905			**1.92** 0.6110	**4.94** 0.1760	**2.23**** 0.0160	**-1.45** 0.1039	**-10.39**** 0.0186	**-3.39**** 0.0106
GERM						**1.04**** 0.0330	 0.0000	**3.08**** 0.0105	**7.20**** 0.0154	**1.33**** 0.0285	**1.62**** 0.0104	**2.25** 0.2400	**2.27***** 0.0005
SMALL							**-0.99** 0.3564		**-3.30*** 0.0801			**-2.17** 0.3147	
Jumbo Mortgage	**2.30***** 0.0004	**2.35***** 0.0003	**2.28***** 0.0003	**2.43***** 0.0003	**2.27***** 0.0003	**2.28***** 0.0003				**2.43***** 0.0002	**1.24***** 0.0071		**0.79*** 0.0623
Traditional Public	**1.97** 0.3388	**1.93** 0.3468	**1.97** 0.3368	**1.91** 0.3484	**2.01** 0.3279	**1.97** 0.3360				**1.93** 0.3415	**2.09** 0.2947		**2.45** 0.2611
Traditional Mortgage	**4.16***** 0.0007	**4.25***** 0.0007	**4.16***** 0.0007	**4.08***** 0.0006	**4.08***** 0.0009	**4.16***** 0.0006	**2.02** 0.1127			**4.09***** 0.0006	**3.08**** 0.0168	**2.68*** 0.0643	**3.55**** 0.0172
AA/A Issuer Rating	**0.24** 0.9218	**-4.00** 0.2417	**0.24** 0.9239	**-0.82** 0.7233	**0.29** 0.9072	**0.30** 0.9020	**-13.10***** 0.0000			**-4.87** 0.1369	**-7.50**** 0.0199	**-0.68** 0.6293	**-7.28***** 0.0067
BBB/BB Issuer Rating	**2.96** 0.3424	**-1.29** 0.7274	**2.97** 0.3360	**1.75** 0.5248	**2.90** 0.3606	**3.12** 0.3124	**-12.18***** 0.0010			**-2.28** 0.5019	**-5.02** 0.1278	**1.00** 0.6694	**-4.09** 0.1287
No Issuer Rating	**9.43***** 0.0019	**5.26*** 0.0567	**9.51***** 0.0015	**8.45***** 0.0075	**9.34***** 0.0027	**9.40***** 0.0020				**4.29** 0.1503	**4.65** 0.1132	**17.91***** 0.0012	**3.70**** 0.0370
AA Bond Rating											**1.87*** 0.0650	**2.57***** 0.0003	**2.23**** 0.0290
No Bond Rating											**-3.10**** 0.0214	**-4.65**** 0.0176	**-2.86**** 0.0200
Relative Age	**7.26***** 0.0016	**7.27***** 0.0018	**7.26***** 0.0017	**7.17***** 0.0016	**7.18***** 0.0017	**7.21***** 0.0018	**6.84**** 0.0113			**7.01***** 0.0023	**6.62***** 0.0021	**6.08***** 0.0068	**5.87***** 0.0052
Issue Size	**-1.11***** 0.0000	**-1.12***** 0.0000	**-1.11***** 0.0000	**-1.16***** 0.0000	**-1.16***** 0.0000	**-1.10***** 0.0000	**-1.13**** 0.0247			**-1.24***** 0.0000	**-1.28***** 0.0000	**-0.70** 0.1771	**-1.17***** 0.0000
Landesbank	**2.01***** 0.0036	**2.21***** 0.0019	**1.98***** 0.0040	**2.01***** 0.0028	**2.07***** 0.0044	**1.90***** 0.0062	**0.66** 0.4454			**2.10***** 0.0034	**1.91***** 0.0018	**0.31** 0.7779	**1.24***** 0.0028
N	2,309	2,309	2,309	2,309	2,309	2,309	657	2,309	657	2,309	2,309	657	2,309
Adjusted R^2	17.5%	17.6%	17.6%	17.8%	17.6%	17.6%	15.2%	1.2%	4.6%	18.1%	20.0%	21.1%	23.6%

Table 6 continued.

Panel B: Subprime Crisis

Regression	A	B	C	D	E	F	G	H	I	J	K	L	M
Constant	**1.30**	**0.92***	**0.32**	**-1.03**	**0.54**	**6.84*****	**8.75*****	**2.86**	**9.46**	**3.59****	**3.88*****	**8.48***	**0.01**
	0.1135	0.0888	0.5438	0.3459	0.6473	0.0001	0.0008	0.5649	0.2231	0.0101	0.0018	0.0928	0.9952
OC		**2.59**						**7.85*****	**10.02*****	**2.72**	**2.75**	**0.73**	**3.40***
		0.2661						0.0069	0.0033	0.1791	0.1834	0.7860	0.0973
$\lvert TRANS \rvert$ (years)			**1.0485****					**0.63****	**0.87****	**0.38**	**0.35**	**1.11*****	**0.45**
			0.0419					0.0407	0.0108	0.2860	0.3190	0.0014	0.1495
PBDUE				**11.96*****				**26.88*****	**-9.65***	**14.95*****	**15.13*****	**-9.32****	**1.72**
				0.0065				0.0045	0.0521	0.0051	0.0024	0.0356	0.3027
CLDUE					**4.05**			**-6.98**	**-0.92**	**1.05**	**0.69**	**2.47**	**1.10**
					0.1751			0.1335	0.8809	0.7456	0.8356	0.8244	0.5575
GERM						**-7.32*****		**-0.51**	**-3.30**	**-8.13*****	**-8.03*****	**-3.97**	**-5.22*****
						0.0003		0.8119	0.1851	0.0001	0.0002	0.2271	0.0011
SMALL							**-5.57*****		**-2.28**			**-0.08**	
							0.0050		0.3003			0.9825	
Jumbo Mortgage	**4.44*****	**4.19*****	**4.35*****	**4.58****	**4.24****	**4.33*****				**4.13****	**4.13*****		**3.31*****
	0.0081	0.0037	0.0048	0.0135	0.0108	0.0066				0.0102	0.0017		0.0043
Traditional Public	**8.82****	**8.90****	**8.71****	**8.64****	**8.87****	**8.96****				**8.83****	**8.86****		**8.67****
	0.0238	0.0247	0.0232	0.0294	0.0232	0.0229				0.0285	0.0287		0.0310
Traditional Mortgage	**8.11****	**7.22****	**7.85****	**8.18****	**7.88****	**8.45****	**5.26****			**7.48****	**7.41****	**4.65**	**6.31****
	0.0196	0.0094	0.0177	0.0244	0.0255	0.0164	0.0298			0.0171	0.0141	0.1903	0.0279
A Issuer Rating	**-4.58*****	**-4.29*****	**-4.61*****	**-4.39*****	**-4.66*****	**-4.58*****	**-8.23*****			**-4.05*****	**-4.07*****	**-7.54**	**-4.39***
	0.0038	0.0054	0.0043	0.0044	0.0046	0.0043	0.0047			0.0071	0.0084	0.1096	0.1048
BBB/BB Issuer Rating	**-2.11****	**-1.77****	**-2.20****	**-2.03****	**-1.88***	**-2.48*****	**-4.31****			**-2.03****	**-2.08****	**-3.55**	**-0.85****
	0.0245	0.0358	0.0289	0.0235	0.0514	0.0078	0.0394			0.0121	0.0109	0.2992	0.0328
No Issuer Rating	**-0.33**	**-0.52**	**-1.42**	**0.09**	**-0.81**	**0.73**	**-2.05***			**0.66**	**1.84**	**1.72**	**1.06**
	0.8724	0.8066	0.5661	0.9647	0.6814	0.7227	0.0724			0.7701	0.5373	0.3663	0.7276
AA Bond Rating											**-0.05**	**0.26**	**0.92**
											0.9678	0.8567	0.1138
No Bond Rating											**-1.35**	**-3.51**	**-1.48**
											0.1744	0.1055	0.2212
Relative Age	**10.32*****	**10.34*****	**10.51*****	**10.16*****	**10.09*****	**10.66*****	**10.99*****			**10.51*****	**10.40*****	**11.84*****	**9.98*****
	0.0008	0.0008	0.0010	0.0009	0.0012	0.0005	0.0003			0.0011	0.0012	0.0000	0.0019
Issue Size	**-1.87***	**-1.89***	**-1.94***	**-1.92****	**-1.96****	**-1.84***	**-0.61**			**-1.96****	**-2.01****	**-0.74**	**-1.69***
	0.0563	0.0591	0.0512	0.0472	0.0380	0.0579	0.3476			0.0348	0.0249	0.1659	0.0523
Landesbank	**1.15**	**0.84**	**1.01**	**1.12**	**1.40**	**2.10**	**2.00**			**1.85**	**1.67**	**3.86**	**1.51**
	0.4519	0.6295	0.5576	0.4921	0.4236	0.2101	0.1538			0.4027	0.4477	0.0619	0.4225
N	1,864	1,864	1,864	1,864	1,864	1,864	458	1,864	458	1,864	1,864	458	1,864
Adjusted R^2	37.5%	37.7%	37.8%	37.9%	37.7%	38.3%	29.3%	5.9%	16.5%	39.3%	39.4%	32.1%	44.8%

Table 6 continued.

Panel C: Banking Crisis

Regression	A	B	C	D	E	F	G	H	I	J	K	K(GIPSI)	L	M
Constant	**-11.41****	**-9.95****	**-13.89****	**-11.13****	**-17.62****	**21.55****	**8.19****	**34.93*****	**47.28*****	**15.76**	**18.67**	**-12.72***	**26.91***	**20.65**
	0.0266	0.0414	0.0386	0.0447	0.0256	0.0162	0.0155	0.0072	0.0093	0.2465	0.2666	0.0533	0.0757	0.2336
OC		**-9.95*****						**-13.19*****	**0.84**	**-1.76**	**1.82**	**3.18**	**6.27**	**4.82**
		0.0057						0.0076	0.8831	0.6592	0.5932	0.5204	0.1034	0.2447
$\lvert TRANS\rvert$ (years)			**2.94**					**4.65*****	**1.25***	**6.48****	**5.87*****	**3.35****	**0.24**	**5.40****
			0.2125					0.0007	0.0538	0.0114	0.0038	0.0313	0.8227	0.0220
PBDUE				**-1.25**				**8.51**	**0.03**	**-30.83****	**-31.59****	**-29.71**	**6.84**	**-32.88*****
				0.8788				0.3227	0.9982	0.0490	0.0103	0.1036	0.5164	0.0068
CLDUE					**37.72****			**12.07**	**-2.37**	**32.46**	**31.18**	**25.83**	**8.78**	**32.04**
					0.0374			0.5258	0.8252	0.1264	0.1525	0.1199	0.6099	0.1474
GERM						**-44.05*****		**-27.87*****	**-30.19****	**-40.98****	**-41.76****		**-56.26****	**-43.16****
						0.0024		0.0084	0.0393	0.0126	0.0160		0.0165	0.0160
SMALL							**-32.30****		**-20.55*****				**3.29**	
							0.0213		0.0079				0.6542	
GIPSI												**69.23*****		
												0.0056		
Jumbo Mortgage	**0.92**	**2.27****	**-0.85**	**0.86**	**-1.08**	**4.50****				**-2.71**	**-7.03***	**-5.92**		**-7.53***
	0.2125	0.0368	0.6121	0.2242	0.3498	0.0398				0.5604	0.0763	0.2543		0.0537
Traditional Public	**38.03*****	**37.82*****	**37.90*****	**38.02*****	**36.40*****	**38.18*****				**36.01*****	**36.40*****	**36.48*****		**36.54*****
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				0.0001	0.0001	0.0010		0.0002
Traditional Mortgage	**25.00*****	**26.99*****	**23.43*****	**24.93*****	**21.43*****	**26.45*****	**15.77*****			**18.64*****	**17.00*****	**17.23****	**16.16*****	**17.62*****
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0002			0.0025	0.0031	0.0176	0.0066	0.0054
A Issuer Rating	**0.93**	**0.50**	**1.30**	**0.91**	**0.23**	**1.10**	**8.49**			**0.79**	**-0.35**	**-4.70**	**8.8**	**-1.00**
	0.8085	0.8941	0.7417	0.8159	0.9527	0.7899	0.1249			0.8477	0.9363	0.3080	0.1263	0.8121
BBB/BB Issuer Rating	**5.08**	**3.87**	**5.11**	**5.11**	**6.88**	**4.16**	**10.46***			**6.40**	**5.53**	**7.63**	**11.89****	**6.10**
	0.3854	0.5026	0.3808	0.3815	0.2439	0.5114	0.0711			0.3046	0.3504	0.1946	0.0437	0.2689
No Issuer Rating	**-14.75****	**-10.16***	**-16.46****	**-14.77****	**-10.50***	**-7.80**	**-5.11*****			**-8.24**	**-8.41**	**-7.80**	**4.34**	**-10.49**
	0.0224	0.0845	0.0246	0.0241	0.0756	0.2079	0.0061			0.3471	0.3499	0.2617	0.4003	0.2063
AA Bond Rating											**9.69****	**13.94****	**17.36****	**10.27****
											0.0379	0.0349	0.0165	0.0267
No Bond Rating											**-2.65**	**-5.45***	**2.4**	**-2.20**
											0.4821	0.0556	0.5636	0.5318
Relative Age	**33.83*****	**33.55*****	**34.58*****	**33.86*****	**32.97*****	**34.81*****	**27.87*****			**36.43*****	**34.72*****	**32.76*****	**29.70*****	**33.13*****
	0.0013	0.0013	0.0018	0.0015	0.0012	0.0007	0.0000			0.0011	0.0009	0.0018	0.0000	0.0006
Issue Size	**-2.68**	**-2.71**	**-2.58**	**-2.69***	**-4.28*****	**-3.40**	**-9.05*****			**-4.60*****	**-4.37****	**-4.35****	**-9.70*****	**-4.55****
	0.1015	0.1103	0.1149	0.0996	0.0087	0.1027	0.0000			0.0084	0.0138	0.0443	0.0004	0.0200
Landesbank	**-11.25****	**-10.20***	**-12.31***	**-11.24****	**-8.77***	**-4.57**	**-5.31**			**-4.95**	**-5.68**	**-4.88**	**-0.36**	**-5.98**
	0.0432	0.0573	0.0552	0.0427	0.0538	0.3861	0.2699			0.3901	0.3318	0.4075	0.9426	0.2996
N	1,915	1,915	1,915	1,915	1,915	1,915	580	1,915	580	1,915	1,915	1,543	580	1,915
Adjusted R^2	32.0%	32.1%	32.1%	32.0%	33.5%	34.8%	33.3%	2.4%	9.4%	36.3%	36.9%	36.0%	40.5%	38.5%

Table 6 continued.

Panel D: Sovereign Crisis

Regression	A	B	C	D	E	F	G	H	I	J	K	K(GIPSI)	L	M
Constant	**0.52**	**1.33**	**1.16**	**1.50**	**-0.27**	**29.68*** **	**-2.02**	**33.50*** **	**6.90**	**29.19*** **	**29.32*** **	**-9.60***	**1.70**	**35.46*** **
	0.8388	0.6025	0.5211	0.6591	0.9157	0.0001	0.7264	0.0002	0.5041	0.0001	0.0000	0.0663	0.8110	0.0000
OC		**-5.09** **						**-8.82** **	**-5.83*** **	**-2.08**	**-0.99**	**-0.83**	**-4.88*** **	**-0.33**
		0.0123						0.0256	0.0001	0.2500	0.4407	0.3445	0.0065	0.8222
$\|TRANS\|$ (years)			**-0.69**					**0.40**	**-1.30**	**0.52**	**0.17**	**0.86**	**-1.95** **	**-0.44**
			0.7766					0.7494	0.3286	0.7994	0.9222	0.7142	0.0215	0.7985
PBDUE				**-10.17**				**-4.05**	**32.84** **	**-11.72**	**-10.88**	**-3.34**	**33.10***	**-12.72**
				0.4321				0.8232	0.0276	0.3552	0.3295	0.6454	0.0728	0.2739
CLDUE					**6.72**			**3.30**	**11.96**	**13.22*** **	**17.43** **	**16.42***	**28.71***	**11.88***
					0.2592			0.2684	0.6038	0.0011	0.0420	0.0501	0.0675	0.0957
GERM						**-37.21*** **		**-35.02*** **	**-7.75*** **	**-37.32*** **	**-38.62*** **		**-9.76*** **	**-39.42*** **
						0.0000		0.0001	0.0006	0.0000	0.0000		0.0026	0.0001
SMALL							**-20.71*** **		**-11.58** **				**-5.38**	
							0.0033		0.0299				0.3818	
GIPSI												**122.30*** **		
												0.0020		
Jumbo Mortgage	**-7.06**	**-5.80**	**-6.88**	**-7.11**	**-7.39**	**-3.16**				**-3.48**	**-3.37**	**-0.17**		**-2.84**
	0.1566	0.1951	0.2149	0.1540	0.1157	0.5059				0.4288	0.3479	0.9539		0.4555
Traditional Public	**20.19** **	**19.74** **	**20.16** **	**20.37** **	**19.75** **	**19.19** **				**18.36** **	**17.32** **	**16.32** **		**16.45** **
	0.0119	0.0123	0.0119	0.0139	0.0163	0.0136				0.0219	0.0115	0.0112		0.0100
Traditional Mortgage	**2.18**	**3.06**	**2.31**	**2.31**	**1.71**	**-0.71**	**4.58*** **			**-1.25**	**-2.65**	**1.42**	**2.53** **	**-2.16**
	0.5769	0.3929	0.5976	0.5315	0.6245	0.8888	0.0021			0.7865	0.6524	0.7906	0.0361	0.7190
A Issuer Rating	**1.01**	**1.23**	**0.86**	**1.18**	**1.19**	**2.13**	**7.28**			**2.88**	**2.21**	**0.96**	**2.17**	**2.76**
	0.7638	0.7245	0.7925	0.7327	0.7192	0.5732	0.1529			0.4937	0.5296	0.7687	0.5458	0.4676
BBB/BB Issuer Rating	**21.51*** **	**20.75*** **	**21.46*** **	**21.29*** **	**21.86*** **	**18.77** **	**22.65*** **			**18.91** **	**17.00*** **	**20.52*** **	**21.80*** **	**16.53*** **
	0.0044	0.0043	0.0047	0.0054	0.0029	0.0181	0.0095			0.0151	0.0032	0.0008	0.0012	0.0074
No Issuer Rating	**-10.61**	**-8.65**	**-10.31**	**-9.78**	**-9.85**	**-1.22**	**3.48**			**1.83**	**2.15**	**1.17**	**7.16**	**3.02**
	0.1681	0.2167	0.2244	0.1613	0.2152	0.8157	0.4522			0.7388	0.6945	0.8478	0.3078	0.5226
AA Bond Rating											**2.63**	**4.02**	**-3.50**	**3.11**
											0.2063	0.1340	0.1331	0.1776
No Bond Rating											**4.47**	**1.44**	**-5.16***	**4.44**
											0.5040	0.8039	0.0762	0.4986
Relative Age	**4.77**	**4.92**	**4.65**	**5.28**	**4.61**	**5.93**	**9.64**			**6.35**	**6.50**	**6.81**	**8.99**	**7.13**
	0.5597	0.5412	0.5584	0.4961	0.5704	0.4939	0.2564			0.4372	0.4297	0.3750	0.3059	0.3840
Issue Size	**-0.04**	**-0.33**	**-0.08**	**0.12**	**-0.40**	**-2.93**	**-2.79**			**-3.54**	**-4.09**	**-5.26***	**-5.81***	**-4.25**
	0.9894	0.9166	0.9811	0.9720	0.9109	0.3477	0.4878			0.3135	0.1808	0.0696	0.0823	0.1661
Landesbank	**-14.86***	**-13.90***	**-14.96** **	**-14.38** **	**-14.76***	**-9.04**	**-8.26**			**-7.82**	**-7.02***	**-5.28**	**-5.07**	**-6.75***
	0.0516	0.0548	0.0432	0.0398	0.0562	0.1557	0.1905			0.1357	0.0900	0.1154	0.3923	0.0864
N	1,044	1,044	1,044	1,044	1,044	1,044	426	1,044	426	1,044	1,044	1,044	426	1,044
Adjusted R^2	18.1%	18.4%	18.1%	18.2%	18.1%	24.8%	25.2%	9.7%	17.0%	25.2%	25.6%	26.6%	33.5%	27.4%