

Liquidity and Credit Risk Premia in the Pfandbrief Market

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Abstract

Yield spreads between German covered bonds (Pfandbriefe) and German government bonds usually have been interpreted as pure liquidity premia. In contrast, our analysis reveals that liquidity is the most important, but not the exclusive risk factor within the Pfandbrief market. We show that Pfandbrief yield spreads also depend on the quality of the issuer, the type of collateral, and the quality of the cover pool. In particular, it is surprising that the issuer's default risk is priced considerably, even though Pfandbriefe are backed by high-quality mortgages or public-sector loans and a Pfandbrief default has never been occurred. Using recently published cover pool data, we also show that the quality of the cover assets is less relevant in a normal market environment, but important in times of financial turmoil. Hence, Pfandbrief issuers with a sustainable cover pool profit from lower refinancing cost, especially during market crises.

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I Introduction

It is generally accepted that the recent financial crisis has its origin in the granting of subprime loans and their securitization. As the mortgage pools experienced declines in credit quality and losses, the market prices of mortgage-backed securities (MBS) and other asset-backed securities (ABS) plummeted, leading to write-downs and losses all over the world. Along with a number of moral hazard problems, this caused a general crisis of confidence on the market for securitized mortgage loans. The confidence crisis also considerably affected the market prices of covered bonds, even though they have a different structure and bear different risks.

The increase of yields also spread to the German Pfandbrief market, although Pfandbriefe are usually seen as close substitutes for high-quality government bonds and there has never been a Pfandbrief default. Due to their security mechanisms and the high quality of their collateral, Pfandbriefe have been considered virtually default-free. Therefore, the yield spread with respect to German government securities has often been interpreted as a liquidity premium. During the recent financial crisis, however, one has observed yield differences between segments of the Pfandbrief market or single Pfandbrief issues whose liquidity is nearly the same. Hence, it is becoming evident that the yield spread between Pfandbriefe and German government securities cannot be interpreted as a pure liquidity premium.

The purpose of this study is an in-depth analysis of the yield spreads *within* the Pfandbrief market. We investigate the main risk factors perceived by investors and their relative valuation for the time period from 2000 to 2009. In particular, we examine whether liquidity, the quality of the issuer, the type of collateral, or the quality of the underlying cover pool is the main driver of the yield spreads between individual Pfandbriefe. Moreover, we gain insights into the behavior of Pfandbrief spreads during different periods – the pre-crisis period and the period of the recent financial crisis.

Our contribution to the literature is threefold. First, in contrast to the assumption of Koziol and Sauerbier (2007) or Kempf et al. (2010), we show that liquidity is an important, but not the exclusive factor when explaining Pfandbrief yield spreads. Second, in addition

to previous studies such as Birkmeyer and Herbert (2002) and Breger and Stovel (2004), we analyze individual Pfandbrief spreads over time and explicitly account for the issuers' default risk. Third, we are the first to study the impact of the cover pool quality by using the publications according to § 28 Pfandbrief Act.

With its origin in 1769, the German Pfandbrief is one of the oldest asset-backed securities in the world. The cover pools mainly consist of high-quality public sector loans or prime mortgage loans. With an average outstanding volume of EUR 916 billion, the Pfandbrief market is one of the largest fixed income markets in the world.¹ In contrast to MBS and ABS, however, the structure is quite different: (i) the Pfandbrief 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,² (v) pool borrowers are liable with all of their assets and not only with the underlying real estate property (no jingle mail). This strong legal protection certainly is one of the reasons that a default on a Pfandbrief has never occurred. As the Pfandbrief has proven to be a successful source of German mortgage and public-sector loan funding and solves some of the moral hazard problems associated with MBS and other ABS, the introduction of a similar covered bond legislation is currently also discussed in the United States.³

Our study is particularly related to the literature on German Pfandbriefe and, in general, to the literature on liquidity and credit risk premia in fixed income markets. Despite the ample size of the German Pfandbrief market and its systemic importance for the German banking system, there are only few academic studies analyzing this market in detail. Empirical studies of the Pfandbrief market usually investigate the yield difference between Pfandbriefe and German government bonds (Bunds). Bühler and Hies

¹Pfandbrief market statistics (2003–2009), Association of German Pfandbrief Banks (vdp).

²In comparison to other covered bond markets, the Pfandbrief is considered to have the most restrictive legal requirements.

³See, e.g., Lucas et al. (2008) and Bernanke (2009).

(1998) and Jobst (2006) investigate the spread dynamics, but do not come up with an economic explanation for the yield differences. Rees (2001) develops a forecasting model for the 10 year Pfandbrief spread using macroeconomic factors. This model, however, does not differentiate between the different types of Pfandbriefe. Koziol and Sauerbier (2007) and Kempf et al. (2010) argue that Pfandbriefe are considered as default-free and that yield differences between Pfandbriefe and Bunds have to be ascribed to liquidity differences. With this presumption, they estimate term structures of illiquidity spreads between Pfandbriefe and Bunds. In contrast to their findings, our results show that liquidity is an important, but not the exclusive factor driving Pfandbrief yield spreads.

Schäfer and Hochstein (1999) and Birkmeyer and Herbert (2002) investigate yield differences in the market for Jumbo Pfandbriefe and relate them to several explanatory variables like the outstanding amount and the Pfandbrief rating. Whereas Schäfer and Hochstein (1999) conclude that the Jumbo Pfandbrief market is rather homogenous, Birkmeyer and Herbert (2002) find higher yields for Pfandbriefe issued by mortgage banks relative to public banks. They expect an increasing importance of the issuer's quality for the relative pricing of Jumbo Pfandbriefe. Breger and Stovel (2004) study the effect of credit risk and liquidity in the market for traditional and Jumbo Pfandbriefe. The authors find a significant liquidity premium of 15 bp between traditional and Jumbo Pfandbriefe whereas differences between AAA and AA rated Pfandbriefe do not have a significant effect. Sünderhauf (2006) investigates the impact of the issuer's default risk on the pricing of Pfandbriefe. By applying and calibrating a structural Merton (1974)-type model for a Pfandbrief bank, he comes to the conclusion that mortgage Pfandbriefe should be considered as widely independent from the issuer's quality. We extend this strand of literature by conducting an in-depth analysis of individual Pfandbrief spreads. In addition to the previous studies, we consider the time-variation by investigating different market environments and explicitly account for the issuers' default risk. Moreover, we are the first to study the impact of the cover pool quality by using the publications according to § 28 Pfandbrief Act.

In a study of the European covered bond market, Packer et al. (2007) argue that the pricing of covered bonds is robust to idiosyncratic shocks to issuer credit risk and to

the value of cover pools. In contrast to their study, we find that, particularly during times of financial turmoil, the issuer rating as well as the cover pool quality has a considerable impact on the yield spreads. In general, we do not aim to contribute to the literature on yield differences between covered bonds in different regulatory environments. Former studies like Packer et al. (2007) and Volk and Hillenbrand (2006) have shown that covered bond yields significantly depend on the nationality of the issuer. As a uniform covered bond regulation does not exist in Europe, it is nearly impossible to meaningfully compare and to unambiguously extract the different risk components. Therefore, we focus on the German Pfandbrief market with a uniform regulatory environment for all issues.

A large number of studies investigate liquidity and credit risk premia in the corporate bond market. These studies, like Collin-Dufresne et al. (2001), Longstaff et al. (2005), Chen et al. (2007), De Jong and Driessen (2007), and Dick-Nielsen et al. (2009), mostly study unsecured bonds that are not backed by collateral. Studies in the corporate bond market, however, suffer from a considerable heterogeneity of bond characteristics and the issuers strongly differ in terms of risk even within a rating class. Therefore, the authors have to rely on strong assumptions to disentangle liquidity and credit risk. In contrast, due to the high level of standardization and the legal requirements, it is relatively easy to isolate the different risk components within the Pfandbrief market.

The main results of our study are the following. First, we show that liquidity is not the exclusive driver of yield spreads between Pfandbriefe and German government bonds and issuer-specific effects as well as the quality of the cover pool are also relevant. Second, yield spreads between individual Pfandbriefe are mainly driven by their relative liquidity and whether they are covered by public-sector or mortgage loans. Whereas the type of cover assets appears to be less important during the recent financial crisis, liquidity proves to have the most important effect and accounts for up to 70 bp of the yield spread. Third, our empirical results reveal that Pfandbrief investors demand an additional default risk premium between low rated and high rated issuers of 7 bp during normal market conditions and up to 40 bp during the financial crisis. Fourth, the impact of the cover pool quality appears to be quite small. During the recent financial crisis, however, maturity mismatches between Pfandbriefe and their corresponding cover pool

assets, the fraction of German cover assets and the granularity of the cover pool show a significant impact on the yield spreads.

The remainder of this paper is structured as follows. In Section II, we begin by describing the institutional details of the Pfandbrief market. Section III describes the methodology of our analysis and presents the data. In Section IV, we provide and discuss the empirical results. Section V concludes.

II Details of the Pfandbrief Market

This section reviews the most important features and the regulatory background of the German Pfandbrief market.⁴ The legal basis for a Pfandbrief issuance is the Pfandbrief Act of 2005 that replaced the Public Pfandbrief Act (ÖPG) and the Mortgage Bank Act (HBG) dating back to 1900. Until 2005, Pfandbrief issuers had to be specialized banks, but nowadays every wholesale bank is allowed to apply for a Pfandbrief licence. The Pfandbrief Act, however, sets restrictive formalities such that Pfandbriefe are highly standardized and investors can easily assess their quality. Beyond the general banking supervision under the terms of the German Banking Act (KWG), Pfandbrief 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.

Pfandbriefe 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 only separated in case of the issuer's default. The cover pool mainly consists of high-quality public-sector or first-rank residential and commercial mortgage loans.⁵ Pfandbriefe backed by loans to public-sector entities are called *public Pfandbriefe* and those backed by mortgage loans are referred to as *mortgage Pfandbriefe*. It is important to note that every issuer has *only one* cover pool for *each* Pfandbrief

⁴A more detailed description of the German Pfandbrief and the European covered bond markets can be found, e.g., in Mastroeni (2001), Packer et al. (2007), and Cross (2008). Moreover, Peterson (2008) investigates the main differences between Pfandbriefe and ABS.

⁵Moreover, Pfandbriefe on ship and airplane loans exist, but only account for a small fraction of the Pfandbrief market.

segment. Hence, every public Pfandbrief of an issuer is backed by the same issuer-specific public cover pool and every mortgage Pfandbrief by the same issuer-specific mortgage cover pool. The Pfandbrief Act sets conservative guidelines for the quality, the size, and the valuation of the cover assets as well as to its supervision to ensure timely payments in case of an issuer's default. Moreover, Pfandbriefe are not subject to prepayment risk, and matured or defaulted loans in the cover pool have to be replaced by the issuer. The issuer also has to assure that the present value of the cover pool assets always exceeds the present value of the outstanding Pfandbriefe by at least 2%. This dynamic feature of the cover pool further ensures a sustainable high collateral value for the Pfandbrief.

Public Pfandbriefe 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 U.S., Canada and Japan. Moreover, loans to German public agencies or public banks that are guaranteed by these bodies are eligible for the public cover pool. It is noteworthy that the withdrawn public sector guarantees for Landesbanks and for debt issued by savings banks in 2005 have led to a shrinking supply of public-sector collateral and, therefore, public Pfandbriefe.⁶ *Mortgage Pfandbriefe* are covered by first rank mortgage loans fully collateralized by real estate properties in the European Economic Area, Switzerland, the U.S., Canada and Japan. The underlying properties may be residential, commercial, or both. The loan-to-value ratio of each underlying loan must not exceed 60% and is subject to permanent supervision. Compared to covered bond legislation in other countries or MBS, the maximum loan-to-value ratio required for Pfandbriefe is most conservative. For the purpose of liquidity management, maturity-matching between cover assets and outstanding Pfandbriefe, and currency hedging, it is allowed to further include specified claims against qualified banks as well as derivatives.

Pfandbrief holders have preferential claims on the cover assets in the event of an issuer's insolvency. In this case, the cover pools are separated and managed by an independent trustee ("Sachwalter") in favor of the Pfandbrief holders. The cover pools are not included in the insolvency proceedings until the Pfandbrief creditors are fully redeemed. Alternatively, another Pfandbrief issuer may take over the cover assets and

⁶See, e.g., ECB (2008), p. 10.

serve the Pfandbrief payments in a timely manner. An early repayment of the Pfandbrief should be avoided. All these arrangements are set to ensure that Pfandbrief holders are additionally protected against insolvency caused outside the issuer's cover operations and that the Pfandbrief payments occur on time.

An important Pfandbrief segment is the market for *Jumbo Pfandbriefe*. This segment is defined by minimum standards agreed on by Pfandbrief banks. It was introduced in 1995 in order to increase the liquidity of large Pfandbrief issues. Jumbo Pfandbriefe 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, Jumbo Pfandbriefe have to be listed at an exchange, and at least five market makers have to continuously provide a price quote 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 Pfandbriefe are very actively traded.⁷ Smaller and less liquid issues in either bearer or registered form are commonly referred to as *traditional Pfandbriefe*.

III Data and Methodology

III.1 Bond Prices and Yield Spreads

Our sample period covers the time span from January 2000 until January 2009. To gain insight into the behavior of liquidity and credit risk premia during the recent financial turmoil, we divide our sample period into three sub-sample periods. The first sub-sample period is referred to as *pre-crisis* and covers the time span previous to the subprime crisis. It ranges from January 2000 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 and ends in January 2009. We refer to the last period as the *post-Lehman period*.

We consider all public and mortgage Pfandbriefe outstanding in our sample period with fixed coupon and without embedded options. Our total sample consists of 6,398

⁷See, e.g., Winkler (2006).

Pfandbriefe issued by 80 different banks. We exclude all Pfandbriefe 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 Pfandbriefe with less than six months to maturity. After this data preparation, we remain with 2,592 Pfandbrief issues and almost 182,000 weekly price observations.

We use weekly mid prices obtained via Bloomberg over the whole observation period. Approximately 60%–70% of the Pfandbrief market volume is traded over the phone and most of the remaining part on electronic trading platforms.⁹ Due to marginal trading on stock exchanges, Bloomberg is the most reliable source available since prices are provided by at least five contributors.¹⁰ Bloomberg prices are quoted on a three-day settlement basis, and we compute accrued interest using the respective day count fraction. We select Wednesdays as valuation days as very few holidays happen to coincide with Wednesdays. We use the price of the same week's Tuesday or Thursday if a Wednesday price is not available. In this case, we adjust the calculation of accrued interest.

Table 1 presents the summary information of the data set. Panel A shows that traditional Pfandbriefe account for the major part of the number of issues in the German Pfandbrief market. However, we have access to price data of only 35% of these issues in contrast to 90% of the Jumbo issues. Moreover, Jumbo and traditional Pfandbrief issues differ considerably in terms of their outstanding amount which is approximately 10 times higher for Jumbos, and the Jumbos in our sample appear to have a slightly longer time to maturity on average. Due to the higher liquidity in the Jumbo segment, it is not surprising that the number of weekly bond price observations for Jumbos exceeds the number for traditional Pfandbriefe. This discrepancy is even more pronounced during the financial crisis. Moreover, it is important to note that nearly all Jumbo and approximately 90% of all traditional Pfandbrief price observations used in our study are on Wednesdays.

Panel B of Table 1 shows the distribution of the Pfandbrief issues with respect to

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

⁹See, e.g., Winkler (2006), p. 25.

¹⁰The prices are indicative and do not represent actual transactions. However, we cross-check our results with data provided by Morgan Stanley and did not find meaningful differences.

the issuer rating classes. Pfandbrief 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. Pfandbrief issuers are mainly rated AA and A and the rating classes are similarly distributed in each of the Pfandbrief segments. As no issuer is rated AAA during the financial 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.

We compute individual yield spreads for every Pfandbrief on a weekly basis relative to (i) German government bonds (Bunds) and (ii) public Jumbo Pfandbriefe. We choose Bunds as the natural risk-free benchmark and public Jumbo Pfandbriefe as they are considered the safest and most liquid instruments in the Pfandbrief market. This approach facilitates identifying risk premia *within* the Pfandbrief market that are not driven by factors that affect the Pfandbrief market as a whole. For yield spreads relative to Bunds, we use Nelson and Siegel (1987) term structure estimates provided by the Deutsche Bundesbank. For public-sector Jumbo Pfandbriefe, we estimate the Nelson-Siegel parameters on a weekly basis by minimizing the squared differences between estimated and observed yields.¹¹ The mean absolute yield error of the estimation is 3.67 bp on average.

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

¹¹This approach is consistent with the methodology of Deutsche Bundesbank. See, e.g., Schich (1997), p. 18.

III.2 Explanatory Variables

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

It is an advantage of the Pfandbrief market that different risk components are relatively easy to identify by just comparing the different market segments. First, we compare the yield spread between mortgage and public Jumbo Pfandbriefe by introducing a mortgage Jumbo dummy variable. Usually, at least before the advent of the Greek sovereign debt crisis, Pfandbriefe backed by mortgages are considered to be more risky than Pfandbriefe backed by high-quality public-sector debt. Therefore, we expect mortgage Jumbo Pfandbriefe to trade at a credit risk yield premium compared to public Jumbo Pfandbriefe. Second, we introduce a dummy for a public traditional Pfandbrief. By definition, Jumbo Pfandbriefe are more liquid in terms of outstanding volume, a maximal bid-ask spread, and the vested market-making, among others. Hence, public traditional Pfandbriefe should trade at a liquidity yield premium compared to public Jumbo Pfandbriefe. Third, a dummy for traditional mortgage Pfandbriefe 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.¹² As the Pfandbrief 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, i.e. a yield premium that is positive, but smaller than the sum of the pure liquidity and the pure credit risk premium.

It is straightforward to classify the different Pfandbrief issues with respect to their Pfandbrief rating. The Pfandbrief rating mainly measures the quality of the underlying cover pool. For a high Pfandbrief rating, it has to be highly plausible that the Pfandbrief payments can be made by the underlying cover pool even if the issuer defaults. At the outset, Pfandbrief ratings were independent from the general financial strength of the

¹²For lower rated bonds, however, they find a positive correlation.

issuer, but nowadays rating agencies also consider the issuer rating to compute a limit for the highest possible Pfandbrief rating.¹³ As Pfandbriefe are backed by the cover pool, however, their rating exceeds or is at least equal to the issuer's long term credit rating.

We use data on the issuance rating published by Bloomberg. This data, however, should be used with care as the fraction of several rating classes changes significantly over time. At the beginning of our sample period, 80% of all price observations are from Pfandbriefe that are not rated. This number declines to approximately 45% until the end of 2004, presumably driven by rating requirements from investors. Starting with the advent of the subprime crisis, this fraction steadily declines below 1%. This sharp decline provides evidence that Pfandbriefe without rating are scarcely traded during the recent financial turmoil. Moreover, conversation with Pfandbrief issuers suggest that in recent years it has become hardly possible to place a Pfandbrief without rating due to the investors' requirements. Vice versa, the fraction of AAA-rated Pfandbrief observations increase from 20% to 88% during our sample period and the fraction of AA-rated Pfandbrief observations from 0% to 11%.

Even though Pfandbriefe are backed by high-quality cover pools that may serve the Pfandbrief payments after an issuer's default, the issuer rating may also have an impact on their relative pricing. For our study, 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. The issuer rating serves as a measure for the issuer's default risk, and its impact on the yield spread can be interpreted either as credit risk premium or as liquidity premium, or both. The credit risk view considers that the cover pool may not be sufficient to serve the Pfandbrief payments after the issuer's default. Then, a direct loss on the Pfandbrief may occur. The liquidity view deems the cover pool to be valuable enough to serve the payments but anticipates a collapse in trading the defaulted issuer's Pfandbriefe. Since both risks are serious for investors and should affect the yield spread in the same direction, it is difficult to isolate the particular premia. In general, however,

¹³Standard & Poor's were the last to consider the issuer's rating when they changed their rating methodology at the end of 2009.

a better long-term issuer credit rating should lead to a lower yield spread.¹⁴

Pfandbrief issuers also differ by the type of institution. Pfandbriefe issued by Landesbanks until 18 July 2005 are guaranteed by the German federal states through a so-called guarantor liability (“Gewährträgerhaftung”) mechanism.¹⁵ Due to this guarantee, we expect Landesbanks’ Pfandbriefe that are issued until 18 July 2005 trading at a yield discount relative to comparable Pfandbriefe of other issuers. After its discontinuation, the yield spreads should rise considerably. Moreover, we investigate whether Landesbank Pfandbriefe trade at significant discounts or premia during the recent financial turmoil.

Typical proxies for the liquidity of a fixed income security are trading activity, the bid-ask spread, the proportion of zero-return days, the outstanding amount, and the age. For this study, 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 Pfandbrief’s age. To account for differences in the maturity spectrum of the Pfandbriefe, we standardize the liquidity measure and use the relative age, i.e. the age divided by the initial time to maturity.

For our study we also consider fixed effects for the single Pfandbrief issuers. Thereby, we take idiosyncratic effects like the financial disorder of Allgemeine Hypothekbank Rheinboden (AHBR) in 2001–2005 and the tremendous problems of DEPFA and Hypo Real Estate during the recent financial turmoil into account. We will address these particular effects when presenting our empirical results.

III.3 Cover Pool Information According to § 28 Pfandbrief Act

For an in-depth yield spread analysis, we further obtain information on the particular cover pools. Since the Pfandbrief Act came into effect on 19 July 2005, issuers are required

¹⁴Instead of only using the rating categories, the use of the Pfandbrief issuers’ CDS spreads would be a meaningful alternative. Unfortunately, CDS spreads are not available for most of the issuers.

¹⁵Due to a Grandfather clause, Pfandbriefe issued after 19 July 2001 are guaranteed if they do not mature after 31 December 2015.

to publish details of their cover pool composition to enhance the transparency of the Pfandbrief market. These publications according to § 28 Pfandbrief Act are compulsory for all issuers starting on 31 December 2005 and are released on a quarterly basis as of 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.¹⁶

The transparency report of an issuer basically contains the following information on the public-sector cover pool and all outstanding public Pfandbriefe as well as on the mortgage cover pool and all outstanding mortgage Pfandbriefe:¹⁷

- Notional Pfandbrief volume outstanding, the corresponding cover pool values, and the amount of overcollateralization
- Present value¹⁸ of outstanding Pfandbriefe, the corresponding cover pool present values, and the amount of overcollateralization
- Maturity profile of outstanding Pfandbriefe and cover loans
- Categorization of mortgage cover pool by cover loan size
- Breakdown of public cover pool by borrower’s place of residence
- Breakdown of mortgage cover pool by real property location and property type financed

We collect these data for 40 Pfandbrief issuers from their website or their investor relations department for the time span from December 2005 to December 2008.¹⁹ These dates are determined by the first compulsory report and the last report within our sample period, respectively. Table 2 presents the summary information for the cover pool information.

¹⁶Recently, the Association of German Pfandbrief Banks has started a transparency initiative and publishes the reports of all their members in a uniform format on their website. This data, however, only dates back to the fourth quarter 2009.

¹⁷Additional cover pool assets and derivatives as well as the cover loans being overdue for at least 90 days are also reported. These values, however, usually account for a negligible fraction of the cover pool and, therefore, are not considered in our study.

¹⁸In this context, the “present value” is defined according to the Pfandbrief-Barwertverordnung (PfandBarwertV) as the sum of future cash flows discounted by using customary yield curves.

¹⁹Due to mergers and acquisitions within the last years, the number of Pfandbrief banks in our sample dropped to 46. Six issuers with in total only 27 outstanding Pfandbriefe do not report according to the current Pfandbrief Act.

The results show that cover pools differ considerably between different issuers. For public Pfandbriefe, for example, the cover pool's notional values range between EUR 60 million and EUR 91,383 million. For mortgage Pfandbriefe, the range lies between EUR 75 million and EUR 54,237 million. On average, approximately 3/4 of the total cover pool consists of public-sector loans. This number slightly declines over time.

Most of the outstanding Pfandbriefe and cover pool loans have a maturity of 1 to 5 years with slight differences between the issuers. For public Pfandbriefe, a large fraction of the pool consists of German cover pool assets. For mortgage Pfandbriefe, the majority is also backed by German cover loans. Whereas a considerable amount of commercial mortgages in the cover pools is from abroad, there is only a small amount of foreign residential mortgages. However, there is a great variety between issuers since issuers without any German cover pool asset as well as issuers without any foreign cover pool asset exist.

Recognizing the differences between the cover pools, we define the following explanatory variables to capture the different types of risk within the cover pools. These variables are calculated for every Pfandbrief issuer on a quarterly basis.

- Overcollateralization: $OC = \frac{\text{Cover pool value} - \text{Outstanding amount Pfandbriefe}}{\text{Outstanding amount Pfandbriefe}}$
- Term transformation: $TRANS = \frac{\text{Average maturity of pool assets} - \text{Average maturity of outstanding Pfandbriefe}}{\text{Average maturity of outstanding Pfandbriefe}}$
- Percentage of Pfandbriefe due the following year:
 $PB_{DUE} = \frac{\text{Amount of Pfandbriefe due next year}}{\text{Outstanding amount Pfandbriefe}}$
- Percentage of cover loans due the following year:
 $CL_{DUE} = \frac{\text{Amount of cover loans due next year}}{\text{Total amount cover loans}}$
- 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 large cover loans: $LARGE = \frac{\text{Amount of cover loans} > \text{EUR 5 million}}{\text{Total amount cover loans}}$
- Percentage of residential cover loans: $RES = \frac{\text{Amount of residential cover loans}}{\text{Total amount cover loans}}$

- Percentage of commercial cover loans: $COM = \frac{\text{Amount of commercial over loans}}{\text{Total amount cover loans}}$

Table 3 shows the summary statistics of these variables. Overcollateralization (OC) can be measured on a notional or present value basis. The median OC amounts to 9.8% for public and 17.8% for mortgage Pfandbriefe on a notional basis and is slightly higher in terms of present value. § 4 Pfandbrief Act requires the OC to be a least 2% on a present value basis and, therefore, the minimum is always above this value. The extreme maximum values are for WestLB that had already built a large cover pool when it started to issue the first public-sector Pfandbriefe under the new Pfandbrief Act, and for SachsenLB with many cover loans, but hardly any mortgage Pfandbrief outstanding shortly before taken over by LBBW. Maintaining the OC on a higher level than the minimum level is often required by rating agencies for assigning a specific Pfandbrief rating. In particular, this requirement is made for mortgage Pfandbriefe, 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 Pfandbrief payments for both, public and mortgage Pfandbriefe. 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 outstanding Pfandbriefe. If $TRANS$ is zero, the average maturities coincide. A higher $TRANS$ signals a shorter average maturity of the outstanding Pfandbriefe, a smaller one signals a shorter average maturity of the cover pool. On average, $TRANS$ is slightly below 1/2 year, i.e. the average cover pool maturity is 1/2 year longer than the average maturity of the outstanding Pfandbriefe. However, there may be large maturity mismatches since $TRANS$ ranges between -6 and 6 years. In general, a maturity mismatch may cause several problems. First, the cover pool and the outstanding Pfandbriefe may react differently to interest rate changes. Second, a shorter maturity of the outstanding Pfandbriefe may lead to the need of 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 Pfandbrief holder and we expect a positive relation between the yield spread and $|TRANS|$.

The interpretation of the next two variables, the percentage of Pfandbriefe and cover loans due the following year (PB_{DUE} and CL_{DUE}), is quite similar. A higher PB_{DUE} may signal the need of 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 15% to 20%, but may also be 0% or almost 100%. These variables, however, have to be used with care since maturity mismatches can also be compensated by the use of derivatives or other bank assets and liabilities.

Pfandbriefe are mainly backed by German cover assets with median values of 89% for public and 98% for mortgage Pfandbriefe. 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 shown less volatile and less overvalued than real estate markets of other countries.²⁰ Therefore, German cover assets can be regarded as less risky leading to a lower yield spread. The empirical analysis will provide evidence whether one of these effects is prevalent or whether the impact even depends on the considered sample period.

$SMALL$ and $LARGE$ show the percentage of mortgage cover loan amounts below EUR 300,000 and above EUR 5 million, respectively. Their values range between 0% and 100%. 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 being negatively related to $SMALL$. Vice versa, we predict a positive relation for $LARGE$ as a measure for low diversification.

On average, Pfandbrief issuers finance residential and commercial mortgages in equal shares. However, there are large differences between issuers, ranging from complete residential financing to complete commercial financing. Since commercial financing is

²⁰For the last ten years, the IPD Total Return Property Index for Germany shows a substantially lower annualized volatility of below 1% compared to values above 2% for most other countries (up to 5% for the United States).

usually more risky and shows a higher dependence on the business cycle, a high fraction of commercial mortgages (*COM*) – or, equivalently, a low fraction of residential mortgages (*RES*) – should lead to a risk premium for the corresponding Pfandbriefe. Moreover, it is important to note that the variables *RES* and *COM* are closely related to *SMALL* and *LARGE* as residential mortgages are typically smaller and commercial mortgages often exceed EUR 5 million. Therefore, it is not surprising that the variables are positively correlated, with $\rho(\text{SMALL}, \text{RES}) = 0.93$ and $\rho(\text{LARGE}, \text{COM}) = 0.89$. To avoid the problem of multicollinearity, we do not simultaneously include them into a regression.

We compute the quarterly yield spreads for each Pfandbrief as the average of the weekly yield spreads during the six weeks following the record date. 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 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. After the quarterly calculation, we remain with 972 outstanding Pfandbriefe with available price data and 4,678 quarterly yield spreads for the time span from December 2005 to December 2008. Table 4 presents the summary information for the quarterly data. The number of available issues drops due to the modification of the time period. The composition of the data set in terms of Pfandbrief segments and rating classes, however, does not change notably.

IV Empirical Results

IV.1 Descriptive Statistics

We first investigate the yield spreads of the different Pfandbrief segments relative to Bunds. Figure 1 shows the average yield spreads of the four segments on a weekly basis. The vertical lines mark the beginning of the subprime crisis period, and the post-Lehman period, respectively. In the pre-crisis period until June 2007, the average Pfandbrief spread for all segments relative to Bunds is approximately 10 bp with a maximum of up to 30

bp. Surprisingly, also periods with average Pfandbrief spreads below zero exist, showing that Pfandbriefe sometimes even trade at a small yield discount relative to Bunds. This result signals the very high quality of Pfandbriefe perceived by investors.

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, after the collapse of Lehman Brothers, the spreads drastically increase to approximately 120 bp for Jumbo Pfandbriefe and 150 bp for traditional Pfandbriefe. These spreads signal the high risk premia demanded by investors during the recent financial turmoil and suggest that, at least during financial crises, Pfandbriefe cannot be regarded as close substitutes for Bunds in terms of risk. Moreover, this figure clearly supports the partitioning of our sample in a pre-crisis period and separate periods for the subprime crisis and the post-Lehman financial crisis.

Comparing the Pfandbrief spreads with respect to Bunds, however, does not allow to disentangle the different risk premia contained in the Pfandbrief market. Hence, it is still questionable whether the strong increase in yield spreads is mainly driven by liquidity or credit risk. For an in-depth analysis, we therefore compute the yield spreads relative to public Jumbo Pfandbriefe. This approach enables us to better isolate the individual risk premia by comparing Pfandbriefe that only differ in one dimension. Figure 2 shows the average yield spreads of the remaining three Pfandbrief segments on a weekly basis and striking yield differences *within* the Pfandbrief market become visible.

Similar to the yield spreads relative to Bunds, this figure also shows a different behavior during the pre-crisis period, the subprime crisis, and the post-Lehman period. In the pre-crisis period, the three average segment yield spreads mostly vary between -5 bp and 10 bp. Whereas mortgage Jumbo Pfandbriefe trade relatively stable at a yield spread of 2 bp on average, traditional Pfandbrief 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 Pfandbriefe and 20 bp for traditional Pfandbriefe, rising up to 50 bp after the collapse of Lehman Brothers.

For a detailed analysis, Table 5 shows the descriptive statistics of the individual yield spreads relative to the average public Jumbo Pfandbrief yield curve for the total

sample and the different subperiods. In general, mortgage Jumbo Pfandbriefe trade at a small premium and traditional Pfandbriefe at a larger premium relative to public Jumbo Pfandbriefe. Hence, Pfandbriefe backed by mortgages seem to be considered as more risky than those covered by public-sector loans. Moreover, the lower liquidity of traditional Pfandbriefe is priced with 4–6 bp on average relative to Jumbo Pfandbriefe. During the crisis subperiods the average yield spreads significantly increase up to 38 bp for public traditional Pfandbriefe. Even though a rise in the credit risk premium for mortgage Jumbo Pfandbriefe can be observed, the effect on the liquidity premia for traditional Pfandbriefe is substantially larger.

Within a specific Pfandbrief segment, however, the yield spreads also vary considerably. During the pre-crisis and the subprime crisis period traditional Pfandbrief spreads are much more volatile with an increasing volatility during the latter period. In the post-Lehman period, yield spreads highly fluctuate within all Pfandbrief segments. Even for public Jumbo Pfandbriefe the yield spreads vary between -48 bp and 192 bp. This observation shows that it is not sufficient to partition the Pfandbrief market into the four segments to entirely explain the varying yield spreads. Hence, further risk factors should be considered.

In summary, the results clearly show that the Pfandbrief market cannot be regarded as homogenous and considerable differences between the Pfandbriefe segments as well as between individual Pfandbriefe exist. In the following, we explore the yield spreads within the Pfandbrief market in detail and relate them to liquidity and credit risk proxies.

IV.2 Analysis of Pfandbrief Spreads

In this section we investigate the Pfandbrief yield spreads on a weekly basis. We aim to assign the different components of the yield spreads to the explanatory variables introduced in Section III.2. Panel A of Table 6 displays seven regression results for the pre-crisis period which all comprise segment dummies and differ by the inclusion of Pfandbrief rating dummies (Regression B) and issuer rating dummies (Regression C). Regressions D to G further include the Pfandbrief's relative age and outstanding amount as liquidity proxies as well as two dummies for Landesbank Pfandbriefe issued before and

after the abolishment of the guarantor liability on 18 July 2005.

The results show a significant and positive relation between the yield spreads and the dummies for mortgage and traditional Pfandbriefe. Depending on the inclusion of further explanatory variables, the average credit risk premium for mortgage Pfandbriefe relative to public Pfandbriefe amounts to 2 bp and the average liquidity premium for traditional Pfandbriefe relative to Jumbo Pfandbriefe adds up to 4 bp. The joint dummy variable is always higher and 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 Pfandbrief 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 Pfandbriefe. Surprisingly, the absence of a Pfandbrief rating does not unambiguously lead to a higher yield spread. This result, however, may be driven by the fact that Pfandbriefe are usually not rated in the beginning of our sample period and, thus, a rating does not signal a higher credit quality per se. Even though the impact of the rating dummies is significant, they hardly explain any variation in the yield spreads when omitting the segment dummies (not reported). In contrast, the issuer rating may explain a meaningful part, increasing the adjusted R^2 up to 10%. The results are also economically significant as a Pfandbrief from a BBB/BB rated issuer on average trades at a premium of more than 4 bp compared to a AAA/AA rated issuer. This result provides evidence that investors already value the long-term issuer credit quality during the pre-crisis period when Pfandbriefe are typically considered as close substitutes to Bunds.

The results also show a significant and positive relation between the yield differences and the liquidity proxies. Besides the premium for traditional Pfandbriefe, a higher relative age and a lower outstanding amount (both signaling a lower liquidity) lead to a significantly higher yield spread. In particular, a Pfandbrief close to maturity on average trades at an additional yield spread of 6 bp relative to its issuance. Hence, liquidity seems to be an important priced risk factor even during the pre-crisis period.

Our results further show that the average yield spreads for Landesbank Pfandbriefe significantly increase after the discontinuation of the guarantor liability. Investors seem

to attribute a risk premium of 3 bp to Pfandbriefe that are not guaranteed by the federal states even though the underlying cover pools did not change considerably. Overall, the full model (Regression G) explains roughly 14% of the yield spread variation within the Pfandbrief market.

The results for the subprime crisis presented in Panel B of Table 6 are similar in terms of sign and significance, but much more pronounced. The yield spreads are higher in absolute terms and the adjusted R^2 is up to 40%. It is important to note that the credit risk premium between mortgage and public Pfandbriefe only increases to 3–5 bp whereas the liquidity premium between traditional and Jumbo Pfandbriefe considerably increases up to 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. 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.

Whereas the yield spread between AA and AAA rated Pfandbriefe is approximately 4 bp, the yield spreads between the issuer rating categories are up to 7 bp. Similar to the pre-crisis period, the issuer rating explains a higher fraction of the variation in the yield spreads. In addition, the Pfandbrief'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 Pfandbriefe, provides evidence of a considerably higher liquidity premium during the subprime crisis.

In contrast to the results during the pre-crisis period, Landesbank Pfandbriefe are penalized with significant yield spreads of up to 4 bp. This result can be rationalized by the fact that nearly all Landesbanks were engaged in unsuccessful investments in the subprime market. Hence, investors also appear to value the risk stemming from non-Pfandbrief businesses. As expected, the yield spread is significantly higher for Pfandbriefe issued after the abolishment of the guarantor liability.

The results substantially change during the period after the collapse of Lehman Brothers. While the explanatory variables explain a large part of the yield spread in

the previous regressions, Panel C of Table 6 shows that the Pfandbrief segments are able to exclusively explain only 16%. The major part can be proxied by the issuer rating dummies, the liquidity proxies and firm-specific effects leading to an adjusted R^2 of 50% for the full model. However, there are still significant differences between the Pfandbrief segments, most notably between traditional and Jumbo Pfandbriefe. The average yield spread between these segments is up to 45 bp and shows the particular relevance of liquidity in the post-Lehman era. Moreover, yield spreads between low and high rated Pfandbriefe as well as low and high rated issuers increase considerably. The average yield spread of a BBB rated issuer compared to an AA rated issuer exceeds 22 bp and is larger than the impact of the Pfandbrief rating or whether the Pfandbrief is covered by mortgage or public-sector loans. This result strongly indicates that investors consider the issuers' default risk even though Pfandbriefe are backed by high-quality cover assets.

Besides the striking yield difference between traditional and Jumbo Pfandbriefe, the relative age has a strong impact of up to 25 bp between recently issued and almost matured Pfandbriefe. Hence, liquidity seems to be the most important factor considered by Pfandbrief investors. However, the Pfandbrief yield spreads are also driven by various issuer fixed effects during this periods. In contrast to the previous results, Landesbank Pfandbriefe trade at a yield discount of up to 17 bp compared to other Pfandbriefe – irrespective whether the Pfandbrief is issued before or after the discontinuation of the guarantor liability. This result signals that, against the background of the financial crisis, investors expect the owners or the state to rescue Landesbanks even though a legal guarantee does not apply any more. Apparently, the evident problems of the private banks DEPFA and Hypo Real Estate are priced by investors with yield spreads of approximately 96 bp and 50 bp, respectively. Hence, investors do not completely anticipate the rescue of these issuers in case of default. However, it is important to note that the problems of these issuers did not arise in the cover pool assets, but are due to non-Pfandbrief business. Therefore, our investigation provides further evidence that investors evaluate the default risk of an issuer to a large extent, even though the cover pools remain reliable.

In summary, our results show that the Pfandbrief market exhibits considerable heterogeneity, and the risks perceived by investors strongly vary over time. During the

pre-crisis and the subprime crisis period, the four Pfandbrief segments account for a large part of the Pfandbrief yield spreads whereas the issuer rating does not play an important role. After the collapse of Lehman Brothers, however, the issuer rating and issuer-specific factors become more important. Moreover, it is surprising that the specific cover pool quality, proxied by mortgage versus public-sector loans as well as the Pfandbrief rating, seems to be only a subordinate factor beyond liquidity and issuer default risk. Therefore, it seems sensible that rating agencies nowadays consider the issuer quality as an additional factor for their rating methodology. Above all, liquidity appears to be the most important risk factor priced in the secondary Pfandbrief market.

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 Pfandbrief rating. In the following, we explicitly consider proxies for the quality of the cover pool using the information according to § 28 Pfandbrief Act presented in Section III.3.

Cover pool information is available on a quarterly basis only. In order to ensure consistency, we initially compare the basic results for weekly and quarterly yield spread data. Table 7 reports the descriptive statistics for the individual Pfandbrief yield spreads relative to public Jumbo Pfandbriefe on a quarterly basis. The results are very similar to those using weekly data and being presented in Table 5: Mortgage Jumbo Pfandbriefe trade at a small premium and traditional Pfandbriefe at a larger premium. The premia substantially increase during the financial crisis. Even though the number of observations is much smaller, the regression results do not change considerably when using quarterly data. Table 8 shows that the sign of the coefficient estimates mostly coincide and the magnitude is quite similar compared to the results displayed in Table 6. Hence, the interpretation of the results does not change compared to the results for weekly data presented in Section IV.2. This robustness check shows the consistency of the samples with weekly and quarterly data. Therefore, we proceed with quarterly data to analyze the impact of the cover pool variables.

The regression results presented in Tables 6 and 8 have shown that the model

including the Pfandbrief segments, the issuer rating, and the liquidity proxies is superior in explaining the individual Pfandbrief yield spreads. Therefore, we use this model as the basic model when measuring the impact of the cover pool variables. In contrast to the previous regressions, however, we refrain from using the Pfandbrief rating dummies since we aim to measure the quality of the cover pool directly by using the cover pool variables defined above. Table 9 displays the regression results for the pre-crisis period (Panel A), the subprime crisis (Panel B) and the post-Lehman financial crisis (Panel C). Regression A shows the basic model and Regression B to G include the six cover pool variables defined in Section III.3 separately. Regression H provides the coefficient estimates for the cover pool variables only, and Regression I presents the results for the full model.

During the pre-crisis period, only the impact of the overcollateralization OC is significant when including the cover pool variables separately. As expected, a higher OC leads to a lower yield spread. The impact, however, is economically small given that an OC of 100% may decrease the yield spread by only 0.22 bp. Considering the six cover pool variables alone, the adjusted R^2 amounts to roughly 3% signaling that only a very small part of the Pfandbrief yield spreads can be explained by the cover pool variables. Estimating the full model, however, leads to superior results. Even though the cover pool variables only account for a small rise of the adjusted R^2 , three of them have a significant impact. First, the OC is significant negative as in Regression B. Second, a higher fraction of German cover assets leads to a higher yield spread. Thus, Pfandbrief investors seem to price the lower regional diversification within the cover pools. Third, Pfandbriefe with a more granular portfolio trade at a significant yield discount, signaling the higher value of Pfandbriefe with a diversified underlying cover pool.²¹

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 8, we provide evidence that, during the pre-crisis period, the Pfandbrief yield spreads are mainly driven by the differences between the four Pfandbrief segments and their relative liquidity. The additional impact of the issuer rating and the quality of the cover pool is of minor importance.

²¹Instead of *SMALL*, we separately include *LARGE*, *RES*, and *COM* into the regression analysis. The results, however, do not change remarkably, and the interpretation remains identical.

The results only slightly change during the period of the subprime crisis. Whereas the four Pfandbrief segments and the liquidity proxies already explain 42% of the variation in the yield spreads, the full model only marginally improves the adjusted R^2 by 1%. During the subprime crisis, however, the variable measuring the term transformation, $|TRANS|$, has a significant impact on the yield spreads. A maturity-mismatch of the cover assets and the outstanding Pfandbriefe by one year accounts for 1 bp of the yield spread. Moreover, a higher fraction of Pfandbriefe due within the following year, PB_{DUE} , is significantly related to a higher yield spread. These results indicate that, during the period of the subprime crisis, investors are concerned about the term transformation of the Pfandbrief issuer. Moreover, as during the pre-crisis period, Pfandbriefe with a more granular portfolio trade at a significant yield discount. However, the Pfandbrief segment variables and the liquidity variables remain the primary drivers of the yield spread.

The picture completely changes when investigating the post-Lehman period. Panel C of Table 8 has already shown that the issuer's long term credit rating is an important driver of the yield spread beyond the Pfandbrief segment and the liquidity variables. In addition, Panel C of Table 9 provides evidence that Pfandbrief investors also evaluate the cover pool quality in detail. When considering the six cover pool variables separately, four of them are significantly related to the yield spread. As during the subprime period, the term transformation, $|TRANS|$, is positively related to the yield spread with an impact of 6 bp for each year of maturity-mismatch. A higher amount of cover loans due within the following year, CL_{DUE} , is also positively related to the yield spread at a 10% significance level. This is consistent with investors being concerned about the capability of the issuer to provide additional cover assets of at least the same quality.

In contrast to the results for 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 turmoils. Moreover, a more granular cover pool as measured with $SMALL$ and, equivalently, a higher fraction of residential mortgages have a significantly negative impact on the yield spread. Thus, Pfandbrief investors prefer cover pools that are less volatile and less dependent on the contemporaneous economic

conditions.

Considering the full model, Regression I shows that the cover pool variables additionally account for almost 4% of the adjusted R^2 compared to the basic model (Regression A). It is surprising that the cover pool variables even explain a larger part of the Pfandbrief yield spread than the consideration of the Pfandbrief rating as in Regression G in Panel C of Table 8. Moreover, it is noteworthy that the overcollateralization OC does not have a significant impact during the period of the subprime crisis and the post-Lehman period. Moreover, the impact is economically very small in the pre-crisis period. Hence, investors do not seem to take into account the amount of OC when pricing a Pfandbrief. 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 can be regarded as less relevant since the number frequently may change by the issuance of new Pfandbriefe. Overall, our results show that the general composition of the cover pool is more important than simply the amount of overcollateralization.

Altogether, the results for the post-Lehman financial crisis provide evidence that liquidity is the most important risk factor for pricing Pfandbriefe. Whereas it is less relevant whether the Pfandbrief is backed by public-sector or mortgage loans, the composition of the cover pool gains more importance. The issuer rating as well as firm-specific effects remain relevant.

V Summary and Conclusion

In this paper we extensively study credit risk and liquidity premia within the Pfandbrief market. In contrast to previous studies, we show that liquidity is not the exclusive driver of yield spreads between Pfandbriefe and German government bonds and issuer-specific effects as well as the cover pool quality is also relevant. Therefore, our results show that the presumption of a homogenous Pfandbrief market cannot be sustained any longer.

Pfandbriefe differ with respect to their type of collateral, the quality of the issuer, the quality of the cover pool, and their liquidity. In general, yield spreads between individual Pfandbriefe are mainly driven by their relative liquidity and whether they are covered by

public-sector or mortgage loans. Even though the recent financial crisis has its origin in the mortgage market, the type of cover assets appears to be less important during this period. Liquidity, however, proves to have the most important effect.

Strict legal requirements ensure the high quality of the Pfandbrief cover pool and aim to guarantee the Pfandbrief holder timely payments of the Pfandbrief obligations. However, the general quality of the Pfandbrief issuer still has an important impact, in particular during the financial crisis. This result shows that Pfandbrief investors are concerned about an issuer's default and the potential subsequent illiquidity or devaluation of a Pfandbrief. Hence, it is not surprising that nowadays all major rating agencies consider the issuer rating as an important factor for their Pfandbrief rating methodology.

In general, the impact of the cover pool quality is quite small. Hence, our results provide evidence that the strict regulation of German Pfandbriefe ensures the overall high quality of the cover pool. During the recent financial crisis, however, some variables like the term transformation between Pfandbriefe and their cover pool or the fraction of German cover assets show a significant impact on the yield spreads. Therefore, the mandatory publications according to § 28 Pfandbrief Act seem to be less important during normal market times, but provide additional value in times of financial turmoil. During these periods, Pfandbrief issuers with a sustainable cover pool may profit from relatively lower refinancing cost.

Altogether, the Pfandbrief market has shown to develop from a relatively homogenous market until the end of the nineties to a heterogenous market with issuer-specific and liquidity related risk premia. The understanding of the different risk premia within the Pfandbrief market is important for investors, issuers, and regulators. Investors are mainly interested in accurately knowing about the risks inherent in the Pfandbrief market during different market environments. Issuers need to know the perceived risk factors priced by investors to design an optimal Pfandbrief issuance. As the Pfandbrief market is systemic for the German banking system, regulators are concerned about the issuers' long-term ability to meet their Pfandbrief obligations. Moreover, regulators from other countries should be informed about the important risk factors when setting up a legal framework for covered bonds.

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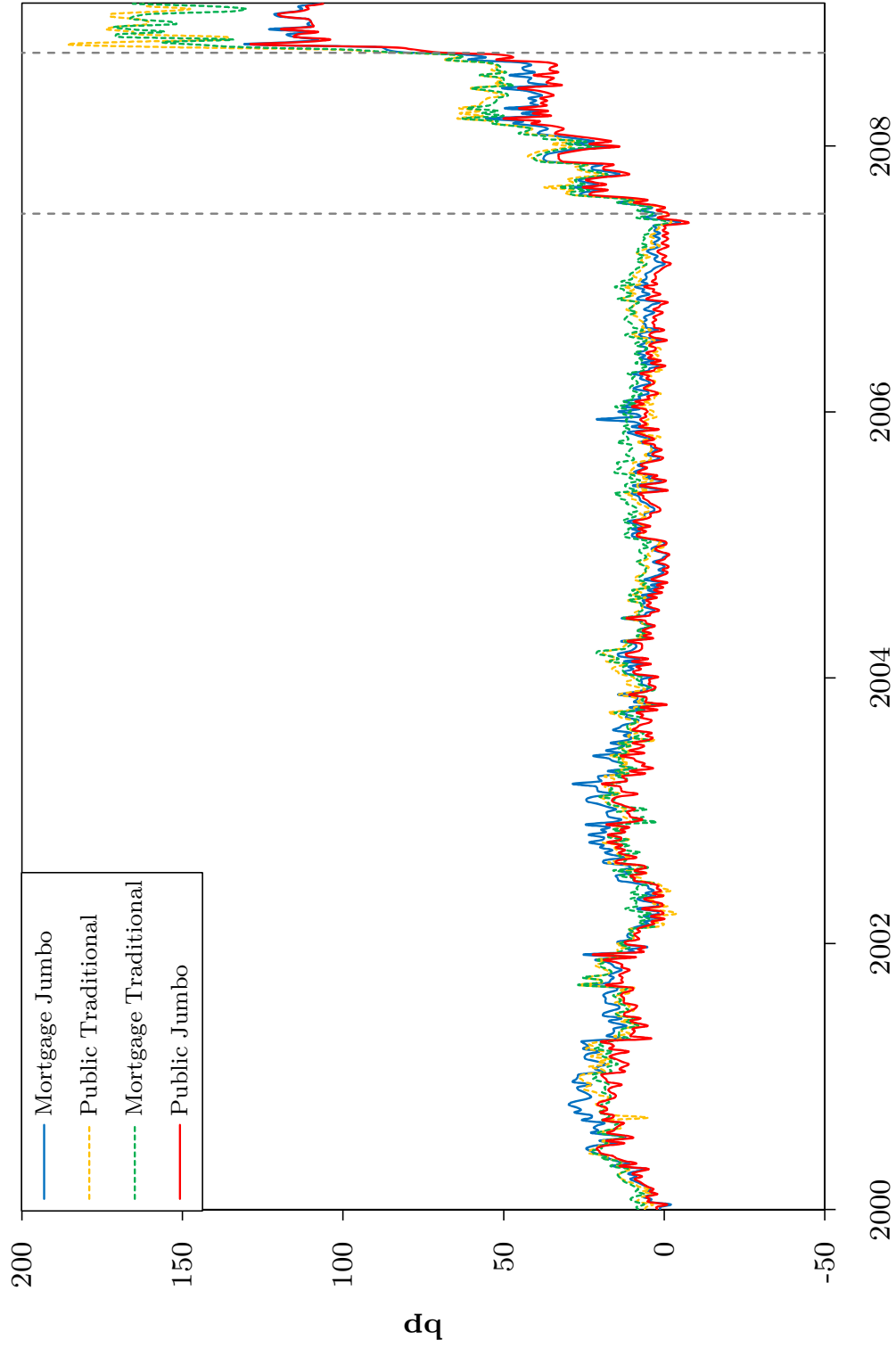


Figure 1: Yield Spreads relative to German Bunds

This figure shows the average yield spreads of the four Pfandbrief 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 2000 until January 2009.

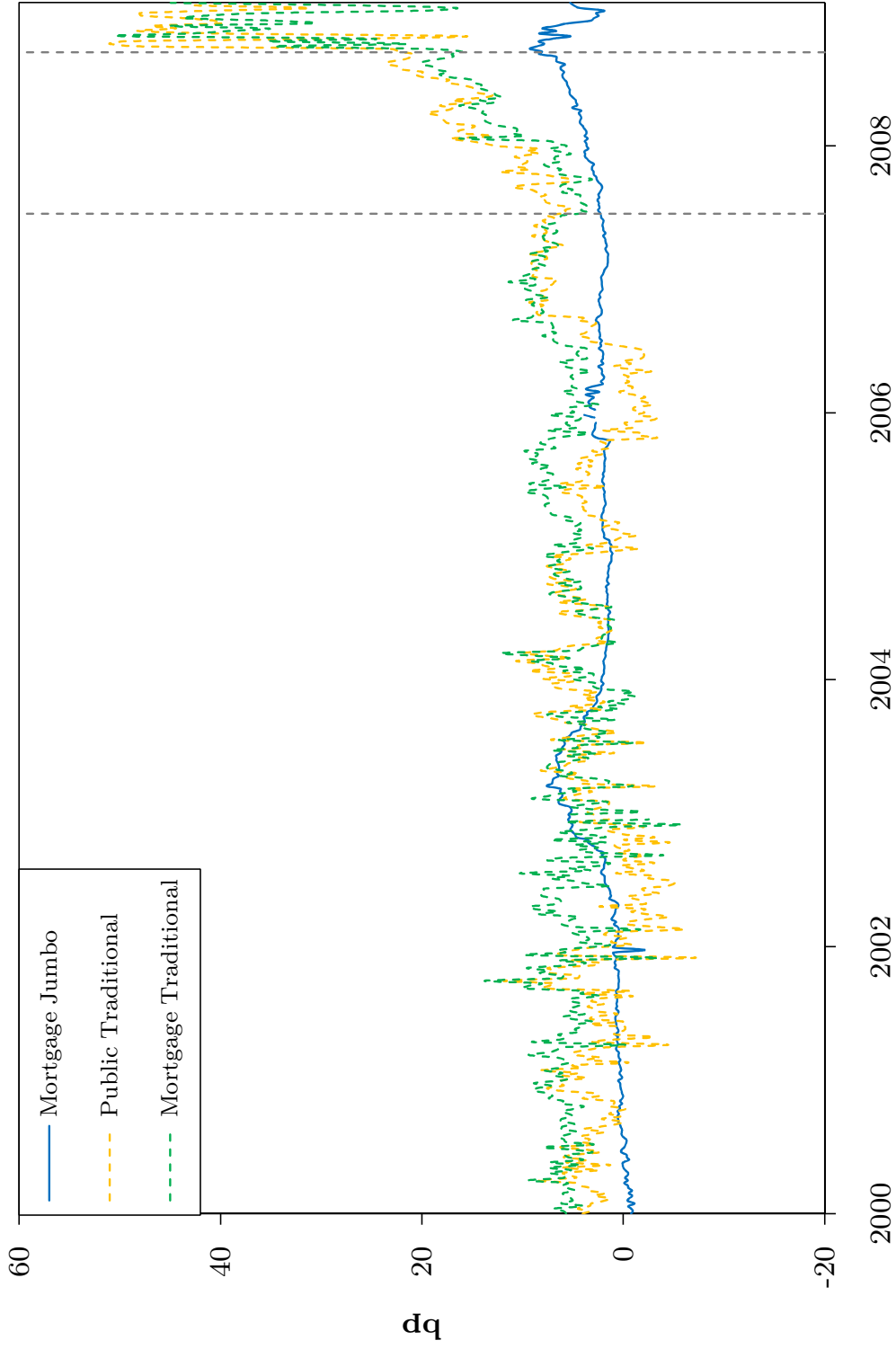


Figure 2: Yield Spreads relative to public Jumbo Pfandbriefe

This figure shows the average yield spreads of three Pfandbrief segments relative to the term structure of public Jumbo Pfandbriefe in basis points. The average yield spreads are calculated on a weekly basis for the time period from January 2000 until January 2009.

Table 1: Summary Information of the Pfandbrief Data Set (Weekly Data)

This table shows the summary information for the Pfandbriefe considered in our study. Panel A breaks down the statistics by the Pfandbrief segment, Panel B by the average long-term issuer credit rating by Fitch, Moody's, and Standard & Poor's. A single issue is unambiguously assigned to a Pfandbrief segment and may be allocated repeatedly for a specific issuer rating due to rating changes. The data on the outstanding amount is 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 then across time. The number of weekly observations is the number of available bond prices for the respective issues during the three sub-periods and the whole sample period from January 2000 to January 2009. The three sub-periods range from January 2000 to June 2007 (pre-crisis), from July 2007 to September 2008 (subprime crisis) and from September 2008 to January 2009 (post-Lehman).

Panel A: Pfandbrief Segment

Pfandbrief Segment	# Issues	# Issues with Price Availability	Outstanding Amount (EUR million)	Time to Maturity (years)			# Weekly Observations (Bond Prices)			Prices occurring on Wednesdays	
				pre-crisis	subprime crisis	post-Lehman	pre-crisis	subprime crisis	post-Lehman		all
Public Jumbo	464	420	1,467	3.16	2.76	2.89	72,546	7,996	2,098	82,640	99.6%
Mortgage Jumbo	96	84	1,514	4.20	3.29	3.33	13,932	2,862	806	17,600	99.7%
Public Traditional	3,617	1,357	165	2.92	1.81	1.90	40,725	6,992	1,329	49,046	89.2%
Mortgage Trad.	2,221	731	125	2.77	2.25	2.26	29,663	2,527	511	32,701	91.1%
Overall	6,398	2,592	409	2.96	2.21	2.39	156,866	20,377	4,744	181,987	95.3%

Panel B: Issuer Rating

Issuer Rating	# Issues with Price Availability			Mortgage			# Weekly Observations (Bond Prices)			
	Public Jumbo	Mortgage Jumbo	Traditional	Traditional	all	all	pre-crisis	subprime crisis	post-Lehman	all
AAA	53	1	567	131	752	11,660	0	0	11,660	
AA	261	44	1,158	505	1,968	65,653	7,585	1,822	75,060	
A	329	78	541	435	1,383	60,334	11,600	2,711	74,645	
BBB	90	20	81	91	282	10,002	299	184	10,485	
BB	31	12	36	19	98	839	650	0	1,489	
No Rating	90	9	173	81	353	8,378	243	27	8,648	

Table 2: Summary Statistics of Cover Pool Information according to § 28 Pfandbrief Act

This table reports the summary statistics of the cover pool information according to § 28 Pfandbrief Act. Panel A shows the data for public Pfandbriefe, Panel B for mortgage Pfandbriefe. The numbers are calculated from quarterly observations for 40 Pfandbrief issuers given in EUR million. Due to missing outstanding Pfandbriefe in a specific segment and acquisitions of Pfandbrief issuers, we remain with 453 observations for public Pfandbriefe and 398 observations for mortgage Pfandbriefe. The total sample consists of quarterly observations from 13 quarters as of December 2005 to December 2008. The overall statistics is based on the average aggregate number for all issuers published by the Association of German Pfandbrief Banks (vdpp) over the 13 quarters of the sample period.

Panel A: Public Pfandbriefe

Variable	Mean	Std. Dev.	Min.	25% Perc.	Median	75% Perc.	Max.	Overall
Notional value cover pool	19,844	21,248	60	3,193	13,077	26,499	91,383	692,004
Notional value outstanding Pfandbriefe	17,928	19,592	23	2,689	11,529	25,262	87,781	625,080
Present value cover pool	20,445	21,971	56	3,216	13,616	26,353	97,382	712,928
Present value outstanding Pfandbriefe	18,216	19,942	23	2,771	11,893	24,983	88,902	635,050
Cover loans with maturity up to 1 year	4,393	5,732	0	426	2,533	5,163	37,377	153,189
Cover loans with maturity > 1 year up to 5 years	7,416	8,376	0	1,061	5,278	9,475	40,150	258,551
Cover loans with maturity > 5 years up to 10 years	5,672	6,792	0	1,235	3,044	6,825	34,105	197,569
Cover loans with maturity > 10 years	2,364	3,293	0	224	1,139	2,782	16,708	81,671
Outstanding Pfandbriefe with maturity up to 1 year	3,413	4,184	0	435	2,232	4,311	24,046	118,811
Outstanding Pfandbriefe with maturity > 1 year up to 5 years	8,919	10,537	0	1,204	6,288	10,528	45,866	311,401
Outstanding Pfandbriefe with maturity > 5 years up to 10 years	3,501	4,180	0	444	2,011	4,878	24,220	121,542
Outstanding Pfandbriefe with maturity > 10 years	2,095	2,775	0	144	1,206	2,849	13,191	72,784
German cover pool assets	16,150	17,884	60	2,885	10,870	20,792	87,158	556,932
Foreign cover pool assets	3,587	6,088	0	274	1,105	4,181	30,875	113,278

Table 2 continued.

Panel B: Mortgage Pfandbriefe

Variable	Mean	Std. Dev.	Min.	25% Perc.	Median	75% Perc.	Max.	Overall
Notional value cover pool	7,619	11,518	75	839	4,509	7,362	54,237	234,364
Notional value outstanding Pfandbriefe	6,567	10,261	3	576	3,970	6,435	48,165	202,058
Present value cover pool	7,915	12,028	76	864	4,621	7,585	58,110	243,416
Present value outstanding Pfandbriefe	6,695	10,549	3	570	4,044	6,406	51,496	205,909
Cover loans with maturity up to 1 year	2,028	3,897	0	112	543	1,778	22,806	62,154
Cover loans with maturity > 1 year up to 5 years	2,985	4,984	7	261	1,632	2,713	28,096	91,984
Cover loans with maturity > 5 years up to 10 years	2,207	2,671	34	318	1,382	2,815	12,624	67,993
Cover loans with maturity > 10 years	396	516	0	34	154	632	1,993	12,062
Outstanding Pfandbriefe with maturity up to 1 year	1,183	2,053	0	22	355	1,305	12,670	36,509
Outstanding Pfandbriefe with maturity > 1 year up to 5 years	3,425	5,580	0	273	1,530	3,559	30,469	105,228
Outstanding Pfandbriefe with maturity > 5 years up to 10 years	1,623	2,642	0	71	782	1,742	16,585	50,082
Outstanding Pfandbriefe with maturity > 10 years	335	564	0	0	116	381	2,765	10,414
Cover loan amount up to EUR 300.000	3,116	5,968	0	87	745	3,229	32,584	95,643
Cover loan amount > EUR 300.000 up to EUR 5 mln	1,758	2,944	0	163	758	1,591	14,055	54,009
Cover loan amount > EUR 5 mln	2,315	3,637	0	190	1,156	3,042	23,562	71,271
German cover pool assets (residential)	4,172	7,238	0	240	1,529	3,735	39,147	131,422
German cover pool assets (commercial)	2,148	3,248	0	345	746	2,392	15,345	62,798
Foreign cover pool assets (residential)	44	132	0	0	0	19	908	1,578
Foreign cover pool assets (commercial)	778	1,876	0	0	22	472	11,514	24,186

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 Pfandbriefe, Panel B for mortgage Pfandbriefe. The numbers are calculated from quarterly observations for 40 Pfandbrief issuers. Due to issuers with outstanding Pfandbriefe in only one segment and due to acquisitions of Pfandbrief issuers, we remain with 453 observations for public Pfandbriefe and 398 observations for mortgage Pfandbriefe. The total sample consists of quarterly observations from 13 quarters as of December 2005 to December 2008.

Panel A: Public Pfandbriefe

Variable	Mean	Std. Dev.	Minimum	25% Perc.	Median	75% Perc.	Maximum
Overcollateralization (notional)	0.2749	0.6241	0.0112	0.0506	0.0976	0.2112	8.1304
Overcollateralization (present value)	0.3453	1.0572	0.0268	0.0731	0.1128	0.2235	14.2730
Average term transformation (years)	0.4323	1.4232	-5.0120	-0.3611	0.4758	1.1438	6.0225
Percentage of Pfandbriefe due the following year	0.1824	0.1290	0.0000	0.1081	0.1820	0.2438	0.9374
Percentage of cover loans due the following year	0.2039	0.1437	0.0000	0.0975	0.1682	0.3117	0.8317
Percentage German cover pool assets	0.8557	0.1353	0.3058	0.7888	0.8851	0.9633	1.0000

Panel B: Mortgage Pfandbriefe

Variable	Mean	Std. Dev.	Minimum	25% Perc.	Median	75% Perc.	Maximum
Overcollateralization (notional)	1.4932	6.1683	0.0228	0.0895	0.1776	0.6506	61.4230
Overcollateralization (present value)	1.4654	5.7029	0.0406	0.1144	0.2035	0.7024	56.4230
Average term transformation (years)	0.4690	1.7885	-6.1132	-0.7951	0.3536	1.5977	5.6263
Percentage of Pfandbriefe due the following year	0.1590	0.1620	0.0000	0.0485	0.1335	0.2145	1.0000
Percentage of cover loans due the following year	0.2082	0.1413	0.0000	0.1080	0.1645	0.2774	0.7331
Percentage of German cover pool assets	0.8943	0.2008	0.0849	0.8944	0.9797	1.0000	1.0000
Percentage of small cover loans	0.3322	0.3025	0.0000	0.0503	0.2449	0.5979	0.9951
Percentage of large cover loans	0.4051	0.2980	0.0000	0.1125	0.3866	0.6290	1.0000
Percentage of residential cover loans	0.4930	0.2856	0.0000	0.2315	0.5013	0.7558	1.0000
Percentage of commercial cover loans	0.5070	0.2856	0.0000	0.2442	0.4987	0.7685	1.0000

Table 4: Summary Information of the Data Set (Quarterly Data)

This table shows the summary information for the Pfandbriefe considered in our study. Panel A breaks down the statistics by the Pfandbrief segment, Panel B by the average long-term issuer credit rating by Fitch, Moody's, and Standard & Poor's. A single issue is unambiguously assigned to a Pfandbrief segment and may allocated repeatedly for a specific issuer rating due to rating changes. The data on the outstanding amount is 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 three sub-periods and the whole sample period from January 2006 to January 2009. The three sub-periods range from January 2006 to June 2007 (pre-crisis), from July 2007 to September 2008 (subprime crisis) and from September 2008 to January 2009 (post-Lehman).

Panel A: Pfandbrief Segment

Pfandbrief Segment	# Issues with Price Availability	Outstanding Amount (EUR million)	Time to Maturity (years)		# Weekly Observations (Bond Prices)				
			pre-crisis	subprime crisis	post-Lehman	pre-crisis	subprime crisis	post-Lehman	all
Public Jumbo Pfandbrief	194	1,440	3.01	2.72	2.86	822	630	210	1,662
Mortgage Jumbo Pfandbrief	57	1,523	3.93	3.40	3.37	261	207	78	546
Public traditional Pfandbrief	526	165	1.79	1.18	0.88	737	761	239	1,737
Mortgage traditional Pfandbrief	195	125	2.03	1.79	0.98	380	255	98	733
Overall	972	396	2.33	1.79	1.73	2,200	1,853	625	4,678

Panel B: Issuer Rating

Issuer Rating	# Issues with Price Availability				# Weekly Observations (Bond Prices)				
	Public Jumbo	Mortgage Jumbo	Public Traditional	Mortgage Traditional	all	pre-crisis	subprime crisis	post-Lehman	all
AAA	17	0	79	53	149	20	0	0	20
AA	127	8	913	276	1,324	672	759	267	1,698
A	298	67	526	424	1,315	1,288	1,028	339	2,655
BBB	87	15	102	99	303	153	31	15	199
BB	28	7	36	19	90	40	20	0	60
No Rating	9	1	7	14	31	27	15	4	46

Table 5: Descriptive Statistics for Yield Spreads (Weekly Data)

This table shows the summary statistics for the Pfandbrief yield spreads relative to the term structure of public Jumbo Pfandbriefe in basis points. The statistics are based on the equally weighted yield spread observations in the respective Pfandbrief segment and time period (winsorized at the 0.5th and 99.5th percentiles). N is the number of weekly observations. The sample period ranges from January 2000 to January 2009 (Panel A) and is partitioned into the pre-crisis period (January 2000 to June 2007, Panel B), the period of the subprime crisis (July 2007 to September 2008, Panel C), and the post-Lehman period (September 2008 to January 2009, Panel D).

Panel A: Total Sample

Pfandbrief Segment	Mean	Std. Dev.	Min.	Median	Max.	% > 0	N
Public Jumbo Pfandbrief	0.0	7.2	-48.3	-0.2	191.5	46.3%	82,640
Mortgage Jumbo Pfandbrief	2.6	8.5	-41.3	1.3	120.6	68.6%	17,600
Public Traditional Pfandbrief	5.5	13.9	-61.9	5.4	187.5	77.0%	49,046
Mortgage Traditional Pfandbrief	6.3	11.3	-36.2	6.1	195.9	81.9%	32,701

Panel B: Pre-Crisis Period

Pfandbrief Segment	Mean	Std. Dev.	Min.	Median	Max.	% > 0	N
Public Jumbo Pfandbrief	0.0	3.5	-9.4	-0.2	15.0	46.9%	72,546
Mortgage Jumbo Pfandbrief	2.1	4.5	-7.6	1.2	21.4	68.3%	13,932
Public Traditional Pfandbrief	2.9	9.9	-61.9	4.6	31.9	74.6%	40,725
Mortgage Traditional Pfandbrief	5.4	9.4	-33.1	5.9	63.0	81.7%	29,663

Panel C: Subprime Crisis

Pfandbrief Segment	Mean	Std. Dev.	Min.	Median	Max.	% > 0	N
Public Jumbo Pfandbrief	0.0	4.9	-12.3	-0.4	22.4	45.6%	7,996
Mortgage Jumbo Pfandbrief	4.0	5.8	-7.0	2.7	22.6	77.1%	2,862
Public Traditional Pfandbrief	14.4	13.1	-30.0	14.0	48.1	89.9%	6,992
Mortgage Traditional Pfandbrief	11.6	13.8	-27.7	11.2	52.4	84.7%	2,527

Panel D: Post-Lehman Period

Pfandbrief Segment	Mean	Std. Dev.	Min.	Median	Max.	% > 0	N
Public Jumbo Pfandbrief	-0.1	39.4	-48.3	-11.0	191.5	27.4%	2,098
Mortgage Jumbo Pfandbrief	5.8	32.6	-41.3	-2.7	120.6	43.1%	806
Public Traditional Pfandbrief	38.2	39.4	-42.7	41.8	187.5	82.8%	1,329
Mortgage Traditional Pfandbrief	30.0	36.9	-36.2	26.9	195.9	79.3%	511

Table 6: Regression Results for Pfandbrief Yield Spreads (Weekly Data)

This table reports the estimated coefficients (in bold) and the t-statistics from the regression of the Pfandbrief 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 Pfandbriefe issued by AAA/AA-issuers. We report selected issuer fixed effect dummies for Pfandbrief issuers being of particular interest during the respective period. The t-statistic is shown below the coefficient estimates and computed using Newey-West HAC standard errors. *** (**, *) denotes the significance at the 1% (5%, 10%) level. N is the number of weekly observations. The sample consists of weekly observations from January 2000 to June 2007 (Panel A), from July 2007 to September 2008 (Panel B) and from September 2008 to January 2009 (Panel C).

Panel A: Pre-Crisis Period

Regression	A	B	C	D	E	F	G
Constant	-0.02 -1.17	-0.41*** -11.21	-0.88*** -23.54	-2.94*** -37.56	-3.04*** -34.60	-3.90*** -49.90	-4.02*** -46.25
Mortgage Jumbo Pfandbrief	2.12*** 37.24	1.82*** 28.50	1.76*** 32.50	2.61*** 40.48	2.10*** 30.91	2.43*** 40.00	2.18*** 33.34
Public Traditional Pfandbrief	2.95*** 42.45	2.92*** 41.93	3.49*** 47.42	3.89*** 47.33	3.87*** 47.01	4.06*** 48.94	4.06*** 48.79
Mortgage Traditional Pfandbrief	5.46*** 71.10	5.33*** 68.28	5.83*** 71.36	6.01*** 65.75	5.91*** 64.62	6.12*** 64.63	6.07*** 63.99
AA Pfandbrief Rating		1.82*** 10.44		2.29*** 13.21	2.29*** 13.21		1.24*** 7.13
No Pfandbrief Rating		0.68*** 12.64		0.05 0.99	0.05 0.99		0.18*** 3.51
A Issuer Rating			0.80*** 14.55			0.87*** 14.42	0.86*** 14.17
BBB/BB Issuer Rating			4.44*** 48.77			4.04*** 42.33	3.91*** 40.69
No Issuer Rating			1.22*** 8.34			1.61*** 11.05	1.59*** 10.83
Relative Age				5.94*** 52.00	6.05*** 53.49	5.62*** 49.91	5.62*** 50.24
Outstanding Amount				-0.02 -0.86	-0.03 -0.93	-0.06** -2.46	-0.08*** -3.06
Landesbank pre July 2005				-0.72*** -11.40	-0.68*** -10.68	0.13* 1.81	0.14* 1.90
Landesbank post July 2005				2.62*** 11.06	2.65*** 11.18	3.27*** 13.19	3.30*** 13.33
N	156,866	156,866	156,866	156,866	156,866	156,866	156,866
Adjusted R^2	0.080	0.083	0.101	0.125	0.127	0.141	0.141

Table 6 continued.

Panel B: Subprime Crisis

Regression	A	B	C	D	E	F	G
Constant	-0.02	-0.45***	1.33***	-4.00***	-4.46***	-4.33***	-4.87***
Mortgage Jumbo Pfandbrief	-0.20	-5.05	7.47	-13.24	-14.73	-11.14	-12.39
	4.04***	1.99***	4.14***	5.15***	3.15***	4.92***	3.09***
	23.60	8.17	26.05	25.51	12.23	26.74	12.74
Public Traditional Pfandbrief	14.43***	14.03***	14.03***	9.84***	9.76***	10.27***	10.17***
	63.40	59.92	59.03	32.66	32.74	35.13	35.13
Mortgage Traditional Pfandbrief	11.59***	10.85***	11.92***	8.67***	7.80***	8.90***	8.04***
	30.24	29.08	31.55	21.25	19.41	22.16	20.31
AA Pfandbrief Rating		4.95***			4.56***		4.23***
		12.33			12.62		11.90
No Pfandbrief Rating		2.32***			-1.33***		-1.55***
		9.90			-5.29		-6.08
A Issuer Rating			-2.68***			0.00	0.00
			-11.87			-0.01	0.00
BBB/BB Issuer Rating			5.99***			7.64***	7.40***
			15.41			16.63	16.06
No Issuer Rating			-1.90***			2.01***	3.24***
			-3.98			3.60	5.70
Relative Age				11.42***	12.81***	10.91***	12.51***
				30.42	29.74	29.22	28.41
Outstanding Amount				-1.84***	-1.87***	-1.84***	-1.88***
				-12.86	-13.24	-14.71	-15.09
Landesbank pre July 2005				1.55***	1.36***	1.96***	1.80***
				5.32	4.87	5.59	5.26
Landesbank post July 2005				4.00***	4.12***	4.25***	4.43***
				15.19	15.70	12.46	12.95
N	20,377	20,377	20,377	20,377	20,377	20,377	20,377
Adjusted R^2	0.302	0.317	0.332	0.371	0.382	0.389	0.400

Table 6 continued.

Panel C: Post-Lehman Period

Regression	A	B	C	D	E	F	G
Constant	-0.13	0.02	-14.61***	-14.17***	-13.95***	-16.71***	-16.31***
	-0.11	0.02	-14.91	-8.07	-7.94	-7.81	-7.73
Mortgage Jumbo Pfandbrief	5.97***	-5.63***	0.30	8.88***	1.10	7.47***	1.60
	3.00	-3.12	0.15	5.44	0.70	4.73	1.06
Public Traditional Pfandbrief	38.33***	38.02***	45.35***	41.06***	41.36***	42.39***	42.47***
	20.67	20.62	26.93	19.14	19.31	19.66	19.80
Mortgage Traditional Pfandbrief	30.11***	24.15***	29.66***	33.01***	29.54***	33.13***	30.43***
	12.57	10.29	12.47	12.93	11.80	12.80	12.03
AA Pfandbrief Rating		22.62***			14.92***		11.68***
		8.55			6.16		4.97
No Pfandbrief Rating		-16.09***			-16.07***		-13.94***
		-5.96			-5.66		-4.70
A Issuer Rating			20.99***			3.80***	3.31**
			15.10			2.65	2.35
BBB/BB Issuer Rating			37.41***			26.28***	22.58***
			7.46			5.08	4.33
No Issuer Rating			3.73			-2.49	0.87
			1.00			-0.52	0.27
Relative Age				24.86***	24.31***	22.38***	22.38***
				8.53	8.39	7.72	7.74
Outstanding Amount				-2.46***	-2.13**	-2.87***	-2.54**
				-2.62	-2.27	-2.83	-2.53
Landesbank pre July 2005				-16.76***	-16.86***	-13.03***	-13.58***
				-10.35	-10.75	-6.92	-7.40
Landesbank post July 2005				-14.60***	-15.16***	-11.77***	-12.55***
				-10.12	-10.46	-6.86	-7.34
DEPFA				96.58***	95.39***	97.42***	96.37***
				19.79	19.42	19.88	19.60
HRE				51.05***	46.39***	52.15***	48.34***
				8.46	7.61	8.53	7.88
N	4,744	4,744	4,744	4,744	4,744	4,744	4,744
Adjusted R^2	0.167	0.188	0.228	0.479	0.488	0.491	0.497

Table 7: Descriptive Statistics for Yield Spreads (Quarterly Data)

This table shows the summary statistics for the Pfandbrief yield spreads relative to the term structure of public Jumbo Pfandbriefe in basis points. The statistics are based on the equally weighted yield spread observations in the respective Pfandbrief segment and time period (winsorized at the 0.5th and 99.5th percentiles on a weekly basis). N is the number of quarterly observations. The sample period ranges from January 2006 to January 2009 (Panel A) and is partitioned into the pre-crisis period (January 2006 to June 2007, Panel B), the period of the subprime crisis (July 2007 to September 2008, Panel C), and the post-Lehman period (September 2008 to January 2009, Panel D).

Panel A: Total Sample

Pfandbrief Segment	Mean	Std. Dev.	Min.	Median	Max.	% > 0	N
Public Jumbo Pfandbrief	-0.3	14.1	-43.3	-0.9	157.2	37.9%	1,662
Mortgage Jumbo Pfandbrief	2.3	13.1	-26.8	0.9	100.1	60.1%	546
Public Traditional Pfandbrief	13.9	21.1	-36.8	9.9	166.7	81.2%	1,737
Mortgage Traditional Pfandbrief	11.6	18.1	-29.9	9.0	128.1	79.1%	733

Panel B: Pre-Crisis Period

Pfandbrief Segment	Mean	Std. Dev.	Min.	Median	Max.	% > 0	N
Public Jumbo Pfandbrief	-0.5	3.5	-8.1	-0.8	12.0	36.5%	822
Mortgage Jumbo Pfandbrief	0.8	3.4	-6.5	0.4	18.2	57.5%	261
Public Traditional Pfandbrief	3.5	9.5	-29.2	4.5	24.1	69.2%	737
Mortgage Traditional Pfandbrief	6.0	8.9	-19.8	6.6	29.5	74.5%	380

Panel C: Subprime Crisis

Pfandbrief Segment	Mean	Std. Dev.	Min.	Median	Max.	% > 0	N
Public Jumbo Pfandbrief	-0.3	4.2	-10.5	-0.5	19.9	43.8%	630
Mortgage Jumbo Pfandbrief	2.8	4.5	-6.1	2.1	19.3	73.4%	207
Public Traditional Pfandbrief	15.3	12.1	-23.4	15.8	43.9	91.6%	761
Mortgage Traditional Pfandbrief	12.0	13.3	-23.9	12.1	47.7	85.5%	255

Panel D: Post-Lehman Period

Pfandbrief Segment	Mean	Std. Dev.	Min.	Median	Max.	% > 0	N
Public Jumbo Pfandbrief	0.5	38.5	-43.3	-13.0	157.2	25.7%	210
Mortgage Jumbo Pfandbrief	6.3	33.1	-26.8	-5.3	100.1	33.3%	78
Public Traditional Pfandbrief	41.3	37.7	-36.8	47.1	166.7	84.9%	239
Mortgage Traditional Pfandbrief	32.1	34.1	-29.9	34.8	128.1	80.6%	98

Table 8: Regression Results for Pfandbrief Yield Spreads (Quarterly Data)

This table reports the estimated coefficients (in bold) and the t-statistics from the regression of the Pfandbrief 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 Pfandbriefe issued by AAA/AA-issuers. We report selected issuer fixed effect dummies for Pfandbrief issuers being of particular interest during the respective period. The t-statistic is shown below the coefficient estimates and computed using Newey-West HAC standard errors. *** (**, *) denotes the significance at the 1% (5%, 10%) level. N is the number of quarterly observations and from January 2006 to June 2007 (Panel A), from July 2007 to September 2008 (Panel B) and from September 2008 to January 2009 (Panel C).

Panel A: Pre-Crisis Period

Regression	A	B	C	D	E	F	G
Constant	-0.52*** -3.22	-1.15*** -5.20	-0.09 -0.26	-2.53*** -4.16	-2.62*** -4.32	-3.71*** -5.32	-3.76*** -5.44
Mortgage Jumbo Pfandbrief	1.31*** 4.27	0.73** 2.22	1.62*** 5.09	2.34*** 5.73	1.46*** 3.53	2.42*** 6.03	1.64*** 3.89
Public Traditional Pfandbrief	4.03*** 8.76	3.84*** 8.38	4.06*** 8.88	2.04*** 3.47	2.12*** 3.67	2.74*** 4.75	2.77*** 4.88
Mortgage Traditional Pfandbrief	6.52*** 11.07	6.24*** 10.57	6.64*** 11.64	4.90*** 7.21	4.83*** 7.10	5.16*** 7.85	5.03*** 7.64
AA Pfandbrief Rating		2.29*** 3.49			2.47*** 3.68		2.18*** 3.25
No Pfandbrief Rating		1.56*** 4.03			-0.81* -1.80		-0.83* -1.84
A Issuer Rating			-1.40*** -3.27			0.28 0.58	0.33 0.68
BBB/BB Issuer Rating			2.74*** 4.11			3.09*** 4.71	2.80*** 4.27
No Issuer Rating			6.23*** 3.98			8.54*** 5.18	8.92*** 5.20
Relative Age				7.83*** 11.45	8.78*** 10.01	7.74*** 11.43	8.73*** 9.87
Outstanding Amount				-1.50*** -5.77	-1.55*** -5.96	-1.19*** -4.59	-1.27*** -4.82
Landesbank pre July 2005				-0.12 -0.27	-0.23 -0.52	0.34 0.65	0.23 0.45
Landesbank post July 2005				3.86*** 6.07	3.88*** 6.06	4.24*** 5.73	4.28*** 5.74
N	2,200	2,200	2,200	2,200	2,200	2,200	2,200
Adjusted R^2	0.108	0.119	0.143	0.214	0.220	0.237	0.243

Table 8 continued.

Panel B: Subprime Crisis

Regression	A	B	C	D	E	F	G
Constant	-0.26	-0.70***	1.78***	-2.33**	-2.80***	-2.09*	-2.64**
Mortgage Jumbo Pfandbrief	-1.21	-2.74	3.42	-2.57	-3.10	-1.72	-2.17
	3.05***	0.91	3.67***	4.39***	2.29***	4.49***	2.38***
	6.71	1.37	7.28	7.17	3.09	7.32	3.17
Public Traditional Pfandbrief	15.58***	15.23***	14.63***	9.93***	9.87***	10.22***	10.16***
	27.92	26.63	23.76	11.27	11.31	11.51	11.57
Mortgage Traditional Pfandbrief	12.28***	11.40***	12.36***	8.12***	7.11***	8.44***	7.41***
	11.74	11.20	12.17	7.03	6.22	7.30	6.48
AA Pfandbrief Rating		5.48***			4.85***		4.90***
		4.67			4.61		4.67
No Pfandbrief Rating		2.18***			-1.47**		-1.50**
		3.53			-2.26		-2.27
A Issuer Rating			-3.22***			-0.88	-0.83
			-5.04			-1.07	-1.02
BBB/BB Issuer Rating			2.24			3.19*	3.12*
			1.54			1.90	1.90
No Issuer Rating			-0.76			2.10	3.31*
			-0.59			1.16	1.83
Relative Age				10.35***	11.86***	10.27***	11.83***
				9.58	9.50	9.49	9.35
Outstanding Amount				-2.70***	-2.73***	-2.49***	-2.51***
				-6.22	-6.41	-5.70	-5.86
Landesbank pre July 2005				1.51**	1.31*	1.07	0.91
				1.98	1.80	1.12	0.98
Landesbank post July 2005				3.71***	3.81***	3.27***	3.42***
				5.34	5.50	3.51	3.65
N	1,853	1,853	1,853	1,853	1,853	1,853	1,853
Adjusted R^2	0.352	0.366	0.369	0.419	0.430	0.422	0.433

Table 8 continued.

Panel C: Post-Lehman Period

Regression	A	B	C	D	E	F	G
Constant	0.47	0.69	-13.94***	-16.48***	-16.05***	-18.93***	-18.72***
	0.14	0.21	-5.10	-4.07	-3.95	-3.98	-4.02
Mortgage Jumbo Pfandbrief	5.86	-7.74	-0.04	9.76**	0.15	8.51**	0.53
	1.03	-1.52	-0.01	2.12	0.04	2.03	0.14
Public Traditional Pfandbrief	40.81***	40.51***	48.42***	45.49***	45.87***	48.23***	48.46***
	9.40	9.47	12.74	10.57	10.76	11.75	11.95
Mortgage Traditional Pfandbrief	31.66***	24.65***	29.86***	34.82***	30.54***	36.50***	32.80***
	6.27	4.94	6.09	6.99	6.17	7.47	6.79
AA Pfandbrief Rating		28.22***			19.20***		16.35***
		4.14			3.52		3.29
No Pfandbrief Rating		-22.61***			-21.92***		-19.40**
		-2.74			-2.77		-2.41
A Issuer Rating			20.71***			0.54	0.64
			6.32			0.15	0.19
BBB/BB Issuer Rating			55.98***			41.76***	38.14***
			3.92			2.90	2.72
No Issuer Rating			-7.76			-18.26	-8.00
			-0.68			-1.22	-0.77
Relative Age				29.26***	28.80***	27.30***	27.14***
				4.80	4.85	4.61	4.66
Outstanding Amount				-2.27	-1.84	-1.35	-0.99
				-1.19	-0.97	-0.73	-0.54
Landesbank pre July 2005				-21.41***	-21.53***	-19.91***	-19.94***
				-5.85	-6.20	-4.52	-4.76
Landesbank post July 2005				-17.31***	-18.39***	-16.06***	-16.90***
				-5.52	-5.76	-3.98	-4.22
DEPFA				103.15***	100.48***	104.04***	101.72***
				20.05	19.12	20.74	20.05
HRE				40.25***	32.90**	41.87***	35.50***
				3.28	2.58	3.38	2.79
N	625	625	625	625	625	625	625
Adjusted R^2	0.199	0.234	0.272	0.528	0.546	0.551	0.563

Table 9: Regression Results for Pfandbrief Yield Spreads on Cover Pool Variables (Quarterly Data)

This table reports the estimated coefficients (in bold) and the t-statistics from the regression of the Pfandbrief 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 Pfandbriefe issued by AAA/AA-issuers. We report selected issuer fixed effect dummies for Pfandbrief issuers being of particular interest during the respective period. The t-statistic is shown below the coefficient estimates and computed using Newey-West HAC standard errors. *** (**, *) denotes the significance at the 1% (5%, 10%) level. N is the number of quarterly observations. The sample consists of quarterly observations from January 2006 to June 2007 (Panel A), from July 2007 to September 2008 (Panel B) and from September 2008 to January 2009 (Panel C).

Panel A: Pre-Crisis Period

Regression	A	B	C	D	E	F	G	H	I
<i>OC</i>		-0.22* -1.82						0.10 0.93	-0.27** -2.14
TRANS (years)			0.04 0.17					0.39 1.42	0.04 0.16
<i>PB_{DUE}</i>				2.88 1.18				-2.75 -0.93	2.02 0.76
<i>CL_{DUE}</i>					1.42 0.91			3.37* 1.79	1.00 0.60
<i>GERM</i>						1.36 1.21		8.21*** 5.16	2.51* 1.84
<i>SMALL</i>							-1.17 -0.95	1.42 1.60	-2.61* -1.75
Constant	-3.71*** -5.32	-3.79*** -5.39	-3.82*** -5.28	-4.26*** -5.44	-3.99*** -5.24	-4.89*** -4.79	-3.76*** -5.39	-5.72*** -3.74	-6.32*** -5.10
Mortgage Jumbo Pfandbrief	2.42*** 6.03	2.49*** 6.13	2.47*** 6.05	2.53*** 6.24	2.44*** 6.02	2.33*** 5.46	2.96*** 4.36	3.42*** 4.49	3.42*** 4.49
Public Traditional Pfandbrief	2.74*** 4.75	2.73*** 4.73	2.73*** 4.72	2.73*** 4.76	2.75*** 4.73	2.76*** 4.83	2.75*** 4.76	2.82*** 4.99	2.82*** 4.99
Mortgage Traditional Pfandbrief	5.16*** 7.85	5.39*** 7.79	5.24*** 7.77	5.26*** 7.82	5.21*** 7.74	5.16*** 7.55	5.79*** 6.33	6.50*** 6.71	6.50*** 6.71
A Issuer Rating	0.28 0.58	0.27 0.53	0.29 0.58	0.31 0.61	0.24 0.49	0.28 0.57	0.33 0.69	0.19 0.38	0.19 0.38
BBB/BB Issuer Rating	3.09*** 4.71	3.07*** 4.56	3.07*** 4.52	3.00*** 4.47	2.96*** 4.30	3.07*** 4.60	3.08*** 4.62	2.73*** 3.89	2.73*** 3.89
No Issuer Rating	8.54*** 5.18	8.80*** 5.00	8.84*** 4.93	9.06*** 4.93	8.78*** 4.97	8.76*** 4.98	8.58*** 4.87	7.88*** 4.32	7.88*** 4.32
Relative Age	7.74*** 11.43	7.83*** 11.36	7.84*** 11.38	7.78*** 11.29	7.80*** 11.30	7.83*** 11.36	7.75*** 11.41	7.75*** 11.24	7.75*** 11.24
Outstanding Amount	-1.19*** -4.59	-1.18*** -4.52	-1.19*** -4.58	-1.21*** -4.64	-1.23*** -4.70	-1.16*** -4.58	-1.19*** -4.57	-1.13*** -4.51	-1.13*** -4.51
Landesbank pre July 2005	0.34 0.65	0.55 0.98	0.42 0.76	0.41 0.75	0.42 0.77	0.20 0.34	0.40 0.75	0.11 0.17	0.11 0.17
Landesbank post July 2005	4.24*** 5.73	4.32*** 5.68	4.26*** 5.58	4.27*** 5.64	4.24*** 5.58	4.05*** 5.11	4.28*** 5.72	3.87*** 4.80	3.87*** 4.80
N	2,200	2,176	2,176	2,176	2,176	2,176	2,183	2,176	2,176
Adjusted R ²	0.237	0.240	0.239	0.240	0.240	0.240	0.237	0.026	0.241

Table 9 continued.

Panel B: Subprime Crisis

Regression	A	B	C	D	E	F	G	H	I
<i>OC</i>		-0.10 -0.33						0.59 1.10	-0.10 -0.37
$ TRANS $ (years)			1.01** 2.34					1.45*** 2.76	0.89** 2.03
<i>PB_{DUE}</i>				11.57*** 2.63				18.82*** 3.09	11.57** 2.28
<i>CL_{DUE}</i>					0.93 0.42			-10.02*** -3.64	-2.50 -0.93
<i>GERM</i>						-1.53 -0.92		9.76*** 4.13	-1.09 -0.56
<i>SMALL</i>							-3.58* -1.83	-3.42** -2.10	-3.96* -1.67
Constant	-2.09* -1.72	-2.10* -1.73	-3.04** -2.41	-3.91*** -2.78	-2.20* -1.74	-0.83 -0.46	-2.12* -1.75	-2.55 -1.13	-3.59* -1.77
Mortgage Jumbo Pfandbrief	4.49*** 7.32	4.48*** 7.28	4.37*** 7.10	4.58*** 7.28	4.43*** 7.18	4.60*** 7.18	5.84*** 5.89	5.84*** 5.89	6.22*** 5.44
Public Traditional Pfandbrief	10.22*** 11.51	10.22*** 11.52	10.17*** 11.53	10.06*** 11.39	10.21*** 11.49	10.20*** 11.40	10.33*** 11.56	10.33*** 11.56	10.13*** 11.49
Mortgage Traditional Pfandbrief	8.44*** 7.30	8.51*** 7.13	8.30*** 7.21	8.47*** 7.25	8.40*** 7.24	8.55*** 7.30	10.14*** 6.66	10.14*** 6.66	10.50*** 6.14
A Issuer Rating	-0.88 -1.07	-0.89 -1.08	-0.93 -1.14	-1.08 -1.32	-0.98 -1.18	-0.98 -1.18	-0.96 -1.17	-0.96 -1.17	-1.03 -1.28
BBB/BB Issuer Rating	3.19* 1.90	3.18* 1.90	3.20* 1.96	2.81* 1.69	3.16* 1.88	3.12* 1.85	3.40** 2.03	3.40** 2.03	3.08* 1.88
No Issuer Rating	2.10 1.16	2.09 1.16	1.61 0.90	1.94 0.93	1.94 1.04	2.31 1.28	1.58 0.85	1.58 0.85	1.52 0.72
Relative Age	10.27*** 9.49	10.28*** 9.47	10.39*** 9.59	10.02*** 9.18	10.24*** 9.28	10.28*** 9.47	10.29*** 9.47	10.29*** 9.47	10.23*** 9.28
Outstanding Amount	-2.49*** -5.70	-2.48*** -5.69	-2.47*** -5.69	-2.55*** -5.86	-2.51*** -5.76	-2.52*** -5.74	-2.43*** -5.52	-2.43*** -5.52	-2.42*** -5.59
Landesbank pre July 2005	1.07 1.12	1.11 1.16	0.98 1.05	0.71 0.77	1.06 1.11	1.28 1.30	0.93 0.98	0.93 0.98	0.70 0.72
Landesbank post July 2005	3.27*** 3.51	3.29*** 3.51	3.16*** 3.44	2.94*** 3.18	3.26*** 3.50	3.47*** 3.63	3.13*** 3.34	3.13*** 3.34	2.87*** 2.98
N	1,853	1,852	1,852	1,852	1,852	1,852	1,852	1,852	1,852
Adjusted R^2	0.422	0.422	0.425	0.426	0.422	0.422	0.423	0.063	0.429

Table 9 continued.

Panel C: Post-Lehman Period

Regression	A	B	C	D	E	F	G	H	I
<i>OC</i>		-3.00 -0.38						-2.92 -0.30	-2.69 -0.34
<i>TRANS</i> (years)			6.49** 2.43					12.40*** 3.53	10.36*** 3.92
<i>PB_{DUE}</i>				-16.74 -1.02				-39.99* -1.76	-46.86*** -2.63
<i>CL_{DUE}</i>					22.90* 1.83			35.82** 2.23	22.12* 1.69
<i>GERM</i>						-47.61*** -4.98		-78.23*** -5.54	-32.83*** -3.46
<i>SMALL</i>								-6.93 -0.73	-20.18* -1.74
Constant								74.76*** 5.31	3.41 0.33
Mortgage Jumbo Pfandbrief								19.64*** 3.02	8.21 1.33
Public Traditional Pfandbrief								49.30*** 12.29	48.62*** 12.12
Mortgage Traditional Pfandbrief								50.99*** 7.01	41.46*** 5.30
A Issuer Rating								0.85 0.24	1.94 0.55
BBB/BB Issuer Rating								39.68*** 2.87	43.03*** 3.57
No Issuer Rating								-21.24 -1.32	-23.39 -1.37
Relative Age								25.65*** 4.39	27.62*** 4.81
Outstanding Amount								-0.72 -0.40	-0.76 -0.42
Landesbank pre July 2005								-20.30*** -4.66	-16.43*** -3.63
Landesbank post July 2005								-16.84*** -4.15	-13.22*** -3.05
DEPFA								103.20*** 20.78	81.09*** 12.34
HRE								37.39*** 3.16	26.62* 1.86
N	625	625	625	625	625	625	625	625	625
Adjusted <i>R</i> ²	0.551	0.550	0.557	0.551	0.554	0.574	0.559	0.164	0.587