



SCHRIFTENREIHE
DES VERBANDES DEUTSCHER PFANDBRIEFBANKEN

Refinancing Real Estate Loans – Lessons to be Learned from the Subprime Crisis

von Professor Dr. Markus Rudolf
und Professor Anthony Saunders

BAND 38
VERBAND DEUTSCHER PFANDBRIEFBANKEN • BERLIN

vdp

Schriftenreihe
des Verbandes deutscher
Pfandbriefbanken

Band 38

Berlin, 2009

Abstract

This study aims at analyzing the credit risk implications of the financial market crisis on three types of financial instruments which securitize mortgage loans: Mortgage Pfandbriefe, Mortgage-Backed Securities (MBS), and Collateralized Debt Obligations (CDOs). While Mortgage Pfandbriefe are the predominant financial instrument to securitize mortgage loans in Germany, CDOs and MBS are forms of securitizing mortgage loans in the UK and the US. The study has shown that there are major legal and regulatory differences between the three instruments.

1. MBS and Mortgage Pfandbriefe are both covered by a pool of mortgages. While the cover pool in the case of Mortgage Pfandbriefe is carefully selected and has to satisfy legal requirements, eligibility criteria for MBS exist only for so-called agency MBS. However, the criteria for a mortgage loan to qualify for an agency MBS are significantly less strict than for Mortgage Pfandbriefe.
2. While Pfandbriefe are bonds issued by Pfandbrief Banks on their balance sheets, this is not the case for MBS and for CDOs. MBS are off-balance sheet assets. In the case of agency MBS however, the agency guarantees the underlying loan. Although that reduces the credit risk of an MBS significantly, according to expert opinions on-balance-sheet assets are still of higher quality since this implies that the issuer and the guarantor are the same institution which takes care of the loans. In fact, it is very difficult to find parameter combinations based on which a default of a Pfandbrief is possible at all. AAA tranches of CDOs do not have such a double safety cushion and they are off-balance-sheet liabilities implying significantly higher credit risks.
3. This report shows that with regard to both, theoretical and empirical considerations, the credit risk of Mortgage Pfandbriefe is significantly lower than for MBS and CDOs.

Table of Contents

Abbreviations	7
1. Economic environment of the subprime crisis	9
2. Legal and historical background of the market for mortgage loans in Germany, UK, and USA	15
2.1 Mortgage loans in Germany	18
2.2 Mortgage loans in the UK	19
2.3 Mortgage loans in the US	19
3. Why Mortgage Pfandbriefe are different from US Mortgage-Backed Securities and Collateralized Debt Obligations	22
3.1 Mortgage-Backed Securities (MBS)	24
3.2 Collateralized Debt Obligations (CDOs)	31
3.3 Mortgage Pfandbriefe	33
4. Credit risk assessment of alternative products	41
4.1 Mortgage-Backed Securities (MBS)	42
4.2 Collateralized Debt Obligations (CDOs)	49
4.3 Mortgage Pfandbriefe	54
4.4 Sensitivity analysis	58
5. Empirical evidence of relative performance of Pfandbrief vs. MBS in the crisis period	61
5.1 Empirical analysis on market developments	61
5.2 Sector trends	67
6. Market expert opinions	69
7. Extended Summary	73
8. References	77

List of Figures

Figure 1: Footprint of the financial crisis	11
Figure 2: Federal Reserve Prime Rates	12
Figure 3: S&P/Case-Shiller Composite-10 Home Price Index in the US ..	12
Figure 4: Delinquency rates of real estate loans in the US	12
Figure 5: Share of ARM loans of overall single-family mortgage loans outstanding	20
Figure 6: Balance sheet of a bank issuing covered bonds	23
Figure 7: Balance sheet of a bank issuing Mortgage-Backed Securities ..	24
Figure 8: Cash flows in the process of securitization	25
Figure 9: Market share of the agencies of overall issuance in the US MBS market	27
Figure 10: Share of US MBS issuances backed by ARM loans	27
Figure 11: Present value of cash flows from different mortgage contracts with regard to interest rate changes	30

Figure 12: Cash flow “waterfall” of CDOs.	31
Figure 13: Tranching of CDOs for credit risk	32
Figure 14: Illustration of mortgage lending values and market values.	37
Figure 15: Credit risk mechanism of Mortgage-Backed Securities.	44
Figure 16: Log-normal distribution for the portfolio of homes underlying the credit portfolio of a bank.	48
Figure 17: Default risk of mortgage loan portfolios for different loan-to-value ratios	48
Figure 18: Value of the homes portfolio and cut-off points for the three tranches.	50
Figure 19: Multiplying excellent credit ratings by tranching	52
Figure 20: Credit risk mechanism of the AAA tranche of a Collateralized Debt Obligation	53
Figure 21: Credit risk mechanism of a Mortgage Pfandbrief	55
Figure 22: Equity ratios and bankruptcy risk of Pfandbrief Banks given an expected change of real estate prices of -5%	57
Figure 23: Sensitivity of losses from holding CDOs respectively Mortgage Pfandbriefe from an investor’s viewpoint when the expected return on real estate prices changes.	59
Figure 24: Sensitivity of losses from holding CDOs respectively Mortgage Pfandbriefe from an investor’s viewpoint when the volatility of real estate prices changes	60
Figure 25: Sensitivity of losses from holding CDOs respectively Mortgage Pfandbriefe from an investor’s viewpoint when the default probability of AAA rated securities changes	60
Figure 26: CDS spreads in the EU and US banking sectors.	62
Figure 27: Rating changes of securitized instruments in Europe	62
Figure 28: Rating changes of securitized instruments in the US	62
Figure 29: Issuance of MBS in Europe.	63
Figure 30: Issuance of MBS in the US.	63
Figure 31: Worldwide issuance of covered bonds.	64
Figure 32: Issuance volume of German Pfandbriefe during the financial crisis	65
Figure 33: Spreads between German Pfandbriefe and German government bonds	66
Figure 34: Covered bond spreads over the 5 year swap rate	67
Figure 35: Average life of different covered bonds	68
Figure 36: Equity ratios of banks historically.	75
Figure 37: Equity ratios of system relevant banks	75

List of Tables

Table 1: Mortgage loan characteristics across different countries.	17
Table 2: Overcollateralization of Pfandbriefe.	35
Table 3: Regional diversification of assets in the cover pool of Hypo Real Estate.	36
Table 4: Issuer and mortgage covered bond ratings.	39
Table 5: Expected Loss due to credit risk for different instruments.	42
Table 6: Description of mortgage loans.	46

Table 7:	Description of model parameters.	46
Table 8:	Typical Pfandbrief Bank balance sheet.	56
Table 9:	Correlation between the asset and liability positions.	57
Table 10:	Issuing volumes of securitized instruments in billion Euro.	63
Table 11:	Covered bond issuance and outstanding volumes in 2007 per country.	65
Table 12:	Institution and position of the sample contacts.	69
Table 13:	Interviewees expressing their agreement on statements regarding general future market developments.	70

Abbreviations

<i>ABS</i>	Asset-Backed Securities
<i>ARM</i>	Adjustable Rate Mortgage
<i>BaFin</i>	Bundesanstalt für Finanzdienstleistungsaufsicht (German federal financial supervisory authority)
<i>BIS</i>	Bank for International Settlements
<i>bn</i>	Billion
<i>CAGR</i>	Compounded Annual Growth Rate
<i>CDO</i>	Collateralized Debt Obligation
<i>CDS</i>	Credit Default Swap
<i>CMBS</i>	Commercial Mortgage-Backed Securities
<i>CMO</i>	Commercial Mortgage Obligation
<i>EEA</i>	European Economic Area
<i>EUR</i>	Euro
<i>FHA</i>	Federal Housing Administration
<i>HFHA</i>	Federal Housing Finance Agency
<i>FRM</i>	Fixed Rate Mortgage
<i>GSE</i>	Government-Sponsored Enterprise
<i>H1</i>	First half of the year
<i>H2</i>	Second half of the year
<i>HUD</i>	Department of Housing and Urban Development
<i>IAS</i>	International Accounting Standards
<i>LGD</i>	Loss Given Default
<i>LIBOR</i>	London Interbank Offered Rate
<i>LTV</i>	Loan-to-value
<i>MBS</i>	Mortgage-Backed Securities
<i>OFHEO</i>	Office of Federal Housing Enterprise Oversight
<i>PAC</i>	Planned Amortization Class
<i>PTI</i>	Payment-to-Income-Ratio
<i>Q1</i>	First quarter of the year
<i>Q2</i>	Second quarter of the year

<i>Q3</i>	Third quarter of the year
<i>Q4</i>	Fourth quarter of the year
<i>REMIC</i>	Real Estate Mortgage Investment Conduit
<i>RMBS</i>	Residential Mortgage-Backed Securities
<i>SIFMA</i>	Securities Industry and Financial Markets Association
<i>SPE</i>	Special Purpose Entity
<i>SPV</i>	Special Purpose Vehicle
<i>UK</i>	United Kingdom of Great Britain and Northern Ireland
<i>US, USA</i>	United States of America
<i>VA</i>	US Department of Veterans Affairs
<i>VDP</i>	Verband deutscher Pfandbriefbanken (Association of German Pfandbrief Banks)
<i>WAC</i>	Weighted-average coupon
<i>WAM</i>	Weighted-average maturity

1. Economic environment of the subprime crisis

“The current financial crisis in the US is likely to be judged in retrospect as the most wrenching since the end of the Second World War.”

Alan Greenspan, former Chairman of the Federal Reserve, 17th March 2008

The current financial crisis started in the US market for subprime mortgage loans. The term subprime is associated to mortgagees with poor credit histories, with payment delinquencies, low credit scores, high loan-to-value-ratios, low income, or other factors which disqualifies them for prime mortgage rates.¹ The crisis started in the subprime segment but it has spilled over to segments which continue to deteriorate investor confidence. Examples are credit cards, student loans, car loans, leveraged buyouts, the market for corporate loans, etc. The result was a chain reaction initialized by subprime loans and meanwhile has affected the entire financial sphere with potentially serious future consequences for both, the financial services industry in general and in particular the refinancing real estate loan market.

The subprime crisis lurked slowly before it culminated in the bankruptcy of the investment bank Lehman Brothers in September 2008. Crouhy, Jarrow, Turnbull (2008) indicate that the historical average fraction of subprime loans accounted for 8% of all mortgage loans. This fraction increased precipitously after 2005. In 2007 origination of subprime loans accounted for more than 20%. In the beginning of 2007 there were approximately \$ 1.3 trillion² in subprime loans outstanding, of which \$ 600 billion³ originated in 2007 alone. Subprime mortgage lending started to expand in the mid 1990s supported by technological and product innovations. Moreover, this facilitated automated procedures of granting loans and managing risks which significantly reduced costs for lenders. Regulatory changes allowed the syndication of loans, created a new access to capital markets for refinancing, lowered transaction costs and made supply of mortgages to all types of households possible. With promised high returns, the market of subprime loans as well as the secondary market for syndicated subprime products increased rapidly.

As problems in the subprime market emerged in July 2007, signs of a substantial self-correction in the market became evident. Underwriting standards became more stringent and credit spreads for selected vintages increased. Credit spreads increased sharply and even ostensibly low-risk tranches of MBS were affected. For example credit spreads in the UK, Portugal and Italy tripled.⁴ During this period, rating

1 See Crouhy, Jarrow, Turnbull (2008), p. 81.

2 Cf. Testimony of Sandra F. Braunstein, Director, Division of Consumer and Community Affairs – Federal Reserve Board, on Sub-prime Mortgages, before the Subcommittee on Financial Institutions and Consumer Credit, Committee on Financial Services, US House of Representatives, March 27, 2007.

3 Cf. Testimony of Sandra L. Thompson, Director, Division of Supervision and Consumer Protection – Federal Deposit Insurance Corporation, Mortgage Market Turmoil: Causes and Consequences, before the Committee on Banking, Housing and Urban Affairs – US Senate, March 22, 2007.

4 Cf. Bank of England, Financial Stability Report (2007), p. 7.

agencies had begun to reevaluate and to downgrade MBS tranches. Investors became more cautious in investing in these assets and liquidity in these markets, particularly in more complex products like CDOs, was reduced significantly. Financial institutions were forced to write down MBS positions and account for losses in their balance sheets. Until August 2008 financial institutions all over the world recognized accumulated losses and write downs exceeding \$ 500 bn.⁵ Since some financial institutions operated with high financial leverage and on small liquidity basis, they were not able to serve their required capital charges or to refinance themselves. This initially led companies that were directly involved in mortgage lending, such as Northern Rock and Countrywide Financial, into severe financial distress. Northern Rock was a special case of a \$ 6 billion bank of which three-quarters of its funds were attributed to the inter-bank market. On September 12, 2007, Northern Rock turned to the Bank of England as lender of last resort after experiencing severe refinancing problems in the capital markets after markets for MBS dried up. This raised concerns about the banks future and a bank run erupted. To avoid eminent collapse, the British Government nationalized Northern Rock on February 17, 2008. Consequently, the order of events made the financial institutions behave with greater caution. Countrywide Financial followed in June 2008 and was acquired by Bank of America in July. Meanwhile stock markets all over the world started to significantly lose value.

In the beginning of March 2008, Bear Stearns, one of the large US investment banks, began to teeter on the brink of financial collapse and could only be saved by an acquisition via J.P. Morgan Chase that was supported by a non-recourse loan of \$ 29 bn by the Federal Reserve. During the proceedings, Bear Stearns and the mortgage lenders Fannie Mae and Freddie Mac collapsed and were taken under conservatorship by the Treasury Department. On September 15, 2008 Lehman Brothers declared bankruptcy after the federal government refused to bail out the investment bank. Figure 1 presents an overview over the different phases of the crisis.

5 Cf. www.bloomberg.com/apps/news?pid=20601087&sid=a8sW0n1Cs1tY&refer=home

Figure 1: Footprint of the financial crisis

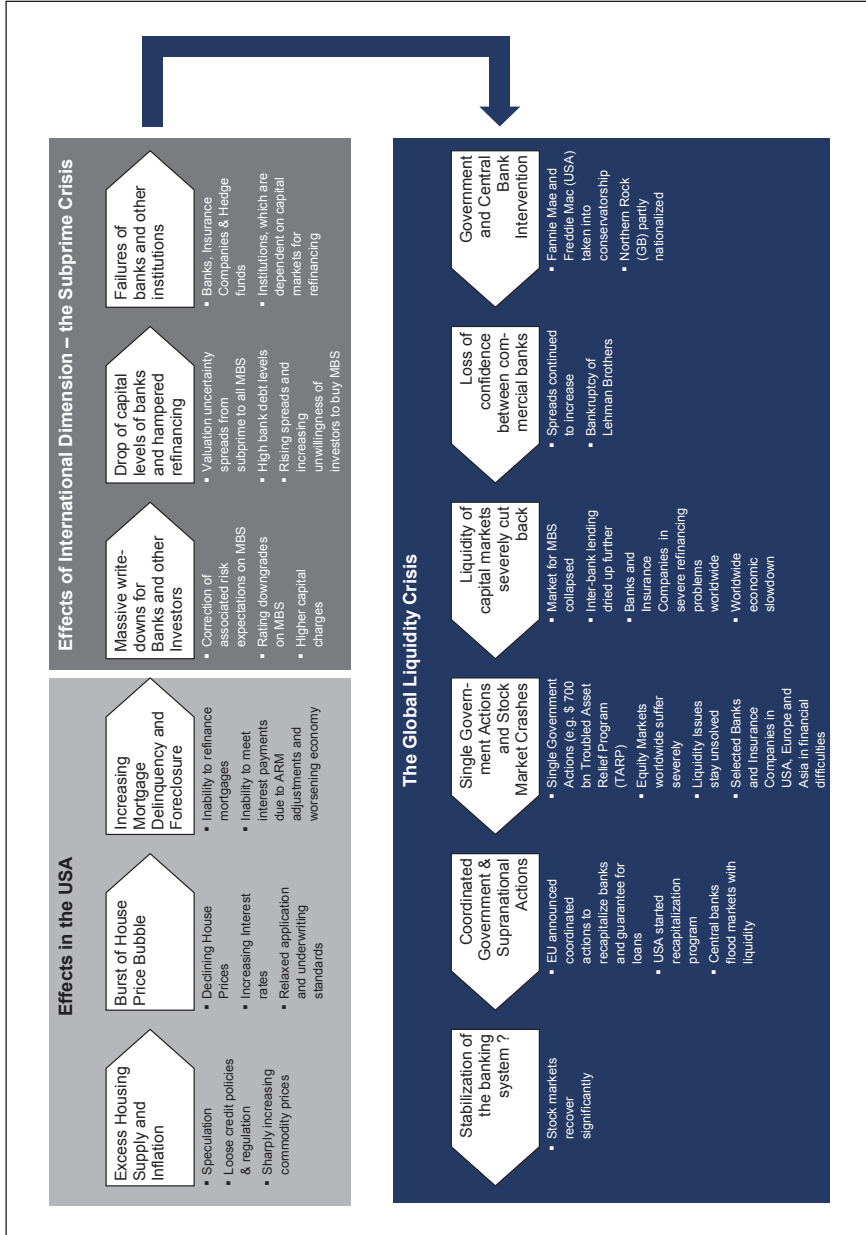
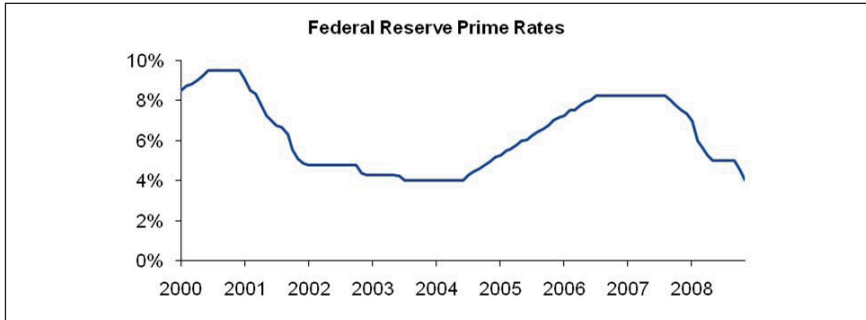
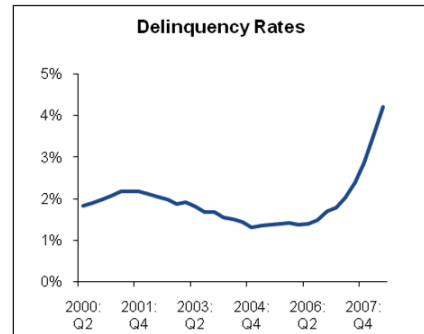


Figure 2: Federal Reserve Prime Rates

Source: Federal Reserve Board. <http://www.federalreserve.gov/datadownload/Build.aspx?rel=H15>, 11th December 2008.

Figure 3: S&P/Case-Shiller Composite-10 Home Price Index in the US

Source: Standard & Poor's. January 2000 equals 100.

Figure 4: Delinquency rates of real estate loans in the US

Source: US Federal Reserve. The data is seasonally adjusted and is based on US banks. Delinquent loans are those past due thirty days or more and still accruing interest as well as those in nonaccrual status. They are measured as a percentage of end-of-period loans.

The target of this paper is to compare several ways to refinance mortgage loans and to gauge exposure to credit risk. The paper aims to contribute to the ongoing discussions on the lessons that can be learned from the subprime crisis and which consequences for refinancing real estate loans in the future can be drawn. Therefore, this first chapter will give an overview of the order of events that led to the financial crisis and the role of certain practices of real estate financing. Chapter 2 will then provide an overview of the differences of the loan origination. Chapters 3 and 4 will illustrate three ways to securitize mortgage loans: Mortgage-Backed Securities (MBS), Collateralized Debt Obligations (CDOs) as the most important credit risk transfer instruments in the mortgage loan market, and German Mortgage Pfandbriefe

of which the other two instruments will be benchmarked. Chapter 3 gives a general overview on the differences between these three instruments; it shows that the three different ways to securitize mortgage loans are not the same. Chapter 4 develops a simple model for assessing the credit risk of the three instruments and relates the driving factors for credit risk to the financial crisis. Chapter 5 deals with empirical aspects of MBS, CDOs, and Pfandbriefe. Chapter 6 provides some opinions of the market for mortgage loans based on 11 interviews with market experts. Chapter 7 provides an executive summary.

The German Pfandbrief is a covered bond having a long tradition on the German capital markets. Pfandbriefe are covered by a pool of mortgages, whereby strict criteria for the cover pool eligibility have to be met. Contrary to Mortgage-Backed Securities, covered bonds are on-balance sheet instruments. This report will show that the strict legal framework and the structure of covered bonds create a refinancing vehicle for mortgage loans which offers a high degree of safety for the creditors – usually confirmed by an AAA rating.

The economic environment in which this report is written can be characterized by some remarks of Ben S. Bernanke,⁶ the chairman of the Federal Reserve, and Crouhy, Jarrow, Turnbull (2008). Six major factors can be identified that finally led to the burst of the subprime bubble.

1. **Macroeconomic factors:** The most important factor for this process is an environment with very low interest rates after the burst of the technology bubble in 2001. Figure 2 shows the sharp decline in the Federal Reserve prime rates between 2001 and 2005. This initiated a search for higher yields among market participants. This was accompanied by significant house price changes in the US which have been another important factor of the financial crisis. Exhibiting a compounded annual growth rate (CAGR) of more than 11% over the last ten years, house prices peaked in the summer of 2006. Since then, they declined by approximately 20% until the summer of 2008 (see Figure 3). Lower house prices imply higher default risks since the loan-to-value ratio increases. Indeed, the share of delinquent residential loans increased dramatically which is depicted in Figure 4.
2. **The regulatory environment:** Another aspect is the regulatory framework Basel II which regulates the coverage of credit risky assets with capital funds in the global banking system. Crouhy, Jarrow, Turnbull (2008) demonstrate that the capital requirement for a AAA credit risk is not higher than 56 basis points, resulting from a 7% risk weight and a 8% capital requirement. This phenomenon has enhanced the use of AAA instruments in banks. Chapter 3 will show how mortgage loans have been structured and packed such that AAA rated investment vehicles were generated out of a pool of mortgage loans with considerably lower credit risk ratings.
3. **Established mortgage structures:** In general, one has to differentiate between two main categories of mortgages: fixed-rate mortgages and adjustable-rate mortgages. Fixed-rate mortgages are characterized by the fact that over the

6 Cf. Chairman Ben S. Bernanke at the Federal Reserve Bank of Chicago's 43rd Annual Conference on Bank Structure and Competition, Chicago, Illinois.

whole period the borrower has to pay a constant sum periodically, the so-called “note rate” which is determined at the inception of the loan. Adjustable-rate mortgages on the other hand use variable periodical payments, which are most of the time linked to an index, like the 12-month LIBOR, plus a predetermined fixed margin. The adjustment of the periodical note rate takes place either monthly, semi-annually or annually. Typically, both types of mortgages have an amortization period of 30 years and a monthly payment frequency. In the subprime market it is very common to use a hybrid structure of the two types of mortgages. Normally, the mortgages are constructed in such a way, that for the first two to three years the payment is fixed, as in a classical fixed-rate mortgage and afterwards becomes variable, like in the adjustable-rate mortgage structure. The most popular subprime product, the 2/28 hybrid loan, for example has a low, fixed rate for the first two years. This is the so-called teaser rate which is much lower than the fair rate. It then becomes adjustable semi-annually for the remaining lifetime of 28 years. Besides those two major and dominant types of mortgages other types exist as well. On the one hand there exist the negatively amortizing mortgages, which are constructed in a way that the borrower pays back less than the full amount of the interest to the lender. The missing payments are consequently added to the principal. On the other hand there is the interest only mortgage. In this case the borrower pays at the beginning of the mortgage lifetime only the interest for pre-set period of time. At the end of the period the borrower has to pay down the principal in addition to the periodic interest.

4. The mortgage application and syndication system: The mortgage application and syndication system contributed in several ways to the crisis. Incentive structures tied the issuer’s revenue to the number and not the quality of loans closed. Furthermore, with the selling of the loans, the issuers were able to pass through most of the risks associated with them to the investors. Issuers were willing to loosen underwriting standards and to accept inaccuracy of necessary mortgage application information, such as weak credit histories, incomplete income documentation and other risk factors. This came along with deficient information and documentation about the mortgage applicants and a resulting overestimation of repayment capacity of both borrowers and lenders. These looser standards very likely were an important source of credit defaults. These behaviors particularly caused issues for subprime tranches originated from 2005 and onwards.

Hence, delinquency rates of subprime mortgage loans increased from 10.33% in 2005 Q2 to 18.67% in 2008 Q2.⁷ Moreover, the performance of different loan pools began to diverge more sharply.⁸

5. High competition in the subprime mortgage business: The fifth factor of the crisis is the high competition in the mortgage business. Investors focused on the search for high yield products and carried much liquidity and issuers were urged to offer further mortgages although the market of potential borrowers

7 Cf. Press releases of the Mortgage Bankers Association and own calculations. <http://www.mortgagebankers.org/NewsandMedia/PressCenter/64769.htm> and <http://www.mortgagebankers.org/NewsandMedia/PressCenter/44582.htm>, 11th December 2008.

8 See for instance Bank of England, Financial Stability Report (2007), p. 7.

decreased and new target groups (with larger risks) had to be identified. That came along with issuers loosening the underwriting and documentation standards in order to realize significant fee revenues. US mortgage brokers are “unlicensed” and “unregulated” and their compensation is almost entirely fee driven.

6. Another important point which led to the crises according to Crouhy, Jarrow, and Turnbull (2008) was the decline in credit standards. Banks were able to generate positive net present values by just repacking their mortgage loans in CDO structures. At the same time, rating agencies spuriously assigned AAA ratings for the senior tranches of CDOs. Moreover, there was clearly a conflict of interest whereby agencies suggested CDO structures and at the same time rated them.

2. Legal and historical background of the market for mortgage loans in Germany, UK, and USA

This chapter gives an overview of the primary mortgage markets, focusing on Germany, the UK and the US. A mortgage loan is a loan that is secured by the underlying real property through the use of a mortgage. The borrower pledges the real property to the lender as a security for the mortgage loan, granting the lender the right to repossess the property in the event of default. Most of the originated mortgages have a first-lien status.⁹ Specific procedures for the foreclosure and the sale of the property exist in nearly every jurisdiction and usually underlie strict governmental regulation. In the following, *mortgage* will be used as a synonym for a mortgage loan, analogously to the everyday usage. This type of lending is primarily used to finance residential properties and leads to a reduced interest rate of the loan by applying a lower risk premium because of the collateral.

Mortgage brokers play a very important role in the UK and the US but not in Germany. They act as an intermediary between the borrower and the lender. The scope of the brokers' activities varies. Brokers can, on the one hand, just collect information on the borrower and pass on the application to potential lenders. On the other hand, their activities can also include comprehensive advice on appropriate loan terms with regard to the borrowers' specific circumstances instead of doing a pure sales-job on behalf of the lending institution.

In general, the loan availability and the conditions of the mortgage loan offered depend heavily on the credit worthiness of the borrower. After having captured the required information on the borrower, the lender decides if the borrower qualifies for the loan and which loan rate will be applied. Instead of offering every borrower the same loan rate, risk-based pricing is the commonly applied methodology. The existence of asymmetric information with respect to the borrower's credit worthiness can potentially lead to a problem of adverse selection. The approach of risk-based

9 Cf. Bhattacharya/Berliner (2005), p. 488.

pricing is based on the evaluation of the borrower's credit worthiness and leads to higher loan rates when certain factors indicate that the borrower has a high risk of default. The approach of relationship-based pricing is a new concept emerging in the financial industry. This concept is taking into account the potential cross-selling opportunities for the lender in the context of a customer relationship with the borrower. In Germany, the branch-based application is the predominant form. Lending institutions often have long-standing customer relationships with the applicants and therefore have a variety of information available to assess the borrower's financial standing more accurately.

In general, the assessment of the borrower's credit worthiness consists of two main evaluations by the lender: First, the evaluation of the borrower's ability to make the scheduled payments, and second, the evaluation of the property which will be pledged as collateral. Important indicators of the credit worthiness and the ability to meet the scheduled payments are credit scores and Payment-to-Income ratios (PTI). Credit scores are numerical summaries of the borrower's credit history and other relevant factors like the employment status, whereas the PTI sets up a ratio between the monthly income and the pay load for the mortgage which should not exceed a certain limit. Key indicators of a property's quality to serve as collateral are the property's usage and type. While owner-occupied homes, especially primary residences, are regarded as implying a low risk of default, this is different for mortgage loans which are used to finance real estate properties for investment purposes. Along these lines, single-family residences are regarded as less risky than multi-family residences or condominiums. Furthermore, the location of the real estate property is an important risk factor. However, the loan amount compared to the real estate value is the main factor of the property's quality to serve as collateral.

The Loan-to-Value ratio (LTV) indicates the leverage used to finance the property. Whereas in some countries, like Germany, the valuation of the property depends on governmental regulation, in others, like the UK, valuation standards are set by the valuation profession itself without the involvement of the governmental authorities. Furthermore, there are even some countries without any legal or self-regulatory rules in place.¹⁰ The higher the LTV, the higher the associated risk for the lender, since it becomes more likely, due to house price declines, that the lender cannot recover all the outstanding balance in the event of default. In most cases, a certain minimum down payment will be required from the borrower, implying that the LTV is not allowed to exceed a certain level. The position of the borrower can be seen as a put option in the pledged property with the remaining loan balance as exercise price. The LTV is an important indicator of the repayment incentives and for the likelihood of the borrower exercising the put option. This put option is usually referred to as default option. Therefore, real estate price developments are important factors influencing the borrower's default probability.¹¹ Deng, Quigley and Van Order (2000) find a significant influence of the LTV ratio on default rates.

10 Cf. European Commission (2006), pp. 15 et seq.

11 Cf. Case/Shiller (1996).

Furthermore, they find significant effects of divorce rates and also unemployment rates which can be interpreted as indicators of the borrower's income situation.¹²

Table 1: Mortgage loan characteristics across different countries¹⁾

	Germany	UK	US
Dominating mortgage loan product	Fixed-rate, with prepayment indemnities	Variable-rate	Fixed-rate, prepayment options without indemnities
Typical LTV	67%	69%	75%
Maximum LTV	80%	110%	97%
Outstanding in Millions (2007)	€ 957,326 ²⁾	£ 875,400 at the end of 2004 ³⁾	\$ 11,135,792 ⁴⁾
Home ownership rate ⁵⁾	42%	70%	69%
Time to debt relief in the case of bankruptcy ⁶⁾	6 years	12 months	--

1) Based on Green/Wachter (2005).

2) Deutsche Bundesbank, Zinsstatistik September 2008.

3) www.housingfinance.org, 24th September 2008.

4) US Office of Federal Housing Enterprise Oversight: <http://www.ofheo.gov/Research.aspx?Nav=111>

5) <http://www.economywatch.com/mortgage/germany.html>, 24th September 2008.

6) According to the German Insolvency Act (*Insolvenzordnung*), the English Enterprise Act 2002 and the US Chapter 7.

Lending institutions face diverse peculiarities in the different national mortgage markets, as can be seen in Table 1. One important factor is the typical amount of money borrowed by the mortgagee and respectively by the amount of financial leverage. In Germany, the LTV ratio is typically significantly lower than in the US and also slightly lower compared to a mortgage loan in the UK. Moreover, the maximum LTV usually accepted in Germany is only 80%, whereas the mortgagees in the US are able to finance nearly the complete property purchase by a loan. In the UK, even up to 110% of the property value can be borrowed. As outlined, these peculiarities of the different mortgage markets imply different risk levels for the lending institutions, since the severity of a borrower's default for the lender depends heavily on the LTV ratio.

Consumer bankruptcy laws are another factor influencing a borrower's default probability. While the US and the UK are viewed as debtor friendly, this is not the case for Germany. According to Chapter 7, consumers in the US can easily file for bankruptcy and discharge their liabilities. Contrary to that, debtors in Germany have generally not been able to discharge their debts until 1999, when the Insolvency Act (*Insolvenzordnung*) was introduced. However, the German Insolvency Act requires a 6 year repayment period as prerequisite of consumer debt relief. During that time the debtor's earnings which exceed a certain limit will be fully used to pay off parts of their debt. In the US, debtors filing under Chapter 7 are not burdened with similar obligations. Generally, they are completely

¹² Cf. Deng/Quigley/Van Order (2000), pp. 283 et seq.

relieved from their debts and are not confronted with income exemptions.¹³ Therefore, incentives not to repay loans and file for bankruptcy are much higher in the US than in Germany.

Mortgages of borrowers with an impaired credit history are referred to as *subprime* mortgages, whereas mortgages of borrowers with high credit worthiness are called *prime* mortgages. This terminology of the US market gained widespread usage in the light of the so-called subprime crisis. *Alternative-A* loans (Alt-A) are characterized as riskier than a prime mortgage, but less risky than a loan from the subprime category in the US mortgage market. Before the beginning of the subprime crisis in 2007, the share of newly originated subprime and Alt-A loans increased dramatically to 24% and 16% in 2006 compared to 9% and 2% respectively in 2003.¹⁴ Traditionally, mortgage applicants are required to document their financial resources as well as income and employment status. However, over the past several years, the trend towards risk-based pricing has led to a relaxation in the documentation requirements by charging higher risk premia for the potentially higher credit risk in the event that the mortgage applicant does not provide a full documentation.¹⁵ Especially in the US, an easing of underwriting standards in general has been notable. Mortgage loans are in most cases fully amortizable, implying level-payments structured like an annuity.¹⁶ Important properties of a mortgage loan are the agreed upon interest rate payments and the loan term. In the mortgage markets, a vast, diverse set of mortgage loans exists. However, in the different national mortgage markets, distinct forms of mortgage loans are prevalent.¹⁷

2.1 Mortgage loans in Germany

In continental Europe, and especially in Germany, loans typically exhibit a fixed interest rate and usually do not offer a prepayment option to the borrower. An early redemption, if possible at all, will come along with a prepayment indemnity to compensate the lender for potential reinvestment losses. In the case of Germany, this prepayment indemnity is based on the legal framework, Art. 490, par. 2 of the German Civil Code. In the first 10 years of a fixed-rate mortgage, the lender normally is not obliged to agree upon an early redemption. Only if the borrower has a legitimate interest in an early redemption, especially when the property is about to be sold, the borrower is granted the right of an early repayment. However, the borrower is still required to compensate the lender for the prepayment. If the fixed-rate period is longer, after 10 years the lender has a legally-defined prepayment option with a six-month notice and without indemnity. These particular loan characteristics of the German mortgage market lead to a high certainty of the future cash flows the lending institution will receive from the borrower.

13 Cf. White (2007).

14 Cf. US Government Accountability Office (2007), p. 18.

15 Cf. Bhattacharya/Berliner (2005), pp. 500 et seq.

16 Cf. Bhattacharya/Berliner (2005), p. 487.

17 Cf. Dübel (2005).

2.2 Mortgage loans in the UK

In the UK mortgage market, loans with variable interest rates are the predominant form. Hence the lenders often offer rates which are below the market rate for a certain period of the loan term (teaser period). Therefore, an early repayment charge applies when the borrower wants to redeem the loan during this incentive period. Furthermore, so-called flexible mortgages became increasingly popular in the UK, giving the borrower the flexibility to temporarily deviate from the regular payment plan. Historically, interest-only mortgages have been important especially in the UK, and especially in the form of investment-backed mortgages. Investment-backed mortgages came along with tax advantages compared to repayment mortgages, although this is no longer the case. The borrower makes regular contributions to a separate investment plan in order to build up a lump sum and repay the mortgage at maturity. Investment-backed mortgages are considered to be of higher risk than those of amortizing loans since the borrower's ability to pay back the loan at maturity depends on the return of the investments. A general major difference to most other mortgage markets is the shorter durations of the mortgage contracts in the UK.

2.3 Mortgage loans in the US

In the US, fixed-rate mortgages (FRMs) are the predominant form.¹⁸ Borrowers are usually granted the option for an early redemption of the loan. Mortgage loans with an adjustable-rate (ARMs) are also available, but accounted only for 23.3% of single-family mortgage loans outstanding in 2007 compared to 76.7% FRMs.¹⁹ Yet, the share of mortgage loans with variable loan rates increased significantly during the last years, as can be seen in Figure 5. However, the trend towards ARM loans seems to have come to a halt. While in 2004 ARMs accounted for 38.91% of newly originated loans, their share was reduced to 16.72% by 2007. These recent developments are in line with tighter lending standards for subprime borrowers, where ARM loans historically have been more important. The share of ARM and FRM loans depends heavily on the interest rate level, as well as the interest rate volatility. Furthermore, the slope of the yield curve, as proxy for the interest rate expectations, is found to be a factor influencing the ARM/FRM share.²⁰ Often, the ARM's initial rate is set lower than the indexed rate as teaser rate. The initial rate is also usually lower for hybrid forms of fixed and adjustable interest rate mortgages that are available on the market and have been the most common form of subprime loans in 2005 and 2006.²¹ They are referred to as hybrid ARMs and have a fixed rate for a certain period of time before the loan rates adjusts to an index. The interest-only hybrid ARM is a recent variation of this mortgage structure.²² Depending on the contract details, a negative amortization is also generally possible.

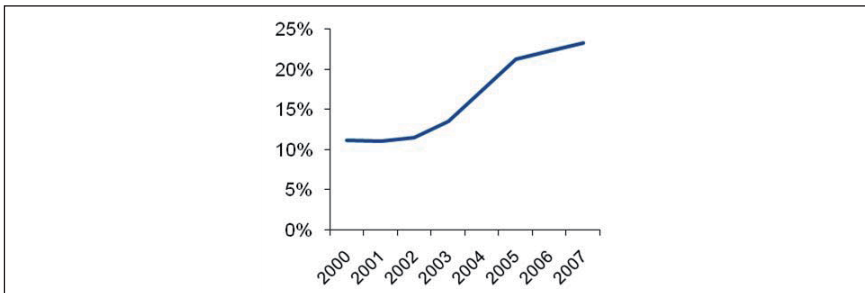
18 Cf. Green/Wachter (2005), pp. 99 et seq.

19 Cf. US Office of Housing Enterprise Oversight: <http://www.ofheo.gov/Research.aspx?Nav=111>, 24th September 2008.

20 Cf. Nothaft/Wang (1992).

21 Cf. Crouhy/Jarrow/Turnbull (2008), p. 83.

22 Cf. Bhattacharya/Berliner (2005), p. 489.

Figure 5: Share of ARM loans of overall single-family mortgage loans outstanding

Cf. US Office of Housing Enterprise Oversight: <http://www.ofheo.gov/Research.aspx?Nav=111>, 24th September 2008.

The option to prepay the outstanding principal before the scheduled payment dates is called a prepayment option and is important especially in the US mortgage market. Due to this option, the cash flows are not known with certainty and the lender is exposed to the so-called prepayment risk. Prepayments usually take place when the borrower decides to sell the underlying property or when the borrower wants to refinance the loan. In particular, refinancing decisions take place when interest rates decline, implying that the lender has to reinvest the prepaid funds at a lower interest rate. Therefore, the lender will demand a higher rate for the loan, taking into account this prepayment risk. However, in most countries the borrower has the possibility to redeem at least a certain fraction of the outstanding face value in any one year without being charged a prepayment penalty.²³ In the case of a FRM loan, the lender bears the risk of changing interest rates because the present value of the outstanding cash flows changes according to the interest rate development. The borrower's payments are unaffected from future interest rates. While in countries such as Germany, the borrower is not allowed to prepay the remaining loan balance or in other cases the individual is charged a prepayment indemnity. As a consequence, the higher certainty of future cash flows leads to attractive refinancing conditions and therefore to comparatively low interest rates of the mortgage loans.

Adjustable-rate mortgages (ARMs) transfer much of the interest rate risk to the borrower since the loan rate will be adjusted periodically to an index. In most cases, the loan rates are capped at a certain level to make sure that the borrower will be able to meet the agreed payments even when interest rates increase significantly. However, the somewhat unpredictable interest rate burden of adjustable-rate mortgages is likely to result in an increased default probability of the borrower. In the crisis-ridden US market, the combination of ARM loans and borrowers with an impaired credit history, subprime ARMs, represents only 7% of the outstanding loans, but accounts for 42% of foreclosures started in the fourth quarter of 2007.²⁴

²³ Cf. Bhattacharya/Berliner (2005), p. 497.

²⁴ Cf. Mortgage Bankers Association: <http://www.mbaa.org/NewsandMedia/PressCenter/60619.htm>, 24th September 2008.

In contrast, subprime FRM loans, which represent 6% of the market, account for 12% of foreclosures during the same period. Even though the foreclosure rate is still disproportionately high due to the low credit worthiness of the borrower, it becomes apparent that the feature of adjustable loan rates is a driving factor of default risk since the foreclosures for subprime FRMs are substantially lower compared to subprime ARMs. When short-term interest rates in the US started to increase in mid 2004, it became increasingly difficult for ARM borrowers to meet their adjusted payment obligations.

To reduce the credit risk inherent in a mortgage loan for the lending institution, mortgage insurances are common in some countries, especially in the US, and there, generally for loans with a LTV ratio higher than 80%. These insurances cover potential losses incurred by the lender when the sale proceeds of the property do not cover the outstanding debt in the event of default. Historically, these guarantees have been installed to stimulate the loan origination. In the aftermath of the Great Depression in the early 1930s, the Federal Housing Administration (FHA) was founded in the US in order to make privately owned homes available for many Americans. For the same reason, the Department of Veterans Affairs (VA) was set up in 1944. Both agencies are under the aegis of the Department of Housing and Urban Development (HUD) and their guarantees are backed by the “full faith and credit” of the US government. The insured borrowers often have a limited income and therefore do not qualify for a prime mortgage. Contrary to these *government loans*, loans without a government guarantee are characterized as *conventional loans*. Private insurance companies exist to provide credit enhancement for borrowers who do not want or do not qualify for a government guarantee. The market shares of FHA and VA insured new mortgages declined from 14% and 8% in 1993 to only 4% and 3% in 2007.²⁵ Often, the lender closes insurance for the borrower and charges the borrower with the corresponding costs.

The mortgage industry is characterized by vast and diverse mortgage loan features, and therefore many different forms of lending institutions have evolved over time. In general, most of the major lending institutions are banks, savings and loans institutions and credit unions as well as building societies and insurance companies. One important distinguishing feature of the lenders is given by the unique refinancing opportunities. Depository institutions, like banks, can use the deposits to refinance the allocation of mortgage loans, while non-depository institutions, like US mortgage banks, are only able to refinance themselves through the capital markets. The close connection of the loan origination process and the refinancing opportunities becomes apparent and will be considered in the following section.

25 Based on the number of new houses sold. Cf. The 2008 Mortgage Market Statistical Annual – Volume I: The Primary Market, p. 385.

3. Why Mortgage Pfandbriefe are different from US Mortgage-Backed Securities and Collateralized Debt Obligations

Historically, retail deposits constituted for a significant share of the banking business and have been the primary source of the funding of mortgage loans. A typical commercial bank frequently held a significant proportion of mortgage loans on its asset side. While the mortgage loan business is one of the classical revenue sources of banks, the assets have to be covered by equity. In order to manage the loan portfolio more effectively and also the adequate equity capital which is needed to cover these loans, many banks have securitized these loans. Broadly spoken, securitization is the creation and issuance of debt securities whose payments of principal and interest stem from cash flows generated by separate pools of assets. This process implies replacing mortgage loans on the asset side by cash. In contrast to mortgage loans, cash does not have to be covered by equity capital which enables banks to increase their return on equity.

Consequently, one of the main functions of the financial intermediaries is the term transformation. This term transformation leads to an interest rate risk for these financial intermediaries. Deposits exhibit a short duration and usually pay a variable interest rate, whereas mortgage loans, particularly in Germany and the US, have maturities of up to 30 years and mostly a fixed rate. The different durations of these assets and liabilities result in a significant interest rate and liquidity risk. The values of the long run fixed-rate mortgage loans show a higher sensitivity to interest rate changes than the deposit values. Furthermore, deposits are usually callable daily without giving any notice or within only a short period of having given notice.

The resulting interest rate and liquidity risk of mortgage refinancing through deposits led to the necessity of alternative refinancing opportunities. Historically, and dependent on the different prevalent primary mortgage markets, different refinancing forms have evolved. The two main alternatives are covered bonds, in particular the German Pfandbrief, which is a covered bank bond; and Mortgage-Backed Securities (MBS), which both will be presented and discussed in the following sections. Another important instrument used in the US for securitizing credit risks of mortgage loans are Collateralized Debt Obligations (CDOs). While MBS are bonds collateralized by mortgage loans, CDOs are structured credit risk derivatives. These two instruments reveal many different features which are going to be described in this chapter and whose credit risk implications are modeled in chapter 4. Both have significant contributions to the subprime crises. The German concept of Pfandbriefe is very old and goes back to the Prussian Empire in the 18th century. Pfandbriefe are different from both CDOs and MBS. The most important distinctions with regard to credit risk between Mortgage Pfandbriefe, MBS and CDOs are:

1. Mortgage Pfandbriefe are on-balance-sheet implying that the issuing Pfandbrief Bank remains to be the obligor. This is not the case for both MBS and CDOs.

2. The cover pool of Mortgage Pfandbriefe is carefully selected and legally regulated which is not the case for both MBS and CDOs.
3. Mortgage Pfandbriefe are covered by a dynamic pool of mortgages. MBS and CDOs have a static cover pool.
4. Like Mortgage Pfandbriefe, agency MBS are guaranteed. While the guarantor in the case of Mortgage Pfandbriefe is a Pfandbrief Bank, it is one of the three agencies for so-called agency MBS. However, in the case of MBS the guarantor and the issuer are not the same institutions.
5. The maximum LTV ratio for loans that make up the mortgage pool of Mortgage Pfandbriefe is 60%. For MBS and CDOs it is significantly higher.

The modeling of credit risk difference and its effects on the credit risk compared to the two other instruments will be analyzed in this section and in section four.

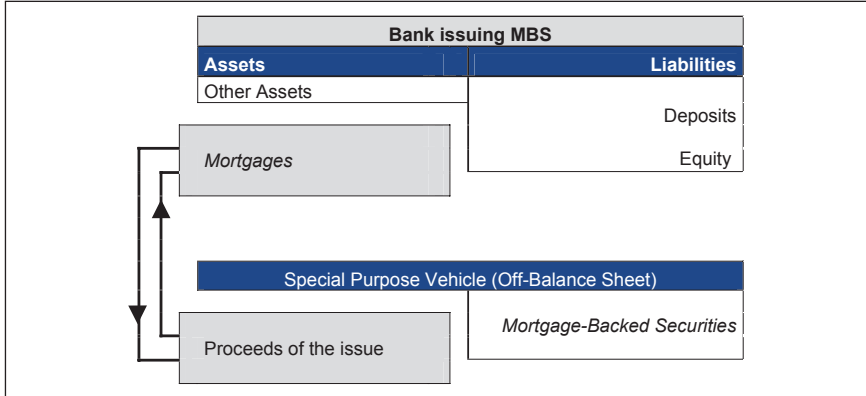
One of the central differences between the Pfandbriefe in Germany and MBS in the US and in UK is that Pfandbriefe are assets which remain on the balance sheet of the issuer, implying that the issuing bank remains to be an obligor of the asset, whereas Mortgage-Backed Securities (MBS) and Collateralized Debt Obligations (CDOs) are sold out of the balance sheet. In the case of agency MBS, there is a guarantee by the agency but the guaranteeing institution is different from the issuing institution. Financial assets which are covered by an asset pool, e.g. mortgages, and which remain on the balance sheet of the issuing institution are called covered bonds.²⁶ One of the advantages of covered bonds compared to other securitized mortgage loans is that the issuer feels responsible for the assets which are collected in the cover pool which is not the case for MBS or CDOs. Consequently, the risk that the assets in the cover pool fail is smaller for covered bonds than for MBS. This difference is depicted in Figure 6 and Figure 7.

Figure 6: Balance sheet of a bank issuing covered bonds

Bank issuing covered bonds	
Assets	Liabilities
Other Assets	Deposits
Proceeds of the issue	Equity
<i>Mortgages</i>	<i>Pfandbriefe (covered bonds)</i>

²⁶ See Winkler, S. (2007), p. 41.

Figure 7: Balance sheet of a bank issuing Mortgage-Backed Securities



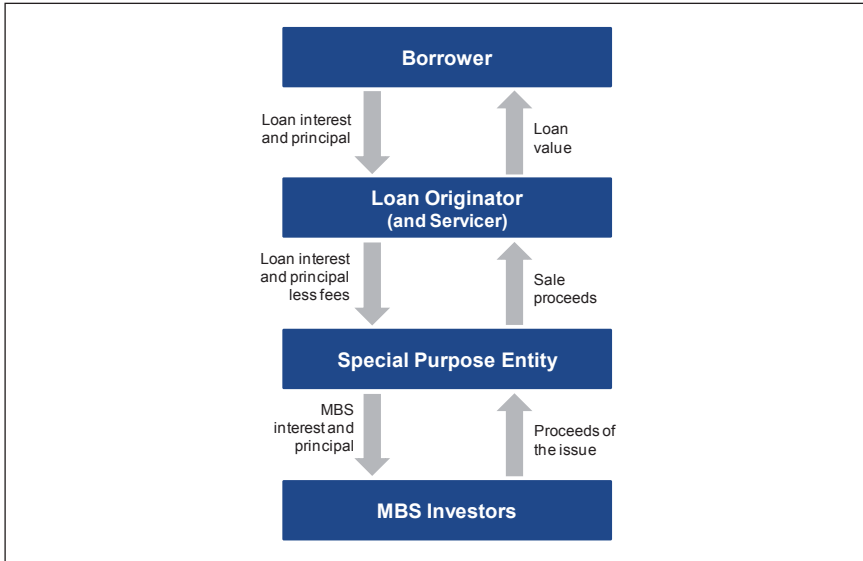
The next three sections discuss the overall differences of MBS, CDOs, and Pfandbriefe with regard to (i) their credit risk, (ii) their interest rate risk, and (iii) other aspects including liquidity risk.

3.1 Mortgage-Backed Securities (MBS)

In contrast to the German system of Pfandbrief refinancing, there has not been a similar system in the UK or in the US, until in the 1970s and 1980s the securitization of loans started to gain widespread popularity.²⁷ In general, the process of securitization involves the pooling and repackaging of cash flows from assets. The financial instruments which are created by the securitization process are called Asset-Backed Securities (ABS). When the resulting instruments are covered by a pool of mortgage loans, they are referred to as Mortgage-Backed Securities (MBS). Broadly spoken, securitization is the creation and issuance of debt securities whose payments of principal and interest stem from cash flows generated by separate pools of assets. This process can be used for any collateral as long as it is associated with cash flows. In our specific case, we want to concentrate on mortgages, i.e. the case where pools of home loans are transferred into tradable securities.

²⁷ There is a young covered bond market developing in the US since 2003. See Winkler, S. (2007), p. 41.

Figure 8: Cash flows in the process of securitization



If the lending institution, the mortgage originator, decides not to keep the loans in the portfolio, it can either pool, securitize and issue the mortgages or sell them to another party. The pooled mortgage loans are usually sold and transferred to a special purpose entity (SPE). This SPE creates and issues Mortgage-Backed Securities from the cash flows from the pooled assets. Mortgage-Backed Securities today are usually issued in the form of Real Estate Mortgage Investment Conduits (REMICs), a form of special purpose vehicle coming along with certain tax advantages for the issuer. In order to protect the potential MBS investors from the default risk of the mortgage originator, the SPE has a bankruptcy remote status. In the case of the originator's insolvency, the assets contained in the mortgage pool are not distributed to other creditors of the mortgage originator.²⁸ However, the effectiveness of the bankruptcy remote status of MBS is lower than for Pfandbriefe. This will be discussed in further detail in section four. If the transfer of the assets to the SPE is regarded as a sale by the respective accounting rules, the assets will no longer be on the originator's balance sheet. According to most accounting standards, this is achieved by the originator being at arm's length distance from the SPE. By the means of securitization, the lending institution is able to directly realize a gain or a loss. With the attained liquid funds, it is possible to originate additional mortgage loans.

A so-called servicer does the operational servicing of the loans, e.g. collecting interest and principal payments and dealing with delinquent borrowers. Besides the possibility of outsourcing these functions to a specialized servicing company, the original lender often continues the operational servicing of the transferred

²⁸ Cf. Sundaresan (1997), p. 359.

loans.²⁹ Furthermore, the proceeds and respectively the cash flows of a mortgage pool have to cover the costs for servicing the loans and setting up the Mortgage-Backed Security. Moreover, they have to cover the costs for lawyers and trustees. The cash flows from the mortgagee all the way to the investors of Mortgage-Backed Securities are summarized in Figure 8.

Pledging the cover pool of an MBS is executed by the so-called Mortgage Bond Indenture Trustee. If an MBS issuance defaults in the US, as was the case for issuances of the Bank of America or Washington Mutual, then the Mortgage Bond Indenture Trustee can require to liquidate the cover pool, after a hold-up period of 45 to 90 days. In addition, the cover pool consists of static assets. This implies that the Mortgage Bond Indenture Trustee can liquidate only those assets which are in the cover pool, unlike covered bond investors which keep the claim on all assets on the balance sheet of the issuing institution.

In the UK, the prevalent form of mortgage loans is short-term loans with an adjustable loan rate. Traditionally, refinancing in the UK is primarily done through the money market and deposits. Since assets and liabilities show similar features with regard to maturity and rates of interest, the burden of term transformation is limited. Long-term fixed-rate covered mortgage bonds would not be appropriate to refinance the short or medium-term variable rate loans in the UK market. Furthermore, customer deposits are usually available at much lower rates than refinancing through the capital markets. The first residential Mortgage-Backed Securities in the UK were issued in 1985. Hence an established market for Mortgage-Backed Securities exists in the UK. Nevertheless, only a small share of mortgage loans is securitized in the UK. An important property of the UK MBS market is that issuances with floating rates have been the dominant form.³⁰ An increasing customer funding gap, defined as the customer lending less customer funding, evolved during the last years. This gap was primarily met by the means of securitization.³¹

The valuation and analysis of Mortgage-Backed Securities is affected particularly by the institutional and legal framework. Therefore, in the following the focus will be primarily on the US market, which is by far the most important market for Mortgage-Backed Securities in the world. In the second quarter of 2008, mortgage related securities amounted to an outstanding volume of \$ 7554.2 billion. Mortgage related debt represents the biggest market segment of the US bond market, larger than that of the corporate debt and treasury debt markets, since the outstanding volume of mortgage related debt increased by approximately 170% over the last 10 years.³² The increasing importance of Mortgage-Backed Securities is in line with a significant increase of outstanding mortgage loans. The high importance of securitization for the primary mortgage loan market also becomes apparent when considering the securitization rates of newly originated mortgage loans which rose to 74.25% in 2007.³³

29 Cf. Bhattacharya/Berliner (2005), p. 498.

30 Cf. <http://www.thefreelibrary.com/Mortgage+bond+and+MBS+market+development+in+the+UK+and+France-a0137012475>, 29th September 2008.

31 Cf. Bank of England (2008), p. 32.

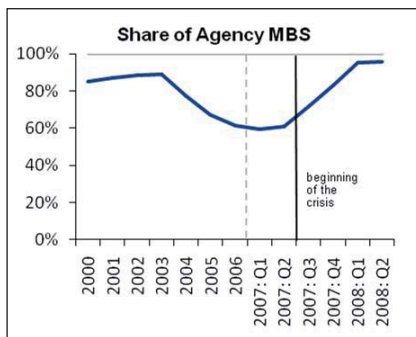
32 Cf. http://www.sifma.org/research/pdf/Overall_Outstanding.pdf, 30th September 2008.

33 Cf. The 2008 Mortgage Market Statistical Annual – Volume II, p. 3.

The US secondary mortgage market is characterized in a way that historically the three agencies, Fannie Mae, Freddie Mac and Ginnie Mae play an important role in the market activity.³⁴ They were founded in order to create a secondary market for mortgage loans and thereby providing better refinancing opportunities. Ginnie Mae is a government-owned corporation, whereas Fannie Mae and Freddie Mac were set up as publicly traded government-sponsored enterprises (GSE). Therefore, Ginnie Mae MBS are backed by the “full faith and credit of the US government”, whereas Fannie Mae and Freddie Mac MBS investors are exposed to credit risk. On 7th September 2008 Fannie Mae and Freddie Mac were put under the conservatorship of the Federal Housing and Finance Association (FHFA) as a consequence of the subprime crisis. The investors in Mortgage-Backed Securities are predominantly institutional investors, like banks, mutual funds, hedge funds and insurance companies as well as the two agencies Fannie Mae and Freddie Mac.

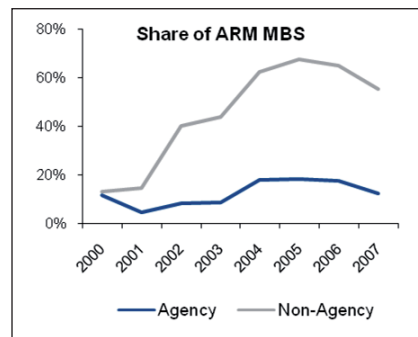
The securitization of mortgage loans by these three agencies has traditionally been very important. At the end of 2007, approximately 68% of the outstanding Mortgage-Backed Securities were guaranteed by one of the three agencies.³⁵ Thereby, the lion’s share was guaranteed by Fannie Mae and Freddie Mac. The market share of non-agency MBS, also called private-label MBS, increased significantly during the last years. Figure 9 shows conversely that the share of agency MBS issuances declined in the years before the beginning of the financial crisis, resulting from drastically increasing issuance volumes of non-agency MBS. However, since the beginning of the financial crisis, issuances of non-agency MBS declined dramatically and virtually are suspended.

Figure 9: Market share of the agencies of overall issuance in the US MBS market



Source: SIFMA, http://www.sifma.org/research/pdf/Mortgage_Related_Issuance.pdf, 27th October 2008.

Figure 10: Share of US MBS issuances backed by ARM loans



Source: The 2008 Mortgage Market Statistical Annual Volume II, p. 9 and p. 251.

34 The full names are: Federal National Mortgage Association (Fannie Mae), Federal Home Loan Mortgage Corporation (Freddie Mac), and Government National Mortgage Association (Ginnie Mae).
 35 Based on single-family mortgages. Cf. OFHEO Mortgage Market Note 08-3, p. 2.

Another property which has been characteristic for the US MBS market in the years before the crisis has been the increased market share of ARM MBS. Figure 10 shows the percentage of both, agency and non-agency MBS backed by ARM loan pools. It becomes apparent that non-agency issuers securitized a highly increasing number of ARM loans. Primarily during the years 2002 until 2005, when interest rates had been at a very low level, the share of non-agency ARM MBS leveled off. Since ARMs transfer most of the interest rate risk to the borrower, the mortgagees faced difficulties to meet their payment obligations when interest rates increased. This has been one important driving factor of the financial crisis.

A loan needs to meet certain criteria to be eligible for an agency guarantee. Eligible loans are referred to as conforming loans, whereas the other loans are referred to as non-conforming. The agencies limit e.g. the maximum loan size that can be included in a mortgage pool. Therefore, so-called jumbo loans, which exceed the conforming loan limit, can only be securitized in private-label transactions. How the regulatory conservatorship from September 2008 of both government-sponsored entities (GSEs) and the Federal Housing Finance Agency (FHFA) will affect the growth of the US MBS market in the future is difficult to say. Especially since the guarantee volume for some of the GSE's has been extended in January 2009. Some thoughts covering the rather unexpected conservatorship can be found in Wagner and Teclaw (2009).

In general, the properties of the loans included in the mortgage pool as well as the specific features of the Mortgage-Backed Security can be diverse and yield very different characteristics and risk attributes of the security. In this context, it has to be highlighted that each Mortgage-Backed Security refers to a specific pool of mortgage loans. This is different to the structure of the German Mortgage Pfandbrief, where a single cover pool with mortgage loans exists for the entirety of the issued Mortgage Pfandbriefe. Furthermore, the MBS investors have only claims against the specific mortgage pools and not against the lender from the primary market. Therefore, the credit risk of the mortgage loans is passed on to the investor. Often, this risk is eliminated through a guarantee or insurance. These credit enhancements are common both for agency as well as for private-label MBS and usually lead to a high credit rating.

The structure of Mortgage-Backed Securities implies a high importance of the mortgagees' characteristics, since the payment behavior of the mortgagees and the risk that they default directly affects the cash flows received and redistributed by the issuer. Therefore, it is important for the investors of MBS to analyze the properties of the underlying mortgage pool. Depending on the structure and the cash flow of the properties, MBS are usually referred to as either mortgage pass-through securities or collateralized mortgage obligations.

The holder of a mortgage pass-through security receives pro rata shares of the cash flows from the mortgage pool.³⁶ This structure is the most common form of Mortgage-Backed Securities. The original cash flows from the mortgagees are *passed-through* to the investor, whereby a small fraction is kept by the servicer for the operational

³⁶ Mortgage pass-through certificates are also sometimes referred to as participation certificates.

servicing of the loans. Furthermore, fees for guarantees or other forms of credit enhancements will be deducted from the cash flows of the mortgage pool. Depending on the specific contract details, the issuer can e.g. guarantee that the investor receives the regular interest and principal payments not later than a certain time period after the scheduled dates, or even guarantee the timely payment.³⁷ Due to these commonly prevalent guarantees, the risk of default of the borrower often transforms in a prepayment risk. However, since mortgagee defaults tend to occur in high interest rate periods, the prepayment uncertainty caused by default tends to be a reward rather than a risk. Depending on the specific details, the investor receives the outstanding principal balance directly when the original borrower defaults. However, the risk that the guarantor, i.e. the GSE, defaults remains.

The properties of the mortgage pools are usually described by the weighted-average coupon (WAC) and the weighted-average maturity (WAM) of the loans included in the pools. Especially agency-guaranteed securities have high requirements regarding the homogeneity of the underlying mortgage pools. Contrary to the cover pools of the German Pfandbrief, the focus of the mortgage pools, on which the mortgage pass-through certificates are based, is not on diversification, but rather on a preferably high degree of homogeneity. For example, the Ginnie Mae I program requires all loans to be issued by a single lender. Furthermore, only fixed-rate loans with roughly the same maturities and interest rates are eligible. However, other programs with less stringent requirements are also available. For instance, the Ginnie Mae II program allows for multiple-issuer pools and also considers loans with variable interest rates.³⁸ Since the cash flows received by the investor depend primarily on the properties of the borrowers and the loan contract details, a high degree of homogeneity makes the complex analysis of the mortgage pass-through certificates and the predictability of future cash flows more manageable. However, such a pool benefits less from diversification compared to less homogenous pools.

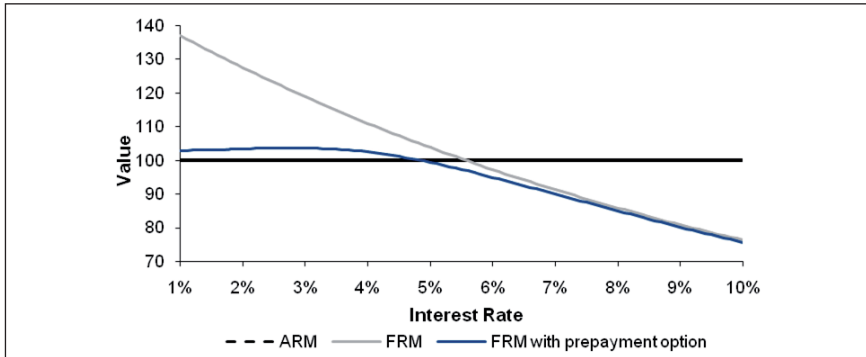
As outlined in chapter 2, the US mortgage market is dominated by long-term loans with a fixed-rate. The borrower is usually granted a prepayment option. Therefore, a mortgage pass-through can be considered as a long position in a bond with the interest and principal payments according to the weighted-average coupon WAC and weighted-average maturity WAM, plus a short position in the prepayment option. The prepayment option behaves like an interest rate floor option. It tends to be exercised when interest rates fall. In the center of valuation issues is the prepayment feature of the US mortgage loans. The mortgagees' prepayment decisions depend on a variety of factors. However, the most important determinant of the prepayment behavior is the incentive to refinance the loan. When the actual market rates are below the agreed upon loan rate, the borrower has an incentive to prepay the loan and close a new one at a lower rate. Besides the interest rate advantage, the costs of closing a new loan have to be considered for the prepayment decision. If interest rates decline, the value of the bond will increase, but at the same time the value of the prepayment option will increase as well. This property describes one of the main characteristics of mortgage pass-through certificates: negative

37 Especially, mortgage pass-through certificates issued from one of the three agencies guarantee the timely payment of the cash flows. Cf. Davidson/Ching (2005), p. 517.

38 Cf. <http://www.ginniemae.gov/issuers/programs.asp?subTitle=Issuers>, 8th October 2008.

convexity of the present value with respect to interest rate changes. This property is shown in Figure 11.

Figure 11: Present value of cash flows from different mortgage contracts with regard to interest rate changes



The valuation of the cash flow streams from the mortgage pool with fixed-rates and prepayment options is based on a structural prepayment model from Stanton (1995). Thereby, the underlying process of the interest rates is based on the discrete one-factor model of Hull/White (1990).

Figure 11 illustrates the effect of different interest rate levels on the valuation of different mortgage pools. As outlined in the previous chapter, the borrower of an ARM, the dominant form in the UK, bears interest rate risk. The value for the lending institution remains unchanged. In Germany, FRMs are the prevalent loan design. The corresponding mortgage pools exhibit value changes with regard to varying interest rates equivalent to bonds with a fixed-rate. Therefore, Mortgage Pfandbriefe from the viewpoint of the issuing bank are appropriate refinancing vehicles for FRMs because they match the duration of mortgage loans.

Fixed-rate mortgages with embedded prepayment options, which are typical for the US market, leave the lender with the prepayment risk. When the refinancing is completed by means of mortgage pass-through certificates, this prepayment risk is passed on to the investor. When refinancing with long-term fixed-rate bonds, like the Pfandbrief, the cash flow uncertainty would remain with the issuer. For the investor of a mortgage pass-through, interest rate driven prepayments imply a reinvestment risk because the investor will have to reinvest the received funds at a lower rate. Conversely, high market rates can slow down the prepayments. When expected cash flows are not obtained due to lower than expected prepayment rates, this can result in liquidity problems for the investor.

To derive the fair value of a mortgage pass-through, a theory on the prepayment behavior and the default risk is necessary. In an option-theoretic approach, the refinancing and default decisions of a mortgagee are often modeled with respect to the developments of interest rates and house prices, since these are the driving factors. In the academic literature two distinct forms for the modeling of the default behavior of the mortgagee can be identified: on the one hand, reduced form models³⁹,

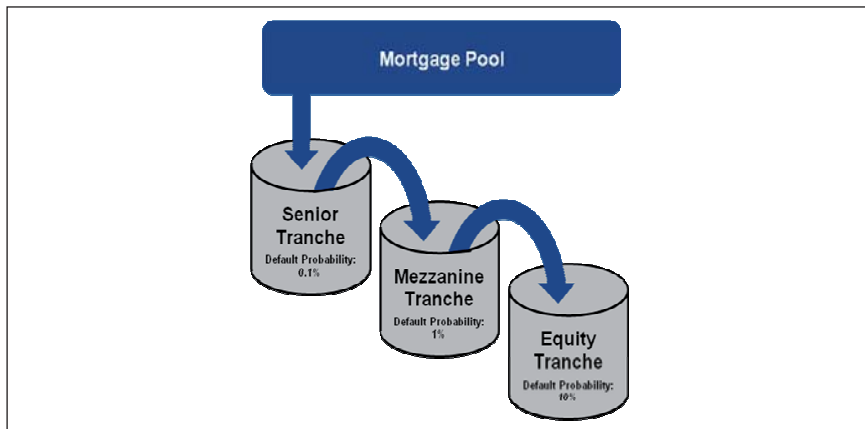
39 See for instance Jarrow and Turnbull (1995) who provided the first reduced form model for credit risk.

and on the other hand, structural models.⁴⁰ The prepayment behavior can be modeled based on term structure models, for instance Muck and Rudolf (2005). However, the prepayment behavior is not necessarily rational from a pure economic point of view. This might be the case because borrowers are often uninformed and are therefore unable to take advantageous refinancing opportunities. Furthermore, other factors like seasonality,⁴¹ the age of the mortgage,⁴² the loan rate, the loan volume,⁴³ and personal circumstances of the borrower play an important role for the prepayment decision. The mortgage pass-through investors will have certain expectations regarding the prepayment behavior of the mortgagees and use these expectations to derive expected future cash flows and thereby price the securities.⁴⁴

3.2 Collateralized Debt Obligations (CDOs)

Differing from mortgage pass-through certificates, Collateralized Debt Obligations (CDOs) are *pay-through* debt vehicles. These innovative investment vehicles were first issued in 1983 by Freddie Mac in the form of a CMO.⁴⁵ Meanwhile, CDOs are established products with agency CDOs having an outstanding volume of \$ 1343.5 billion at the end of 2007.⁴⁶ The issuer does not redistribute the cash flows on a pro-rata basis, but issues different tranches with varying coupons, maturities and payment priorities. The collaterals for CDOs may include pools of mortgage loans, mortgage pass-through certificates, and tranches of other CDOs. CDOs can be based on a variety of different collaterals, not limited to mortgage related assets.

Figure 12: Cash flow “waterfall” of CDOs



40 The initial form of a structural model was provided by Merton (1974).

41 Cf. Fabozzi (2007), p. 260.

42 Cf. Sundaresan (1997), p. 367.

43 Cf. Canner/Dynan/Passmore (2002), pp. 471 et seq.

44 Prepayment projections are published regularly by SIFMA: http://www.sifma.org/research/statistics/mbs_prepayment.html, 30th September 2008.

45 Cf. Mohebbi/Li/White (2006), p. 465. CMOs are collateralized mortgage obligations.

46 Cf. SIFMA (2008), p. 1.

The most important form of credit protection is achieved by structuring the cash flows according to subordination principles. Credit losses are then allocated to the different tranches of securities in reverse order of their seniority. Therefore, any potential losses are first absorbed by the holders of the most subordinate tranche, the so-called equity tranche, before the next highest tranche faces losses. For the mean of higher transparency and investor confidence, ratings for the different tranches, except the equity tranche, are obtained. The tranche sizes are set in a way that the more senior tranches receive high credit ratings. Often the first loss tranches are retained by the originator. A general overview of the cash flow structure of the subordination principle is given in Figure 12. More detailed explanations about the identification of the credit risk tranches will be found further below in Figure 13.

While the primary focus of this analysis here is on CDOs which package the credit risk of the underlying mortgage loan portfolio, the cash flow streams can also be structured in order to redistribute the prepayment risk associated with the mortgage loans serving as collateral. This meets the investors' demand to control the receipt of cash flows more closely. Hence it is possible to structure CDOs in a way that some tranches receive principal right away and have much shorter durations than the original loan term. In the US, mortgage pass-through certificates normally have terms of 15 or 30 years, analogous to the terms of the underlying mortgage loans. Thus, many investors are looking for investment opportunities with shorter durations. *Sequential* CDOs are structured in a way that the different tranches receive principal in a sequential order. At the beginning, only the first tranche receives principal payments. The second tranche does not start receiving principal payments until the first tranche is retired and so on.

Figure 13: Tranching of CDOs for credit risk

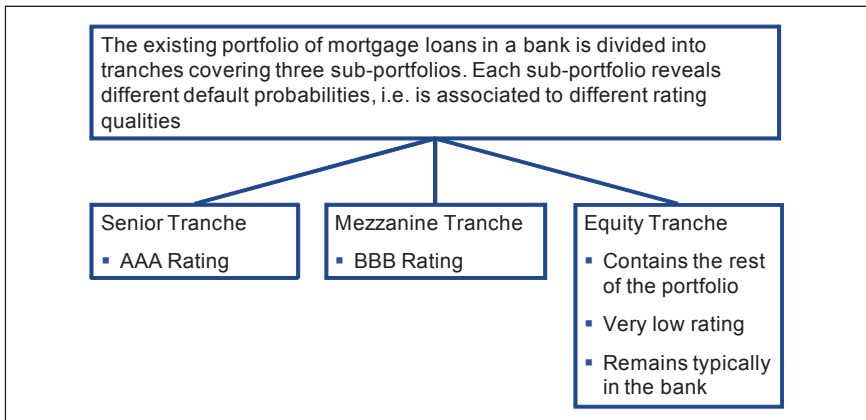


Figure 13 illustrates which tranches can be filled with loans out of the credit portfolio of a bank. The equity tranche reveals the worst credit quality. I.e. the first loans which default will be covered by those investors which bought the equity tranche. Congruent to the high risk case, this tranche offers the highest expected return to investors. Even though the equity tranche is typically not sold to the

capital market, the total risk of this tranche for the mortgage bank is very limited in most cases due to a very small exposure. By far, most of the credit exposure of the original credit portfolio is finally covered by both, the mezzanine tranche and the senior tranche. These two tranches are sold to the capital market. The mezzanine tranche can for instance be structured such that it accords to a BBB rating, i.e. having a default probability equivalent to BBB. The senior tranche usually has an AAA label by rating agencies. Therefore, the default risk must be very low. It is important to note that the assignment of different loans in the credit portfolio is not based on individual ex-ante mortgage loan ratings. The assignment is based on ex-post observations: When the first of the loans in the credit portfolio defaults, then this loan is assigned to the equity tranche. This will be done regardless of whether this loan was originally qualified as a high or as a low credit quality loan. When more loans default, the losses resulting from these defaults are attributed to the equity tranche until the relative frequency of defaulted loans accords exactly to the default risk of the next tranche – the mezzanine tranche. This principle is called the waterfall principle. It is illustrated in Figure 12. The effects of the waterfall principle are the following:

- Rating on the edge principle: If an investor buys the senior tranche of a CDO, he can be almost sure that the default risk is exactly 0.1% if this is the default risk of a AAA rating, as it is indicated by Figure 12. When non-structured AAA rated instruments are purchased, the maximum default risk is 0.1%.
- Once the individual credit qualities of the individual loans are part of a pool of loans, they cannot be determined anymore. It is possible that the losses resulting from an ex-ante AAA rated loan will have to be covered by those investors who have purchased the equity tranche and that losses from a C loan is part of the senior tranche. To which tranche a loan belongs depends on the time of default and not on its original rating.

Due to the low credit risk of Mortgage Pfandbriefe, only the senior CDO tranche is used for comparison.

3.3 Mortgage Pfandbriefe

The German Pfandbrief is a covered bank bond complying with certain legal requirements defined by the German Pfandbrief Act (*Pfandbriefgesetz*). Pfandbrief investors have a prior claim on the cover assets in the case of insolvency. The German Pfandbrief, and especially the Pfandbrief issuer, is governed by strict regulation following the guiding idea of investor protection. Therefore, Pfandbriefe are regarded as almost free of default risk, exhibiting only low spreads over government bonds (see Figure 33).

The focus will be on the German Pfandbrief since this is the most established covered bond, looking back on a history starting in the 18th century and accounting for approximately 44% of the total covered bond market.⁴⁷ Since the former legal framework, the Mortgage Bank Act (*Hypothekbankgesetz*), became effective in

47 Cf. www.vdp.de, 26th September 2008.

1900, not a single default of a Pfandbrief occurred. The Mortgage Bank Act was revised and replaced by the German Pfandbrief Act, July 19, 2005. In Germany, three different forms of Pfandbrief securities exist:

- If the Pfandbrief is covered by mortgage loans, it is referred to as a mortgage Pfandbrief, which will be the center of interest here.
- Furthermore, ship and public-sector Pfandbriefe are available.

At the end of 2007, about 889 billion Euro were outstanding in the Pfandbrief segment; thereof 0.5% Ship Pfandbriefe, 23.2% Mortgage Pfandbriefe and 76.3% Pfandbriefe collateralized by loans given to the public sector. Having a 25% market share, the Pfandbrief market is the second largest segment of the German fixed income market, only behind the segment of government bonds.⁴⁸ The average maturity of newly issued Pfandbriefe is between 7 and 7.5 years.⁴⁹ Investors in Jumbo Pfandbriefe⁵⁰ are predominantly banks (close to 50% of all investors), but also mutual funds (approx. 20%), central banks, insurance companies, and smaller proportions are purchased by pension funds, agencies, hedge funds, and others.⁵¹

The bondholders usually receive a fixed coupon over the term of the Pfandbrief, independent of the rates of the loans included in the cover pool. This type of refinancing is especially suitable for mortgage markets which are dominated by long-term loans with fixed future cash flows. As outlined in chapter 2, loans with fixed rates and long durations are prevalent in the German mortgage market. The prepayment indemnities assure that the resulting cash flows received by the mortgagee are almost known with certainty. Therefore, a refinancing tool with a fixed coupon and preferably with duration similar to the duration of the originated loans is needed. In particular, depository institutions can achieve a better hedge against interest rate risk by closing the duration gap between assets and liabilities. The burden of term transformation will be reduced by partly refinancing the long-term loans with long-term Mortgage Pfandbriefe compared to a refinancing based solely on deposits. Furthermore, this implies a decreased liquidity risk, since the proportion of daily callable deposits of overall liabilities is reduced.

The strict legal regulation which Pfandbriefe are subject to is one of the most important characteristics of the German Pfandbrief. To be allowed to issue Pfandbriefe, issuers need a Pfandbrief license from the federal financial supervisory authority (BaFin). A sustained issuance and special expertise are required to be eligible for the Pfandbrief license. Furthermore, a minimum core capital of € 25 million is required, as well as certain standards of monitoring and risk management. The institution that aims for a Pfandbrief license needs to intend an engagement in the Pfandbrief market on a sustained and regular basis; this has to be documented by the submission of a business plan.⁵² The close legal regulation leads to a high degree of certainty for the investors with close to zero default risk and is a central building block for the high systemic importance of the Pfandbrief for the German financial system.

48 Cf. www.vdp.de, 26th September 2008.

49 See Winkler, B. (2007), p.13.

50 Issuance volume at least € 1 bn.

51 See Winkler, S. (2007), p. 52.

52 Cf. www.vdp.de, 27th September 2008.

The Mortgage Pfandbrief holders' claims have to be covered by mortgage loans at all times. Thereby, the present value of the issued Mortgage Pfandbriefe and the present value of the Pfandbrief Bank's interest and principal claims regarding the assets in the cover pools are compared, and an additional minimum mark-up of 2% on the outstanding Mortgage Pfandbriefe is required for the cover pool. The additional 2% mark-up primarily serves as a liquidity cushion in the event of a Pfandbrief Bank's default and covers potential fees.⁵³ Stress tests have to be applied at least on a weekly basis to ensure that the coverage of the Pfandbriefe is sufficient in the event of interest or exchange rate fluctuations. Furthermore, the cover pools are subject to public supervision and will be audited regularly by the federal financial supervisory authority (BaFin). Table 2 illustrates that Mortgage Pfandbriefe are usually significantly over-collateralized. It becomes apparent that the mortgage cover pool volume of Hypo Real Estate is 5.9% higher than the volume of outstanding Mortgage Pfandbriefe. In practice, this overcollateralization serves as additional cushion to the 60% LTV limit based on the conservatively appraised mortgage lending value. This observable overcollateralization can be expected to be another factor leading to excellent credit ratings – even for Mortgage Pfandbriefe issued by troubled institutions. Hence, Mortgage Pfandbriefe issued by Eurohypo, one of the biggest players on the Pfandbrief market, exhibit an overcollateralization of more than 10%, while Mortgage Pfandbriefe of Landesbank Baden-Württemberg are backed by a cover pool which's volume is even about 115% higher than the volume of outstanding Mortgage Pfandbriefe.

Table 2: Overcollateralization of Pfandbriefe

	Hypo Real Estate	Landesbank Baden Württemberg	Eurohypo
Outstanding Mortgage Pfandbriefe	€ 15,990 million	€ 2,586 million	€ 45,667 million
Cover Pool	€ 16,934 million	€ 5,561 million	€ 50,313 million
Overcollateralization	€ 944 million [5,90%]	€ 2,975 million [115,04%]	€ 4,646 million [10,17%]

Source: Information from Hypo Real Estate and Landesbank Baden-Württemberg according to § 28 Pfandbrief Act, as of 30th September 2008. Information on Eurohypo Pfandbriefe as of 3rd October 2008.

The high standards and the permanent monitoring of the quality of the assets included in the cover pools ensure a high level of safety for the investors. The real estate properties which serve as collaterals for Mortgage Pfandbriefe must be located in the European Economic Area (EEA), Switzerland, the USA, Canada or Japan,⁵⁴ and the issuing institution needs to have the necessary expertise in the respective mortgage market. Similar conditions hold for ship and public-sector Pfandbriefe. Loans to the public sector are subject to public guarantees, and the

53 Cf. VDP (2008): The Pfandbrief 2008/2009, p. 13. [http://www.pfandbrief.de/d/bcenter.nsf/0/9457D89EEE354F80C12574CC003041EF/\\$FILE/EN_PFB%202008_2009.pdf](http://www.pfandbrief.de/d/bcenter.nsf/0/9457D89EEE354F80C12574CC003041EF/$FILE/EN_PFB%202008_2009.pdf), 15th December 2008.

54 According to § 13 Pfandbrief Act.

conservative loan appraisal in ship and real property lending is an important characteristic of the German market.

Mortgage loans and loans given to the public-sector are held in two distinct cover pools. These cover pools are dynamic. Unlike in the case of the static MBS cover pool, the total of loans included in the cover pool serves as collateral for the total of Pfandbriefe issued. For that reason, a diversification effect is achieved by the plurality of the different loans which serve as collaterals. Contrary to MBS cover pools, the cover pool of Mortgage Pfandbriefe is comparatively well diversified.⁵⁵ 11.5% of the cover assets of German Mortgage Pfandbriefe are foreign assets. Since Mortgage Pfandbrief cover pools are collective pools for all Mortgage Pfandbriefe, a diversification effect is achieved due to the regional dispersion of

Table 3: Regional diversification of assets in the cover pool of Hypo Real Estate

Country	Volume (Euro mn.)	
	Commercial	Residential
Germany:		
Baden-Württemberg	751	198
Bavaria	1,840	1,228
Berlin	645	1235
Brandenburg	300	289
Bremen	32	31
Hamburg	388	325
Hesse	958	271
Mecklenburg-Western Pomerania	94	248
Lower Saxony	310	153
Northrhine-Westphalia	1,866	1,366
Rhineland-Palatinate	166	142
Saarland	72	11
Saxony	406	532
Saxony-Anhalt	149	329
Schleswig-Holstein	113	106
Thuringia	150	291
Germany total	8,240	6,756
Belgium	1	0
France/Monaco	34	3
Great Britain (excl. Channel Islands)	25	0
Netherlands	314	6
Austria	47	1
Switzerland	129	0
USA	769	110
Total	9,558	6,876

Source: Information from Hypo Real Estate according to § 28 Pfandbrief Act, as of 30th September 2008.

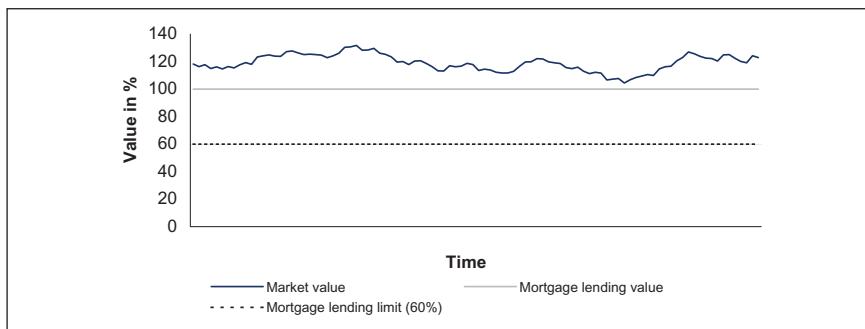
⁵⁵ See VDP (2007), pp. 25

loans included in the pool, both internationally and nationally. 12% of the cover pools consist of apartment buildings, 53% of residential homes (21% condominiums), 26% of office buildings. Table 3 shows the cover assets of Hypo Real Estate Mortgage Pfandbriefe in order to illustrate the geographic diversification of mortgage loans. It becomes apparent that besides an international diversification effect, there is a high regional dispersion within Germany as well.

Cover pools are dynamic, i.e. non-performing assets will be substituted by performing ones. Furthermore, the underlying real-estate properties have to be insured against the relevant risks of the buildings, according to § 15 Pfandbrief Act. This guarantees a comparatively high credit quality of the collaterals in the cover pool. In the case of Mortgage Pfandbriefe, mortgage loans are only eligible for the cover pools with a LTV ratio of up to 60%, based on the conservatively appraised mortgage lending value. This mortgage lending value is not based on the market value of the property; it is based on an accounting value, taking into account the volatility risk of the housing market. Thereby, the conservatively appraised mortgage lending value is limited by the market value. The property appraisal is governed by the German mortgage lending value regulation (*Beleihungswertermittlungsverordnung*). The appraisal is based on the principle that throughout the term of the mortgage the potential proceeds from the property's sale must not be below the mortgage lending value. Therefore, the mortgage lending value has to be determined in a way that takes into account and thereby excludes economically induced, temporary market value fluctuations. Hence, speculative elements are not allowed to find their way into the mortgage lending value. The valuation will rather be based on long-term sustainable aspects of the property while considering the future marketability.

It has to be emphasized that contrary to MBS, claims are only eligible to serve as collateral up to 60% of the property's appraised mortgage lending value. It follows that, with regard to the quality of the cover pools, there are two main factors. First, the mortgage lending value will be prudently determined. Second, the 60% limit serves as an additional cushion for real estate price changes. Figure 14 illustrates the relationship between the market value and the conservatively appraised mortgage lending value. It becomes apparent that property values have to drop drastically before the assets in the pool are not sufficient anymore to cover the claims of the Pfandbrief investors.

Figure 14: Illustration of mortgage lending values and market values



The assets which cover the Pfandbrief securities have an insolvency remote status. If the issuing institution becomes insolvent, the cover assets do not participate in the insolvency proceedings until the Pfandbrief creditors' claims are satisfied. The Pfandbrief creditors' insolvency privilege serves as protection against the claims of other creditors. It has to be noted that, in the event of an issuer's default, the Pfandbrief investors' claims are satisfied in the appointed manner out of the pool of collaterals, according to the terms of the respective Pfandbrief issue. This legal structure leads to a high certainty of the future cash flows received by the Pfandbrief holders, with respect to the cash flow volume and also their timing. The coordination of the servicing of the outstanding Pfandbrief issuances in the event of an issuer's default will be done by an authorized expert (a so-called "cover pool administrator") appointed by the competent court at the issuer's seat. Special insolvency proceedings would be instituted for the cover pool in the event that coupon payments and principal redemptions cannot be made according to the agreed upon Pfandbrief terms.⁵⁶

The holders of covered bonds have a dual claim: On the one hand against the issuer, and on the other against the cover pool. If the issuer defaults, the bondholders will have a preferential claim against the cover pool. The Mortgage Pfandbrief holders will only be confronted with a default of the Mortgage Pfandbrief, when the issuing institution defaults and when additionally the mortgage loans contained in the cover pool default. The joint incidence of these two events is very unlikely and for that reason not a single default of a German Pfandbrief occurred for more than a hundred years. While most Pfandbrief Banks have an excellent credit rating anyway, the structure of the issued Pfandbriefe and the tight legal framework normally lead to an AAA rating for the Pfandbriefe. Table 4 provides an overview of issuer and Mortgage Pfandbrief ratings, illustrating the high credit quality of this important refinancing vehicle.

56 Cf. http://www.pfandbrief.de/d/internet.nsf/tindex/en_safety.htm, 27th September 2008.

Table 4: Issuer and mortgage covered bond ratings

Pfandbrief Issuer	Fitch		Standard & Poor's		Moody's	
	Issuer Rating	Mortgage Pfandbrief Rating	Issuer Rating	Mortgage Pfandbrief Rating	Issuer Rating	Mortgage Pfandbrief Rating
Aareal Bank AG	A-	AAA				
Bayerische Hypo- und Vereinsbank AG	A	AAA	A+ (Negative)		A1	Aa1
Bayerische Landesbank	A+	AAA	A (Negative)	AAA	Aa2	Aaa
Berlin-Hannoversche Hypothekenbank AG	A+	AA+			Aaa	
COREALCREDIT BANK AG	BBB-	AA				
Deutsche Apotheker- und Ärztebank eG	A+		A+ (Stable)	AAA	A2	
Deutsche Genossenschafts-Hypothekenbank AG	A+	AAA	A (Negative)	AAA	Aa3	
Deutsche Postbank AG	A	AAA	A- (Positive)	AAA	Aa2	
EUROHYPO AG	A	AAA	A (Negative)	AAA		
HSH Nordbank AG	A	AAA	A (Negative)		Aa3	Aaa
Hypo Real Estate Bank AG	A-	AA+	BBB (Developing)	AAA ¹ (CW Negative)	A2	Aa3 (Possible Downgrade)
Landesbank Baden-Württemberg	A+	AAA	A+ (Negative)		Aa1	Aaa
Landesbank Hessen-Thüringen Girozentrale	A+	AAA	A (Stable)		Aa2	
Westdeutsche ImmobilienBank			A- (CW Neg)	AAA		
Westfälische Landschaft Bodenkreditbank AG WL BANK AG	A+		A+ (Stable)	AAA		
Wüstenrot Bank AG Pfandbriefbank	A-	AAA	BBB+ (Stable)			

1) Covered bonds issued by Hypo Real Estate have been put on "Credit Watch negative" since the 30th September 2008 in the following of the multibillion funding facility in favour of the group. Standard & Poor's stated that the covered bonds are predominately rated based on the credit and market risk of the cover pool and that they give only limited consideration to the counterparty risk. Therefore, covered bond ratings remain on a higher level than the issuer rating which has steadily declined from A to BBB in the light of the current financial crisis.

Sources: Fitch and Standard & Poor's, as of 12th December 2008, Moody's as of 15th December 2008.

Another property, which is important for investors of Pfandbriefe, is the high degree of transparency that is achieved by regularly disclosing key data on the cover assets and outstanding Pfandbriefe. According to § 28 of the German Pfandbrief Act, issuers have to publish information on a quarterly basis on e.g. maturity structures and volumes. Furthermore, it has to be noted that the assets which are serving as collateral in the cover pool remain on the balance sheet of the issuing institution. Therefore, the issuers have incentives to uphold a high quality standard of the loans.

A more recent innovation, first issued in 1995 on the market for Pfandbriefe, is the Jumbo-Pfandbrief. Jumbo-Pfandbriefe accounted for 35% of the outstanding Pfandbrief volume at the end of 2007.⁵⁷ They have a minimum volume of € 1 billion and fulfill certain minimum standards set up by the Association of German Pfandbrief Banks (VDP). Jumbo-Pfandbriefe have to be structured like *straight bonds* with a fixed coupon and bullet redemption. Generally, a minimum of five market makers have to be assigned to quote bid and ask prices during normal trading hours. Thereby, restrictions on the maximal bid/ask spread levels exist. Due to the high degree of standardization and the assured market making, Jumbo-Pfandbriefe are set up to be highly liquid. This is especially important for the Jumbo-Pfandbrief investors, consisting mainly of institutional investors like banks, insurance companies and pension- and investment funds. The share of Jumbo-Pfandbriefe bought by non-institutional investors is estimated to be less than 10%.⁵⁸ The institutional investors are often subject to certain minimum standards with respect to liquidity and default risk of their investments.

Pfandbriefe can either be issued by a private or a public placement whereas Jumbo-Pfandbriefe are always listed on an organized public market. During the last years the share of publicly placed Pfandbriefe declined from 66% in 2003 to only 43% in 2007.⁵⁹ This trend is in line with tailor made Pfandbriefe with respect to especially the maturity and the coupon coming up. Recently, structured Pfandbrief instruments allowed investors to enter interest rate positions and create specific risk/return profiles without being subject to significant default risk.

Due to the acknowledged high credit standing of Pfandbriefe, issuers are able to place new issues at the market even in times of difficult market situations, while refinancing by other instruments would be costly or impossible in the first place. The long tradition of institutional investors buying Pfandbriefe secures an ongoing and reliable access to the capital markets. The liquidity and the high security of Pfandbriefe together with a yield pick-up over the coupon of government bonds are the main characteristics of Pfandbriefe from an investor's point of view. The efficient refinancing opportunities through Pfandbriefe, particularly with regard to the properties of the German mortgage market, give the lending institutions the opportunity to offer attractive mortgage rates.

57 Cf. [http://www.pfandbrief.de/d/internet.nsf/0/3EE2340BD8133889C125745100323B4C/\\$FILE/04_Outstanding_Jumbo.pdf?OpenElement](http://www.pfandbrief.de/d/internet.nsf/0/3EE2340BD8133889C125745100323B4C/$FILE/04_Outstanding_Jumbo.pdf?OpenElement), 28th September 2008.

58 Cf. [http://www.pfandbrief.de/d/internet.nsf/0/EC64F0688969BB1BC12571E0002E616A/\\$FILE/2005-12-31%20Retail-Kunden.pdf](http://www.pfandbrief.de/d/internet.nsf/0/EC64F0688969BB1BC12571E0002E616A/$FILE/2005-12-31%20Retail-Kunden.pdf), 28th September 2008.

59 Cf. [http://www.pfandbrief.de/d/internet.nsf/0/C22A4760EDB1BADDCC125745100323B59/\\$FILE/14_complete.pdf?OpenElement](http://www.pfandbrief.de/d/internet.nsf/0/C22A4760EDB1BADDCC125745100323B59/$FILE/14_complete.pdf?OpenElement), 28th September 2008.

4. Credit risk assessment of alternative products

There are several types of risk present in financial markets. According to the general understanding of risk by the Bank for International Settlements (BIS), we distinguish between market risks and credit risks, among others. While market risk deals with changes of stock prices, interest rates, commodity prices, or exchange rates, credit risk focuses on the ability of one of the counterparties of a financial instrument to pay the promised cash flows. The credit risk is low if the probability that the promised cash flows will be paid is high. An example would be a German government bond where it is very likely, that the bond issuer, i.e. the Federal Republic of Germany, will be able to pay the promised coupons as well as the principal at maturity. Such a bond therefore reveals an extremely low credit risk which rating agencies, e.g. Standard & Poor's or Moody's, express as an AAA rating. An AAA rating implies low credit risk but it does not imply a low probability that the price of that bond changes due to interest rate fluctuations on the market. If interest rates on the market change, the bond price will change respectively. However, this phenomenon is called market risk. Credit risk refers to the ability to pay the promised amounts which is not necessarily associated to changes of the capital market environment. Many credit risk models even assume statistical independence between market and credit risk, for instance the model of Jarrow and Turnbull (1995).

The financial market crisis was initiated by the inability of mortgagees to pay back their promised rates. The mortgage banks have securitized the mortgage loans as CDOs or as MBS or as other securitized instruments. Among those mortgage loans which have been securitized, there were also so-called subprime loans. A subprime borrower is classified as someone who has a high debt-to-income rate, a bad or minimal credit history or other characteristics that give reason to expect a high probability of default of this borrower.⁶⁰ In addition, these borrowers typically have a loan-to-value ratio (LTV) in excess of 80 percent. Consequently, the lender assumes with this type of borrowers a higher risk, as it is much harder to recover the loan from the collateral as the borrower defaults. This is especially true in times when home price appreciation is flat or, even worse, negative. Due to those higher risks, the subprime mortgages typically exhibit higher spreads than prime mortgages. Moreover, it is necessary to provide sufficient credit history documentation to the originator. If borrowers fail to do so, they are classified as Alt-A borrowers, even though they fulfill the credit characteristics of a prime borrower. As Alt-A borrowers they do not qualify for the lower prime mortgage rates and have to pay more for their mortgage.

The earliest instruments which contributed to the genesis of the crisis have been CDOs. According to Bloomberg news ticker, Merrill Lynch posted its largest-ever loss in 2007 after writing down the value of its CDOs and other assets related to subprime mortgages by more than \$ 24 billion. Merrill Lynch's then new Chief

⁶⁰ Cf. Zimmerman (2006), pp. 98 et seq.

Executive Officer John Thain therefore announced that Merrill Lynch was not going to be in the CDO and structured-credit types of businesses anymore, even though the bank has been the world's largest broker for these types of structured products.

Hence, the subprime crisis has initially been a credit risk crisis rather than a crisis associated to market risk. Currently we also observe a crisis in the financial markets. This does not contradict the fact that the initiation of the crisis occurred from credit risk.

Therefore, it seems to be reasonable to analyze the credit risk of the three different products for the securitization of mortgage loans (Mortgage-Backed Securities – MBS, Collateralized Debt Obligations – CDOs, and Mortgage Pfandbriefe) of the preceding chapter. This chapter deals with the drivers of the credit risk associated to these three instruments. Such an analysis enables us to simulate a crises scenario by shocking the credit risk drivers. This is done by constructing a simple credit risk model for these three instruments. The result is an expected basis point loss due to credit risk. It can be summarized by Table 5 which shows that the credit risk exposure for Mortgage Pfandbriefe is clearly the smallest of the three instruments.

Table 5: Expected Loss due to credit risk for different instruments

	Expected Loss in Basispoints
MBS	121.4
CDO	108.6
Mortgage Pfandbrief	28.8

The next section will outline the credit risk model for MBS, section two for CDOs, and the third section analyzes the credit risk behavior of Mortgage Pfandbriefe.

4.1 Mortgage-Backed Securities (MBS)

In order to find a standard of common MBS, this section concentrates on the government-sponsored securitization of residential mortgage loans as pass-through securities. Pass-through securities pool residential mortgage loans and offer investors a fraction of all cash flows generated by the pool of loans. These cash flows are directly passed through to the investor. There are three US institutions, so-called agencies, namely Ginnie Mae (GNMA), Fannie Mae (FNMA), and Freddie Mac (FHLMC). While Ginnie Mae is a government owned corporation, Fannie Mae and Freddie Mac are government-sponsored enterprises (GSEs). One of the services that the agencies provide for the pass-throughs is guaranteeing the bondholder interest and principal payments at the calendar date promised (see Saunders and Cornett (2003), p. 734). In addition to the collateral, there is an additional stage to protect the investor from the credit risk becoming effective. A MBS is based on a pool of residential mortgage loans with an average credit score (an average rating) which is typically below AAA. Comparing the default risk of the senior CDO tranche to MBS therefore yields that the default risk on this stage is higher

for MBS than for CDOs. However, there is a second stage to take into consideration, namely the guarantee of the agency.

Agency mortgage backed securities (MBS) reveal many diverse features and characteristics. LTV's of MBS are generally higher than for Mortgage Pfandbriefe where we have maximum loan-to-value-ratios of 60%. Several MBS allow LTVs which are between 90 and 95%. Non-agency MBS do not have any comparable rules – anything can be securitized in general. By far the biggest proportion of MBS based on subprime mortgage loans are non-agency MBS. However, in order to obtain a comparison to Mortgage Pfandbriefe, the analysis here concentrates on agency MBS. They are not as regulated as Mortgage Pfandbriefe, but more so than non-agency MBS.

With regard to the mortgage loans which are securitized, there is a distinction between conventional and non-conventional (sometimes also referred to government) loans. Government loans are insured by government institutions like the FHA or VA in order to facilitate access to the credit market for less credit worthy mortgagees. Ginnie Mae guarantees exclusively government loans. Whereas, Fannie Mae, Freddie Mac and private label issuers securitize mostly conventional loans. However, Ginnie Mae loans are state guaranteed anyway. There is no difference in the credit risk of the different agency MBS as long as the GSEs do not come under pressure. This seemed to be the case for the two GSEs Fannie Mae and Freddie Mac early in 2008 until the US government promised to cover all losses occurring from GSE MBS.

The arguments above indicate the major differences between MBS and CDOs. There are common aspects as well as differences between Mortgage Pfandbriefe and MBS. One of the most important obvious differences is the prepayment property of MBS. This property was discussed in chapter 3. The prepayment option of the mortgagees implies that there is risk that the loan is prepaid early, from the viewpoint of the investor. Since this risk tends to occur more often when interest rates are low, investors have a reinvestment risk. Pricing the prepayment risk is not trivial. References are for instance Matthey and Wallace (2001) who measure conditional prepayment rates of between 10% and 15%. However, the prepayment risk is a risk which depends on the interest rate behavior on the capital market. It is therefore a market risk and not a credit risk. Prices of MBS reflect the prepayment risk. When one wants to compare the credit risk of MBS and Mortgage Pfandbriefe, the prepayment risk cannot be considered.

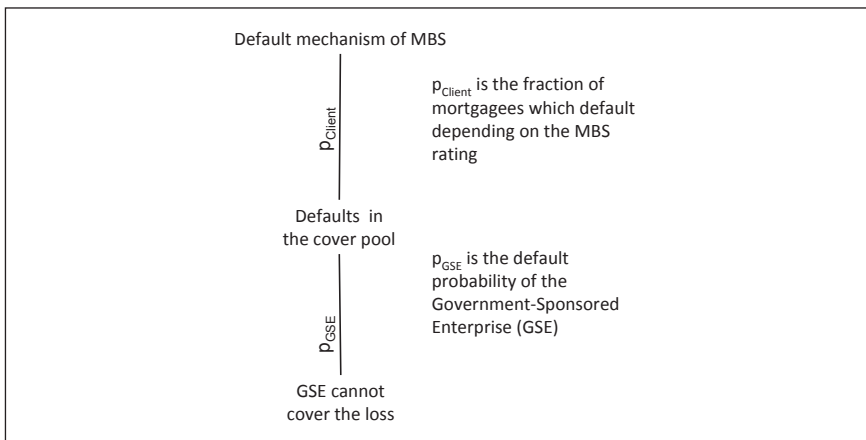
There might, however, be one exception. If one of the mortgagees in the mortgage pool fails to pay the promised amounts and if the investor has purchased an agency pass-through MBS, then the agency will repay the principal of the loan early, that is shortly after the mortgagee has declared default. This situation is clearly exposed to credit risk. However, it does not necessarily correlate to the interest rate level on the capital market. While the prepayment option of a MBS tends to be executed when interest rates are low, the agency payment occurs in the event that one mortgagee defaults. This is not necessarily related to low interest rate levels. One could even argue that defaults occur more often when interest rates are high since high interest rates make adjustable rate mortgages (ARMs) more difficult to pay back. If the mortgage loans are paid back when interest rates are high then there

is no re-investment risk from the viewpoint of investors. Consequently, prepayment risk is not a risk which should be considered here where we are attempting to compare the credit risks of CDOs, MBS and Mortgage Pfandbriefe.

Another difference between Mortgage Pfandbriefe and MBS which is relevant for the assessment of credit risk is (i) the loan-to-value ratio and (ii) the selection of the assets in the cover pool. As previously mentioned, a Pfandbrief requires a maximum loan-to-value ratio of 60%. This is significantly below the average loan-to-value ratio in the case of MBS which differs but is usually significantly higher (see for instance above or Fannie Mae (2007)). Agency MBS have comparatively strict requirements with regard to the homogeneity of the pooled mortgage loans. The weighted average coupon rate and the weighted average remaining maturity as well as the average credit score of each loan reveal typically very low volatilities. The cover pool of Pfandbriefe is less homogenous implying better diversification effects. MBS investors need to analyze the cover pool much more carefully than Pfandbrief investors. Based on the average LTVs, maturities, credit scores, and coupons, risk assessments can be made.

A further distinction between Mortgage Pfandbrief and MBS pools is that the Mortgage Pfandbrief cover pool is dynamic whereas the cover pool for MBS is static. The Mortgage Pfandbrief pool could include in principle all mortgage loans of a Pfandbrief bank which qualify as cover pool assets. In the case of MBS, the cover pools are static, i.e. the covering mortgage loans are given and if one of them defaults, the guarantee of the agency becomes effective. Since the cover pool of a MBS is likely to be composed of similar mortgage loans, for instance mortgage loans in the same geographical area, there is a lower diversification effect between the loans in the MBS pool than those loans which span the cover pool of a Mortgage Pfandbrief.

Figure 15: Credit risk mechanism of Mortgage-Backed Securities



Agency pass-through MBS will be analyzed in the following. The major differences of MBS affecting their credit risk in comparison to CDOs and Mortgage Pfandbriefe are the following:

- Agency pass-through MBS have an additional guarantee preventing the investor from credit risk compared to CDOs. This guarantee is given by one of the three agencies Fannie Mae, Ginnie Mae or Freddie Mac.
- The average rating of the cover pool of a MBS is typically below AAA. Consequently, a MBS does often not reveal a AAA rating which is different in the case of the senior CDO tranche. Mortgage Pfandbriefe have a very carefully selected cover pool. Their rating is AAA in most cases.
- The loan-to-value ratio of the cover pool in the case of Mortgage Pfandbriefe is 60%. In the case of MBS it is very often 90%.
- Mortgage Pfandbrief cover pool assets are more diversified with regard to coupon, maturity, and regional distribution than MBS cover pool assets. This implies a higher default risk for the guaranteeing institution⁶¹ for MBS than for Mortgage Pfandbriefe. That increased risk is balanced out by the fact that a Pfandbrief is guaranteed by a bank whereas the US government guarantees agency MBS. For modeling the credit risk, we will assume equal default risks for both, the Pfandbrief Bank and the GSE. The rationale behind this assumption is that as in the US the German Pfandbrief Banks are expected to be covered by the German government in the case of a serious threat, due to the high systemic importance of the Pfandbrief market. This could be seen in the case of Hypo Real Estate in the autumn 2008.

Non-agency MBS are significantly less standardized and secured and therefore not comparable to Pfandbriefe which are strictly regulated by the Pfandbrief Act. There are insurance contracts for non-agency MBS available in the market. However, these MBS lose the market's confidence very quickly in crises situations, as Figure 30 (page 63) indicates.

These findings can now be used to model the credit risk mechanism of MBS. This can then also be the base for modeling the credit risk mechanism for Mortgage Pfandbriefe in the next paragraph.

Figure 15 indicates that we have to consider two stages in the credit risk mechanism of MBS. The first stage is the fraction of clients in the cover pool which default. This probability p_{Client} depends on the average credit score in the pool. For the analysis which follows we assume that the average credit quality of the mortgage loan pool is BBB rated. According to Table 7, this implies a default risk of 5% which exaggerates the reality in order to obtain results which can be easier interpreted. Since it is the relative comparison between MBS, CDOs, and Mortgage Pfandbriefe which is the focus rather than the absolute analysis of these instruments, this didactical bias will not affect the interpretation of the results. For the default risk of the Government-Sponsored Enterprise (GSE) we assume the same default

61 An agency in the case of MBS, a Pfandbrief Bank in the case of Mortgage Pfandbriefe.

risk as for the Pfandbrief Bank in section 4.3, namely $p_{\text{GSE}} = 46\%$. This implies a default risk for the MBS modeled here of:

$$P_{\text{MBS}} = P_{\text{Client}} \cdot p_{\text{GSE}} = 5\% \cdot 46\% = 2.3\%$$

Determining the default risk p_{GSE} of the GSE is based on the volatilities of all asset positions and the liability side positions of the GSE as well as the correlation between the two sides. Since we assume identity between the default risk of the GSE in the case of MBS as of the Pfandbrief Bank in the case of Mortgage Pfandbriefe, section 4.3 shows in detail how $p_{\text{GSE}} = 46\%$ has been calculated.

For the analysis a portfolio of mortgage loans is assumed. For simplicity, we assume that the price of each home which has been purchased based on these loans is \$ 250,000. The average loan-to-value ratio in the example is assumed to be 90%, i.e. the average mortgagee will borrow \$ 225,000. If the mortgagee defaults, i.e. if he or she is unable to provide the agreed payments, then the home underlying the mortgage contract will be liquidated. Typically, houses under these conditions are sold below market value. We assume an average recovery rate of 50%. This data is summarized in Table 6.

The bank contributing mortgage loans to their clients manages a portfolio of mortgage loans. The risk based on the asset market value of this portfolio is driven by two components:

- The first component is the risk of each individual loan, i.e. the probability of default of each individual client who borrows money for his/her home.
- The second component is the correlation between the risks of all clients.

Table 6: Description of mortgage loans

Value of each house	\$ 250,000
Loan-to-value ratio (underfunding ratio)	90%
Mortgage loan size	\$ 225,000
Average recovery in the case of default	50.0%
Average correlation between loans	0.5
Expected change of real estate prices	-5.0%
Volatility of real estate prices	10.0%

Table 7: Description of model parameters

Deposit volatility	3.0%
Deposit expected return	3.0%
Expected change of real estate portfolio	-5.0%
Volatility of real estate portfolio	7.1%
Average recovery in the case of default	50.0%
AAA default probability	2.0%
BBB default probability	5.0%

The principal idea of portfolio management is that, due to diversification effects, a portfolio of assets is less risky than each individual asset. Diversification effects can be represented by the average correlation between the assets. The lower the average correlation, the lower the portfolio risk will be. This is the classical finding of Harry Markowitz (1952) who applies it to the market risk of portfolios of risky assets.

Many have also applied the diversification principle to credit portfolios. The idea is that the credit risk of mortgagee Mr Myers is not perfectly correlated, if not independent, to the credit risk of Ms Brown. This implies significant diversification effects. For our numerical example according to Table 6, the average correlation between all loans in the credit portfolio is assumed to be 0.5. One aspect, however, which will become relevant in the course of the analysis of credit risks is that the correlation between the borrowers is not the only correlation figure which matters. Also the correlation between the collaterals of the loan, i.e. the real estate assets, affects the credit quality of the securities. This will be illustrated in the following sections.

We therefore assume a bank with a loan portfolio of real estate, with an expected return on the real estate assets of -5% p.a. (see Table 6). We model a recession situation with shrinking real estate values in order to approximate the current credit crisis. Moreover, we assume a return volatility of real estate of 10% p.a.⁶² Based on an average correlation between the real estate assets of 0.5, as it is given in Table 6, this implies a risk of a perfectly diversified real estate portfolio which equals the average covariance⁶³

$$\sqrt{10\%^2 \cdot 0.5 - 7.1\%}.$$

Therefore, in our analysis, we use a volatility estimate for the real estate portfolio underlying the credit portfolio of 7.1% and an expected return of -5%. Figure 16 visualizes the distribution of a real estate portfolio, where we assume log-normality. The portfolio consists of 10 identical loans, each is used to finance a private home with a value of \$ 250,000. The total value of the homes portfolio is \$ 2,500,000. Since according to Table 6, the loan-to-value ratio is assumed to be 90%, this accords to a value of the loan portfolio of \$ 2,250,000. The loss area covers all values of the portfolio of homes implying a loss on the credit portfolio, i.e. all house portfolio values below \$ 2,250,000. The loss area covers 21.7% of all observations. Hence this setting clearly indicates a crises scenario.

62 15% volatility p.a. is the volatility as it has been measured based on the S&P Citigroup World Property Index based on monthly data between 1990 and 2006. See Engelbrecht (2008). It should be mentioned that the German Pfandbrief Index PEX, which refers to 30 German synthetic Pfandbriefe with maturities from 1 to 10 years, has a significant lower volatility.

63 In the case of a large number of mortgage loans, the variance of the real estate portfolio can be approximated by the average covariance.

Figure 16: Lognormal distribution for the portfolio of homes underlying the credit portfolio of a bank

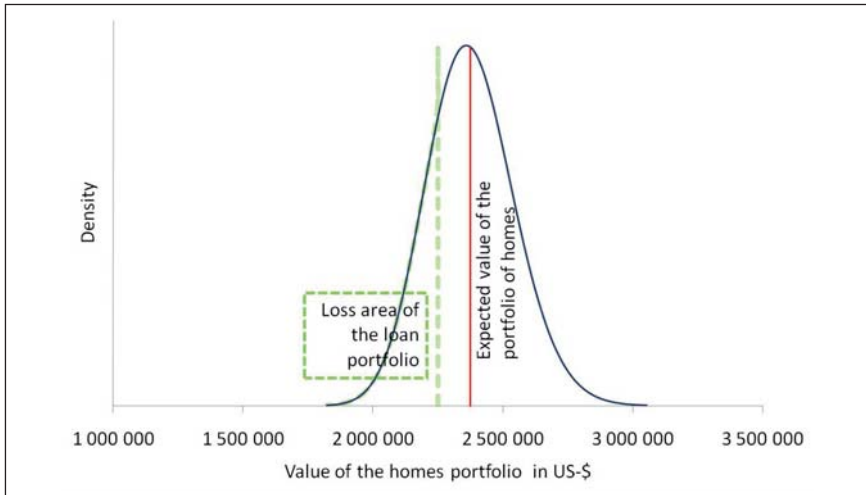
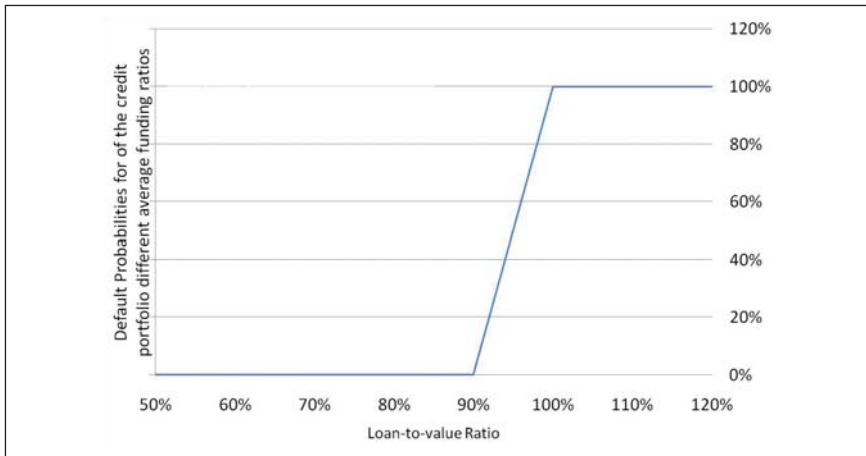


Figure 17: Default risk of mortgage loan portfolios for different loan-to-value ratios



The loss area in Figure 16 implies that the loan will not be completely covered by the collateral, if the value of the home declines by more than 10% down to \$ 225,000. Since there is a 21.7% chance of losses on the loan portfolio, it would reveal an extremely poor rating. However, the poor rating does not necessarily affect the rating of the CDO which securitizes the loan portfolio.

Figure 17 illustrates the relationship between the loan-to-value ratio and the rating, respectively the default probability, of the loan portfolio. It becomes very obvious that the loan-to-value ratio is one of the really important drivers of the credit risk

of a mortgage loan portfolio. It should also be noted that the loan-to-value ratio increases sharply in crises situations when the real estate market is adversely affected. One of the reasons of the current crises particularly in the UK and the US was that relatively high loan-to-value ratios were possible due to high expected returns on the real estate market. When the market stopped growing at the pace that it had grown for the last 15 years, the loan-to-value ratio increased immediately. This caused and still causes significantly increased default probabilities as they are indicated in Figure 17.

Above Table 1 has further illustrated that the typical but also the maximum loan-to-value ratio is significantly higher in the UK and the US market compared to the German market. Moreover, as was pointed out in chapter 3.3, mortgage loans are only eligible for the Mortgage Pfandbrief cover pools up to a loan-to-value ratio of 60% based on the conservatively appraised mortgage lending value. Due to coverage by the collateral, shortfalls of Mortgage Pfandbriefe are close to 0% of all cases even in the case of a sharp down-market as it is described in Figure 17.

For the portfolio value of homes we assume the log-normal distribution with an expected return of -5% and a volatility of 7.1%. The expected portfolio value is then \$ 2,375,000. Given that the average credit score for the MBS is BBB, the default risk is 5% (see Table 7), implying that the house portfolio value lies below \$ 2.117 million.⁶⁴ The loss of the portfolio of residential homes must at least be 15.3% for the BBB MBS to default.

Value of the portfolio of homes	\$ 2,500,000
Value of the credit portfolio based on the portfolio of homes	\$ 2,250,000
15.3% loss of the homes portfolio	\$ 383,038
Remaining value of homes before recovery	\$ 2,116,962
Sell homes at recovery rate of 50%	\$ 1,058,481
Loss given default on the credit portfolio	\$ 1,191,519

The expected loss on the agency MBS based on the parameter setting is obtained by multiplying the loss probability by the loss given default:

$$\$ 1,191,519 \cdot 5\% \cdot 46\% = \$ 27,320,$$

equaling 121 basis points of the total loan portfolio.

4.2 Collateralized Debt Obligations (CDOs)

It will be interesting to see how CDOs are affected by such a crisis in the real estate market compared to MBS and Mortgage Pfandbriefe. In order to view the effects, we will first illustrate the way in which tranches of CDOs are built. The principle of securitizing such a mortgage loan portfolio is done by building tranches of different credit qualities (refer to chapter 3.2). The amount of lost money which is attributed to each of the three tranches depends on the default risk which according

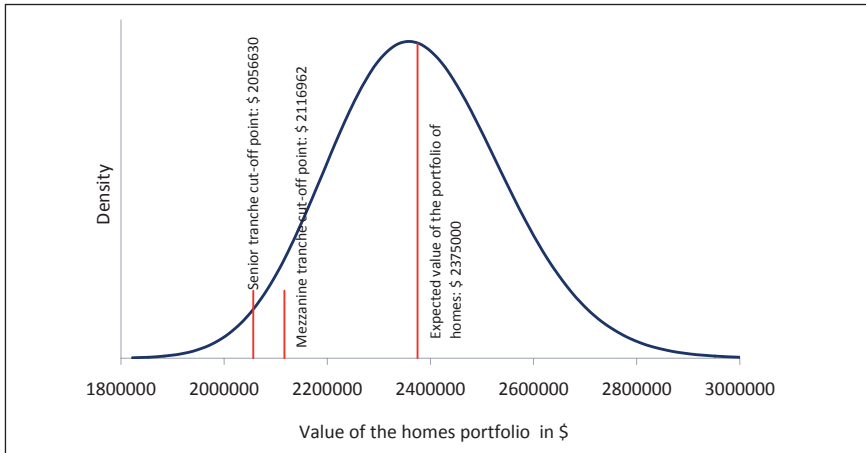
⁶⁴ \$ 2,117 million corresponds to the 5% percentile of the log-normal distribution of the mortgage pool.

to their rating each tranche should have. When the senior tranche is for instance structured in such a way that it will only be affected in the 2% worst cases of losses, the minimum loss which must occur based on the loan pool is given by the percentile of the log-normal distribution (2% percentile). Given an expected return of the portfolio of homes of -5% and a volatility of 7.1%, the expected portfolio value is at \$ 2,375,000. The 2% percentile is reached for a house portfolio value of \$ 2.056 million, i.e. 17.7% below the initial value. It is of course very unlikely that this point is reached unless in a crises situation where the real estate market breaks down. A loss on the credit portfolio would have to be at least as high as

$$\text{\$ } 2,250,000 - \text{\$ } 2,056,630 = \text{\$ } 193,370$$

before the senior tranche will be touched. \$ 133,038 would be the according loss for the mezzanine tranche.⁶⁵ If the loss on the loan portfolio exceeds zero but does not exceed \$ 133,038, then the loss has to be covered solely by the equity investors. If the loss lies between \$ 133,038 and \$ 193,370, then the loss bearing capacity of the equity tranche is exhausted and the waterfall goes to the mezzanine tranche. The buyers of the mezzanine tranche must cover those losses. If the loss exceeds this value, then this will affect the owners of the senior tranche. Under regular conditions to reach the AAA tranche is extremely unlikely. Under the assumptions specified here, this happens in 2 out of 100 cases.

Figure 18: Value of the homes portfolio and cut-off points for the three tranches



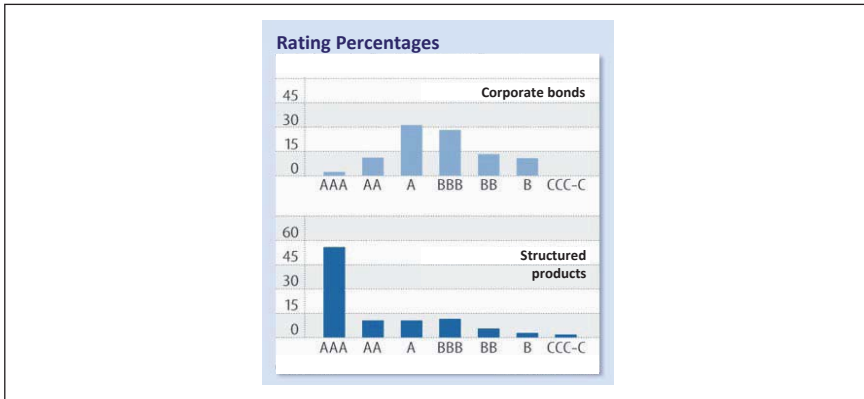
⁶⁵ Assuming a BBB rating and therefore a 5% default probability for the mezzanine tranche.

However, if the loss exceeds these limits, then there is no additional protection in the case of CDOs. Moreover, these boundaries for the tranches depend on the accurate parameter estimation. Especially in crises situations, home price declines are typically accompanied with

- ... an increasing volatility in home prices and
- ... an increasing correlation between single home prices.

Default risks react very sensitively to increasing correlation coefficients. Also higher price risks of residential homes cause higher default risk. Due to changes in correlation and volatility parameters, a former senior tranche might become of mezzanine or equity quality during financial crises. Investors might have first class rated instruments on their books which will then be quickly downgraded even if the credit quality of each individual loan remains unchanged. This can imply that a former AAA tranche of a CDO which is on the books for example of a European pension fund must be sold due to the fact that this pension fund is only allowed to hold AAA instruments. If that happens frequently, it is quite obvious that this puts pressure on the market prices of former AAA tranches which could lead to a further downgrading of these instruments. Therefore, it seems to be extremely important, that there is an additional mechanism protecting securitized AAA mortgage loans from downgrades. One of these protection mechanisms is a lower loan-to-value ratio. Another mechanism would be an additional counterparty which guarantees that the instrument is covered by underlying assets. As the next section will show, this is exactly what is standing behind a Mortgage Pfandbrief.

Figure 18 assumes that the values on the portfolio of homes are log-normally distributed and that the expected return and the volatility of the returns have been accurately estimated as in Table 7. The portfolio volatility depends on the assumption that the credit risks of the mortgagees reveal a correlation of 0.5. In the course of the current credit crisis, we observe high correlations of the collaterals of the loans, i.e. the private homes. Most of the homes which have been financed by a mortgage bank are typically geographically concentrated. It is therefore quite likely that the values of these homes move jointly. In the current crisis, real estate prices on average go down. Hence, if a loan portfolio covers loans for homes in concentrated locations, they tend to be highly correlated. This does not directly affect the value of the loan portfolio, unless the credit worthiness of the home owners and loan takers worsens on an aggregated basis because of an economic crisis. If the correlation of the individual credit risks has been incorrectly estimated and it goes up from 0.5 in average to 0.9, then the portfolio risk increases from 7.1% to 9.5% implying that the senior tranche cut-off point is roughly \$ 100,000 below the cut-off point in Figure 18. Hence, in this case, 4.5% of the credit portfolio would be labeled as AAA tranche even though it only deserves a BBB mezzanine rating. This is exactly what seems to have happened during the credit crisis. The correlation between the risks in the loan portfolios of mortgage banks turned out to be significantly higher in the crisis than they seemed to be prior to the cascading of events. Due to the lack of an additional protection mechanism, this has led to a significant worsening in the credit quality of senior tranches.

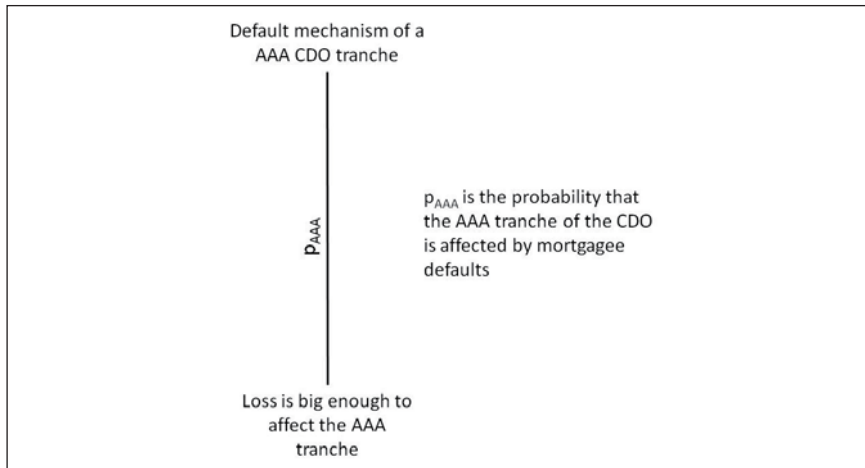
Figure 19: Multiplying excellent credit ratings by tranching

Source: Frankfurter Allgemeine Zeitung based on Fitch ratings, 7th February 2008.

Another interesting aspect of tranching is that the original portfolio with a very poor credit quality (default risk 21.7%) can be converted into a senior tranche which covers \$ 2,056,630, more than 91% of the total portfolio. Hence a very poor credit risk portfolio can be converted into a portfolio consisting by more than 90% of first class credit instruments. Obviously, this implies a very attractive selling price for a high credit risk portfolio. Only a small proportion usually remains with the equity tranche which the bank keeps on its books. Figure 19 shows how the conversion of mediocre credit portfolios into very impressive senior tranches takes place in practice. A more or less symmetrical credit rating distribution converts towards a significantly right skewed distribution. How much of the original portfolio can be attributed to the senior tranche depends predominantly on two factors:

- The higher the default probability of the senior tranche, the more of the original portfolio can be attributed to the senior tranche.
- If the loan-to-value ratio goes below 85%, more than 95% of the credit portfolio can be converted to the senior tranche, even if the average credit quality of the individual loans is much lower.

The credit risk mechanism of CDOs is based on the default risk of the AAA tranche. This requires modeling the default probability as well as the loss given default (LGD) for the AAA tranche of a CDOs and compare it to the credit risk mechanism of Mortgage Pfandbriefe. Figure 20 shows the credit risk mechanism from the viewpoint of an AAA CDO investor. Default is possible when mortgagees default and this affects the AAA tranche. That implies that the mortgage pool covering the CDO has depreciated so dramatically that the mezzanine and equity investors have already covered losses of other mortgagees. The probability that the AAA tranche is affected in Figure 20 is indicated as p_{AAA} .

Figure 20: Credit risk mechanism of the AAA tranche of a Collateralized Debt Obligation

The default risk of the AAA tranche equals the default risk of the CDO from the viewpoint of the investor. The probability of a CDO credit event p_{CDO} is assumed to be 2% (see Table 7):

$$p_{\text{CDO}} = p_{\text{AAA}} = 2\%$$

In order to compare CDOs to Mortgage Pfandbriefe, the default probability of Mortgage Pfandbriefe (i.e. their distance to default) and MBS will have to be compared to p_{CDO} . As we already know, MBS have an additional stage preventing the investor from default; and so do Mortgage Pfandbriefe as will be shown in the next section. In the case of Mortgage Pfandbriefe the second stage of credit risk protection is the bank which issues the Pfandbrief. In the case of an agency MBS this is the agency.

Now we calculate the risk that the AAA tranche of a CDO will be affected by the underlying credit portfolio and the associated loss given default. We need an assumption about the fraction of clients declaring default p_{Client} .

AAA default probability	2.0%
BBB default probability	5.0%

Table 7 completes Table 6; it indicates that the default risk of the AAA tranche is as high as 2%. This certainly exaggerates the default risk in a typical mortgage loan portfolio. However, this exaggeration allows us to demonstrate the effects of the crisis more drastically and it does not affect the relative comparison between CDOs and Mortgage Pfandbriefe, as long as the same assumptions are applied to both types of instruments. Under regular conditions one would not expect a 2% default probability when one buys a AAA rated instrument. Given a default risk of 2%, the return on the homes portfolio would have to be as low as -17.7%, given

the expected return of -5% and the portfolio volatility of 7.1%, as is indicated by Table 7. The figure -17.7% is the 2% percentile of the log-normal distribution. In order to calculate the loss given default, we again assume an average recovery rate of 50%. Given a loan-to-value ratio of 90%, a 17.7% loss on the real estate portfolio will affect the loan portfolio of the bank. According to the assumed recovery rate, the default of the client induces a sale of the home at the recovery rate. Table 7 summarizes the parameters needed additionally to those given in Table 6.

Value of the portfolio of homes	\$ 2,500,000
Value of the credit portfolio based on the portfolio of homes	\$ 2,250,000
17.7% loss of the homes portfolio	\$ 443,370
Remaining value of homes before recovery	\$ 2,056,630
Sell homes at recovery rate of 50%	\$ 1,028,315
Loss given default on the credit portfolio	\$ 1,221,685

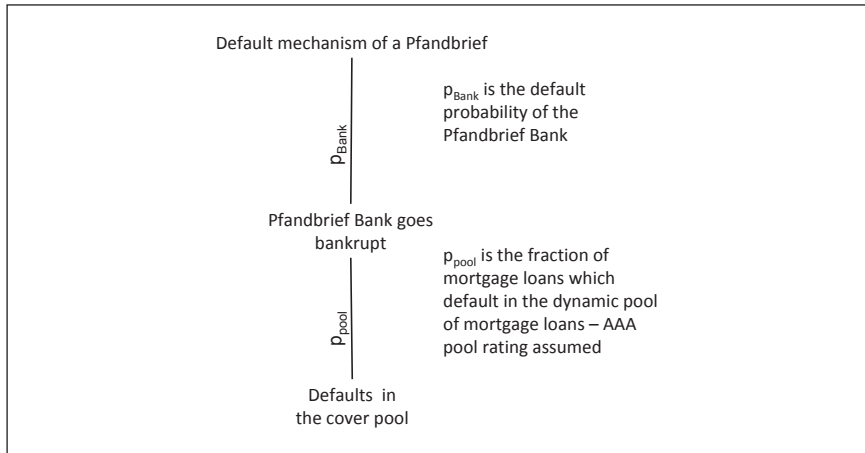
Due to the fact that this analysis refers to the AAA tranche, the probability of a loss on the loans portfolio is 2%. The expected loss on the AAA tranche of the CDO based on the parameter setting is obtained by multiplying the loss probability by the loss given default:

$$\text{\$ } 1,221,685 \cdot 2\% = \text{\$ } 24,434,$$

equaling 109 basis points of the total loan portfolio. The question which has to be addressed next is the expected loss figure for Mortgage Pfandbriefe. We will then be able to vary the most influential parameters and to calculate their effects on the expected loss expressed in basis points for CDOs as well as MBS and Pfandbriefe.

4.3 Mortgage Pfandbriefe

The credit risk mechanism of Mortgage Pfandbriefe consists of a second stage in contrast to CDOs. In comparison to the second stage of agency MBS, the guaranteeing function of the agency is replaced by the Pfandbrief Bank guaranteeing the Pfandbrief issuances. Furthermore, the cover pool is dynamic and a common cover pool exists for all Mortgage Pfandbrief issuances. Another difference exists in the fact that Pfandbrief creditors have a claim first against the Pfandbrief Bank and in the case of default against the cover pool. Contrary to this, agency MBS creditors have claims against the original mortgagees included in the cover pool, and only in the case of the mortgage pool's default the agency's guarantee is used to cover the creditors' claims. Figure 21 illustrates the credit risk mechanism.

Figure 21: Credit risk mechanism of a Mortgage Pfandbrief

According to the analysis of the credit risk mechanism of MBS in Figure 15, we start with the second stage of Mortgage Pfandbriefe which is associated to the default probability of the pool p_{pool} . The client default risk is no longer directly relevant due to the fact that we have a dynamic pool in contrast to MBS where the pool is statically given. This implies diversification effects and hence $p_{\text{pool}} < p_{\text{Client}}$. This is supported by the fact that Pfandbriefe are covered bonds which remain on the balance sheet of the issuing Pfandbrief Bank and MBS and CDOs are off-balance-sheet assets (see Figure 6 and Figure 7). The difference compared to CDOs is, however, that even if the client's default comes simultaneously with a sharp decline of the collateral value the covered bond does not default as long as the issuing institution survives, i.e. the Pfandbrief Bank. Here, we nevertheless assume $p_{\text{Pool}} = p_{\text{Client}}$ as long as the rating is the same, which by tendency overestimates the risk of Mortgage Pfandbriefe compared to MBS. On the other hand, a MBS has a guarantee of a GSE which is at least as valuable as the Pfandbrief Bank as obligor. Moreover, many assets in the cover pool are insured. These two factors justify equalizing the client default probability p_{Client} and the pool default probability p_{pool} . It will become evident, that the Mortgage Pfandbrief clearly dominates both, MBS and CDOs with regard to credit risk. If neither the client nor the collateral is able to cover the contracted credit sum, the Pfandbrief Bank would be held responsible to cover the losses in the loan portfolio. Pfandbrief Banks typically reveal excellent ratings so that the probability of a bank default is very small. However, a significant proportion of a Pfandbrief Bank's assets are invested in mortgage loans so that a Mortgage Pfandbrief and the default risk of the bank is likely to be positively correlated to each other. However, the balance sheet of a Pfandbrief Bank does

not exclusively include real estate assets. According to the VDP annual report,⁶⁶ the Pfandbrief Bank sector includes the following assets on an aggregated basis:

- Real estate loans (approx. € 521 billions)
- Loans to governments (approx. € 750 billions)

More than half of the business of an average Pfandbrief Bank is therefore not completely correlated to real estate assets. Moreover, when one does not consider an average Pfandbrief Bank but a single Pfandbrief Bank, the cover pool does not exclusively consist of mortgage loans but also on other cover assets. Both arguments imply diversification effects for the Pfandbrief Bank. The diversification effect enables Pfandbrief Banks to survive and to cover losses on real estate loan portfolios in a crises situation. If one wants to compare the basis point loss of Mortgage Pfandbriefe one would have to estimate the bankruptcy probability of the Pfandbrief Bank. Therefore, we assume a structure of a Pfandbrief Bank as in Table 8. This structure uses the aggregated asset side of the VDP member banks.

Table 8: Typical Pfandbrief Bank balance sheet

	Assets in bn €	Liabilities in bn €	
Mortgage loans			
Private homes	261	70	Equity
Company loans	260	1,201	Deposits
Government loans	750		
	1,271	1,271	

In order to approximate the default risk we need the following parameters:

- The volatility of all asset side positions that is mortgage loans and government loans, are needed.
- The calculation of the default risk of the Pfandbrief Bank's equity requires the volatility and the expected return of the deposits. According to Table 7, both are 3%.
- Finally but most importantly, the correlation structure between all assets and liability positions is needed. Table 9 shows the assumptions regarding the correlation between private homes, company and government loans as well as deposits. Empirical correlations between real estate and bonds range around zero (see Engelbrecht (2008), p. 226). Since other effects, for instance interest rate developments, can be expected to imply a positive correlation of real estate loans with bonds, 0.5 is a reasonable assumption. The correlation between company and government bonds used as approximation for the company and government loans empirically ranges around 0.7.⁶⁷ Table 9 assumes an average

⁶⁶ See VDP (2007), p. 24.

⁶⁷ The correlation of daily returns on the Citigroup US Broad Investment Grade Indexes for Corporate and Government Bonds is around 0.67 (Source: Thomson Financial Datastream and own calculations). Since we are considering the bond correlations as an approximation for the loan correlations, 0.5 seems to be a reasonable assumption.

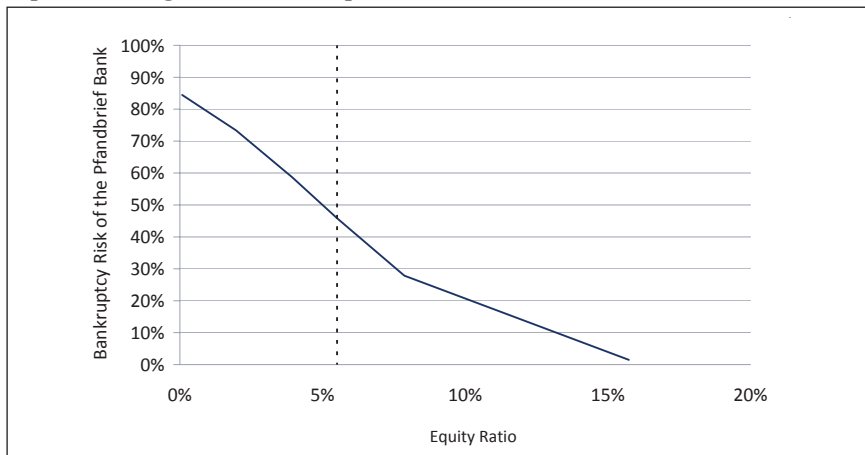
value of 0.5 for all correlations. Varying these figures causes only small changes in the results.

Based on this risk information, we can calculate the volatility of the Mortgage Pfandbrief's equity and, if the equity is log-normally distributed, the volatility and the expected return of the equity. The bank which is described in Table 8 reveals a low expected equity return due to the mortgage loan returns which have been assumed to be -5% p.a. in Table 6. This assumption is supposed to describe a severe crises scenario. Given a deposit expected return of 3% this results in an expected equity return and an equity return volatility which imply a default risk of 46% which is the same figure as the default risk of the GSE of the preceding section. This is unrealistically high in almost all cases. Figure 22 illustrates the bankruptcy risk of a Pfandbrief Bank for different equity ratios. The Pfandbrief Bank default risk reduces quickly with an increase of the equity ratio. The equity ratio modeled here is indicated by the vertical dotted line in Figure 22. The equity ratio is 5.5% and accords to a bankruptcy probability of 46%.

Table 9: Correlation between the asset and liability positions

Correlation Matrix	Company loans	Government loans	Deposits
Private homes	0.5	0.5	0.5
Company loans		0.5	0.5
Government loans			0.5

Figure 22: Equity ratios and bankruptcy risk of Pfandbrief Banks given an expected change of real estate prices of -5%



Another difference between CDOs, MBS and Mortgage Pfandbriefe is the loan-to-value ratio (LTV). This is relevant for the comparison of the expected losses of the two instruments. As was pointed out in section 3.1, the maximum loan-to-value ratio for a Pfandbrief is as low as 60%. If the value of the portfolio of homes is again € 2,500,000, this implies that the loan size must be less than € 1,500,000.

Quite obviously, the lower loan-to-value ratio significantly reduces the credit risk of a Mortgage Pfandbrief compared to CDOs.

The credit risk mechanism in Figure 21 needs assumptions about both, the pool credit risk and the credit risk of the Pfandbrief Bank. Since the pool credit risk given a AAA rating is $p_{\text{Pool}} = 2\%$, we obtain for the credit risk of a Pfandbrief:

$$P_{\text{Pfandbrief}} = p_{\text{Pool}} \cdot p_{\text{Pfandbrief Bank}} = 2\% \cdot 46\% = 0.9\%,$$

which is significantly below the credit risk of both, MBS and CDOs. We now perform the same calculation as in the last section in order to obtain the loss given default:

Value of the portfolio of homes	\$ 2,500,000
Value of the credit portfolio based on the portfolio of homes	\$ 1,500,000
17.7% loss of the homes portfolio	\$ 443,370
Remaining value of homes before recovery	\$ 2,056,630
Sell homes at recovery rate of 50%	\$ 1,028,315
Loss on the credit portfolio	\$ 471,685

Despite of the comparatively high default risk of the Pfandbrief Bank assumed here, we have only 29 basis points expected loss which is almost 100 basis points below the MBS level. In the reality, the difference in bankruptcy probabilities of Mortgage Pfandbriefe compared to MBS is likely to be even greater. This is the case, particularly because of (i) the fact that a bankruptcy risk for a Pfandbrief Bank of $p_{\text{Bank}} = 46\%$ is useful for illustrative purposes but is higher than in the reality and (ii) the 60% LTV ratio of the cover pool is a maximum ratio which in average is much lower even though German law requires comparatively conservatively calculated value figures.

On the other hand, the legal conservatorship for Fannie Mae and Freddie Mac contributed in September 2008 and renewed in January 2009 has illustrated, that the default risk of an GSE is de-facto limited to the default risk of the United States, i.e. virtually and hopefully 0. Therefore, assuming a 46% default risk for GSEs, as we did it above, is a clear over-estimation. Probably to a more significant degree than for the Pfandbrief Bank default risk. Under realistic parameter assumptions, the default risk of both, an agency MBS as well as a Mortgage Pfandbrief, is therefore close to zero. While for Mortgage Pfandbriefe this is due to the valuation principles and the LTV ratios for eligible mortgage loans, the de-facto (but not legal) zero credit risk for agency MBS is caused by the recent conservatorship for agency MBS. In order to illustrate the transmission mechanism which leads to credit risk for both agency MBS and Mortgage Pfandbriefe, the simple models invented here are useful. Under legal settings, Mortgage Pfandbriefe reveal significant less credit risk than both CDOs and MBS.

4.4 Sensitivity analysis

The last section has shown that Pfandbriefe dominate both, CDOs and MBS with regard to credit risk. In order to obtain interpretable results we have selected quite extreme parameter combinations. We have for instance assumed that the default

risk of a AAA rated security is as high as 2% and of a BBB rated instrument is 5%. Both figures are by far too high. The parameter selection of the preceding sections can however be justified by two reasons:

- It is easier to illustrate the differences between the three instruments with these rather extreme parameter settings. More realistic parameter selections would reveal the same relative results but would imply a zero credit risk especially for Mortgage Pfandbriefe which is not very satisfying if one wants to understand the credit risk mechanism. Taking into consideration the recent conservatorship for agency MBS in the US, their credit risk is also close to zero under realistic terms (not necessarily under legal terms).
- The second argument is that the financial crisis has indeed shocked many parameters, especially the default probabilities of AAA rated tranches. Hence, even if our parameter selection seems unrealistic in regular situations, it is not so unrealistic in a crisis scenario.

In order to illustrate how the credit risks react on parameter variations, we conclude this chapter with three sensitivity analyses of the basis point losses of MBS, CDOs, and Mortgage Pfandbriefe. The three parameters which are varied here are

- the expected change on real estate prices
- the default probability which is associated to an AAA rated instrument as it is given by rating agencies
- the volatility of real estate prices.

All other parameters remain as in Table 6 and Table 7. Figure 23, Figure 24, and Figure 25 show the results.

Figure 23: Sensitivity of losses from holding CDOs respectively Mortgage Pfandbriefe from an investor's viewpoint when the expected return on real estate prices changes

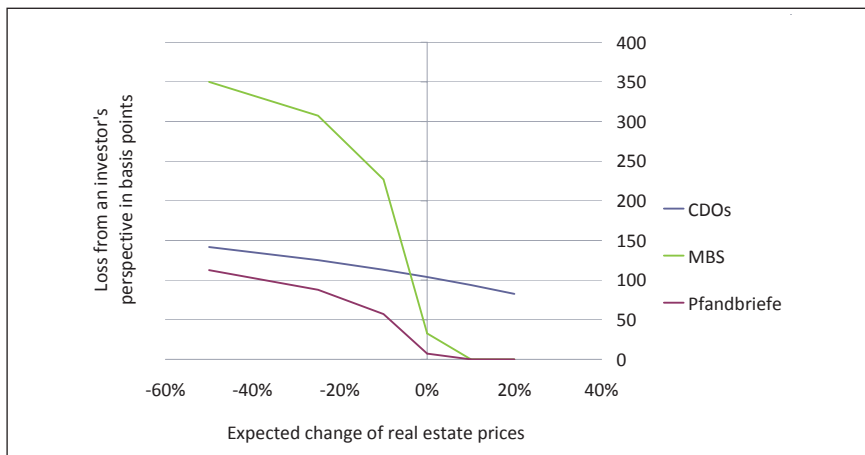


Figure 24: Sensitivity of losses from holding CDOs respectively Mortgage Pfandbriefe from an investor’s viewpoint when the volatility of real estate prices changes

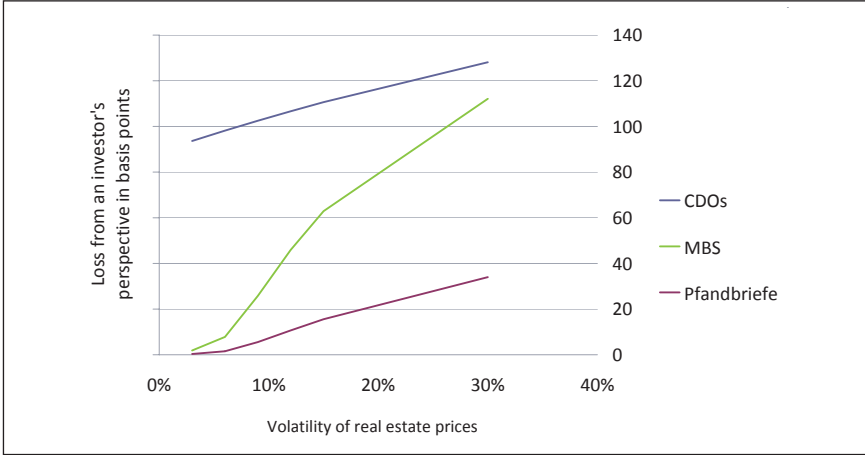
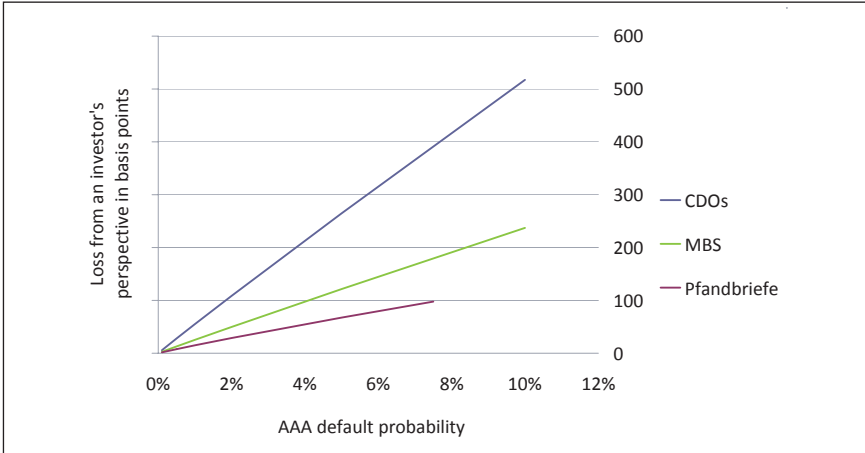


Figure 25: Sensitivity of losses from holding CDOs respectively Mortgage Pfandbriefe from an investor’s viewpoint when the default probability of AAA rated securities changes



All three figures show that Mortgage Pfandbriefe clearly dominate both MBS and CDOs. If it is true that the current crisis has been initiated by a bursting bubble of homes prices in the US,⁶⁸ the burst of the bubble can be modeled by negative expected real estate returns. Figure 23 shows that Mortgage Pfandbriefe are affected by negative expected returns, however significantly less than MBS and CDOs.

The same observation can be made for the volatility of real estate prices. An increasing volatility increases the basis point losses. For MBS and CDOs we have very high basis point losses while the loss for Mortgage Pfandbriefe is very much lower. This can be seen from Figure 24. Finally, one aspect of the current crisis is that the old ratings have significantly underestimated the credit risk of CDOs. I.e. the bankruptcy probabilities of these instruments have been significantly underestimated. Figure 25 indicates a monotonous increase of the losses in MBS and CDOs as well as significant smaller increases in the basis point losses for Mortgage Pfandbriefe.

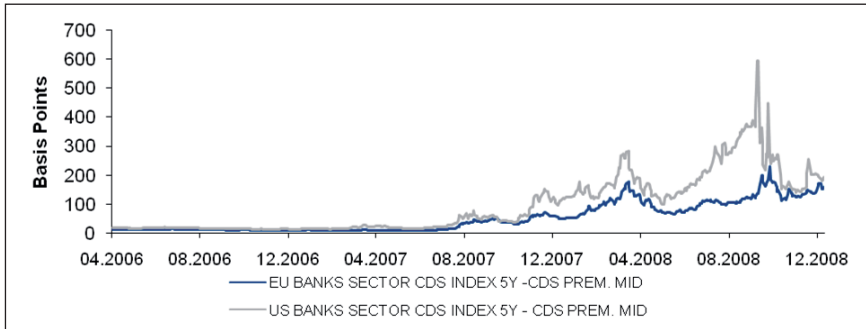
5. Empirical evidence of relative performance of Pfandbrief vs. MBS in the crisis period

While the last chapter has collected theoretical arguments for the comparatively low credit risk of Mortgage Pfandbriefe compared to MBS and CDOs, this chapter illustrates some empirical information about the credit risk status of German Pfandbriefe compared to other covered bonds and Mortgage-Backed Securities. Thereafter, a short presentation of general sector trends will be given.

5.1 Empirical analysis on market developments

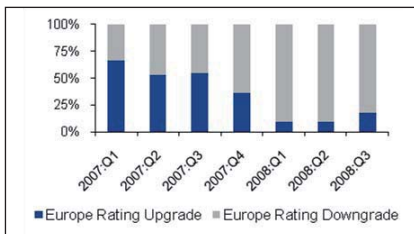
Recent developments on the capital markets are dominated by a high degree of uncertainty and mistrust among the market participants. The anticipated high risk of default is reflected in high costs for credit insurances for financial instruments. The most important credit derivative instruments to hedge this default risk are credit default swaps (CDS). Thereby, the premium for the credit protection is called the CDS spread. CDS spreads are the most recognized indicator of the credit risk inherent in the markets. Figure 26 shows the development of the CDS spreads for the banking sectors in the European Union and the US. It becomes apparent that the spreads increased dramatically since the beginning of the subprime crisis in the summer 2007, both in Europe and even more so in the US.

68 See for instance Franke and Krahen (2008).

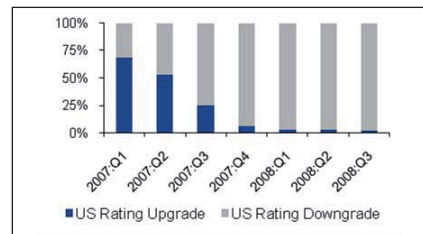
Figure 26: CDS spreads in the EU and US banking sectors

Source: Thomson Financial Datastream.

The negative market situation and the higher anticipated default risk of securitized instruments is also reflected in rating changes. Since the first quarter of 2007, the proportions of rating upgrades to downgrades changed completely (Compare Figure 27 and Figure 28). In the second quarter of 2008, the upgrades of ratings made by Standard & Poor's accounted for less than 9% in Europe and approximately 3% in the US.⁶⁹

Figure 27: Rating changes of securitized instruments in Europe

Source: European Securitisation Forum (2008) based on Standard & Poor's ratings.

Figure 28: Rating changes of securitized instruments in the US

Source: European Securitisation Forum (2008) based on Standard & Poor's ratings.

Issuing volumes of securitized instruments are highly dependent on the market situation and therefore are highly volatile since the beginning of the financial crisis, not only in the US, but also in Europe and more so in the UK. Table 10 shows that securitized instruments like CDOs and MBS, or ABS in general, play a minor role in Germany. In contrast, the UK market is the most important market for securitizations in Europe. In line with the European total issuance, the issuance in the UK market declined by more than 85% from the first quarter of 2007 to only € 8.8 billion in the first quarter of 2008. However, issuing volumes recovered during the second and third quarter of 2008. Regarding this recovery, it has to be noted that the majority of issued MBS has been retained by the issuing banks for

⁶⁹ Source: European Securitisation Forum (2008) based on Standard & Poor's ratings.

Table 10: Issuing volumes of securitized instruments in billion Euro

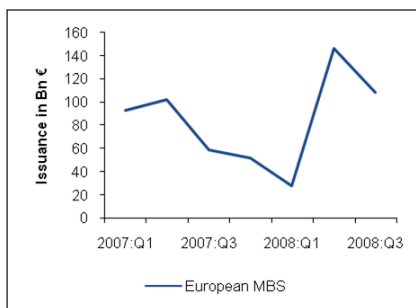
Country	2007: Q1	2007: Q2	2007: Q3	2007: Q4	2008: Q1	2008: Q2	2008: Q3	CAGR 07Q2-08Q3
Germany	3.5	8.2	1.8	5.1	3.8	1.3	3.3	-51.72%
UK	62.5	62.1	30.2	17.8	8.8	73.8	79.6	21.97%
European Total	128.7	152.0	98.3	74.7	40.0	169.6	134.1	-9.54%
US	623.4	658.9	429.4	342.8	254.2	297.3	198.8	-61.66%

Source: European Securitisation Forum (2008). Figures include ABS, CDOs, RMBS and CMBS.

use in the Bank of England’s Special Liquidity Scheme, while the market for public placements almost completely dried up.⁷⁰

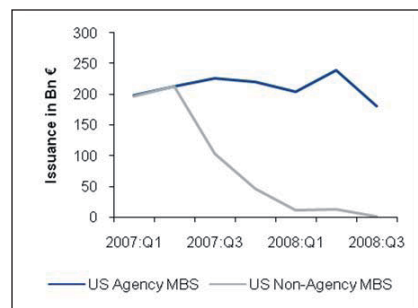
In the US market, by far the largest market for securitized instruments, issuing volumes reached an impressive size of approximately € 659 billion in the second quarter of 2007, just prior to the onset of the financial crisis. In comparison, Treasury bond’s issuance was only approximately € 117 billion over the same time period.⁷¹ However, since the beginning of the financial crisis, investors avoid investing in securitized instruments. Therefore, volumes declined sharply. The issuance of agency MBS remained relatively stable and also accounted for the temporary slight recovery of total issuing volumes in the second quarter of 2008, while the issuance of non-agency MBS declined by 94.06% between the second quarter of 2007 and 2008. In the third quarter of 2008 virtually no issuances of non-agency MBS took place. Therefore, it has to be noted that the market for non-agency MBS has almost completely dried up. Analogous to the overall issuance of securitized instruments, European Mortgage-Backed Security issuances faced a sharp decline prior to recovering in the second quarter of 2008. As previously stated, the new increase is mainly the result of the retained high MBS issuances in the UK. Figure 29 and Figure 30 illustrate the total issuance of MBS in Europe and the US since the beginning of the financial crisis.

Figure 29: Issuance of MBS in Europe



Cf. European Securitisation Forum (2008).

Figure 30: Issuance of MBS in the US



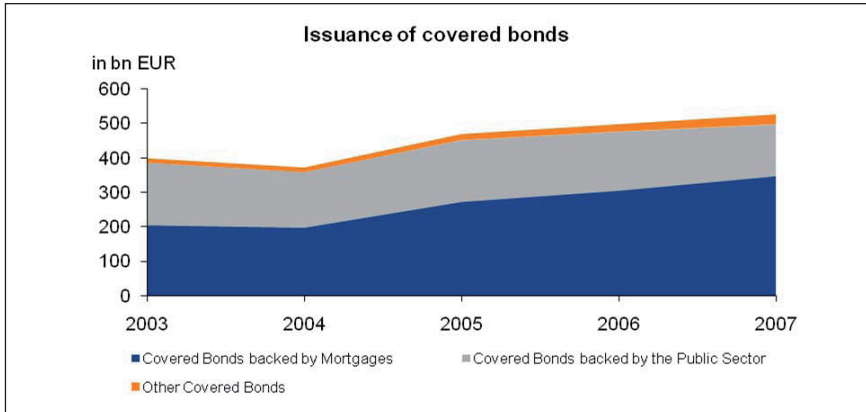
Cf. European Securitisation Forum (2008).

70 Cf. Crosby (2008), p. 25-26.

71 Cf. http://www.sifma.org/research/pdf/Overall_Issuance.pdf, 28th September 2008. The in US Dollar denominated volumes were converted from Dollar to Euro based on the \$/€ exchange rates as of quarter-end.

It becomes apparent that, especially in the US, market participants are less willing to take the risks inherent in the often opaque non-agency Mortgage-Backed Securities in the light of the financial crisis. The more liquid and standardized securities, issued by the US agencies, seem to better account for investors' demands in the current market situation.

Figure 31: Worldwide issuance of covered bonds



Source: ECBC (2008), p. 319.

The market for covered bonds showed a significant increase over the last years, as can be seen in Figure 31. Especially, covered bonds backed by mortgages fostered this trend. The year 2007, which was dominated by a major decline of volumes in the market for other securitized financial instruments, marked a new record with regard to the worldwide issuance volume of covered bonds. The country with the highest issuance volume in 2007 was Denmark, followed by Germany. Historically, the German Pfandbrief market is the most important market for covered bonds. Even though various other countries exhibited a tremendous growth over the last years, indicating the increasing importance of covered bonds, Germany remains by far the biggest market with an outstanding volume of approximately € 889 billion, equaling a market share of 42.11%. Other important players on the markets for covered bonds are Denmark, France and Spain. The outstanding volume in France increased 130% in the years 2003 to 2007, while the volume in Spain surged by approximately 357% during the same time period. Clearly, covered bonds became an essential refinancing vehicle in many countries. Therefore, the systemic relevance of covered bonds increased in a variety of different financial markets.

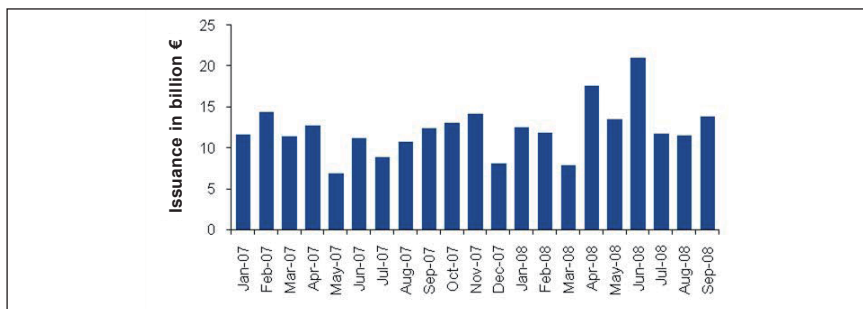
Table 11: Covered bond issuance and outstanding volumes in 2007 per country

Country	Outstanding 2007 in million Euro	Issuance 2007 in million Euro
Germany	888,558	135,375
Denmark	344,572	141,349
Spain	283,334	56,861
France	200,055	60,623
Sweden	92,254	36,638
UK	81,964	31,874
Ireland	64,779	11,208
Luxembourg	33,891	10,052
USA	12,859	8,859
Rest	107,831	33,192
Total	2,110,097	526,031

Source: ECBC (2008), pp. 319-341.

In the beginning of the crisis it appeared as if covered bonds were relatively immune against the turmoil on the financial markets. However, the volatile markets became a burden especially for the institutions which committed themselves to quote bid and ask prices with certain maximum spread levels. While bid/ask spreads increased significantly in other markets, these institutions were forced into buyer positions when the markets deteriorated. As a result, bid/ask spreads widened until the market makers withdrew from quoting prices and started trading over the phone. The reduced degree of transparency and liquidity led to an increased uncertainty among the investors.⁷² According to market participants, the worldwide trend of increasing covered bond issuance volumes is temporarily interrupted by the turbulence in the financial markets. Pfandbriefe, however, have not been affected by this interruption, as can be seen in Figure 32.

Figure 32: Issuance volume of German Pfandbriefe during the financial crisis

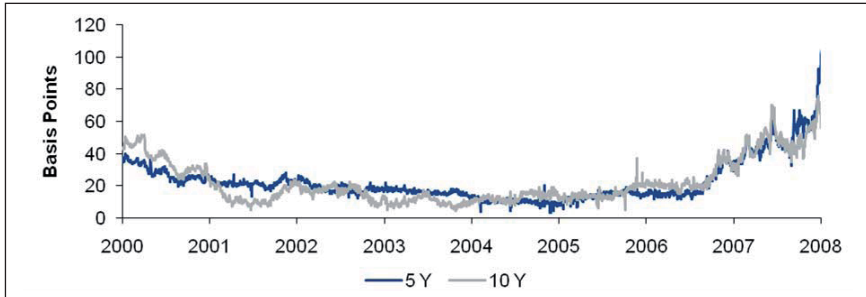


Source: Deutsche Bundesbank.

72 Cf. ECBC (2008), pp. 20 et seq.

Even though Pfandbriefe are viewed in close proximity to risk free assets, the spreads between government bonds and Pfandbriefe increased during the financial crisis as well (refer to Figure 33). This spread accounts for the liquidity of the instruments and also is a risk premium for the higher credit risk compared to government bonds.

Figure 33: Spreads between German Pfandbriefe and German government bonds

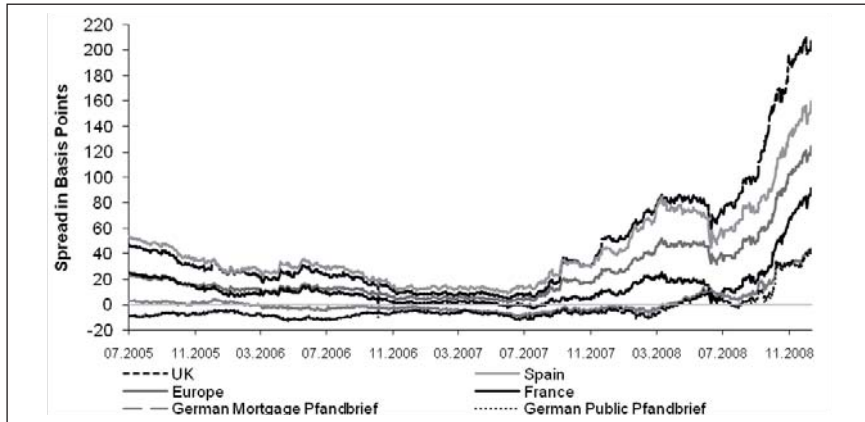


Sources: VDP and Thomson Financial Datastream.

Figure 33 illustrates that Pfandbriefe generally trade at a very low spread over German government bonds. During the last years, spread levels have been as low as 10 to 30 basis points. This very low spread level, compared to other fixed income securities, is evidence of the perceived safety of the German Pfandbrief. However, since autumn 2007, spread levels increased as a reflection of the higher anticipated uncertainty in the financial markets. Even though the spreads increased, they still remain on a relatively low level (compared e.g. with the CDS spread development for banks in Europe and the US: Figure 26).

Besides the spread development relative to German government bonds, the spread development relative to swap rates is of interest. Contrary to German government bonds, swap rates are not free of default risk, even though the inherent credit risk is rather negligible. Nevertheless, the spreads of covered bonds over swap rates allow for a relative analysis of the development of different financial instruments in the light of the financial crisis. As can be seen in Figure 34, the years before the beginning of the financial crisis have been characterized by a convergence of the covered bonds from various jurisdictions. In the first half of the year 2007, spreads have been in a tight band gravitating around zero. While the spreads of covered bonds from Spain and the UK have been slightly positive, the spreads of German Pfandbriefe have even been negative, confirming the strong credit standing of the Pfandbrief.

Figure 34: Covered bond spreads over the 5 year swap rate



Source: Thomson Financial Datastream. Covered bond yields are based on IBOXX quotes.

However, due to the volatility of the markets, differences between the various covered bonds became apparent. The former convergence turned into a divergence of the spread levels. In particular, UK covered bonds and covered bonds from Spain leveled off. Spreads widened from less than 20 basis points up to more than 200 basis points in the UK and more than 150 basis points in Spain. The German Pfandbrief remained comparatively robust, but especially in the autumn 2008, spreads began to increase as well. Nonetheless, it should be noted that the German Pfandbrief has been less affected by the financial crisis than covered bonds from other jurisdictions. One reason for this divergence can be supposed to be the long and excellent track record of the German Pfandbrief. Furthermore, Pfandbriefe have a long-standing and close relationship with a broad institutional investor basis. Together with the strict legal framework, these are the cornerstones of the Pfandbrief's stability. Depending on the specific characteristics of the distinct covered bonds, they are more or less capable of absorbing market turbulences. However, covered bonds in general have been less affected than other securities by the turmoil on the financial markets even if the spread of the AAA swap rates according to Figure 34 remains to be positive implying a higher expected credit risk or covered bonds than for AAA rated swaps.

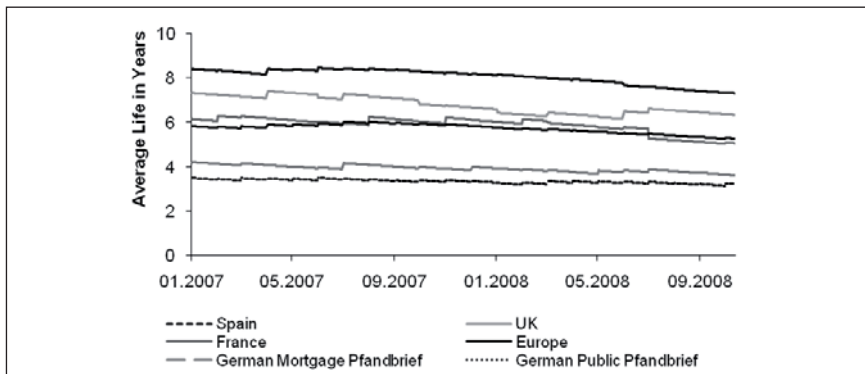
5.2 Sector trends

The market for covered bonds expanded enormously over the past decade in terms of volume and also in terms of geographical reach (Refer to Figure 31 and Table 11). According to market participants and issuance volumes, the success of securitization came to a halt. Overall, it can be noted that the refinancing by Pfandbriefe or other covered bonds became increasingly important during the last years. Especially covered bonds backed by mortgages have fostered the trend of increasing covered

bond volumes. It is interesting that the Crosby (2008)⁷³ report on UK mortgage finance includes a suggestion that the UK issuers should set up a body such as the VDP to promote UK covered bonds. The Crosby report is regularly published by the UK government Office of Public Sector Information.

One increasingly important trend within the class of covered bonds is the issuance of tailor-made covered bonds in Germany. These bonds are set up according to the investors' needs, especially with regard to the volume, the coupon and the maturity. This trend is in line with an increasing importance of private instead of public placements in the German Pfandbrief market. While in 2003 private placements of Pfandbriefe in Germany accounted for only 34.3%, their share of new issuances increased steadily up to 57.2% in 2007.⁷⁴ However, Jumbo Pfandbriefe and Jumbo covered bonds in general will continue to play an important role, since they typically provide a higher degree of liquidity in the secondary market. The liquidity of financial instruments is a major criterion for institutional investors and therefore can be expected to be a central aspect in future developments as well. The attractiveness of Pfandbriefe is also supported by a recent offering as exchange traded fund (ETFs). iShares as the largest ETF provider in Germany has issued an ETF on German Jumbo Pfandbriefe with high acceptance among institutional investors. The assets under management (October 2008) are € 900 million.

Figure 35: Average life of different covered bonds



Source: Thomson Financial Datastream, based on IBOXX quotes. The average life is the weighted average of the times of principal redemption. Jumps are due to index adjustments.

Another trend in the market for covered bonds is declining maturities. Figure 35 shows the average life of distinct covered bonds. It can generally be seen that the average life declined since the beginning of the financial crisis. In Germany, this is especially true for Jumbo Pfandbriefe and it holds less true for other Pfandbriefe. This fact is in line with the higher uncertainty in the financial markets and the investors' higher reluctance to take risks in the current market situation. It becomes apparent that covered bonds from distinct jurisdictions exhibit different peculiarities.

⁷³ See paragraph 5.28.

⁷⁴ Source: www.vdp.de, 12th December 2008.

The mean average life of German Mortgage and Public Pfandbriefe declined by 0.54 and 0.23 years, respectively, from January 2007 to October 2008. During the same time period, the mean average life of covered bonds from Spain and the UK declined by 1.05 and 0.94 years, respectively. Even though, these covered bonds' average life is generally higher compared to the German Pfandbrief, it can be assumed that the higher anticipated credit risk compared to Pfandbriefe is a major driving factor of this development as well (Refer to Figure 34 for an assessment of the different covered bonds during the financial crisis).

Generally, the financial crisis highlights the investors' requirements with regard to liquidity, transparency and safety with regard to default risk. While agency MBS remained relatively stable, non-agency MBS volumes faced a dramatic decline as a result of the investors' unwillingness to invest their funds in these risky and often non-transparent securities (see Figure 30). Similar patterns are recognized in the context of covered bonds. The German Pfandbrief, which is characterized by a strict legal framework, has remained relatively weakly affected by the turmoil in the markets compared to other covered bonds and especially in comparison to Mortgage-Backed Securities.

6. Market expert opinions

The outlook in this section is based on expert interviews which have been conducted with 11 market participants in Germany. Table 12 characterizes the institutions and the positions of the experts which have been involved. The interviews have been done based on open, explorative questions.

Table 12: Institution and position of the sample contacts

Institution	Position of contact
Barclays Capital	Group Head
Bayerische Hypo- und Vereinsbank AG	
COREALCREDIT BANK AG	Member of the board
Deutsche Hypothekbank Act.-Ges.	Member of the board
Dresdner Kleinwort Research GmbH	Research Analyst
DZ Bank AG	Research Analyst
Eurohypo AG	Member of the board
HSH Nordbank AG	Group Head
Landesbank Baden-Württemberg	Division Head
Société Générale	Group Head
Union Investment GmbH	Fund Manager

Even though market participants express various views, one statement remains constant over all experts: The financial world we know today has dramatically changed. As a matter of fact, interviews among only 11 experts can only indicate a rough trend about the covered bond and Mortgage-Backed Securities market. Nevertheless, a clear direction of expert views can be identified. Most experts expect a lower number of products, more regulation, more national intervention,

and last but not least more awareness of risk will characterize financial markets in the future. Table 13 summarizes the most important questions referring to the mortgage loans market in general and to Mortgage-Backed Securities respectively Pfandbriefe in particular.

Table 13: Interviewees expressing their agreement on statements regarding general future market developments

Statement	Number of agreements
The Pfandbrief market will recover very soon	11
The Pfandbrief market will not recover	0
The Pfandbrief market will gain significance as a refinancing instrument for banks	9
Other covered bonds will recover soon	6
ABS will recover soon.	4
There will be a tendency towards more on-balance sheet thinking	9
The German Pfandbrief system can be exported to other countries	6
There will be stricter regulation in the future	9
The Pfandbrief will gain importance for international investors	9
A major advantage of the Pfandbrief is its simplicity	7
The MBS market is dead and will not recover	4
The MBS market will recover after the product has undergone severe changes	5
The MBS market will recover in its current form	2

While most of the statements in Table 13 are self explaining, the international perspective of the Pfandbrief and its underlying legal and regulatory structure is of special interest in this report. The opinion in the financial community concerning this question is not very consistent. Table 13 shows that only 6 out of 11 interviewees agree with the statement “The German Pfandbrief system can be exported to other countries”. Most experts expect covered bonds to gain significance not only in Germany but also in many other countries including the US and the UK. This corresponds to the view advocated in the Crosby (2008) report.⁷⁵ The legal framework though used to be quite different between the countries. This difference is recognized by the market participants as Figure 34 shows. Nevertheless, all market participants expect tougher regulations and stronger coverage of the bond by the issuers. This might imply that they expect a tendency towards a convergence of the global covered bond market to the German Pfandbrief system. As chapter 4 has shown, this trend would reduce the credit risk of securitized instruments drastically. As one of the experts stated, “if you cover for the loan you are granting, you won’t give it to an unemployed person without any income, as you just don’t want to have something like this on your books. If you can hide it in a pool you don’t have to cover for, you are just looking at the fee you earn and of course you will grant this loan.” Consequently, the market community sees an internationalization of the Pfandbrief system, which already started before the crisis.

⁷⁵ See paragraph 5.28.

A minority in our sample though expects no recovery of the structured covered bond market. Those interview partners advocate the view that only a government intervention would be appropriate to stimulate the market again. They mention pre-dominantly two reasons for their view. The more pessimistic interview partners do not believe that globally acting investors get used to structured covered bonds. The second argument is that even covered bonds do not provide enough safety, as long as they are not regulated more stringently. All of the 11 interviewed experts see the close future over the next couple of weeks as decisive for the German Pfandbrief system. Some partners mentioned that a second case similar to the sudden almost fall of Hypo Real Estate will cause a severe damage on the image of the Pfandbrief in the financial community. On the other hand, the fact that not a single Pfandbrief issued by Hypo Real Estate defaulted because of a government bailout proves the safety of Pfandbriefe even in extreme situations. Another threat to the regaining of market share is seen in the currently prevailing tendencies for nationalization and guarantees for banks. This might foster a system of public guarantees for banks weakening the private banking system. Therefore, the next weeks are very important since they will show whether the currently observed immense degree of government intervention in the banking system is a phenomenon which disappears after the trust in the financial system has been recovered or not.

While the assessment regarding the Pfandbrief among the experts was rather unanimous the opinion regarding the future of MBS and unsecured debt certificates is somewhat more ambiguous. The expectations range from “it is already dead and will never come back” to “it is a great instrument, which will definitely come back and have an important market share”.

Table 13 shows that the majority does not expect MBS to survive in its current form. Those who have negative expectations regarding MBS expect a stronger responsibility of the loan issuer as a prerequisite for a survival of the market. This implies that the originating banks keep an important part of the securitized loans on their balance sheet. Not only this lack of responsibility but also the high degree of staging in originating MBS and CDOs was criticized. The multi-stages process comes together with a generous fee structure. Therefore, as all interviewees stated, the trust in such products has been highly damaged. The majority of the interviewees expect a very long recovery period for the MBS market. Additionally, many experts expect the MBS market to return to its roots, i.e. they expect much simpler structures and more transparency. However, a smaller part of our sample believes that structured credit products will survive the crisis, maybe with lower volumes and higher spreads. Another argument supporting MBS was that MBS are exclusively driven by the underlying asset, i.e. mortgages, while Pfandbriefe are driven by the credit quality of the issuing bank, in addition to mortgages.

There are a couple of rather unstructured opinions about the future of the securitization of mortgage loans among market experts which can be summarized by the following points.

1. One important aspect which was mentioned to be insightful during this crisis is the importance of a sound and strong financial supervision. One of the market experts compared the regulatory framework with a playpen for little children, where the banks are the little children. When the playpen is small enough,

nothing can happen. As soon as you open the doors of the playpen and the child can walk around in the apartment you must supervise it to prevent damage in the interior. The same has happened before the crisis. The regulatory framework for the financial industry was very loose, giving the financial markets the opportunity to circumvent certain intentions of the regulatory authorities.

2. Another insight of the crisis according to market experts is the fact that with many parties involved in the whole loan creation and securitization process, none of them at the end takes the responsibility for the product. Therefore, a containment of the work sharing is needed. In this respect a more strict regulation of the incentive structure in this process is needed. The current incentive structure is dependent on the created volume, independent of the quality of this volume. Such an incentive structure leads, as we have learned, to a huge degree of moral hazard, finally resulting in a loosening of the credit lending standards. By making the fees dependent on the quality of the mortgage arranged, a huge part of the crisis could have been prevented.
3. Another issue arising in the analysis of the financial crisis are the before mentioned standards for loan appraisal. The weakness and the will that everybody should be granted a loan led in the end to the heating up of the housing bubble. In the future, tougher standards for loan appraisal are necessary combined with regulations assuring a conservative appraisal of the collateral and a limitation of the loan to value ratios.
4. The experts consider as the most important lesson to be learned the fact that many of the investors did not understand what they had bought into their portfolios and were surprised when they were hit by losses. As a consequence, this led to the huge crisis of trust, which finally made the financial crisis to an overall economic crisis. Consequently, refinancing products must be more transparent, more standardized and less complex, assuring that investors understand what they are buying.⁷⁶ There is a strong need for plain vanilla instruments and a clear need for a back to the roots and basics dynamic.
5. The lack of understanding of the instruments has not only been a problem of investors but also of rating agencies. The rating agencies have not been able to correctly assess the risks inherent in securitized instruments. Furthermore, they have been slow in responding to the rising risk of subprime MBS. However, rating agencies play a vital role in the financial industry and also in the evaluation of financial instruments by investors because they often rely on these ratings. Therefore, the rating models need to be approved and a higher degree of transparency of the rating process is necessary.⁷⁷ An additional issue in the context of rating agencies is their conflicts of interest. In many cases they designed the CDO tranche structure for a fee and at the same time rated the issue for a fee. This is especially problematic for more complex structures like for instance CDOs – squared.

Extended Summary: Refinancing Real Estate Loans – Lessons to be Learned from the Subprime Crisis, by Markus Rudolf and Anthony Saunders

⁷⁶ Cf. Crouhy/Jarrow/Turnbull (2008), p. 97 et seq.

⁷⁷ Cf. Crouhy/Jarrow/Turnbull (2008), p. 95 et seq.

7. Extended Summary

At the forefront of the so-called subprime crisis a variety of new structured products for the securitization of mortgage loans have been invented, particularly in the US and UK markets. Among those instruments, Collateralized Debt Obligations (CDOs) have been especially sophisticated. With the creation of structured products such as CDOs, it became possible for banks to convert a credit portfolio of average credit quality into a portfolio of credit risk tranches where a AAA rated tranche could account for more than 90% of the entire portfolio of loans. In addition to the inherent risk of CDOs, Mortgage-Backed Securities (MBS) enabled banks to completely release the credit portfolio from the stock of bank assets to the capital market. Both effects, the tranching and the releasing of the loans, results in lower capital requirements for the banks.

While these new types of securitization instruments have been considered as an enormous advancement in the financial industries, the US and the UK have subsequently experienced a rapid decline of real estate prices beginning in spring 2007. The pronounced downturn in real estate prices had negative consequences for CDOs and later also for MBS. Very quickly it became apparent that the construction of these instruments had inherent weaknesses particularly in crisis situations. The most severe weakness turned out to be the fact that the responsibility for the mortgage loans used as collateral for CDOs and MBS was completely dispensed by the banks and passed to the capital market implying that banks passed the entire responsibility for these loans to the capital market. It became evident that the lack of responsibility for securitized loans affects the accuracy with which the loan pool covering CDOs or MBS is selected. Moreover, due to the fact that compensation schemes for US mortgage brokers are almost exclusively fee driven, there are strong incentives to amplify the process of securitizing mortgage loans. After the spring of 2007 it became evident that legal and contractual regulation in the US has not been sufficient to protect the market for CDOs and MBS. Additionally, the rating processes for CDO tranches is debatable. Rating agencies have been involved in the construction of AAA rated tranches out of a pool of mortgage loans and at the same time have been rating these tranches. Obviously, this implies a conflict of interest which might explain to some extent that the rating agencies dramatically underestimated the credit risks associated to CDOs.

In some parts of Europe and particularly in Germany the process of using mortgage loans as collateral for funding these loans has a long tradition based on Pfandbriefe. There are important differences between the German Pfandbrief and CDOs and respectively MBS. While both, MBS and Mortgage Pfandbriefe are covered by a pool of mortgages, the eligibility criteria for the cover pool and its management in the case of Mortgage Pfandbriefe are legally regulated by the German Pfandbrief act whilst in the US, there are eligibility criteria for MBS only for so-called agency MBS. The criteria for a mortgage loan to qualify for an agency MBS are much more relaxed than those for Mortgage Pfandbriefe. The most important difference between the two instruments refers to the fact whether they are on-the-balance-sheet or off-the-balance-sheet. Mortgage Pfandbriefe are bonds issued by Pfandbrief Banks which remain on the balance sheet implying an incentive to carefully select

the loans covering the Pfandbrief. This is not the case for MBS and for CDOs. Both are off-balance sheet instruments. Although agency MBS are guaranteed which consequently reduces the credit risk of such a MBS significantly; it does, however, not solve the mentioned incentive problem. It must be mentioned that the MBS securitizing sub prime mortgages have not been the agency MBS type.

On the other hand, Pfandbriefe and agency MBS have a double safety cushion in the case of a default of the mortgagee. One is the real estate asset which serves as a collateral, the second is the guarantee of a Government Sponsored Enterprise, e.g. Freddie Mac or Fannie Mae, which have recently been nationalized due to the vast loss they were running, in the case of MBS respectively the creditworthiness of the Pfandbrief Bank in the case of the Pfandbrief. CDOs and non-agency MBS lack the second safety cushion, even though the AAA tranches account for the vast majority of all traded CDO tranches. Due to the better incentive effect by having the issued bonds on the balance sheet and due to strict eligibility criteria for the covering assets based on the German Pfandbrief act, this report advocates the view that the credit risk for Pfandbriefe is significantly lower than for MBS as well as for CDOs. It is extremely unlikely, that crises like the current subprime crisis would have evolved if the global system of granting and funding of mortgage loans would have been organized like the German Pfandbrief system. This report has shown based on theoretical and empirical arguments, that the German Pfandbrief system dominates the market for MBS and CDOs with regard to credit risk.

It is very likely that the way to grant and fund mortgage loans will change in the future. Currently, the market for CDOs has completely dried up and it is not very likely that it will recover soon; according to expert opinions it is even arguable that it will not recover at all. Nobody knows right now in which direction the structure of the markets for mortgage loans will take. There are, however, indications for some measures in the Anglo-Saxon markets to move more in the direction of the German Pfandbrief system. The Crosby (2008) report for instance suggests a mortgage business for the UK which takes the direction of the German system which is supported by a strict and detailed legal act. This implies two things: Firstly, a stricter legal environment for covered bonds similar to the Pfandbrief is very likely to be chosen in many jurisdictions. This tighter regulation will especially affect the eligibility criteria for the cover pools of these bonds. Secondly, there will be a trend toward a system where those mortgage bonds and the underlying loans are not completely released from the balance sheet of the issuing institution. Evidently, there will also be a vast plurality of covered bond systems in the future, but we assume that these two elements will be added to many legislations covering these bonds.

The last question to be addressed here concerns political implications of the crises. The legal environment determines the playing field within which financial markets act. One of the most dominating global legal developments is the Basel II framework for the determination of adequate equity capital for banks. Basel II lays the foundation for a special focus on the credit risk in banks, i.e. loans associated to credit risk have to be covered by equity capital the higher the credit risk is. This makes equity capital to be a lean and expensive resource. The process which led to the Basel II rules started more than 10 years ago and was characterized by

intense debates especially between the US and the European countries. Finally, this debate led to an equity capital standard with comparatively low equity ratios. Figure 36 shows that the equity ratios of banks in the last 40 years are historically low although the development of new financial market instruments in the same period was immensely fast. Basel II led to much more sophisticated rules but obviously not to higher equity ratios.

Figure 36: Equity ratios of banks historically

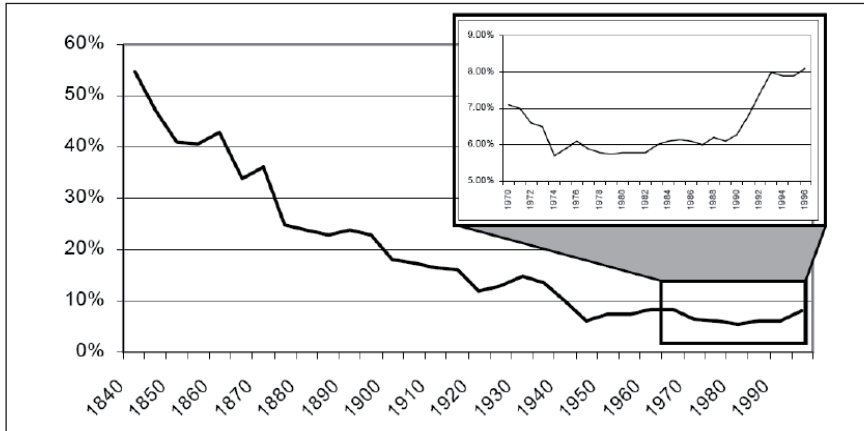
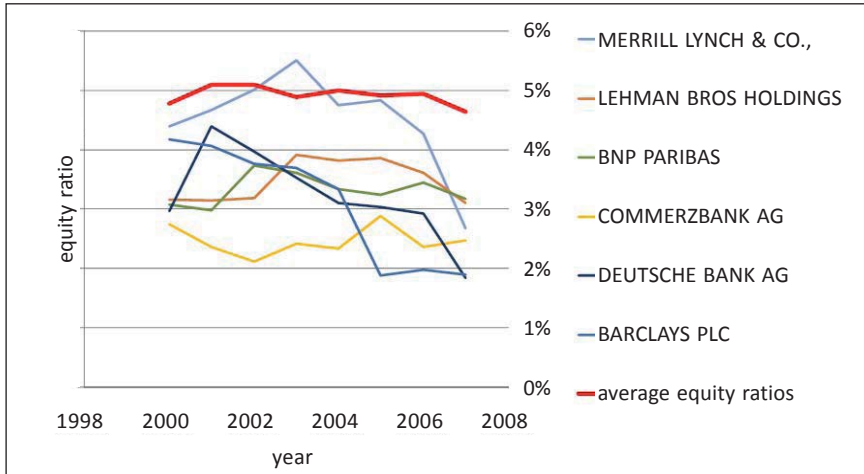


Figure 37: Equity ratios of system relevant banks



Source: Thomson Financial Datastream and own calculations.

The Basel II efforts did have two effects. Firstly, banks aimed for securitization of their assets in order to lower their capital requirement which enhanced the creation of credit derivatives like CDOs and other instruments. Secondly, in order to avoid competitive disadvantages for *their* banks, governments negotiated the

Basel II accord such that the capital ratios finally turned out to be comparatively low. As figure 37 shows, the equity to total assets ratio has been around 5%. The efforts of Basel II have hardly been appropriate enough to lift this ratio. In the wake of the aftermath of the financial crises, many governments are requiring higher equity ratios of their banks. The first has been the UK government. Equity ratios in the short term will therefore grow to close to 10%. We are prognosticating that they will grow even more in the long term. The equity endowment of the global banking system during the crises was definitively too low and amplified the credit risks originally arising from the mortgage loan securitization business in the US. In fact, if one considers the capital market as playground for banks and ignores any ethical dimension which the banking community without any doubt has to follow, then the rules of the game have been inappropriate for a system relevant sector like the financial sector. The rules have been too complex, focusing not on the risks but rather on the preferences of the individual banks. We expect higher equity ratios in the future and more transparent, simpler, probably less differentiated rules for determining equity capital.

8. References

- Bank of England (2007):** “Financial Stability Report”, Issue No. 22.
- Bank of England (2008):** “Financial Stability Report”, Issue No. 23.
- Bhattacharya, Anand K.; Berliner, Williams S. (2005):** “An Overview of Mortgages and the Mortgage Market”, in: Fabozzi, Frank J.: *The Handbook of Fixed-Income Securities*, 7th edition, McGraw-Hill.
- Canner, Glenn; Dynan, Karen; Passmore, Wayne (2002):** “Mortgage Refinancing in 2001 and Early 2002”, in: *Federal Reserve Bulletin*, December, pp. 469-481.
- Case, Karl E.; Shiller, Robert J. (1996):** “Mortgage Default Risk and Real-Estate Prices: The Use of Index-Based Futures and Options in Real-Estate”, in: *Journal of Housing Research*, Vol. 7, No. 2, pp. 243-258.
- Crawford, Alexander (2005):** “Collateralized Mortgage Obligations”, in: Fabozzi, Frank J.: *The Handbook of Fixed-Income Securities*, 7th edition, McGraw-Hill.
- Crosby, James (2008):** “Mortgage finance: final report and recommendations”, Office of Public Sector Information, November.
- Crouhy, Michael G.; Jarrow, Robert A.; Turnbull, Stuart M. (2008):** “The Subprime Credit Crisis of 2007”, in: *The Journal of Derivatives*, Fall 2008, pp. 81-110.
- Davidson, Andrew; Ching, Anne (2005):** “Agency Mortgage-Backed Securities”, in: Fabozzi, Frank J.: *The Handbook of Fixed-Income Securities*, 7th edition, McGraw-Hill.
- Deng, Yongheng; Quigley, John M.; Van Order, Robert (2000):** “Mortgage Terminations, Heterogeneity and the Exercise of Mortgage Options”, in: *Econometrica*, Vol. 68, No. 2, pp. 275-307.
- Dübel, Hans Joachim (2005):** “Fixed-rate Mortgages and Prepayment in Europe”.
- ECBC (2008):** “European Covered Bond Fact Book 2008”. <http://ecbc.hypo.org/Content/Default.asp?PageID=294>, 10th October 2008.
- Engelbrecht, Marc (2008):** “Anlageklassen des Private Banking im Überblick”, in: Rudolf, Markus: *Private Banking*, 1st edition, Frankfurt am Main 2008.
- Engelbrecht, Marc (2008):** “Verteilungseigenschaften klassischer und innovativer Anlageklassen”, in: Rudolf, Markus: *Private Banking*, 1st edition, Frankfurt am Main 2008.
- European Commission (2006):** “Report of the Mortgage Funding Expert Group”, Brussels, 22nd December 2006.
- European Securitisation Forum (2008):** “ESF Securitisation Data Report Q3 – 2008”. http://www.europeansecuritisation.com/Market_Standard/2008-08%20ESF%20Q3.pdf, 13th December 2008.

- Fabozzi, Frank J. (2007):** “Bond Markets, Analysis, and Strategies”, 6th edition, McGraw-Hill.
- Fannie Mae (2007):** “Guaranteed Mortgage Pass-Through Certificates – Residential Mortgage Loans”, Supplement to Prospectus, June 1st 2007.
- Franke, Günter; Krahen, Jan Pieter (2008):** “The Future of Securitization”, Center of Financial Studies Working Paper, No. 2008/31.
- Green, Richard K.; Wachter, Susan M. (2005):** “The American Mortgage in Historical and International Context”, in: Journal of Economic Perspectives, Vol. 19, No. 4, pp. 93-114.
- Greenbaum, Stuart I.; Thakor, Anjan V. (2007):** “Contemporary Financial Intermediation”, 2nd edition, Elsevier Academic Press, Burlington.
- Hänsel, Dennis N.; Krahen, Jan P. (2007):** “Does Credit Securitization Reduce Bank Risk? Evidence from the European CDO Market”, Working Paper, Goethe-University Frankfurt.
- Hull, John C.; White, Alan (1990):** “Pricing Interest-Rate-Derivative Securities”, in: The Review of Financial Studies, Vol. 3, No. 4, pp. 573-592.
- Instefjord, Norvald (2005):** “Risk and Hedging: Do Credit Derivatives Increase Bank Risk?”, in: Journal of Banking and Finance, 29, pp. 333-345.
- International Accounting Standards Board (2004):** International Financial Reporting Standard No. 39: Financial Instruments.
- International Monetary Fund IMF (2008):** “Global Financial Stability Report”, April 2008.
- Jarrow, Robert A.; Turnbull, Stewart (1995):** “Pricing Derivatives on Financial Securities Subject to Credit Risk”, The Journal of Finance 50, pp. 53-85.
- Krahen, Jan P.; Wilde, Christian (2006):** “Risk Transfer with CDOs and Systemic Risk in Banking”, Working Paper, Goethe-University Frankfurt.
- Markowitz, Harry M. (1952):** “Portfolio Selection”, The Journal of Finance, Volume 7 No. 1, pp. 77-91.
- Mattey, Joe; Wallace, Nancy (2001):** “House Price Cycles and Prepayment Rates of U.S. Mortgage Pools”, Journal of Real Estate Finance and Economics 23 (2), pp. 161-184
- Merton, Robert C. (1974):** “On the Pricing of Corporate Debt: The Risk Structure of Interest Rates”, The Journal of Finance, 29, pp. 449-470.
- Michalak, Tobias; Uhde, André (2008):** “Securitization and Systemic Risk in European Banking”, Working Paper, Bochum University.
- Mohebbi, Cyrus; Li, Gary; White, Todd:** “Stripped Mortgage-Backed Securities”, In: Fabozzi, Frank J.: The Handbook of Mortgage-Backed Securities, 6th edition, McGraw-Hill.

Muck, Matthias; Rudolf, Markus (2005): “Improving Discrete Implementation of the Hull and White Two-Factor Model”, *The Journal of Fixed Income*, 14 (March), pp. 67-75.

Nera (2007): “The Subprime Meltdown: A Primer”.

Nothhaft, Frank E.; Wang, George H. K. (1992): “Determinants of the ARM Share of National and Regional Lending”, *Journal of Real Estate Finance and Economics*, 5, pp. 219-234.

OECD (2008): *OECD Economic Outlook*, No. 83, Volume 2008, Issue 1.

OFHEO Mortgage Market Note 08-3. <http://www.ofheo.gov/media/mmnotes/MMNOTE083.pdf>

Saunders, Anthony; Cornett, Marcia (2003): “Financial Institutions Management: A Risk Management Approach”, McGraw-Hill, 4th edition.

Schröck, Gerhard (2002): “Value Creation in Financial Institutions”, John Wiley & Sons.

SIFMA (2008): “An Investor’s Guide to CDOs”.
[http://www.sifma.org/services/publications/pdf/An_Investors_Guide_to_CDOs\(2\).pdf](http://www.sifma.org/services/publications/pdf/An_Investors_Guide_to_CDOs(2).pdf)

Stanton, Richard (1995): “Rational Prepayment and the Valuation of Mortgage-Backed Securities”, in: *Review of Financial Studies*, Vol. 8, No. 3, pp. 677-708.

Sundaesan, Suresh M. (1997): “Fixed Income Markets and Their Derivatives”, South-Western College Publishing, Cincinnati.

The 2008 Mortgage Market Statistical Annual – Volume I: The Primary Market, Inside Mortgage Finance Publications.

The 2008 Mortgage Market Statistical Annual – Volume II: The Secondary Market, Inside Mortgage Finance Publications.

US Government Accountability Office (2007): “Information on Recent Default and Foreclosure Trends for Home Mortgages and Associated Economic and Market Developments.”

Verband Deutscher Pfandbriefbanken VDP (2007): “Der Jahresbericht”.

Verband Deutscher Pfandbriefbanken VDP (2007): “Der Pfandbrief – Fakten und Daten zu Europas führendem Covered Bond”.

Wagner, Victoria; Teclaw, Daniel E. (2008): “How Conservatorship Will Affect Fannie Mae And Freddie Mac – And What It Means For Creditors And Investors”, in: *Standard & Poor’s: RatingDirect*, September 9.

White, Michelle J. (2007): “Credit Cards and Personal Bankruptcy”, *American Law & Economics Association Annual Meetings*, paper 49.

Winkler, Bodo (2007): “Der Pfandbriefmarkt 2006/2007“, in: *Verband Deutscher Pfandbriefbanken VDP (2007): “Der Pfandbrief – Fakten und Daten zu Europas führendem Covered Bond”.*

Winkler, Sabine (2007): “Der Covered Bond Markt in den USA: Ein weiter Weg von den Kinderschuhen bis zur Marktreife”, in: Verband Deutscher Pfandbriefbanken (2007): “Der Pfandbrief – Fakten und Daten zu Europas führendem Covered Bond”.

Zimmerman, Thomas: “Defining Nonagency MBS”, in: Fabozzi, Frank J.: The Handbook of Mortgage-Backed Securities, 6th edition, McGraw-Hill.

In der Schriftenreihe des Verbandes deutscher Pfandbriefbanken erschienen bisher:

Bühler/Hies/Zimmermann:

Liquidität für den deutschen Pfandbrief

Fritz Knapp Verlag, 1996

ISBN 3 7819 0575 6

Band 1

Hies:

Refinanzierung deutscher Hypothekenbanken – Gegenwart und Zukunft

Fritz Knapp Verlag, 1996

ISBN 3 7819 0578 0

Band 2

Dübel/Pfeiffer:

Risikogewichtete Eigenkapitalanforderungen und die Risiken des gewerblichen Hypothekarkredites in Europa

Fritz Knapp Verlag, 1996

ISBN 3 7819 0585 3

(auch in Englisch)

Band 3

Gluch:

Gewerbliche Bauinvestitionen in ausgewählten EU-Staaten Entwicklung und Strukturen seit 1980

Fritz Knapp Verlag, 1997

ISBN 3 7819 0595 0

Band 4

Stöcker:

Die Hypothekenbanken und der Pfandbrief in den mitteleuropäischen Reformländern

Fritz Knapp Verlag, 1998

ISBN 3 7819 0627 2

Band 5

Verband deutscher

Hypothekenbanken (Hrsg.):

Die Steuerreform aus immobilienwirtschaftlicher Sicht – Materialien

Fritz Knapp Verlag, 1998

ISBN 3 7819 0629 9

Band 6

Stürner:

Die Sicherung der Pfandbrief- und Obligationengläubiger vor einer Insolvenz der Hypothekenbank – Geltendes Recht und Reformvorschläge

Fritz Knapp Verlag, 1998

ISBN 3 7189 0633 7

Band 7

Köndgen/Dübel/Lea:

Die vorzeitige Rückzahlung von Festzinskrediten. Eine rechtsvergleichende und ökonomische Analyse

Fritz Knapp Verlag, 2000

ISBN 3 7819 061 5

Band 8

Stürner/Stadler:

Deutsche Pfandbriefe und Deckungswerte in den Niederlanden Ein Gutachten

Fritz Knapp Verlag, 2000

ISBN 3 7819 0655 8

Band 9

Stürner/Schumacher/Bruns:

Der deutsche Pfandbrief und englische Deckungswerte

Fritz Knapp Verlag, 2000

ISBN 3 7819 0656 6

Band 10

Verband deutscher

Hypothekenbanken (Hrsg.):

Struktur und Entwicklung der Eigenheim- und Gewerbefinanzierung der deutschen Hypothekenbanken

Fritz Knapp Verlag, 2000

ISBN 3 7819 0663 9

Band 11

Birg:

Trends der Bevölkerungsentwicklung

Fritz Knapp Verlag, 2000

ISBN 3 7819 0668 X

Band 12

Rüchardt:

Der Beleihungswert

Fritz Knapp Verlag 2001

ISBN 2 8314 0715 0

(auch in Englisch)

Band 13

Picherer:

Sicherungsinstrumente bei Konsortialfinanzierungen von Hypothekenbanken

Fritz Knapp Verlag, 2002

ISBN 3 8314 0718 5

Band 14

Stürner/Stadler:

Pfandbriefe und Beleihung in Spanien

Fritz Knapp Verlag, 2002

ISBN 3 8314 0734 7

Band 15

Schätzl:

Strukturwandel im Gewerbeimmobilienmarkt

Fritz Knapp Verlag, 2002

ISBN 3 8324 0729 0

Band 16

Schmidt:

Absicherung von Darlehen durch Grundpfandrechte

Fritz Knapp Verlag, 2004

ISBN 3 8314 0761 4

Band 17

Stöcker:

Realkredit und Pfandbriefsicherheit

Fritz Knapp Verlag, 2004

ISBN 3 8314 0769 X

Band 18

Stürner:

Deutsche öffentliche Pfandbriefe und Deckungswerte aus Darlehen an US-amerikanische öffentliche Körperschaften

Fritz Knapp Verlag, 2005

ISBN 3 8314 0787 8

Band 19

Dübel/Köndgen:

Die vorzeitige Rückzahlung von Festzinskrediten in Europa – Zwei Gutachten

Fritz Knapp Verlag, 2006

ISBN 3-8314-0796-7

Band 20

Ebner:

Grundeigentum und Sicherheiten in Tschechien

Hrsg.: vdp, 2006

ISBN 3-9811273-0-7

Band 21

Biederer:

Die rechtlichen Voraussetzungen elektronischer Grundstückstransaktionen in rechtsvergleichender Sicht

Hrsg.: vdp, 2006

ISBN 3-9811273-1-5

Band 22

Stöcker:

Flexibilität der Grundpfandrechte in Europa Band I

Hrsg.: vdp, 2006

ISBN 3-9811273-2-3

Band 23

Stürner/Kern:

Deutsche öffentliche Pfandbriefe und japanische Deckungswerte

Hrsg.: vdp, 2006

ISBN 3-9811273-3-1

Band 24

Rechtsfragen der Immobilienfinanzierung in England und Wales

Hrsg.: vdp, 2006

ISBN 978-3-9811273-4-8

Band 25

Voigtländer/Hofer:

Mietwohnungsmarkt und Wohneigentum – Zwei Gutachten

Hrsg.: vdp, 2006

ISBN: 978-3-9811273-5-5

Band 26

Ebner/Illa:

**Grundeigentum und Sicherheiten
in Ungarn**

Hrsg.: vdp in Zusammenarbeit mit dem
Center of Legal Competence (CLC),
Wien, 2007
ISBN: 978-3-9811273-6-2
Band 27

Stürner/Kern:

**Deutsche Hypothekendarfbriefe und
U.S.-amerikanische Deckungswerte**

Hrsg.: vdp, 2007
ISBN: 978-3-9811273-8-6
Band 28

Sacalschi:

**Grundeigentum und Sicherheiten
in Rumänien**

Hrsg.: vdp in Zusammenarbeit mit dem
Center of Legal Competence (CLC),
Wien, 2007
ISBN: 978-3-9811273-9-3
Band 29

Lassen:

**Die Hypothek nach russischem Recht
als Kreditsicherungsmittel**

Hrsg.: vdp, 2007
ISBN: 978-3-9811816-0-9
Band 30

Stürner/Stadler:

**Hypothekendarfbriefe und
Deckungswerte in der Schweiz**

Hrsg.: vdp, 2007
ISBN: 978-3-9811816-1-6
Band 31

Stöcker:

**Flexibilität der Grundpfandrechte
in Europa Band II**

Hrsg.: vdp, 2007
ISBN: 978-3-9811816-2-3
Band 32

Crimmann/Rüchardt:

**Der Beleihungswert
– Zwei Teile –**

Hrsg.: vdp, 2008
ISBN: 978-3-9811816-3-0
Band 33

Stessl:

**Real Property Rights in the
Slovak Republic**

Hrsg.: vdp in Zusammenarbeit mit dem
Center of Legal Competence (CLC), 2008
ISBN: 978-3-9811816-4-7
Band 34

Stoimenov/Ivanov:

**Grundeigentum und Sicherheiten
in Bulgarien**

Hrsg.: vdp in Zusammenarbeit mit dem
Center of Legal Competence (CLC), 2008
ISBN: 978-3-9811816-5-4
Band 35

Linkert:

**Insolvenzrechtliche Risiken bei
Asset-Backed Securities**

Berlin, 2008
ISBN: 978-3-9811816-6-1
Band 36

Stöcker/Stürner:

**Flexibilität, Sicherheit und Effizienz der
Grundpfandrechte in Europa Band III**

Berlin, 2008
ISBN: 978-3-9811816-7-8
Band 37

Herausgeber:

Verband deutscher Pfandbriefbanken e.V.

Georgenstraße 21

10117 Berlin

Telefon: +49 30 20915-100

Telefax: +49 30 20915-419

E-Mail: info@pfandbrief.de

Internet: www.pfandbrief.de

Postanschrift:

Postfach 64 01 36

10047 Berlin

ISBN 978-3-9811816-8-5