# What are the main determinants of subordination levels in European Commercial Mortgage-Backed Securities transactions?

by

Jord van Wingerden

259745jw

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## Abstract

In this thesis I fill the gap of knowledge and research about determinants and the levels of subordination of the commercial mortgage-backed securities transactions in Europe. I perform cross sectional tests of differentials in European CMBS subordination levels using a unique dataset of European CMBS transactions and test the significance of determinants indicated by the rating agencies methodology as well as by academic research. The results show that weighted average loan-to-value, debt service coverage ratio, loan-to-value at maturity, loan concentration are significant factors in determining European CMBS subordination levels. In addition, I observe that subordination levels in the European CMBS market have not substantially declined over time in contrary to the trend observed in the US CMBS market.

*Keywords: Structured finance; CMBS; Subordination levels; European market*

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# List of Abbreviations

| | |
|---|---|
| **ABCP** | Asset-Backed Commercial paper |
| **ABS** | Asset-Backed Securities |
| **AFME** | Association for Financial Markets in Europe |
| **CDO** | Collateralised Debt Obligations |
| **CMBS** | Commercial Mortgage-Backed Securities |
| **CMSA** | Commercial Mortgage Securities Association Europe |
| **DSCR** | Debt Service Coverage Ratio |
| **EMEA** | Europe, Middle-East and Africa |
| **ESF** | European Securitisation Forum |
| **Fitch** | Fitch Ratings |
| **Freddie Mac** | Federal Home Loan Mortgage Corporation |
| **LTV** | Loan-to-Value ratio |
| **MBS** | Mortgage-Backed securities |
| **Moody's** | Moody's Investor Services |
| **NR** | Not rated |
| **RMBS** | Residential Mortgage-Backed Securities |
| **RTC** | Resolution Trust Corporation |
| **S&P** | Standard & Poor's |
| **SPV** | Single Purpose Vehicle |
| **WA** | Weighted Average |

# 1. INTRODUCTION

## 1.1. Subject

The 'credit crunch' of mid 2007 marked the start of the current financial crisis. Rising interest rates and declining house prices in the American mortgage market caused unanticipated growth of foreclosures and losses in sub-prime Residential Mortgage-Backed Securities ("RMBS") transactions. The structured nature of these products and the lack of knowledge about these structures by investors made the worldwide exposure unclear and created a loss of confidence between banks and investors. Credit markets froze, losses and defaults of lenders and investors in the structured finance market increased heavily, and a worldwide cycle of write-down of assets started. The values of all sorts of structured products as Collateralised Debt Obligations ("CDOs"), but also products to be assumed safer, such as prime RMBS, decreased to historical lows. The issuance of structured finance products declined to almost zero in the years 2008 and 2009. In this thesis I analyse another popular structured finance instrument, the Commercial Mortgage-Backed Securities ("CMBS"). These instruments are structured securities with an underlying asset portfolio of loans, and as security mortgages on commercial real estate as offices, warehouses and hotels.

The market and media appoint some of the blame for the financial crisis to the rating agencies. They accuse the agencies of being too optimistic with their ratings and of being too superficial with their assessments of structured finance transactions and their information supply on these structures. The media questions the role of rating agencies in the financial, and in particular structured finance, market and their modelling approach once again. The accusations towards the rating agencies raise the question whether rating agencies' approaches and internal models are really that opaque as one assumes, and whether the methodologies lack parameters as some academic research indicates[1]. Furthermore the market questions whether rating agencies use the right variables to judge the credit risk, in the form of assigned ratings, in CMBS transactions.

The main rating agencies in the world financial markets, which are Fitch Ratings ("Fitch"), Moody's Investor Services ("Moody's") and Standard & Poor's ("S&P"), all have different opinions and views on the modelling of and assigning ratings to a CMBS transaction. Each rating agency uses its own internal model for subordination design and the information on their methodologies is not entirely disclosed or freely available to all market participants. This fact, together with the technical jargon used, causes a lack of knowledge on structured finance products design and determination of credit risk in transactions. CMBS issuers, investors and financial economists know little about how different credit risk factors affect subordination levels and do not grasp the limitations of the assigned ratings. The Committee on the Global Financial System (2005) already noted the existence of and warned for this 'black spot' in a report that predates the financial crisis by 2 years. Implications from this lack of knowledge and risk awareness have been witnessed from mid 2007 onwards.

[1] See for example research by Tu and Eppli (2003), Downing and Wallace (2005), Deng and Sanders (2006) and An and Deng (2007).

## 1.2. Research objectives, questions and structure

Following the above standing, in this thesis I aim to fill the gap of knowledge about determinants and levels of subordination of this particular type of mortgage-backed securities transactions, the CMBS, in the European market. The level of subordination is the maximum amount of principal loss on the underlying mortgage pool that can occur without a given security, or tranche, suffering any loss. I use a self-made and unique dataset of European CMBS transactions and their underlying tranche information construed from the rating agencies and market databases. Furthermore I use academic research and reports written by associations as the Bank for International Settlements as sources of information. Due to the immaturity of the European CMBS market little academic research is published on the European CMBS market and research published on this subject is solely based on US CMBS market data. Therefore this thesis is a good addition to existing research papers concerning the structured finance market. The main research question for this thesis will be:

*"What are the main determinants of subordination levels in European CMBS transactions?"*

I answer this main research question by testing the determinants indicated in the rating agencies methodology reports as well as by academic research for the US market[2], in order to assess their significance in the European CMBS market and their influence on the different rated tranches within the transactions. In addition, I analyse the European subordination levels throughout time to verify the stylised fact that levels have significantly dropped in recent years, similar to the US market[3]. In order to be able to answer the main question, I divide my thesis in several subsections or sub questions which provide the necessary knowledge of the product CMBS, the process of structuring and rating a CMBS, and the models used by rating agencies to evaluate a transaction. These sub research questions are:

*"How is a CMBS transaction structured and why do they exist?"*

*"How does the process of rating a CMBS work and what is the role of the rating agency in this process?"*

After this introduction on the product and the processes, the focus aims at the models used by the rating agencies to determine subordination levels, the driving variables of the models, and the determinants of subordination which academic literature indicate to be significant. I test if the indicated variables are significant determinants in setting subordination levels by means of simple regression analyses.

[2] For example by Polleys (1998), Riddiough (2001) and recently by An and Deng (2007).

[3] Downing, Stanton, and Wallace (2008) for example find a decline in subordination levels from 35.59% to 14.08% for AAA rated tranches and from 14.34% to 3.72% for BBB tranches. See also Figure 8.

# 2. COMMERCIAL MORTGAGE-BACKED SECURITIES

To fully understand the models and parameters used to assess, design and rate CMBS transactions this chapter explains the background and essential details of CMBS transactions. First of all, I discuss the definitions of securitisation, structured finance and CMBS to provide a good understanding of the market and its motives. Then I provide a detailed look on CMBS structural features by explaining a generic European structure, and give more insight in the CMBS market by sketching an overview of the European market and its motives. This section answers the sub research question *"How is a CMBS transaction structured and why do they exist?"*.

## 2.1. Definition

Following the guidelines on the definition of structured finance as stated by the Committee on the Global Financial System (2005), structured finance is a form of financial intermediation based on securitisation principles. The pioneering work of Rosenthal and Ocampo (1988) provides a clear definition of securitisation:

> "The carefully structured process whereby loans and other receivables are packaged, underwritten, and sold in the form of securities which are instruments commonly known as asset-backed securities."

Because of its broad use for all kind of structured products and even the entire market, an exact or all-embracing definition of structured finance does not exists. Jobst (2005a), for example, defines structured finance on a broader scale:

> "Structured finance encompasses all advanced private and public financial arrangements that serve to efficiently refinance and hedge any profitable economic activity beyond the scope of conventional forms of on-balance sheet securities (like debt, bonds, equity) in the effort to lower cost of capital and to mitigate agency cost of market impediments on liquidity."

Besides this strict definition three main characteristics typically distinguish structured finance instruments or products from other financial products, as stated by the Committee on the Global Financial System (2005). These characteristics together can alternatively be used as a definition and are; (i) the pooling of assets, on either cash basis or synthetically created, (ii) tranching of the securities issued, (iii) de-linking of the credit risk of the collateral from the credit risk of the originator. However, Fabozzi, Davis, and Choudray (2006) find this definition too narrow as in their view securitisation is a subset of structured finance and this definition has a focus on securitisation only. This clearly underlines that opinions on the exact definition differ across the world.

The range of financial assets suitable to be involved in securitisation or structured finance transactions is not limited to loans or receivables. The only necessary condition is that the underlying assets are generating stable, predictable and regular cash flows and have, preferably, a low risk of default. With respect to consumer loans or related assets most common assets are credit card receivables, automotive loans and leases, residential mortgages. On the other hand, insurance receivables, trade receivables, real estate loans and mortgages are examples of corporate related assets which can be and are being securitised. Figure 1 shows an overview of the structured finance product universe, also referred to as asset-backed securities ("ABS"), divided into different subsections. The first division is based upon maturity of the products; the short term Asset-Backed Commercial Papers ("ABCP") versus the "Term ABS". The section "Term ABS" is then divided into

tranched and untranched transactions, the latter being a minority in the market. The tranched ABS subsection is then further subdivided on base of number of obligors and asset types. The CDO pools are mainly synthetic and complex transactions, while the traditional ABS pools largely consist of true sale and more straightforward transactions. Compared to the CDO transactions, which can contain all sorts of assets as collateral such as loans, bonds, and other CDO, RMBS or CMBS transactions, CMBS transactions are limited to one asset class being commercial real estate. In Figure 1 the part of interest for this thesis is highlighted in blue.

Because the subject of this thesis is regarding solely CMBS, I conclude by stating a short but clear definition of CMBS according to Beekwilder (2005):

> "CMBS are mortgage backed securities where the underlying assets are a portfolio of loans with as security (a mortgage on) commercial real estate, i.e. the interest and redemption of the notes depends on the cash flows derived from the real estate."

## 2.2. History

CMBS transactions are generally considered to be originated in the early 1990s in the US, but in fact this is not entirely the case. The origin of CMBS, similar to those of RMBS, can be found in the housing market of the US in the 1970s. One of the three government sponsored entities, the Federal Home Loan Mortgage Corporation ("Freddie Mac"), issued its first mortgage-backed participation certificate in 1971 and private label mortgage-backed securities ("MBS") began in the late 1970s. Although these were residential real estate pools and hardly comparable to structures currently issued, these transaction structures reflected the altering insight that cash flows could be separated from the loan or asset which they arose from and could be used to pay interest and principal on securities backed by the underlying loans or pools of assets. Further developing this insight in the 1980s the US government put into place legal structural foundations to let the CMBS market mature further. But although many of the pre-requisites for modern structured finance transactions were in place, CMBS remained a small factor in the debt markets. The CMBS market grew enormously after the 'savings and loan' crisis in the US in 1988, which deepened into a crisis affecting all commercial mortgage lenders in the early 1990s. This crisis led to the creation of the Resolution Trust Corporation ("RTC"). This organisation was charged with resolving failed thrift institutions and the disposal of their assets. RTC used CMBS to liquidate the troubled loans it had acquired from insolvent associations. After the termination of RTC in 1995, private mortgage conduits became the major issuers in the CMBS market. The market grew by more than 60 percent each year after 1995 until reaching its peak in 2007.

The origin of the European securitisation market began during the mid 1980s with transactions using UK mortgages, followed in the early 1990s by transactions featuring collateral from Spain and France. These structures were copied from earlier US based transactions and mainly executed by American banks. Despite rapid growth during the mid-1990s, the market did not really take off until 2000. This was due to some uncertainty regarding the interpretation of several key securitisation factors such as regulatory treatment of securitisation, banking secrecy law, and perfection and enforcement of security issues. While these issues continue to exist to certain respect even today, market pressure to achieve efficient capital usage and reliable access to liquidity in the capital markets led to many asset originators developing solutions which offered effective risk transfer. In

continental Europe, the market initially was entered by the UK, followed by Spain and France. Subsequently, the Netherlands, Germany and Italy became attractive securitisation markets given that each is a major domicile for collateral in CMBS transactions. Before reaching its expected peak in 2007 the European CMBS market was grinded to a halt after the summer of 2007, making 2006 the peak of the European market till this moment.

## 2.3. Structure

Because of the diversity in terms of underlying collateral, security types and the different legal jurisdictions in Europe I describe a generic European CMBS structure and therefore this description may not cover all aspects. I divide this paragraph in subsections to be able to briefly address all aspects.

### 2.3.1. Basics

Figure 2 illustrates the basics of a securitisation or structured finance transaction. These basics also apply to CMBS and are, simplified, a two step process. To create an asset- or mortgage-backed security the originator of the transaction first assigns a pool of assets or mortgages to an issuer vehicle, which is a non-recourse, single-asset finance company or 'Single Purpose Vehicle' ("SPV"). This SPV creates the needed de-linking of the credit risk of the asset pool and the credit risk of the originator and is the essence of every securitisation transaction. The issuer then places tradable securities into the capital markets, private market or gives them as collateral at the central banks. To satisfy to the risk, return and maturity characteristics of different investors, these securities are sliced in different classes with different priorities of payments of interest and principal. Due to these different priorities a different risk and return profile is created for every tranche, ranging from credit ratings AAA till B[4]. The proceeds of the sale of the tranches are used by the issuer to purchase the assets from the originator in case of a true sale construction. The collected cash flows from the assets are used by the issuer to make principal and interest payments to the owners of the securities according to the priority of their securities.

### 2.3.2. Credit enhancement

In general several tranches of notes (or classes) are issued through a CMBS transaction. The vast majority of these notes are floating-rate with spreads commonly expressed as a number of basis points[5] above interbank interest rates as the 3 months EURIBOR or LIBOR rate. In most transactions also an unrated first loss piece, also known as an equity piece, is incorporated. To obtain a certain credit rating on a tranche an adequate level of protection against loss on the note has to be in place. This protection is called credit support or credit enhancement and is incorporated into the transaction in several different forms.

The main and most used form of credit enhancement is subordination, which is implicitly incorporated by the issuance of different tranches. The senior tranche has the first claim on the transaction's cash flows while a subordinated tranche has a lower claim. The subordinated tranche provide credit enhancement by absorbing losses on the underlying asset pool before more senior tranches absorb losses. The equity or non-rated ("NR") piece bears the first loss, if losses are larger

[4] For an overview of credit ratings and their meanings I refer to Table 1.
[5] A basis point or 'bps' is one hundredth of one percent.

than the equity piece the next lowest rated notes bear the rest of the losses. The level of subordination for a certain class is defined as the proportion of principal outstanding of other classes with lower rating. In the transaction overview, which Figure 3 shows, credit support for class A is the sum of classes B, C, D, F and credit support for class B consist of the sum of classes C, D, F. The credit support for a class must be fully extinguished before any default loss can affect the class. When we relate this to Figure 3 class A experiences 37,7% credit enhancement, or subordination. Thus the pool underlying would need to suffer a loss of 37,7% of the loan balance before this class would be impacted with loss. This principle of subordination is often referred to as 'waterfall' and most of the times this waterfall is sequential. This means interest and redemptions are first made to the senior tranche, thereafter to the next senior tranche and so on. The second type is a pro rata waterfall, redemptions are then made on base of the size of the tranches or, in a modified case, according to repayment dates of the loans.

Several other forms of credit enhancement are commonly incorporated to cover the credit risks. First common form is the usage of excess spread, defined as the interest payment received on the assets less the one made to the notes along with fees and expenses on the transaction. Typically this is the first line of defence for absorbing losses; it is tapped before any other type of enhancement is used. Secondly, a reserve account can be filled during the transaction using the excess cash flows or with cash at issuance date. If the reserve account is used to absorb losses, excess cash flows may be used to replenish the account to the specified level again. A third form often used is over-collateralisation. When the value of assets in the reference pool exceeds the amount of notes issued, cash flows generated by the extra collateral can be used to absorb losses if the cash flows from the securitised pool are insufficient. Over-collateralisation together with subordination, excess cash and reserve accounts are internal forms of credit enhancement, in that they are part of the transaction. Besides these internal forms of credit enhancement, external credit support mechanisms such as third-party guarantees from banks are often used to mitigate credit risk. Most common used form in Europe is the liquidity facility, which provides liquidity to pay interest in case of insufficient cash flows. This guarantees the needed full and timely payment of interest and principal. Drawback of this type of external credit enhancement is the additional exposure to the credit risk of the third-party guarantor.

### 2.3.3. Structure of a transaction

The structure of a CMBS transaction requires balancing a variety of potential conflicting factors and the involvement of a number of parties including the originator, the issuer, trustees, rating agencies, servicers, legal counsels and financial guarantors. Figure 4 broadly shows the different parties involved and their interaction, which provides an idea of the complexity of a CMBS transaction[6].

On base of the type or number of commercial loans involved in a CMBS transaction one can make a distinction between three general types of transactions. However this classification is not strict, because there are a wide variety of European CMBS transactions backed by one form or another of commercial property. To complicate matters further, a number of different structures types are used to create these securities and they are sometimes used as a means of categorising transactions. The first type of CMBS transactions I distinguish is the classic transaction which consists out of one loan

[6] For a more detailed description of the role of each actor in a CMBS transaction I refer to Beekwilder (2005).

backed by a portfolio of, preferably diversified, commercial real estate from one real estate company. This type is often referred to as a single borrower or limited asset CMBS. The second and most common CMBS transaction type is the large multiborrower transaction. In this case numerous commercial property loans, originated to numerous borrowers and secured on a variety of properties are grouped together in one transaction. Thirdly, there are the securitisations of sale and lease back transactions. In a sale and lease back transaction the real estate of a company is sold and leased backed by this company.

## 2.4. Rationale for CMBS

Rationale for a CMBS transaction is in great extend similar to the rationale for securitisation, except for some real estate company specific motives. Issuers are varied and encompass most entities that own real estate or some form of direct or indirect real estate. Companies consider securitisation for many reasons. Principally to raise funds when other forms of finance are more expensive, but also to diversify their funding sources, have access to a deep investor base and to reduce credit exposure to particular asset classes. However, due to the global financial crisis the credit spreads on securitisation transactions have reached historical high levels in 2009. Because of this high costs and the dried up liquidity in the market, securitisation at this moment in time is no longer a cheaper funding option compared to bank loans. The diminishing market confidence in the securitisation principle and the negative reports in the media about the risks of securitisation are reasons to not consider securitisation as a funding option. Besides the current market conditions the relatively high structuring costs and the level of information disclosure needed are some other requirements and characteristics in a CMBS transaction which are generally seen as disadvantages.

Nevertheless the securitisation principle has created a higher degree of liquidity in the capital markets in recent years and was one of the key drivers of the global economic growth in the financial markets of recent years. Because of the legal separation of good credit quality assets from a company's core business, the securities backed by those assets will likely have higher rating than the company. Therefore these securities are more attractive to investors and could result in a lower cost of funding. For banks or bank related companies another general motive for securitisation is regulatory capital relief. By creating CMBS transactions from their commercial real estate related loans banks replace the usually non-rated loans by rated securities and lower capital reserves have to be maintained. Also banks have the possibility to fund themselves at the national banks by borrowing against a pledge of these rated securities, known as a repurchase agreement[7]. In the current market circumstances almost all transactions are originated and executed by banks.

## 2.5. Information availability

No comprehensive and uniform market data on the European CMBS or whole structured finance market is currently available. However, there are several sources which provide useful market information. Major banks, government and market associations and the rating agencies being the most important ones. They produce yearly and sometimes quarterly overviews of the number and size of the transactions, breakdowns by region of issuance, by type of transaction or by collateral

[7] Repurchase agreements are commonly referred to as 'REPO' transactions.

type. In contrary to the US, where standard investors reporting packages are used by every issuer, in Europe no standard in reporting is available. Every European issuer uses different formats and levels of information disclosure, which is mainly caused by the different legal jurisdictions existing within Europe. Both the Commercial Mortgage Securities Association Europe[8] ("CMSA") and the European Securitisation Forum[9] ("ESF") have initiated standard reporting templates and are trying to agree on the creation of one standardised database with all market participants in Europe.

## 2.6. European CMBS market

As Panel A of Figure 5 shows, the European CMBS gas grown steadily until it reached its peak in 2006. The market especially experienced a strong growth in the period 2005 until summer 2007 with number of transactions issued in the year 2006 reaching an unprecedented 90 transactions. During the year 2007 the transaction boom was continued in the first half of the year, but due the start of the liquidity crisis the total issuance did not reached a new peak level. Panel C of Figure 5 reports the spread for AAA notes within the European market where one can notice the same movement. After staying at all time lows for over some years, the spreads started widening from the summer 2007 onwards, moving towards levels that have not been witnessed before. During the financial crisis spreads even tipped the 1200 bps level. From the second half of 2009 onwards spreads start to slowly narrow, but are still above the 1000 bps level.

The European CMBS market has been dominated by the UK throughout the years. Panel B of Figure 5 shows that of the few transactions issued in 2009 most of them are issued using UK based assets. Also panel B reflects that in recent years the German market has become a more dominant and important player in the market, which is mainly due to the large size multifamily transactions issued in recent years. The other transactions issued in 2009 are pan-European transactions, thus with assets based in two or more different countries. The second graph in Panel B shows the outstanding amounts of CMBS transactions as of the end of 2009 by country. The UK market is responsible for half of the total market size in European CMBS. One quarter is pan-European, while Germany is only responsible for one eight of the current outstanding CMBS transactions in matter of size.

[8] The CSMA has recently changed their name to CRE Finance Council. The European CMSA chapter website can be accessed by http://www.crefc.org/global/europe.aspx?id=10592.
[9] The ESF has recently joined forces with the Association for Financial Markets in Europe ("AFME"), their website can be accessed by http://www.afme.eu/dynamic.aspx?id=2294.

# 3. EUROPEAN CMBS RATING METHODOLOGIES

Rating agencies play an important role in the structured finance market; all European CMBS transactions are rated by at least one agency and to a great extent they determine how a transaction is structured and how this is or can be modelled. Or as Riddiough and Chiang (2003) state: "Rating agencies actively control security design through their determination of subordination levels required to achieve particular security outcomes." In this section I first comment on the role of rating agencies within the structured finance market and the process of retrieving a rating. Thereafter I explain the credit ratings provided by the agencies and describe the rating models and the main determinants used within their internal models. This section answers the sub research question *"How does the process of rating a CMBS works and what is the role of the rating agency in this process?"*

## 3.1. Role of the rating agencies

The role of the rating agencies is primarily to provide a third-party opinion on the quality of each bond class in CMBS structures as well as to determine the requisite amount of credit enhancement or subordination level in a transaction[10]. For determining these levels of subordination and to approve the final transaction structure the rating agencies use their own internal models. Information on their methodology is published (semi-)publicly to investors and issuers, and makes it possible to, partly, recreate models and create own analyses of the products. Although the agencies present themselves as open on information and methodology, market participants, academic literature and more recent public opinion make critical comments on their information availability and transparency. Riddiough and Chiang (2003) for example conclude that rating agencies clearly produce valuable information to market participants, but also that they suffer from many of the same information frictions that investors themselves suffer from.

On the other side one can argue, as is done by the Committee on the Global Financial System (2005), that agencies as 'delegated monitors' help to overcome asymmetric information problems and improve efficiency. Due to the complexity of most structured finance transactions, documents published provide insight to market participants and the rating agencies contribute to the development of accepted market standards. But market participants have to be aware of the limitations of the information which the rating agencies provide, especially in the case of structured finance ratings. The one-dimensional nature of credit ratings based on expected loss is not an adequate metric to fully gauge the riskiness of these instruments. The Committee on the Global Financial System (2005) already concluded that "risks associated with structured products may not have been fully grasped by some investors" and that "The use of structured finance instrument together with the occurrence of worst case scenarios relating to mispriced or mismanaged exposures, might lead to situations in which extreme market events could have unanticipated systemic consequences." This is exactly what has happened during the last years. Especially banks have written down large sums on their structured products because of mispriced and mismanaged exposures in the structured finance market and this was one of the causes of the financial crisis, currently still prevailing.

[10] For more discussion on the role of the rating agencies I refer to e.g. Riddiough (2001) and Polleys (1998).

## 3.2. Structuring process

A typical rating process, according to Fitch Ratings (2005) and Moody's Investors Service (2005), starts with the rating agency receiving an information package from the issuer. This package includes an overview of the transaction and the proposed structure in the form of a term sheet, property operating history and cash flow projections as well as other descriptive materials, such as recent rent information, property descriptions, relevant market data, and background information on the different parties involved in the transaction. The rating agency will evaluate the proposed transaction both on quantitative factors, such as examination of property's operating history and market conditions, and qualitative factors, such as sponsorship, location, geographic concentration. After this first assessment the finalisation of the review consist of site tours of the collateral, review of third-party valuation reports, review of legal documents and the finalisation of the structure.

The CMBS issuer initially proposes a debt structure and the rating agencies independently perform their analysis to examine whether the proposed structure can assure the tranches to reach certain ratings. Removal of certain loans from the pool or change in the size of a tranche in order to assign certain rating to a tranche can be required by the agencies. This iterative process leads to a final, jointly determined, transaction structure design and assigned ratings. It is common, and for almost all public transactions required, to appoint two or more rating agencies to complete this proposing-revising process simultaneously. After the final transaction structure is determined by the agency and the issuer, the agency's rating credit committee will decide on the definitive structure and size and rating of each tranche. This committee consist of several senior credit experts and have to jointly agree on the definitive structure. If not, then the iterative process of structure design has to be redone until the committee agrees on the structure, as Figure 6 also shows. When the committee has agreed on the structure a new issue report is released by the agency. This report contains a summary of the main components of the transaction and a short description of the assets underlying. The publication does not terminate the involvement of an agency as they will monitor the transaction on a quarterly or monthly basis and will review the entire structure yearly during the maturity of the transaction.

This process of determining the final structure follows in a great extent the supply-driven description of Ross (1989) with at least one difference as pointed out by Riddiough and Chiang (2003). They state that the rating agencies are inserted into the market in order to provide product quality certification. Because they exert control on the design of the final product, but do not have any claim on the cash flows, market participants consider the rating agencies as *de facto* regulators of product design.

## 3.3. Credit ratings in CMBS

The key factor in a CMBS transaction is the rating obtained on the different tranches. From the beginning back in the 1970s the structured finance market has largely been a 'rated' market. Issuers and investors want the notes issued to be rated according to scales identical to those for bonds. Issuers, at least in the case of banks, need these because of the regulatory capital relief possibilities. While investors are commonly bound by investment constraints based on ratings and need a rating to be able to purchase structured finance products. According to Moody's Investors Service (2005), a

rating for a long-term obligation is a measure of the expected loss which is determined by multiplying the probability of default, based on the default rate, its timing and its volatility, by the severity of loss, assessed based on recovery values of the assets and their timing and volatility.

The key distinguishing factor between bond ratings and structured finance ratings is the level of involvement of the rating agency itself in the determination of the rating. This is because a tranche rating reflects a judgement about both the credit quality of the underlying portfolio of assets and the level of credit enhancement that must be provided through the structure to achieve the rating targeted by the issuer. The issuer uses the rating agency information to pre-structure transactions and subsequently engages in the iterative dialogue to finalise the structure. As a result, structured finance product ratings have an indisputable ex ante character compared to traditional bond rating were a rating has more an ex post character and discussions about the rating are very limited.

To conclude this section I quote the definition of a credit rating assigned to a CMBS transaction according to Standard & Poor's (2004): “The credit rating assigned to a CMBS transaction is an opinion on the ability of the collateral to pay interest on a timely basis and to repay principal by the rated final distribution date, according to the terms of the transaction. The rating does not reflect the impact of prepayment or any other factors that may affect investors’ yields”

## 3.4. Rating agencies’ general framework

Despite the usage of different internal models by the rating agencies , the general framework for the three major rating agencies’ CMBS models is approximately the same as can be derived from criteria reports published by Fitch Ratings (2004), Fitch Ratings (2007), Standard & Poor's (2004) and Moody's Investors Service (2001) in which methodologies are broadly explained. Four levels of analyses are typically performed depending on the kind of transaction;

Tenant level: Tenants of commercial property are assessed by their public rating or a ‘shadow’ rating is calculated to provide an indication of their probability of default;

Property level: Property net operating income, provided by the issuer, is adjusted according to the view of the agency on market assumption and qualitative aspect of the property such as location, specification and type. After deduction of capital items, such as capital reserves, tenant improvement and leasing commissions, a net cash flow remains. Based on this cash flow the property value is calculated using capitalisation rates as determined by the agency, which in general are more conservative or ‘stressed’ compared to market capitalisation rates;

Loan level: Borrower quality, amortisation, cash management, over-collateralisation are analysed to make adjustments to the basic credit support assessments;

Portfolio level: Pool diversity, information quality and legal and structural issues are examined within this level of analysis. Subordination levels are assigned to each, by the issuer, proposed tranche. Final adjustments are made to the structure design and final tranche ratings are assigned.

Traditionally agencies use a static approach in their transaction analyses. In recent years they have developed and incorporated dynamic default probability and loss severity models in their analyses to predict commercial mortgage and CMBS pool expected loss over a relatively long horizon. This is a more desirable approach because the optimal subordination design is essentially the expected life time loss of the transaction. An and Deng (2007) conclude that this more dynamic approach plays a complementary role in the industry and that the static approach is still the major methodology used by the agencies. On the contrary, due to the recent developments in the market, agencies are updating the methodologies rapidly and it's expected that within a short time frame methodologies will be fully dynamic[11].

## 3.5. Rating agencies' internal models

Although methodologies can be generalised, each agency has its own unique features incorporated in their internal model. To gain more inside in the main determinants of each agency's model I briefly discuss the models used in the European CMBS market and the difference within the approaches. Because Fitch and Moody's posses the largest market share within the European CMBS market and thus have rated most of the European CMBS transactions, I focus on their approach and therefore I discuss the S&P's model in lesser extent.

Moody's Investors Service (2001) beliefs that the credit enhancement needed to achieve a rating level for a proposed transaction typically depends on the expected frequency, severity, and timing of future losses. An estimation of frequency and severity of losses is usually based on a statistical analysis of historical performance data. However, commercial mortgages are not uniform in character, and relevant historical loss information is limited or not available at all, especially in Europe. Fitch Ratings (2004) also notes this fact in determining their approach for the European CMBS market. As a result, Moody's as well as Fitch analyse the fundamental real estate credit risk of each asset to estimate the frequency and severity of losses within the legal and structural framework of the transaction. Fitch concludes that the principal determinant of default probability on any particular commercial-backed loan was property income, thus a property level or even tenant level analysis was preferable. Other factors such as borrower quality, a higher analysis level, were considered but given significantly less weight as the vast majority of loans were backed by SPVs whose only tangible asset in the event of insolvency is the actual property itself. Thus if one could simulate future property income, one could then more accurately predict default probability and possible loss severity on loans.

To determine the appropriate credit enhancement on this level Fitch, Moody's and Standard & Poor's (2004) typically adjusts the cash flows of the underlying pool of properties to derive an estimate of the stabilized net cash flow that the property can be expected to sustain over the life of the transaction. These adjusted cash flows are summed to a loan level basis and are used as basis for modelling credit support for the transaction and thus the determination of the probability of default. This probability is partly measured by the debt service cover ratio ("DSCR") which is the ratio of the available cash flow from a property or the total pool of properties to its required debt payments

[11] See for example Commercial Mortgage Metrics by Moody's Investors Service (2008)

under the loan agreement. Commonly a loan is in default if the DSCR ratio falls below one for consecutive periods. If a loan defaults the loss severity is determined commonly by usage of the loan-to-value ratio ("LTV"), defined as the loan balance divided by the value of the property, of the underlying loan. This ratio gives a good indication of the proceeds of a sale of the property and subtracting the liquidation and other cost gives the agencies a good approximation of loss severity.

Because both agencies use a property level approach also several portfolio characteristics are considered in their analysis. One such characteristic is the portfolio diversity, which can be measured by property type distribution, geographic location distribution, economic diversity and loan concentration. Moody's views portfolios with multiple property types and geographic locations as more stable. Fitch assumes that different property types have different risk profiles, rental income volatility and market dynamics, as Figure 7 shows. Property type diversification mitigates the expected losses in a pool. Geographic diversification helps mitigate the risk of single market declines, and serves to smooth the variability around an expected loss. It helps offset the impact to a pool from a regional downturn.

## 3.6. Summary

As I point out in this chapter LTV and DSCR are two key factors in subordination design by the rating agencies. Pools with higher LTV are seen as bearing higher risk, and thus require more subordination, while those with higher DSCR will have less subordination requirements. Besides these two key factors also other pool characteristics as property type, geographic location and loan concentration are possible determinants of subordination levels. The next chapter performs a literature review to judge whether academic literature agrees on these factors as being the main determinants of subordination levels in CMBS transactions.

# 4. ACADEMIC DETERMINANTS OF SUBORDINATION LEVELS

Extensive articles on defaults and a few on the loss severity of commercial mortgages are available in the US market. Literature regarding the European market on the contrary is almost none existing due the unavailability of proper datasets and the relatively adolescent nature of the market. Therefore this literature review will mainly be based on US market research. Howsoever, because CMBS structures and rating methodologies in Europe have been based on the front running US market this research can be considered as a good indicator of possible determinants of subordination levels.

The first studies regarding the determinants of subordination levels in CMBS transactions where focussed on the time series perspective of subordination design. Riddiough and Chiang (2003) are one of the first to study how CMBS subordination and credit spread evolve over time. They analyse cross-sectional and time-series variation of CMBS subordination attributes using AAA-rated security tranches. They find that credit variables explain 76 percent of the variation in subordination level, and that of these variables LTV and DSCR are the most significant. Also the refinancing risk variable is a significant determinant. Their results support the emphasis that rating agencies place large weight on the effects of pool diversity when determining the security structure because of the significance of some concentration and diversification variables.

Downing and Wallace (2005) focus on optimal subordination design in CMBS. From CMBS issuers' perspective, the least subordination for a given rating structure is desirable because the issuers can sell the senior tranches with a premium while the subordinated tranches sell with a discount. On the other hand, investors buying senior tranches always want as much subordination as possible to protect them from the pool default risk. Therefore the optimal subordination design requires a fair coverage of the credit risk. Subordination levels observed in the market are higher than their estimates and they conclude that the market will likely see further reductions in subordination levels. In a subsequent paper, Downing, Stanton, and Wallace (2008), also confirm the stylized fact that subordination levels have declined over the years, as An, Deng, and Sanders (2006) address in their study.

In addition to this time series perspective of subordination design, the cross sectional properties of subordination levels are an interesting research topic. Only limited empirical work has been done to examine determinants of subordination. The first academic research to address the determinants of subordination is done by Polleys (1998) in her empirical investigation of CMBS subordination levels and pricing. This study uses a dataset of AAA rated classes only from the US market to test whether only non-credit variables influence CMBS pricing after credit risk variables are used to determine the level of subordination. The main hypothesis is rejected because also credit variables influence pricing. This implicates the existence of asymmetry between the rating agencies and the investors with respect to the assessments of risk. I only use the first part of this research, the determination of the drivers of subordination levels, which is also the basis for subsequent research papers as written by Riddiough and Chiang (2003), An, Deng, and Sanders (2006) and An and Deng (2007). Furthermore Polleys proves by usage of regression analysis that pool averaged LTV and DSCR, proxies for the degree of pool diversification and certain property types are particularly important and significant in the determination of subordination levels. Besides these determinants also

transaction size and time of issuance, which are supposed to be non-credit variables, are reported to influence subordination.

As I conclude in the previous section using transaction cut-off information, as LTV and DSCR, only may not produce good estimates of commercial mortgage credit risk and thus may not be good determinants of subordination levels. An, Deng, and Sanders (2006) and An and Deng (2007) reply to this issue by performing cross sectional analysis of subordination determinants on CMBS transaction level. Based on a comprehensive US dataset of CMBS transactions they find DSCR at origination, measures of transaction property type and prepayment protection to be significant and important determinants in subordination design. Together these variables explain 90 percent of the cross sectional variations in AAA subordination levels and 80 percent in BBB subordination levels. LTV however is judged differently in the latter research, and is excluded because of it is supposed to be highly correlated with DSCR. Besides the analysis of subordination drivers both studies further the research by estimating the default risk of the underlying pool. An, Deng, and Sanders (2006) show that CMBS pool default risk has little explanatory power of the transaction AAA subordination level and conclude that there is a misspecification problem in subordination design. An and Deng (2007) emphasize more on expected loss as explanatory factor and their conclusion mitigates to "it is difficult to establish a deterministic relationship between subordination level and default loss, a priori." In both case investor thus should be sceptical about subordination levels, which again is in line with the conclusions from Polleys (1998).

Recent empirical studies have indicated cut-off LTV and DSCR, proxies for the degree of pool diversification and certain property types as main determinants of subordination levels in CMBS transaction in the US market. This is in line with the summary of chapter 3, where I state these variables to be the main determinants according to the rating agencies' internal models. Main difference between the academic workings and the rating agencies models is the purpose of the models used. While academic research is mainly ex post and follows the market, the purpose of rating agencies' model is ex ante determination of subordination levels and thus rating agencies are actually try to forecast the market.

# 5. DATA

I compose a dataset on European CMBS transactions based on information collected from Bloomberg® and complemented with, partly disclosed, information retrieved from issuance reports of the transactions from the rating agencies Fitch and Moody. This initial database encompasses 280 Euro and British Pound denominated CMBS transactions and covers almost all CMBS transactions issued in Western Europe during the period of 1999 to 2009. The data collection point is October 27, 2009. For each transaction detailed information is available on characteristics such as cut-off date, balance, LTV, DSCR, property type composition, property country location distribution, number of loans and number of tranches. Table 2 presents which source I use as leading in retrieving the different characteristics of the CMBS transactions.

## 5.1. Dataset creation

The final dataset is limited to the historical fact that Fitch or Moody's was assigned to rate a certain transaction and thus an issuance report with the needed information is available. Also the limited information available for transactions from before 2000 determines the final amount of data points. From the original 280 transactions, I exclude 71 because of either lack of information, structure deviations, different types of asset underlying the transaction, number of tranches equal to one, or other reasons as tap or disposal fund transactions. I exclude another 10 transactions because being synthetic transactions which due to this show abnormal subordination levels. The final sample contains 199 transactions. Table 3 lists the year of issuance and the names of the included transactions alongside with the denomination, and the original number of tranches within the transaction. Also Table 3 states the number of observations used in the regression analysis, which I explain further in the next section.

Panel A and B from Table 4 report the cut off year distribution of the 199 European CMBS transactions. While in the early years of the European market (2000-2004) the number of transactions and amount slowly increases, the years 2005-2007 show an explosion in the number of transactions and amounts marking the boom years of the CMBS market. Few transactions are placed into the capital markets from August 2007 onwards due to the financial crisis. Table 4 also shows the distribution of Euro and British Pound denominated transactions. The UK CMBS market is equal to the Western European market in number of transactions but half the European market in transaction amounts. However Panel C shows that most of the collateral is based in the UK, making it the leading country in the European CMBS market. Furthermore Panel A and B show that the sample covers almost 60 percent of all CMBS transactions in the EMEA region. This region also contains transactions in Russia and Dubai, which are not of interest for this thesis. Panel C finally shows that for 95 percent of the transactions 2 or more ratings agencies have assigned a rating and that all agencies have rated around the same amount of transactions.

## 5.2. Subordination level calculation

To determine the exact subordinations levels for each transaction and to exclude external credit enhancement support I calculate the subordination level manually. I first generalise the ratings over the original rating of the tranche, assigned by either Fitch, Moody's or S&P's, by distributing the

assigned rating per rating agency into general rating buckets. To do this I use the generalised rating table as panel C of Table 5 shows. Secondly, I take the lowest rating of these generalised ratings as final rating of the tranche. To be able to calculate the actual subordination of the tranches in a transaction I select the lowest tranche in the structure of each transaction as the level of subordination for a certain rating. Each transaction can provide only one data point for each generalised rating. Panel A shows the number of tranches with their original rating, while panel B reports the number of tranches with their constructed generalised rating. The number of observations in panel B is the number or observations for the regression analysis of the subordination levels. Finally I calculate the percentage of subordination level for a certain tranche by dividing the total amount of the tranches underlying the tranche by the total transaction amount. Also I weight them to the notional amount of the tranche in its cut-off year to create yearly weighted average subordination levels.

Table 6 summarizes the descriptive statistics of the 199 transactions and characteristics of variables used in the analysis. AAA subordination levels range from 4,3% to 71,1% with an average of 26,1% over the period 2000-2009. AA, A, BBB and BB subordinations levels also vary largely, with an average level steadily decreasing from 16,3% for AA to 0,3% for BB. Because of the low number of observations for B rated tranches I do not analyse these figures. The weighted average LTV at cut off shows an average of 70% within a range from 34,8% and 95%, which reflects the lower LTV of commercial mortgage loans compared to residential ones. Also the figure reports the weighted exit LTV or LTV at maturity, which is a proxy for balloon or refinancing risk. Weighted average DSCR at cut-off ranges from the minimum 1,0 to 3,88 with a reasonable average of 1,55. This average indicates that cash flows received from the assets can fulfil the interest payment on and repayment of the loans and that there is room for some cash flow decreases. However, a rising default rate among tenants together with higher vacancy rates could lead to cash flow problems relatively soon. Property type and country concentration differ between 0% and 100% for all types or countries and reflects the diversity of CMBS transactions in Europe in terms of underlying assets and location of the assets.

# 6. EMPIRICAL APPROACH AND RESULTS

## 6.1. Empirical approach

The determinants of the subordination of CMBS transactions I point out in the previous chapter are based solely on research in the US CMBS market. I investigate if these variables are also the determinants of CMBS subordination levels in Europe. I do this by estimating a linear regression model. Within this model the dependent variables are the subordination levels of the classes with equal ratings and the explanatory variables are the different transaction variables as Table 7 describes. Furthermore I test if weighted average loan-to-value and debt service cover ratio at origination of the transaction are indeed the main drivers of the levels and thus implicitly of the probability of default of the underlying portfolio. A parallel question concerning CMBS subordination design is whether cross sectional differentials in subordination reflect differences in credit risks of CMBS pools.

Because no standard dataset for the European CMBS market is available I will make use of a European CMBS transaction level dataset created from publicly available information and partly disclosed information from the rating agencies. The linear regression model is estimated based on observations measured at transaction cut-off date according to

$$S_i = a + X_i\beta + \varepsilon_i, \quad i = 1,\cdots n \tag{1}$$

where $S_i$ is the subordination level of transaction $i$ divided into five datasets of generalised ratings (AAA, AA, A, BBB and BB), $X_i$ is a vector of variables including LTV, DSCR, property type and loan concentrations identifiers as defined in Table 7 and $\varepsilon_i$ is the normal distributed disturbance**.** I use Newey-West standard errors and covariance to create heteroskedasticity consistent and robust coefficients.

I also test the empirical observations that rating agencies tend to be conservative in the early stage of the CMBS market or apply a “learning by doing” approach in subordination design, as is stated by Sanders (1999) and Riddiough and Chiang (2003). A simple line graph provides the necessary insight for this analysis. When we compare this output to the output as Downing, Stanton, and Wallace (2008) construct for the US CMBS market we can asses if levels have also dropped in Europe.

## 6.2. Regression results

Table 8 and Table 9 report regression results of all subordination levels with restricted explanatory variables. Academics point out LTV and DSCR ratio’s as the most important concern of CMBS investments and also rating agencies report to pay special attention to LTV, DSCR and balloon risks. Therefore I first run the simple models that include LTV, DSCR, and Exit LTV as explanatory variables (Table 8) and include these 3 variables separtely (Table 9). The latter model I use as a robustness check of the variables. The results in Table 9 show that LTV is, in accordance with academic literature, an important and significant variable in subordination design, except for B subordination levels. Table 9 shows that explanatory power of LTV differs from a low 6% for BBB till 37% for A tranches. The coefficient is positive corresponding to expectations expressed in Table 7. Furthermore both the DSCR and Exit LTV are not significantly influencing levels when regressed

together with LTV. When DSCR or Exit LTV is used as sole explanatory variable it becomes significant which confirms the issue of multi-collinearity as An, Deng and Sanders (2008) note in their research. DSCR is negative related but both the explanatory power and size of the coefficient are marginal. The coefficient of the Exit LTV is positive, which corresponds to the lower credit risk associated with a lower Exit LTV or refinancing risk. However explanatory power of both variables on a separate base is low.

In the extended model I add a number of variables. Again, I run two models to account for the multi-collinearity problem of LTV and DSCR as indicated by An, Deng Sanders (2007). For example, I add variables measuring loan and borrower concentration, property composition variables, and a vintage indication. Most of the relationships seen from the estimates are conforming to expectations from Table 7, e.g. the higher the percentage of loan concentration of the first loan, the higher the subordination levels are; while the lower the WA DSCR levels, the lower the subordination levels are, as Table 10 and Table 11 report. When we look at the loan concentrations variables only loan concentration seems to have some influence. Surprisingly the sign for top 1 and top 3 is contrary to each other, where the positive sign of the top 1 loan concentration matches the expectations. Also the sign of this variable changes within the BBB regression, which can be an indication that dataset values of this subordination level are unreliable. Within the country concentration variables only the percentage of Italian based assets is significant in explaining the variations in the AAA, AA, and A subordination levels in both models. The sign is positive as expected due to the relative poor performance of Italian assets and loans, and the risk of non performance. Coefficient signs of the other, not significant, countries are negative which indicates that concentrations in these countries are regarded as positive by the rating agencies and thus lower the subordination levels. Furthermore regression results show that the higher a single country concentration, the higher the subordination levels are, penalising the single market decline risk. However, this variable is only significant in the model without LTV for AAA and BBB subordination levels. The property indication variables do not show an added value in explaining variations in subordination levels. None of the variables are significant in either model and signs are strictly positive in contrary to expectations. There seems no evidence that rating agencies account for property type diversification or concentrations in their determination of subordination levels in contrary to statements and methodology description as Figure 7 shows.

The overall fitting of the two models is reasonable and explains a low 30% till a high 60% of the variations in subordination levels of AAA, AA, A ,BBB and BB. However, only a few variables are significant and the values of the variable coefficients are generally low. This is an indication that not a single variable, except for the WA LTV, is determining the subordination level and the rating agencies use a combination of several variables together to determine the requisite level of subordination.

## 6.3. Development of subordination levels

Table 12 and Panel A from Figure 8 report the weighted average AAA, AA, A, BBB subordination levels for the years 2000-2009, which follow a stable pattern except for the recent years. To provide some insight in the variations of the levels Figure 9 shows the AAA subordination levels of

transaction issued in 2006 and 2007. We clearly observe large deviations in the levels within the same rating class which hampers the determination of a clear trend line. Because of the low number of observations and the conservatism of the rating agencies following the financial crisis we should disregard the years 2008 and 2009 when determining a trend line in subordination levels. When we zoom in on the years with higher number of observations (2002-2007) we observe a slight decrease as Panel B from Figure 8 shows. However this decline is not substantial contrary to observations by Sanders (1999), Riddiough and Chiang (2003). By way of comparison, Panel C Figure 9 shows the results of recent research by Downing, Stanton and Wallace (2008). They found a substantial declining trend of subordination levels in the US CMBS markets. When we compare these figures we see a clear and substantial decline in the years 2002-2005 in the US market, while almost no decline is present within the European market and levels stay around the same percentages. Furthermore when we look at the vintage variable included in the regression models of Table 10 and Table 11 vintage is only significant for the AA levels and shows a very low coefficient sign. Again this confirms that levels have hardly changed throughout the years and vintage is of no influence on the subordination levels.

# 7. CONCLUSION

Subordination plays an important role in the structure of securitised transactions such as Commercial Mortgage-Backed Securities. Subordination design is in the interests of CMBS investors, issuers and rating agencies because subordination levels determine how investors buying senior CMBS notes are protected from credit risk and how much an issuer can get out of a certain commercial mortgage pool. Rating agencies essentially determine subordination levels for each CMBS transaction.

In this thesis I fill the gap of knowledge and research about determinants and the levels of subordination of the CMBS market in Europe. I perform cross sectional tests of differentials in European CMBS subordination levels using a unique dataset of European CMBS transactions. I test the determinants indicated in the rating agencies methodology reports as well as by academic research in order to assess their significance in the European CMBS market and their influence on the different rated tranches within the transactions. The results show that CMBS cut-off weighted average loan-to-value, debt service coverage ratio, loan-to-value at maturity, loan concentration and asset country concentration in Italy are significant factors in determining CMBS subordination levels. The extended model with all variables explains roughly 50% of cross sectional variations in AAA, AA, A, BBB and B subordination levels. However the weighted average LTV and weighted average DSCR themselves do not have a high explanatory power. The results furthermore show not a single variable, except for the weighted average LTV, is determining the subordination level. The rating agencies seem to use a combination of several variables together to determine the requisite level of subordination. Also results are not stable over the different ratings classes, which may be caused by the large variety of transactions structures and included assets within the European CMBS market.

In terms of evolvement of the subordination levels I observe that subordination level in the European CMBS market have not substantially declined over time. The European CMBS market does not seem to be influenced by the 'learning by doing' effect in the early stage of the market as has been observed in the US CMBS market.

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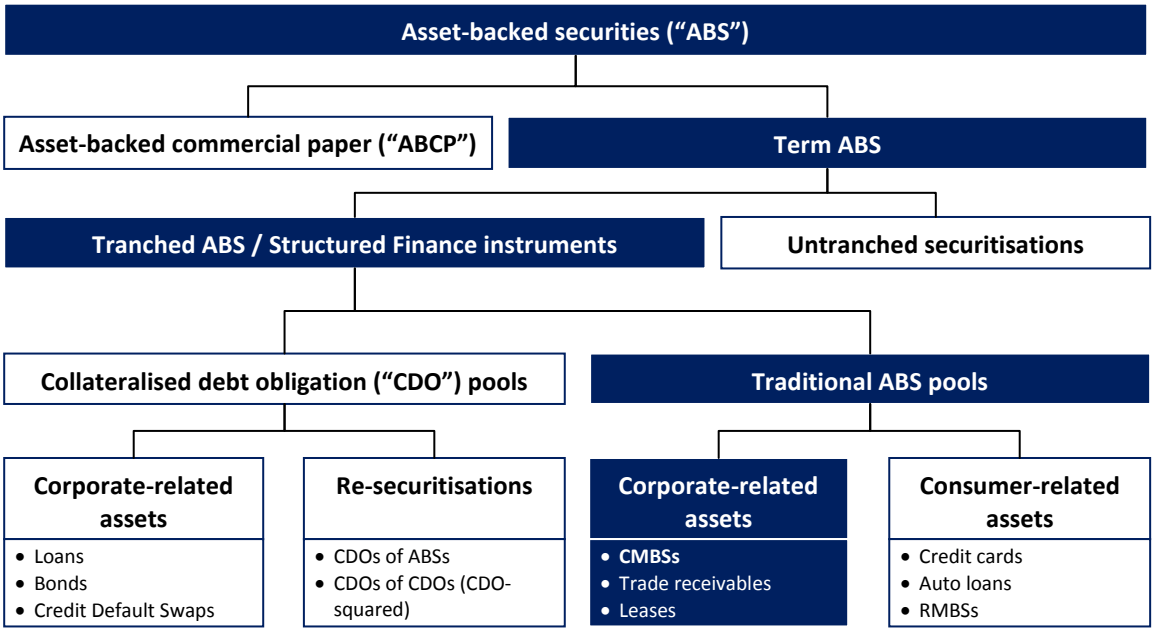
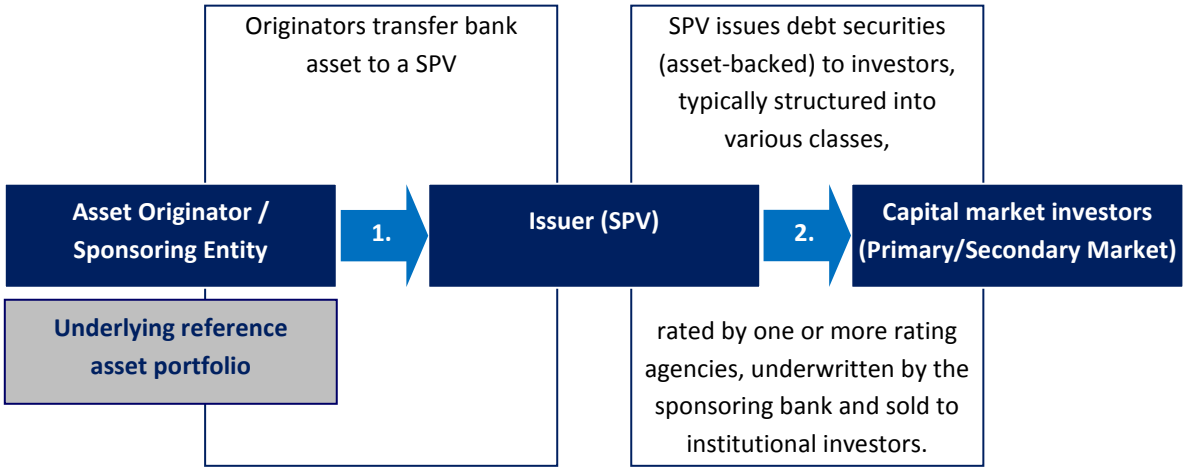
## FIGURE 1: ABS UNIVERSE

The figure is derived from the report published by the Committee on the Global Financial System (2005) and shows a stylised overview of the range of structured finance products as part of the ABS Universe. Within the overview the blue shaded part indicates the area of CMBS.



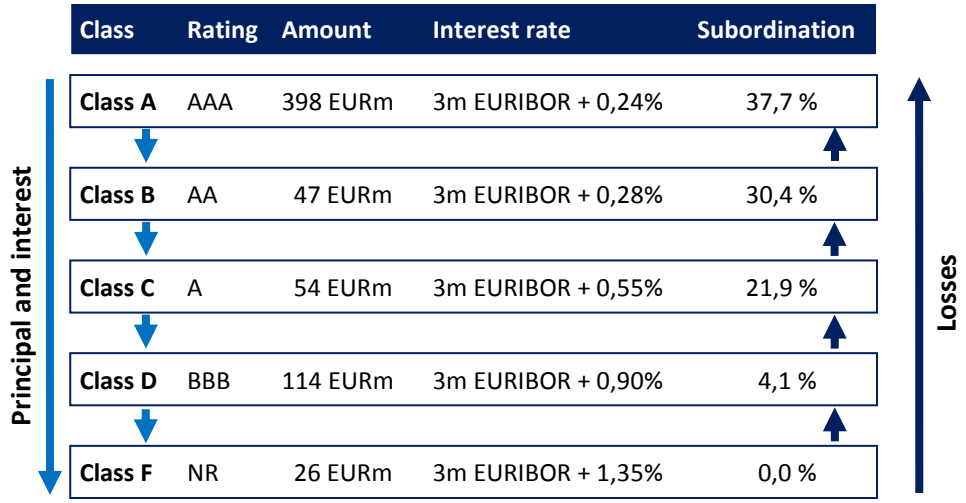

## FIGURE 2: BASIC SECURITISATION PROCESS

The figure is derived from Jobst (2005b) and shows the two basic steps in the creation of a securitisation transaction which is eventually placed in the capital markets.



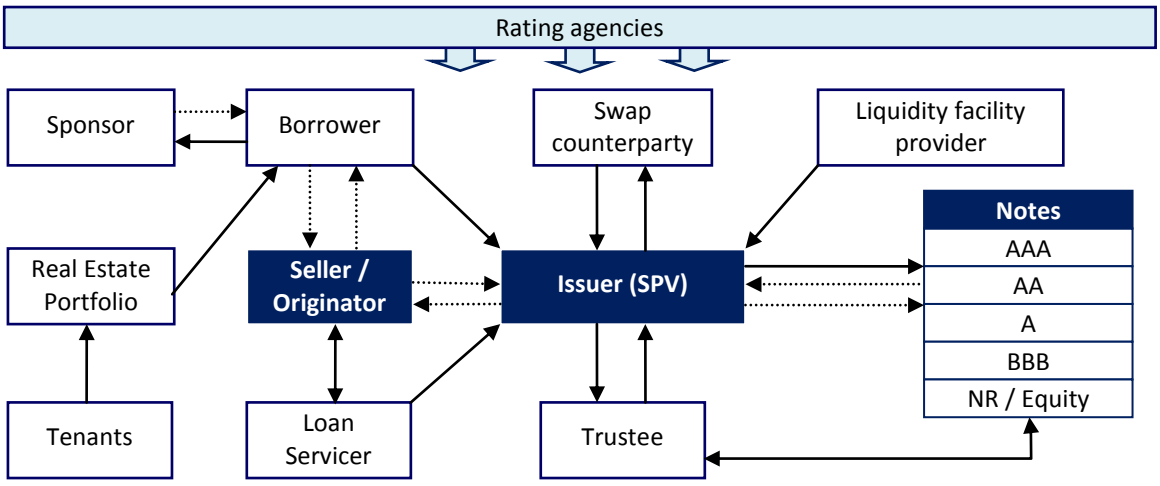
## FIGURE 3: EXAMPLE OF A 'WATERFALL'

The figure presents an example of a sequential pay structure, often referred to as 'waterfall'. The example is based on a simplified transaction overview of the CMBS transaction MESDAG Delta B.V. as reported in a new issue report by Fitch Ratings (2007).




## FIGURE 4: GENERIC EUROPEAN CMBS STRUCTURE

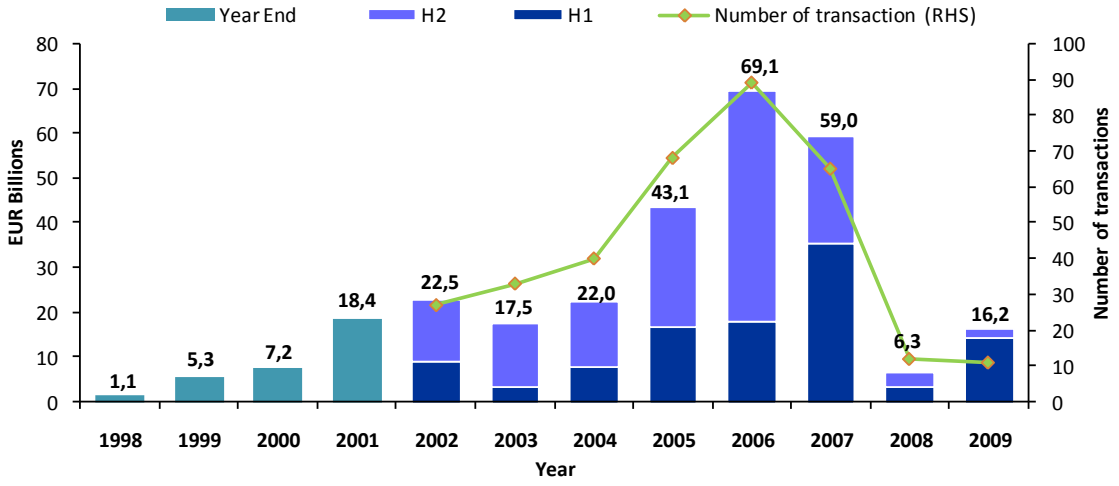
The structure overview is derived from Beekwilder (2005) and presents a simplified overview of a typical European CMBS transaction with the different actors.



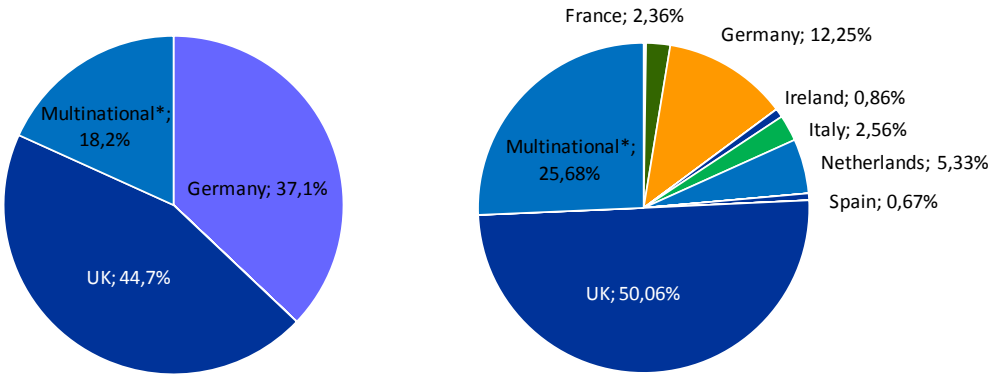
## FIGURE 5: EUROPEAN CMBS MARKET OVERVIEW

These figures present an overview of the European CMBS market as of the end of 2009. Panel A reports the yearly issuance and number of transactions stratified by half years as reported by Moody's. Panel B shows the segmentation by country both for the transactions issued in 2009 as well as for the total amounts outstanding of the current, still open, CMBS transactions. These figures are derived from the European Securitisation Forum quarterly reports. Finally Panel C reports the AAA CMBS spreads during the years 2007-2009 as reported by Markit.

**Panel A: EMEA CMBS Annual New Issuance Trend**

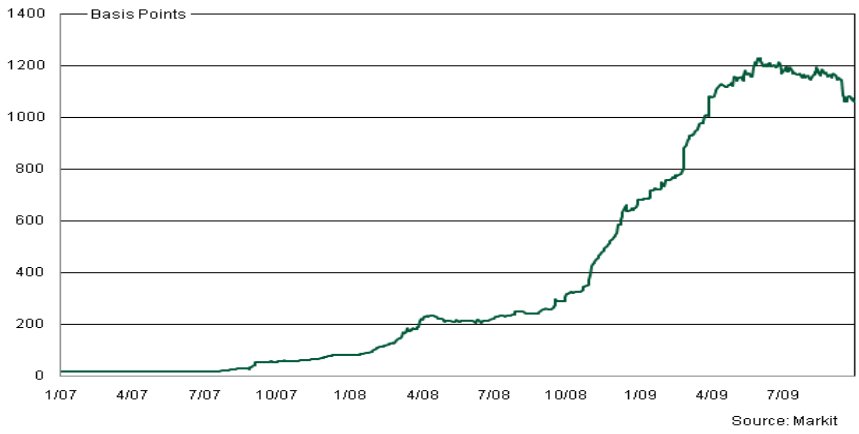



**Panel B: European CMBS Issuance by Country 2009 & Balances Outstanding by Country 2009**



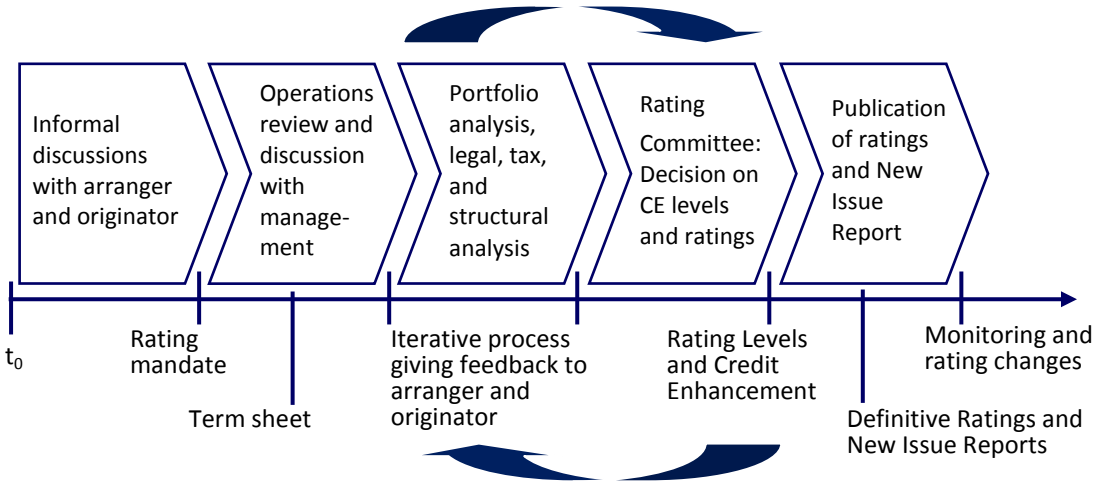

* Other includes European countries with outstanding securities that are too small to be displayed, such as Georgia, Iceland, China, Ukraine, Switzerland, Hungary, and Finland.

**Panel C: European 3-5 Yr AAA CMBS Spreads**



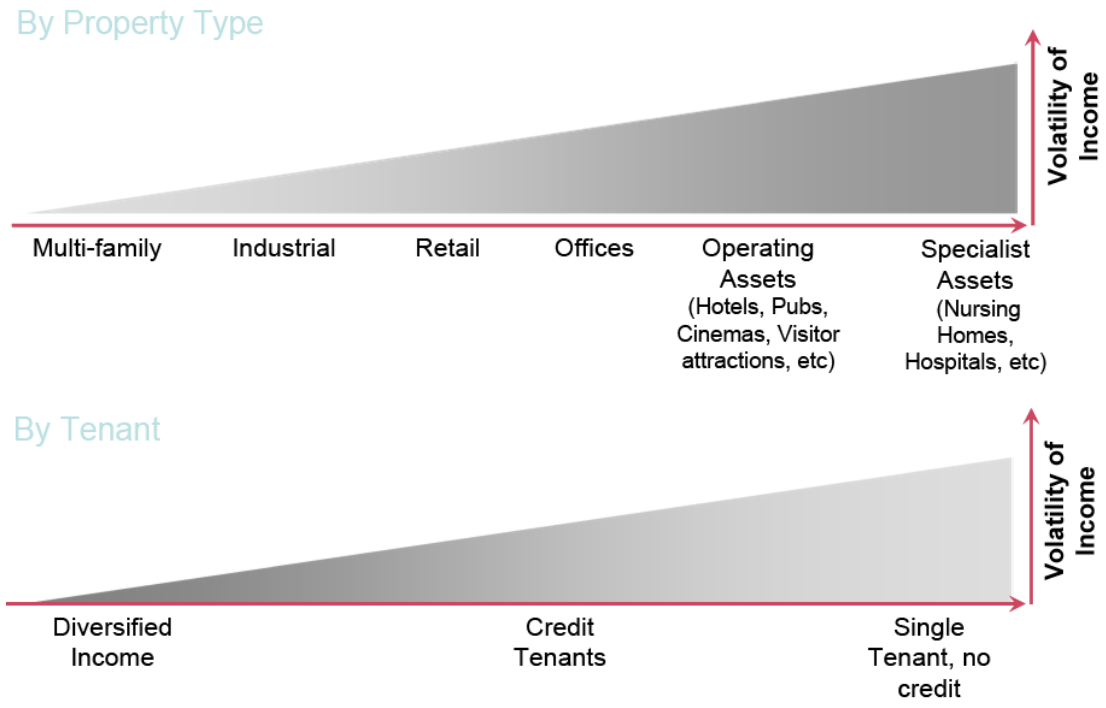
## FIGURE 6: A TYPICAL RATING AGENCY PROCESS

The figure presents the typical process of retrieving a credit rating on structured finance transaction according to Moody's Investors Service (2005).




## FIGURE 7: RISKS ASSOCIATED WITH PROPERTY TYPE

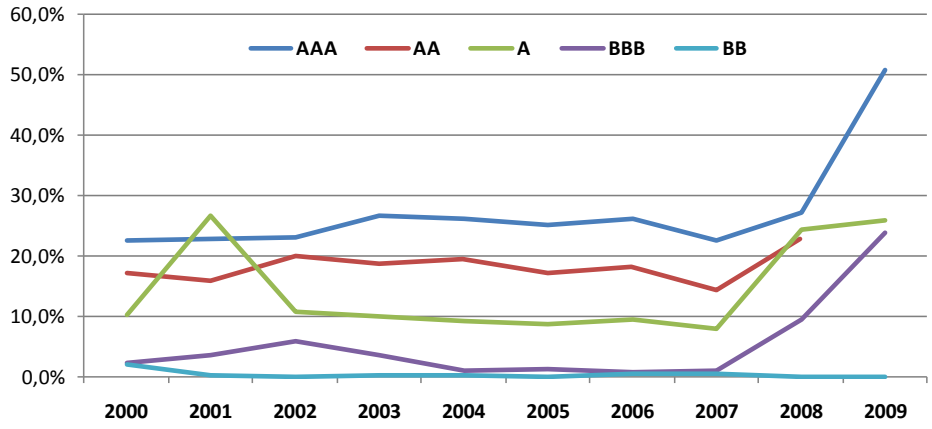
The figures present an overview of the risk weights measured by rental income volatility distributed to property type and property income volatility distributed to number and type of tenants. Presented by Fitch on the CMSA-Europe conference 2008 and derived from Pelletier, Tayebi, and Paredes (2008)



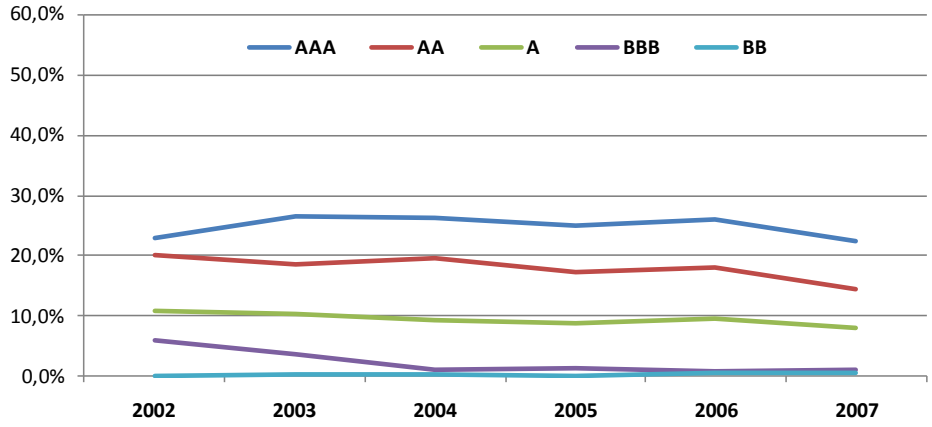
## FIGURE 8: HISTORICAL WEIGHTED AVERAGE SUBORDINATION LEVELS OBSERVED IN THE SAMPLE

These figures plots the calculated historical weighted average subordination levels in European CMBS transactions over the years 2000 till 2009 based on generalised ratings. A trend line for B rating subordination levels is not available due to the low number of observations. Panel A shows all years, while Panel B covers the period 2002-2007 which provide a better view of the trend in subordination levels because of the omission of early and recent year's observations which have a low number of observations. Panel C shows the decline in subordination levels in the US market over the years 1995-2005 as observed by Downing, Stanton, and Wallace (2008), who observe a clearly declining line in contrary to the European figures.

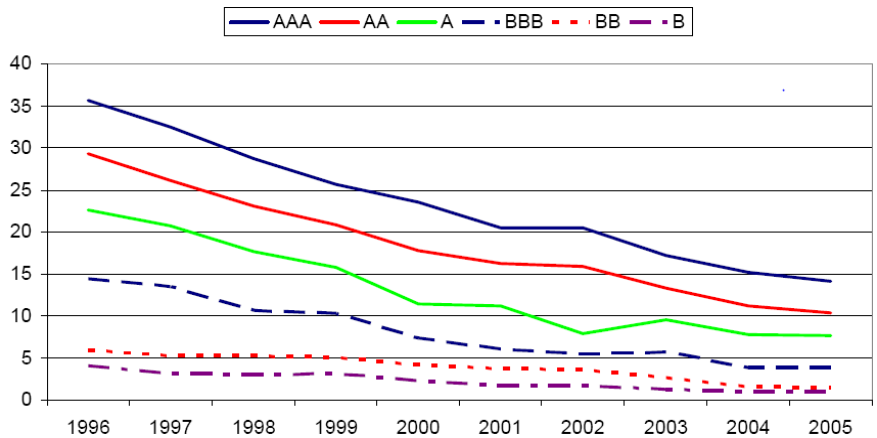
**Panel A: Historical Weighted Average Subordination Levels in the Sample 2000-2009**




**Panel B: Historical Weighted Average Subordination Levels in the Sample 2002-2007**

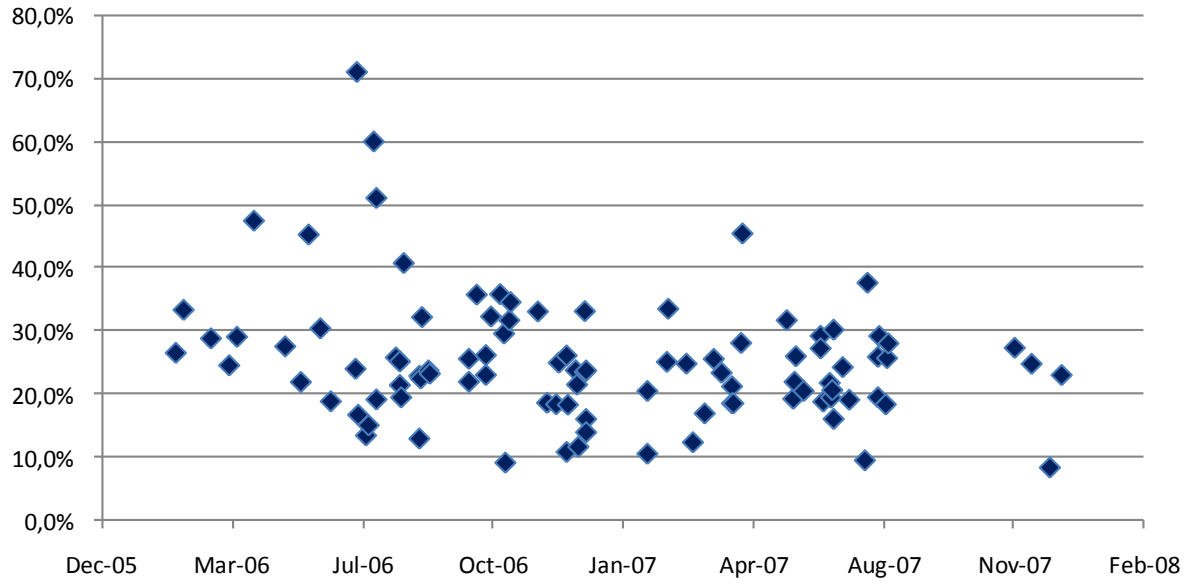



**Panel C: US subordination levels 1996-2005 derived from Downing, Stanton, and Wallace (2008)**



## FIGURE 9: VARIATIONS OBSERVED IN HISTORICAL AAA SUBORDINATION LEVELS 2006-2007

The figure plots the calculated historical AAA subordination levels in European CMBS transactions in the sample against the issue date. The figure is limited to the range begin of 2006 till the end of 2007 to provide some insight in the variation of subordination level for the same rated tranches within European CMBS transactions.



## TABLE 1: OVERVIEW OF INTERNATIONAL LONG-TERM CREDIT RATINGS

The table presents mapped international long-term credit rating as assigned by the three major rating agencies. Ratings below BBB, indicated by the dotted line, are non-investment grade, while all ratings from BBB till AAA are investment grade.

| Moody's* | Fitch** | S&P*** | Definition |
|---|---|---|---|
| Aaa | AAA | AAA | Minimal credit risk |
| Aa | AA | AA | Very low credit risk |
| A | A | A | Low credit risk |
| Baa | BBB | BBB | Moderate credit risk |
| Ba | BB | BB | Substantial credit risk |
| B | B | B | High credit risk |
| Caa | CCC | CCC | Very high credit risk |
| Ca | CC | CC | Some prospect for recovery |
| C | C | C | Little prospect for recovery |
| | RD | | Indicates an entity that has failed to make due payments (within the applicable grace period) on some but not all material financial obligations, but continues to honor other classes of obligations. |
| | D | D | Defaulted |
| | | N.R. | This indicates that no rating has been requested, that there is insufficient information on which to base a rating, or that Standard & Poor's does not rate a particular obligation as a matter of policy. |

* Moody's appends numerical modifiers 1, 2, and 3 to each generic rating classification from Aa through Caa. The modifier 1 indicates that the obligation ranks in the higher end of its generic rating category; the modifier 2 indicates a mid-range ranking; and the modifier 3 indicates a ranking in the lower end of that generic rating category.

** The modifiers "+" or "-" may be appended to a rating to denote relative status within major rating categories. Such suffixes are not added to the 'AAA' Long-term rating category, to categories below 'CCC', or to Short-term ratings other than 'F1'.

*** Plus (+) or minus (-) :The ratings from 'AA' to 'CCC' may be modified by the addition of a plus (+) or minus (-) sign to show relative standing within the major rating categories.

## TABLE 2: SOURCES AND WAY OF CALCULATION OF THE VARIABLES IN THE SAMPLE

The variables are all observed at transaction cut-off / issue date and have been retrieved from Bloomberg®, complemented in large extend with information from the rating agencies Moody's and Fitch retrieved from available issuance reports of all transactions. The availability of these report thus is limited to the historical fact that Fitch or Moody's was assigned to rate a certain transaction. In this table the leading source I use is indicated for each variable, also the table explains adjustments to the data or ways of calculation.

| | Leading Source | Other sources | Comment |
|---|---|---|---|
| **Subordination levels** | Calculated | | The subordination level for a certain tranche has been calculated by dividing the total amount of the tranches underlying the tranche by the total deal amount and thus represents the percentage loss the deal can handle before the mentioned tranche will suffer a loss. |
| **WA LTV** | Fitch | Moody's Bloomberg | Leading source is Fitch, if information was not available then Moody's figures were taken. If both are not available the Bloomberg is taken as source. |
| **WA Exit LTV** | Fitch | Moody's | Leading source is Fitch because exit LTV is standard reported in issue reports, if information was not available then Moody's figures were taken. Bloomberg does not report exit LTVs.<br>For regression purposes blank values have been replaced with the WA LTV, which indicates no amortisation of the loans and thus the highest risk of refinancing. |
| **WA DSCR** | Fitch | Moody's Bloomberg | Leading source is Fitch, if information was not available then Moody's figures were taken. If both were not available the Bloomberg was taken as source. |
| **Number of Loans** | Moody's | Fitch | Leading source is Moody's, if information was not available then Fitch figures were taken. |
| **Loan concentration variables** | Fitch Moody's | | Combined information from Fitch and Moody's issue reports. Percentages of loan concentration are base on loan amount compared to total deal amount. |
| **Number of Borrowers** | Moody's | Fitch | Main source is Moody's, because number of borrowers is standard reported in their issue reporting. If not available because Moody's haven't rated the deal then Fitch was used as source. |
| **Geographic concentration variables** | Fitch Moody's | | Combined information from Fitch and Moody's issue reports. Country distribution of the assets is measured in percentage of total market value. |
| **Property type variables** | Fitch Moody's | | Combined information from Fitch and Moody's issue reports. Distribution of each type of property is in percentage of total market value. |
| **Number of Properties** | Fitch Moody's | | Combined information from Fitch and Moody's issue reports. |

## TABLE 3: LISTING OF EUROPEAN CMBS TRANSACTIONS INCLUDED IN THE SAMPLE

The table lists all transaction included in the sample and states their year of issuance, transaction name, full name, denomination and original number of tranches.

| Year | Deal name (Bloomberg) | Deal name | Denomi-nation | Original number of tranches | Number of obs. in Sample [1] |
|---|---|---|---|---|---|
| 2000 | EURL 1 | Europa One Limited | EUR | 9 | 5 |
| 2000 | MONU 1 | Monument Securitisation No. 1 plc | GBP | 5 | 4 |
| 2000 | EURO 4X | European Loan Conduit No.4 plc | GBP | 5 | 3 |
| 2001 | EURL 2 | Europa Two Limited | EUR | 10 | 5 |
| 2001 | EURO 5X | European Loan Conduit No 5 plc | GBP | 6 | 4 |
| 2001 | HERIT 1 | Heritage Mortgage Securities | GBP | 5 | 4 |
| 2001 | EURO 7X | Bromios (European Loan Conduit No. 7) plc | GBP | 6 | 4 |
| 2001 | EURO 8X | Coronis (European Loan Conduit No.8) plc | GBP | 6 | 4 |
| 2001 | AMETH 1 | Amethyst Finance PLC | GBP | 3 | 1 |
| 2001 | WINDM 1X | Windermere CMBS plc | GBP | 6 | 4 |
| 2002 | PROLO 2 | Pan-European Industrial Properties Series II S.A. | EUR | 3 | 2 |
| 2002 | HELOC 1X | HOTELoC plc | GBP | 7 | 4 |
| 2002 | NYMPH 2002-1 | Nymphenburg 2002-1 Limited | EUR | 11 | 5 |
| 2002 | DUKEL 02 | DUKE 2002 Limited | EUR | 7 | 4 |
| 2002 | EURO 11X | Feronia (European Loan Conduit No.11) plc | GBP | 5 | 4 |
| 2002 | WUERT EU-1 | WuerttHyp EU-1 | EUR | 6 | 4 |
| 2002 | GECO 2002 | GECO 2002 Limited | EUR | 8 | 5 |
| 2002 | BAMBU 1 | Bamburgh Finance No.1 Plc | GBP | 5 | 4 |
| 2002 | INTRA 1 | Intra Mortgage Finance 1 S.r.l. | EUR | 3 | 2 |
| 2003 | PROLO 3 | Pan-European Industrial Properties Series III S.A. | EUR | 3 | 2 |
| 2003 | EURO 12 | Gorgons (European Loan Conduit No. 12) FCC | EUR | 8 | 4 |
| 2003 | REC 1 | Real Estate Capital No. 1 Plc | GBP | 6 | 4 |
| 2003 | LOMB 1 | Lombard Securities No.1 plc | GBP | 9 | 5 |
| 2003 | EURO 14X | Hermione (European Loan Conduit No.14) plc | GBP | 7 | 4 |
| 2003 | DECO 2003-CITX | DECO SERIES 2003 - CIT p.l.c. | GBP | 5 | 3 |
| 2003 | EURO 15X | IOLAUS (European Loan Conduit No. 15) plc | GBP | 10 | 4 |
| 2003 | OPERA 1 | Opera Finance No.1 plc | GBP | 5 | 4 |
| 2003 | PARES 1X | Paris Residential Funding | EUR | 5 | 4 |
| 2003 | DECO 2003-CENX | DECO Series 2003 - Centro Limited | EUR | 7 | 3 |
| 2003 | NIGHT 1 | Nightingale Funding PLC | GBP | 5 | 4 |
| 2003 | EURO 17X | Khronos (European Loan Conduit No. 17) S.A. | EUR | 6 | 4 |
| 2003 | COEUR 1 | Coeur Defense F.C.C. | EUR | 4 | 3 |
| 2004 | LADF III | La Defense III Plc | EUR | 3 | 2 |
| 2004 | WTOW 2004-1 | White Tower 2004-1 Plc | GBP | 5 | 4 |
| 2004 | SANDW 1 | Sandwell Commercial Finance No.2 plc | GBP | 5 | 4 |
| 2004 | REC 2 | Real Estate Capital No. 2 Plc | GBP | 5 | 4 |
| 2004 | EURO 18X | Leto (European Loan Conduit No.18) FCC | EUR | 6 | 4 |
| 2004 | MARL 1 | Marlin (EMC-II) B.V. | EUR | 4 | 3 |
| 2004 | OPERA LAKE | Opera Finance (Lakeside) PLC | GBP | 3 | 2 |
| 2004 | EURO 19X | Morpheus (European Loan Conduit No.19) plc | GBP | 5 | 4 |
| 2004 | EURO 20 | Nereus (European Loan Conduit No. 20) p.l.c | EUR | 5 | 3 |
| 2004 | EPICP CASP | Epic (Caspar) plc | GBP | 4 | 3 |
| 2004 | SELFS 1 | Self-Storage Securitisation B.V. | EUR | 3 | 2 |
| 2004 | EPOP ARLI | Epic Opera (Arlington) plc | GBP | 5 | 3 |
| 2004 | WINDM IVX | Windermere IV CMBS plc | GBP | 8 | 4 |
| 2004 | TITN 2004-1 | Titan Europe 2004-1 plc | GBP | 6 | 5 |
| 2004 | HALLM 1 | Hallam Finance Plc | EUR | 3 | 2 |
| 2004 | QSTAR 1 | Quick Star Plc | GBP | 5 | 3 |
| 2004 | TITN 2004-2X | TITAN EUROPE 2004-2 p.l.c. | EUR | 6 | 5 |

| | | | | | |
|---|---|---|---|---|---|
| 2005 | OPERA METC | Opera Finance (MetroCentre) PLC | GBP | 4 | 3 |
| 2005 | EPICP UNIT | Epic (UNITE) plc | GBP | 6 | 3 |
| 2005 | TAURS 1 | Taurus CMBS No. 1 plc | GBP | 6 | 3 |
| 2005 | REDEV 1 | Redevco Original Commercial Securitisation PLC | GBP | 2 | 1 |
| 2005 | ECLIP 2005-1 | AQUILA (ECLIPSE 2005-1) plc | GBP | 5 | 4 |
| 2005 | REC 3 | Real Estate Capital (Foundation) Limited | GBP | 3 | 2 |
| 2005 | OPERA FP | Opera Finance (Fosse Park) plc | GBP | 4 | 3 |
| 2005 | OPERA SCOT | Opera Finance (Scottish Retail) PLC | GBP | 4 | 3 |
| 2005 | OPERA CSC3 | Opera Finance (CSC 3) PLC | GBP | 4 | 3 |
| 2005 | WTOW 2005-1 | White Tower 2005-1 plc | GBP | 5 | 4 |
| 2005 | WINDM VX | Windermere V CMBS S.R.L. | EUR | 7 | 3 |
| 2005 | OPERA UNI | Opera Finance (Uni-Invest) B.V. | EUR | 4 | 3 |
| 2005 | TMAN 1 | TALISMAN-1 FINANCE P.L.C. | EUR | 7 | 4 |
| 2005 | FORES 1 | Forest Finance Plc | EUR | 3 | 2 |
| 2005 | VALES 1 | Valesco Funding plc | EUR | 7 | 3 |
| 2005 | TITN 2005-1X | TITAN EUROPE 2005-1 p.l.c. | EUR | 6 | 4 |
| 2005 | DECO 2005-C1X | DECO Series 2005 - UK Conduit 1 plc | GBP | 5 | 3 |
| 2005 | DOLER 2 | Dolerite Funding No. 2 plc | GBP | 5 | 4 |
| 2005 | EPRE 1-X | European Prime Real Estate No.1 plc | GBP | 4 | 3 |
| 2005 | FLTST 1 | Fleet Street Finance One plc | GBP | 5 | 4 |
| 2005 | URSUS 1-X | Ursus EPC p.l.c. | GBP | 5 | 4 |
| 2005 | DECO 2005-E1X | DECO Series 2005 - Pan Europe 1 p.l.c. | EUR | 9 | 4 |
| 2005 | ECLIP 2005-2 | BELLATRIX (ECLIPSE 2005-2) plc | GBP | 5 | 3 |
| 2005 | SANDW 2 | Sandwell Commercial Finance No.2 Plc | GBP | 5 | 4 |
| 2005 | DECO 2005-UK1X | DECO 5 - UK Large Loan 1 plc | GBP | 3 | 1 |
| 2005 | TITN 2005-CT1X | Cornerstone Titan 2005-1 plc | GBP | 7 | 4 |
| 2005 | EMC 3 | Victoria Funding (EMC-III) plc | GBP | 5 | 4 |
| 2005 | WINDM VI-X | Windermere VI CMBS Plc | GBP | 6 | 4 |
| 2005 | PROUL 1 | LCP Proudreed PLC | GBP | 4 | 3 |
| 2005 | PROUD 1 | FCC Proudreed Properties 2005 | EUR | 5 | 3 |
| 2005 | IMMEO 1 | Immeo Residential Finance plc | EUR | 4 | 3 |
| 2005 | OPERA MEPC | Opera Finance (MEPC) Plc | GBP | 4 | 2 |
| 2005 | LORDS 1 | London & Regional Debt Securitisation No.1 plc | GBP | 2 | 1 |
| 2005 | DECO 6-UK2X | DECO 6 - UK Large Loan 2 plc | GBP | 5 | 3 |
| 2005 | PROMI 1 | Prominent CMBS Funding No.1 PLC | GBP | 6 | 4 |
| 2005 | EPICP AYTN | Epic (Ayton) plc | GBP | 6 | 3 |
| 2005 | EURO 21 | Odysseus (European Loan Conduit No. 21) FCC | EUR | 3 | 2 |
| 2005 | TAURS 2 | TAURUS CMBS No.2 S.r.l. | EUR | 7 | 4 |
| 2005 | EPC 3 | European Property Capital 3 p.l.c. | EUR | 4 | 3 |
| 2005 | ECLIP 2005-4 | DRACO (ECLIPSE 2005-4) plc | GBP | 6 | 3 |
| 2005 | TAHIT 1 | Tahiti Finance Plc | GBP | 3 | 2 |
| 2005 | ECLIP 2005-3 | Centaurus (Eclipse 2005-3) plc | EUR | 5 | 3 |
| 2005 | TITN 2005-CT2X | Cornerstone Titan 2005-2 plc | GBP | 7 | 4 |
| 2005 | EURO 22X | Perseus (European Loan Conduit No.220 plc | GBP | 6 | 3 |
| 2006 | VWALL 1 | Vanwall Finance plc | GBP | 6 | 3 |
| 2006 | OPERA CMH | Opera Finance (CMH) p.l.c. | EUR | 4 | 3 |
| 2006 | MESDG 1 | MESDAG (Berlin) B.V. | EUR | 6 | 5 |
| 2006 | TITN 2006-1X | TITAN Europe 2006-1 p.l.c. | EUR | 8 | 5 |
| 2006 | DECO 7-E2X | DECO 7 - Pan Europe 2 p.l.c. | EUR | 9 | 4 |
| 2006 | WTOW 2006-1 | White Tower 2006-1 plc | GBP | 4 | 3 |
| 2006 | DECO 8-C2X | DECO 8 - UK Conduit 2 plc | GBP | 8 | 4 |
| 2006 | WINDM VII-X | Windermere VII CMBS plc | EUR | 7 | 4 |
| 2006 | LEOCM 1 | LEO (UK) CMBS No.1 plc | GBP | 3 | 2 |
| 2006 | TITN 2006-2X | TITAN Europe 2006-2 p.l.c. | EUR | 9 | 5 |
| 2006 | TMAN 3 | TALISMAN-3 FINANCE PLC | EUR | 6 | 5 |
| 2006 | TITN 2006-3X | TITAN Europe 2006-3 p.l.c. | EUR | 8 | 5 |
| 2006 | PTRMO 2006-1 | Patrimonio Uno CMBS S.r.l. | EUR | 6 | 2 |
| 2006 | EPICP BROD | Epic (Brodie) plc | EUR | 7 | 3 |
| 2006 | ECLIP 2006-1 | EQUINOX (ECLIPSE 2006-1) | GBP | 6 | 3 |
| 2006 | EURO 23X | Quirinus (European Loan Conduit No. 23) plc | EUR | 6 | 3 |
| 2006 | WTOW 2006-2 | White Tower 2006-2 plc | GBP | 5 | 3 |
| 2006 | TAURS 3 | Taurus CMBS (Germany) 2006-1 plc | EUR | 4 | 3 |
| 2006 | URSUS 2-X | Ursus 2 (Octane) plc | GBP | 6 | 2 |
| 2006 | LORDS 2 | London & Regional Debt Securitisation No.2 plc | GBP | 3 | 2 |

| | | | | | |
|---|---|---|---|---|---|
| 2006 | EMC 4 | EuroProp (EMC) S.A. (Compartment 1) | EUR | 6 | 4 |
| 2006 | TITN 2006-CT1X | Cornerstone Titan 2006-1 plc | GBP | 9 | 5 |
| 2006 | WINDM VIII-X | Windermere VIII CMBS Plc | GBP | 7 | 4 |
| 2006 | GRND 1 | German Residential Asset Note Distributor p.l.c. | EUR | 6 | 3 |
| 2006 | DECO 9-E3X | DECO 9 - Pan Europe 3 p.l.c. | EUR | 10 | 4 |
| 2006 | TMAN 4 | TALISMAN-4 FINANCE PLC | EUR | 7 | 5 |
| 2006 | QUOKK 2006-1 | Quokka Finance p.l.c. | EUR | 5 | 3 |
| 2006 | REC 5 | REC Plantation Place Limited | GBP | 5 | 3 |
| 2006 | GRF 2006-1 | German Residential Funding p.l.c. | EUR | 6 | 3 |
| 2006 | EURO 24X | Radamantis (European Loan Conduit No.24) plc | GBP | 7 | 3 |
| 2006 | ECLIP 2006-2 | Fornax (Eclipse 2006-2) B.V. | EUR | 7 | 4 |
| 2006 | OPERA GER1 | Opera Germany (No. 1) GmbH | EUR | 4 | 3 |
| 2006 | LEMES 2006-1 | LEO-MESDAG B.V. | EUR | 5 | 3 |
| 2006 | EPICP INDU | Epic (Industrious) plc | GBP | 6 | 3 |
| 2006 | EMC 5 | Victoria Funding (EMC V) Plc | GBP | 4 | 3 |
| 2006 | INFIN CLAS | Infinity 2006-1 Classico | EUR | 5 | 2 |
| 2006 | EPICP MLDN | Epic (More London) plc | GBP | 6 | 3 |
| 2006 | EPC 4 | European Property Capital 4 p.l.c. | GBP | 5 | 3 |
| 2006 | FOX 1 | Fordgate Commercial Securitisation No.1 plc | GBP | 2 | 1 |
| 2006 | PPCRE 2006-1 | Paris Prime Commercial Real Estate FCC | EUR | 5 | 3 |
| 2006 | FLTST 2 | Fleet Street Finance Two P.L.C. | EUR | 4 | 3 |
| 2006 | ECLIP 2006-3 | GEMINI (ECLIPSE 2006-3) plc | GBP | 5 | 3 |
| 2006 | TAURS 4 | Taurus CMBS (UK) 2006-2 Plc | GBP | 4 | 3 |
| 2006 | WINDM IX-X | Windermere IX CMBS (Multifamily) S.A. | EUR | 4 | 2 |
| 2006 | TAURS 2006-3 | Taurus CMBS (Pan-Europe) 2006-3 P.L.C. | EUR | 4 | 3 |
| 2006 | DECO 2006-E4X | DECO 10 - Pan Europe 4 p.l.c. | EUR | 7 | 4 |
| 2006 | WTOW 2006-3 | White Tower 2006-3 plc | GBP | 5 | 3 |
| 2006 | ECLIP 2006-4 | Hercules (Eclipse 2006-4) plc | GBP | 5 | 3 |
| 2006 | TMAN 5 | Talisman-5 Finance PLC | EUR | 5 | 3 |
| 2006 | NEMUS 2006-2 | Nemus II (Arden) PLC | GBP | 6 | 4 |
| 2006 | USAF 2006-1 | UNITE (USAF) plc | GBP | 2 | 1 |
| 2006 | OPERA GER2 | Opera Germany (No. 2) p.l.c. | EUR | 5 | 3 |
| 2006 | DECO 2006-C3X | DECO 11 - UK Conduit 3 plc | GBP | 8 | 4 |
| 2006 | NACRE 2006-1 | FCC Nacrea | EUR | 2 | 1 |
| 2006 | TITN 2006-5X | TITAN Europe 2006-5 p.l.c. | EUR | 8 | 4 |
| 2006 | RIVOL 2006-1 | RIVOLI Pan Europe 1 plc | EUR | 3 | 2 |
| 2007 | WILCO 2007-1 | Wilco 2007–1 GmbH | EUR | 2 | 1 |
| 2007 | BRUNT 2007-1 | Bruntwood Alpha PLC | GBP | 3 | 2 |
| 2007 | EPICP CULZ | Epic (Culzean) plc | GBP | 6 | 3 |
| 2007 | REC 6 | Alburn Real Estate Capital Limited | GBP | 5 | 3 |
| 2007 | TITN 2007-CT1X | Cornerstone Titan 2007-1 p.l.c. | EUR | 8 | 4 |
| 2007 | DECO 2007-C4X | DECO 12 - UK Conduit 4 plc | GBP | 7 | 4 |
| 2007 | EURO 25X | SILENUS (European Loan Conduit No. 25) Limited | EUR | 7 | 4 |
| 2007 | DECO 2007-E5X | DECO 14 - Pan Europe 5 B.V. | EUR | 9 | 4 |
| 2007 | TMAN 6 | Talisman-6 Finance PLC | EUR | 6 | 4 |
| 2007 | WINDM X-X | Windermere X CMBS Limited | EUR | 6 | 4 |
| 2007 | ECLIP 2007-1X | Indus (ECLIPSE 2007-1) plc | GBP | 5 | 4 |
| 2007 | EURO 26X | Triton (European Loan Conduit No.26) plc | GBP | 9 | 3 |
| 2007 | MESDG CHAR | MESDAG (Charlie) B.V. | EUR | 5 | 3 |
| 2007 | OPERA GER3 | Opera Germany (No. 3) limited | EUR | 2 | 1 |
| 2007 | TITN 2007-1X | Titan Europe 2007-1 (NHP) Limited | GBP | 5 | 3 |
| 2007 | INFIN SOPR | Infinity 2007-1 “SoPRANo” | EUR | 7 | 4 |
| 2007 | ECLIP 2007-2X | Juno (Eclipse 2007-2) Ltd | EUR | 5 | 4 |
| 2007 | WTOW 2007-1 | White Tower Europe 2007-1 | EUR | 5 | 4 |
| 2007 | IMMEO 2 | Immeo Residential Finance No. 2 Limited | EUR | 4 | 2 |
| 2007 | FLTST 3 | Fleet Street Finance Three P.L.C. | EUR | 6 | 3 |
| 2007 | TITN 2007-2X | Titan Europe 2007-2 Limited | EUR | 8 | 4 |
| 2007 | EPICP DRUM | EPIC (DRUMMOND) LIMITED | EUR | 7 | 3 |
| 2007 | EMC 6 | EuroProp (EMC VI) S.A. | EUR | 6 | 4 |
| 2007 | SMPER 2007-1 | Semper Finance 2007-1 GmbH | EUR | 9 | 5 |
| 2007 | DECO 2007-E6X | DECO 15 - Pan Europe 6 Limited | EUR | 9 | 4 |
| 2007 | SKYL 2007-1 | Skyline 2007 B.V. | EUR | 6 | 5 |
| 2007 | TMAN 7 | Talisman-7 Finance Limited | EUR | 10 | 5 |
| 2007 | EURO 27X | Ulysses (European Loan Conduit No.27) PLC | GBP | 5 | 3 |
| 2007 | PROMI 2 | Prominent CMBS Conduit No.2 Limited | GBP | 6 | 4 |
| 2007 | EPICP VRET | Epic (Value Retail) Limited | EUR | 3 | 1 |

| | | | | | |
|---|---|---|---|---|---|
| 2007 | PROMI 2 | Prominent CMBS Conduit No.2 Limited | GBP | 6 | 4 |
| 2007 | EPICP VRET | Epic (Value Retail) Limited | EUR | 3 | 1 |
| 2007 | MESDG DELT | MESDAG (Delta) B.V. | EUR | 6 | 3 |
| 2007 | TAURS 2007-1 | Taurus CMBS (Pan-Europe) 2007-1 Limited | EUR | 7 | 4 |
| 2007 | WINDM XI-X | Windermere XI CMBS Plc | GBP | 5 | 4 |
| 2007 | EPOP ARL2 | Epic Opera (Arlington) Limited | GBP | 6 | 3 |
| 2007 | EURO 28X | VULCAN (European Loan Conduit No. 28) Limited | EUR | 7 | 4 |
| 2007 | TITN 2007-3X | Titan Europe 2007-3 Limited | GBP | 8 | 5 |
| 2007 | WINDM XII-X | Windermere XII FCC | EUR | 8 | 3 |
| 2007 | GRGER 2007-1 | Portfolio GREEN German CMBS GmbH | EUR | 8 | 6 |
| 2007 | WINDM XIV-X | Windermere XIV CMBS Limited | EUR | 6 | 3 |
| 2007 | CXNOV 2007-1 | AyT Caixanova Hipotecario I | EUR | 5 | 4 |
| 2007 | DECO 2007-E7X | DECO 17 - Pan Europe 7 Limited | EUR | 8 | 4 |
| 2008 | EURO 29X | Xuthus (European Loan Conduit No. 29) SA | EUR | 3 | 2 |
| 2008 | SANDW 3 | Sandwell Commercial Finance No.3 Limited | GBP | 8 | 4 |
| 2008 | FOUND 2008-1 | Foundation CMBS Limited | EUR | 2 | 1 |
| 2008 | PROOD 2008-1 | Proodos Funding Limited | EUR | 2 | 1 |
| 2008 | REC 7 | Real Estate Capital No. 7 Plc | GBP | 2 | 1 |
| 2009 | WIRE 2008-1 | WIRE 2008-1 GmbH | EUR | 3 | 1 |
| 2009 | MRGAN 2009-1 | Morrigan CMBS 1 Limited | EUR | 2 | 1 |
| 2009 | MRGAN 2009-2 | Morrigan CMBS 2 Plc | GBP | 2 | 1 |
| 2009 | PALLD 2009-1 | Palladium Funding No.1 Limited | EUR | 3 | 2 |

[1] See Table 5 for an explanation of the number of observations included.

## TABLE 4: CUT-OFF YEAR DISTRIBUTION OF THE EUROPEAN CMBS TRANSACTIONS IN THE SAMPLE

The table reports summary statistics for the sample stratified on cut-off year or issue date of the transaction. The original dataset included 280 transactions back to 1995, of which 71 were excluded because of either lack of information, structure deviations, different types of asset underlying the transaction, number of tranches equal to one, or other reasons as tap or disposal fund transactions. Another 10 were excluded because being synthetic and showing abnormal subordination levels.

**Panel A: Number of Transactions**

| Year | Frequency | Percentage of total | Frequency EUR denom. deals | Frequency GBP denom. deals | All EMEA deals in the year [2] | Percentage of all EMEA deals in the year |
|---|---|---|---|---|---|---|
| 2000 | 3 | 1,5% | 1 | 2 | n.a. | n.a. |
| 2001 | 7 | 3,5% | 1 | 6 | n.a. | n.a. |
| 2002 | 9 | 4,5% | 6 | 3 | 27 | 33,3% |
| 2003 | 13 | 6,5% | 6 | 7 | 33 | 39,4% |
| 2004 | 17 | 8,5% | 7 | 10 | 40 | 42,5% |
| 2005 | 44 | 22,1% | 13 | 31 | 68 | 64,7% |
| 2006 | 56 | 28,1% | 32 | 24 | 89 | 62,9% |
| 2007 | 41 | 20,6% | 29 | 12 | 65 | 63,1% |
| 2008 | 5 | 2,5% | 3 | 2 | 12 | 41,7% |
| 2009 | 4 | 2,0% | 3 | 1 | 11 | 36,4% |
| **Total** | **199** | **100,0%** | **101** | **98** | **345*** | **57,7%*** |

**Panel B: Size (x 1.000.000)**

| Year | Total deal amount in EUR [1] | Percentage of total | Deal amount EUR denom. deals in EUR | Deal amount GBP denom. deals in GBP | Total EMEA deal amount in the year [2] | Percentage of EMEA deal amount in the year |
|---|---|---|---|---|---|---|
| 2000 | 2.756 | 1,7% | 1.345 | 847 | 7.200 | 38,3% |
| 2001 | 5.352 | 3,4% | 1.531 | 2.375 | 18.400 | 29,1% |
| 2002 | 6.443 | 4,0% | 4.749 | 1.081 | 22.500 | 28,6% |
| 2003 | 6.628 | 4,2% | 3.170 | 2.438 | 17.500 | 37,9% |
| 2004 | 8.209 | 5,1% | 2.866 | 3.638 | 22.000 | 37,3% |
| 2005 | 27.823 | 17,4% | 7.679 | 13.764 | 43.100 | 64,6% |
| 2006 | 47.068 | 29,5% | 29.386 | 12.013 | 69.100 | 68,1% |
| 2007 | 41.438 | 26,0% | 30.803 | 7.190 | 59.000 | 70,2% |
| 2008 | 4.922 | 3,1% | 4.069 | 676 | 6.200 | 79,4% |
| 2009 | 8.913 | 5,6% | 8.040 | 776 | 14.700 | 60,6% |
| **Total** | **159.551** | **100,0%** | **93.637** | **44.799** | **279.700** | **57,0%** |

**Panel C: Other characteristics**

| | Frequency | Percentage of total | Total deal amount in EUR [1] | Percentage of total |
|---|---|---|---|---|
| **Type of Deal** | | | | |
| True Sale | 19 | 9,5% | 16.123 | 10,1% |
| Synthetic | 180 | 90,5% | 143.428 | 89,9% |
| Single Borrower | 61 | 30,7% | 38.109 | 23,9% |
| Multi Borrower | 138 | 69,3% | 121.442 | 76,1% |
| **Main Country of Assets** | | | | |
| UK | 97 | 48,7% | 65.040 | 40,8% |
| Pan-Europe | 56 | 28,1% | 53.456 | 33,5% |
| Germany | 24 | 12,1% | 25.912 | 16,2% |
| France | 9 | 4,5% | 5.875 | 3,7% |
| Italy | 6 | 3,0% | 2.665 | 1,7% |
| Other [3] | 7 | 3,5% | 6.603 | 4,1% |
| **Number of Deals Rated by** | | | | |
| Fitch | 140 | | 123.395 | |
| Moody's | 171 | | 138.015 | |
| S&P's | 182 | | 139.906 | |
| 1 CRA | 9 | 4,5% | 13.530 | 8,5% |
| 2 CRA's | 86 | 43,2% | 50.275 | 31,5% |
| 3 CRA's | 104 | 52,3% | 95.745 | 60,0% |

* Measured over years 2002-2009

[1] GBP amounts converted to EUR with exchange rate as of closing date.

[2] As reported by Moody's Investors Service for the EMEA region.

[3] The Netherlands, Spain, Ireland, Austria

## TABLE 5: CUT-OFF YEAR DISTRIBUTION OF NUMBER OF TRANCHES AND THEIR RATINGS IN THE SAMPLE

The table reports summary statistics for the number of tranches in the sample stratified on cut-off year and rating. Panel A reports the original number of tranches in the sample. The rating is first generalised over the assigned tranche rating on issue date, thus the original rating of the tranche, by dividing the assigned rating per rating agency into general rating buckets using the generalised rating table as Panel C states. Secondly the lowest rating of the provided ratings by either Fitch, Moody's, or S&P's is taken as final rating of the tranche.
To be able to calculate the subordination of the tranches in a transaction I select the lowest tranche in the structure of each transaction as the level of subordination for a certain rating, i.e. each transaction only can provide one data point for each generalised rating. Panel B shows the selected tranches and their generalised ratings which are the base dataset and number of observations for the regression analysis of the subordination levels.

**Panel A: Number of Tranches in Sample**

| Year | AAA | AA | A | BBB | BB | B | NR | Total | Average number of tranches per deal |
|---|---|---|---|---|---|---|---|---|---|
| 2000 | 5 | 3 | 3 | 4 | 2 | 0 | 2 | **19** | 6,3 |
| 2001 | 10 | 7 | 9 | 8 | 6 | 0 | 2 | **42** | 6,0 |
| 2002 | 17 | 10 | 9 | 8 | 7 | 0 | 4 | **55** | 6,1 |
| 2003 | 20 | 15 | 15 | 14 | 12 | 0 | 4 | **80** | 6,2 |
| 2004 | 16 | 18 | 18 | 19 | 8 | 2 | 0 | **81** | 4,8 |
| 2005 | 55 | 51 | 45 | 47 | 18 | 0 | 2 | **218** | 5,0 |
| 2006 | 86 | 67 | 62 | 72 | 20 | 6 | 2 | **315** | 5,6 |
| 2007 | 61 | 45 | 45 | 70 | 25 | 5 | 4 | **255** | 6,2 |
| 2008 | 5 | 3 | 3 | 1 | 2 | 0 | 3 | **17** | 3,4 |
| 2009 | 2 | 0 | 2 | 1 | 0 | 0 | 5 | **10** | 2,5 |
| **Total** | **277** | **219** | **211** | **244** | **100** | **13** | **28** | **1092** | **5,5** |

**Panel B: Number of Tranches after Adjustment for Subordination Calculation in Sample**

| Year | AAA | AA | A | BBB | BB | B | NR | Total | Average number of tranches per deal |
|---|---|---|---|---|---|---|---|---|---|
| 2000 | 3 | 2 | 3 | 3 | 2 | 0 | | **13** | 4,3 |
| 2001 | 6 | 6 | 7 | 6 | 6 | 0 | | **31** | 4,4 |
| 2002 | 9 | 8 | 9 | 8 | 5 | 0 | | **39** | 4,3 |
| 2003 | 13 | 13 | 13 | 12 | 7 | 0 | | **58** | 4,5 |
| 2004 | 16 | 16 | 17 | 15 | 8 | 2 | | **74** | 4,4 |
| 2005 | 44 | 44 | 40 | 35 | 15 | 0 | | **178** | 4,0 |
| 2006 | 56 | 56 | 52 | 46 | 18 | 6 | | **234** | 4,2 |
| 2007 | 41 | 39 | 39 | 36 | 23 | 5 | | **183** | 4,5 |
| 2008 | 3 | 3 | 3 | 1 | 1 | 0 | | **11** | 2,2 |
| 2009 | 2 | 0 | 2 | 1 | 0 | 0 | | **5** | 1,3 |
| **Total** | **193** | **187** | **185** | **163** | **85** | **13** | | **826** | **4,2** |

**Panel C: Generalised Rating Table**

| Fitch, S&P's | Moody's | Generalised rating |
|---|---|---|
| AAA | Aaa | **AAA** |
| AA+, AA, AA- | Aa1, Aa2, Aa3 | **AA** |
| A+, A, A- | A1, A2, A3 | **A** |
| BBB+, BBB, BBB- | Baa1, Baa2, Baa3 | **BBB** |
| BB+, BB, BB- | Ba1, Ba2, Ba3 | **BB** |
| BB, BB-, B+ | B1, B2, B3 | **B** |

## TABLE 6: DESCRIPTIVE STATISTICS OF THE SAMPLE

The table reports summary descriptive statistics for variables in the sample which are used in the regression analysis of the subordination levels. The number of observations of the subordination levels of different generalised ratings differs and thus limits the number of data points used in the regression analysis.

| | Mean | Standard Deviation | Minimum | Maximum | **Observations** |
|---|---|---|---|---|---|
| AAA subordination | 26,1% | 10,4% | 4,8% | 71,1% | 193 |
| AA subordination | 16,3% | 6,9% | 0,0% | 37,1% | 187 |
| A subordination | 8,8% | 5,7% | 0,0% | 42,3% | 185 |
| BBB subordination | 1,8% | 2,9% | 0,0% | 23,9% | 163 |
| BB subordination | 0,3% | 0,5% | 0,0% | 4,3% | 85 |
| B subordination | 0,2% | 0,6% | 0,0% | 2,2% | 13 |
| WA LTV | 70,0% | 8,2% | 39,6% | 94,0% | 199 |
| WA Exit LTV * | 65,2% | 11,0% | 0,0% | 96,2% | 157 |
| WA DSCR | 1,55 | 0,42 | 1,00 | 3,88 | 199 |
| Loan concentration Top 1 | 54,8% | 34,8% | 0,5% | 100,0% | 199 |
| Loan concentration Top 3 | 74,2% | 28,3% | 1,5% | 100,0% | 199 |
| Number of Loans | 72 | 457 | 1 | 5.784 | 199 |
| Number of Borrowers | 71 | 436 | 1 | 5.524 | 199 |
| Borrower-to-loan ratio | 1,70 | 2,63 | 0,02 | 31,00 | 199 |
| Geographic concentration Top 1 | 90,0% | 19,7% | 23,1% | 100,0% | 199 |
| % in GBR | 51,5% | 48,9% | 0,0% | 100,0% | 199 |
| % in DEU | 24,1% | 38,9% | 0,0% | 100,0% | 199 |
| % in FRA | 9,8% | 24,5% | 0,0% | 100,0% | 199 |
| % in ITA | 3,8% | 17,4% | 0,0% | 100,0% | 199 |
| % in NLD | 4,0% | 15,9% | 0,0% | 100,0% | 199 |
| Property type concentration Top 1 | 70,5% | 22,4% | 28,9% | 100,0% | 199 |
| Number of properties | 1.662 | 8.407 | 1 | 87.993 | 199 |
| Borrower-to-property ratio | 0,32 | 0,34 | 0,00 | 1,50 | 199 |
| % of Specialist assets | 1,5% | 10,3% | 0,0% | 100,0% | 199 |
| % Operating assets | 2,4% | 11,4% | 0,0% | 100,0% | 199 |
| % of Offices | 43,9% | 33,2% | 0,0% | 100,0% | 199 |
| % of Retail | 25,2% | 29,3% | 0,0% | 100,0% | 199 |
| % of Industrial | 8,0% | 17,8% | 0,0% | 100,0% | 199 |
| % of Mixed use | 3,8% | 9,2% | 0,0% | 54,0% | 199 |
| % of Residential | 11,0% | 25,0% | 0,0% | 100,0% | 199 |
| % of Other | 4,0% | 11,2% | 0,0% | 100,0% | 199 |

* Actual number of observations is 157 but for regression purposes blank values have been replaced with the WA LTV.

## TABLE 7: EXPLANATORY VARIABLES USED IN THE ANALYSIS

The table reports the various explanatory variables I use in my regression analysis, the predicted coefficient sign of the variable from the regression analysis and an explanation of what the variable is intended to measure.

| | Description | Sign | Explanation |
|---|---|---|---|
| WA LTV | Weighted average loan-to-value ratio of the loan pool at deal cut-off date | + | Measures pool credit quality based on loan collateral |
| WA Exit LTV | Weighted average expected loan-to-value ratio of the loan pool at maturity on deal cut-off date | ? | Measures credit risk due to balloon payment at maturity |
| WA DSCR | Weighted average debt service coverage ratio of the loan pool at deal cut-off date | - | Measures pool credit quality based on loan cash flows |
| Loan concentration Top 1 | Maximum top 1 loan size as percentage of total loan pool | + | Measures loan concentration risk |
| Loan concentration Top 3 | Maximum top 3 loan size as percentage of total loan pool | + | Measures loan concentration risk |
| Number of Loans | Number of loans in the deal | ? | Reflects loan concentration risk |
| Number of Borrowers | Number of borrowers in the deal | ? | Reflects loan concentration risk |
| Borrower-to-loan ratio | Number of borrowers divided by the number of loan in the deal | + | Indication of loan concentration |
| G-concentration Top 1 | Geographic concentration; highest country concentration as percentage of total loan pool according to market value | + | Measures geographical concentration risk |
| % in GBR | Percentage of assets based in the UK measured according to market value. | - | Measures geographical concentration risk |
| % in DEU | Percentage of assets based in Germany measured according to market value. | - | Measures geographical concentration risk |
| % in FRA | Percentage of assets based in France measured according to market value. | - | Measures geographical concentration risk |
| % in ITA | Percentage of assets based in Italy UK measured according to market value. | + | Measures geographical concentration risk |
| % in NLD | Percentage of assets based in the Netherlands measured according to market value. | - | Measures geographical concentration risk |
| P-concentration Top 1 | Property type concentration; highest property type concentration as percentage of total loan pool according to market value. | + | Measures property sector concentration risk |
| Number of properties | Number of properties in the deal | ? | Measures property sector concentration risk |
| Borrower-to-property ratio | Number of borrowers divided by the number of properties in the deal | - | Indication of property concentration |
| % of Specialist assets | Percentage of specialist assets in the deal measured according to market value. | + | Indicates highest volatility of the property income. Specialist assets are nursing homes, hospitals, etc. |
| % Operating assets | Percentage of operating assets in the deal measured according to market value. | + | Indicates high volatility of the property income. Operating assets are hotels, pubs, cinemas, etc. |
| % of Offices | Percentage of office properties in the deal measured according to market value. | + | Indicates high volatility of the property income. |
| % of Retail | Percentage of retail properties in the deal measured according to market value. | ? | Indicates normal volatility of the property income. |
| % of Industrial | Percentage of industrial properties in the deal measured according to market value. | - | Indicates low volatility of the property income. |
| % of Mixed use | Percentage of mixed use properties in the deal measured according to market value. | - | Indicates low volatility of the property income. |
| % of Residential | Percentage of residential properties in the deal measured according to market value. | - | Indicates low volatility of the property income. |
| % of Other | Percentage of other assets in the deal measured according to market value. | ? | Other types of assets |

## TABLE 8: ESTIMATES OF THE CMBS TRANSACTION SUBORDINATION MODEL USING WA LTV, WA DSCR, AND WA EXIT LTV COMBINED

The table reports ordinary least squares estimation results with the dependent variables AAA / AA / A / BBB / BB subordination levels at transaction cut-off date. Standard errors are in parentheses. *** for p<0.001; ** for p<0.01; * for p<0.05.

In this model estimation only WA LTV, WA DSCR and WA Exit LTV variables are included to test the significance of these variables in the determination of subordination levels. Both Polleys (1998) and Riddiough and Chiang (2003) found LTV and DSCR to be significant determinants in the US CMBS market, however in this analysis only LTV is proved to be a significant determinant.

| | AAA subordination | AA subordination | A subordination | BBB subordination | BB subordination |
|---|---|---|---|---|---|
| Intercept | -0,017 | -0,136 | -0,246 *** | -0,048 | 0,002 |
| | (0,134) | (0,072) | (0,057) | (0,032) | (0,018) |
| WA LTV | 0,370 * | 0,347 ** | 0,428 *** | 0,117 ** | -0,003 |
| | (0,170) | (0,112) | (0,125) | (0,042) | (0,019) |
| WA DSCR | -0,009 | -0,007 | 0,002 | -0,007 | -0,003 |
| | (0,024) | (0,011) | (0,008) | (0,006) | (0,004) |
| WA Exit LTV | 0,051 | 0,101 | 0,043 | -0,011 | 0,010 |
| | (0,097) | (0,071) | (0,079) | (0,017) | (0,011) |
| Number of observations | 193 | 187 | 185 | 163 | 85 |
| R-squared | 0,115 | 0,269 | 0,374 | 0,074 | 0,015 |
| Adjusted R-squared | 0,101 | 0,257 | 0,364 | 0,057 | -0,021 |
| F Statistic | 8,15 | 22,40 | 36,10 | 4,24 | 0,42 |
| Durbin-Watson | 1,79 | 1,91 | 1,83 | 1,06 | 0,98 |

## TABLE 9: ESTIMATES OF THE CMBS TRANSACTION SUBORDINATION MODEL USING WA LTV, WA DSCR, AND WA EXIT LTV SOLELY

The table reports ordinary least squares estimation results with the dependent variables AAA / AA / A / BBB / BB subordination levels at transaction cut-off date. Standard errors are in parentheses. *** for p<0.001; ** for p<0.01; * for p<0.05.

In this model I test the independent influence of WA LTV, WA DSCR and WA Exit LTV variables on subordination levels to verify the robustness of the variables. All variables are significant on a stand-alone basis, however explanatory power is low, especially for WA DSCR and WA Exit LTV.

| | AAA subordination | AA subordination | A subordination | BBB subordination | BB subordination |
|---|---|---|---|---|---|
| Intercept | -0,044 | -0,151 * | -0,232 *** | -0,068 * | -0,003 |
| | (0,070) | (0,058) | (0,046) | (0,028) | (0,009) |
| WA LTV | 0,437 *** | 0,448 *** | 0,454 *** | 0,121 ** | 0,009 |
| | (0,097) | (0,080) | (0,067) | (0,041) | (0,013) |
| Number of observations | 193 | 187 | 185 | 163 | 85 |
| R-squared | 0,112 | 0,253 | 0,370 | 0,067 | 0,004 |
| Adjusted R-squared | 0,107 | 0,249 | 0,366 | 0,062 | -0,008 |
| F Statistic | 24,10 | 62,62 | 107,32 | 11,62 | 0,31 |
| Durbin-Watson | 1,79 | 1,90 | 1,81 | 1,05 | 1,00 |

**Panel B: WA DSCR**

| | AAA subordination | AA subordination | A subordination | BBB subordination | BB subordination |
|---|---|---|---|---|---|
| Intercept | 0,339 *** | 0,239 *** | 0,152 *** | 0,039 *** | 0,007 |
| | (0,026) | (0,020) | (0,016) | (0,011) | (0,004) |
| WA DSCR | -0,050 ** | -0,049 *** | -0,041 *** | -0,014 * | -0,003 |
| | (0,016) | (0,013) | (0,009) | (0,006) | (0,003) |
| Number of observations | 193 | 187 | 185 | 163 | 0 |
| R-squared | 0,041 | 0,075 | 0,086 | 0,024 | 0,008 |
| Adjusted R-squared | 0,036 | 0,070 | 0,081 | 0,018 | -0,004 |
| F Statistic | 8,08 | 14,99 | 17,27 | 3,98 | 0,64 |
| Durbin-Watson | 1,84 | 2,00 | 1,83 | 1,00 | 0,91 |

**Panel C: WA Exit LTV only**

| | AAA subordination | AA subordination | A subordination | BBB subordination | BB subordination |
|---|---|---|---|---|---|
| Intercept | 0,101 | -0,014 | -0,048 | -0,002 | -0,004 |
| | (0,064) | (0,054) | (0,048) | (0,013) | (0,006) |
| WA Exit LTV | 0,243 * | 0,269 *** | 0,205 ** | 0,031 | 0,010 |
| | (0,094) | (0,080) | (0,070) | (0,020) | (0,009) |
| Number of observations | 193 | 187 | 185 | 163 | 85 |
| R-squared | 0,059 | 0,165 | 0,142 | 0,011 | 0,010 |
| Adjusted R-squared | 0,054 | 0,160 | 0,138 | 0,005 | -0,002 |
| F Statistic | 12,01 | 36,48 | 30,41 | 1,80 | 0,84 |
| Durbin-Watson | 1,81 | 2,01 | 1,88 | 1,00 | 1,03 |

## TABLE 10: ESTIMATES OF THE CMBS TRANSACTION SUBORDINATION MODEL USING ALL VARIABLES

The table reports ordinary least squares estimation results with the dependent variables AAA / AA / A / BBB / BB subordination levels at transaction cut-off date. Standard errors are in parentheses. *** for p<0.001; ** for p<0.01; * for p<0.05.

In this model estimation all available variables are included to test the significance of these variables in the determination of subordination levels. The explanatory power has improved compared to the model with WA LTV, WA Exit LTV and WA DSCR, but still seems to be low in contrast with US market results. Only the LTV is significant throughout all subordination levels, also loan concentration and the geographic location are significant, and the particularly a concentration of properties in Italy significantly influence the subordination level of AAA and AA.

| | AAA subordination | AA subordination | A subordination | BBB subordination | BB subordination |
|---|---|---|---|---|---|
| Intercept | -6,285 | 8,188 | 3,676 | 1,573 | 2,732 |
| | (12,129) | (5,852) | (5,126) | (3,522) | (1,611) |
| WA LTV | 0,503 ** | 0,449 *** | 0,464 ** | 0,092 ** | -0,039 |
| | (0,152) | (0,115) | (0,147) | (0,035) | (0,021) |
| WA DSCR | -0,015 | -0,012 | -0,003 | -0,014 * | -0,007 |
| | (0,022) | (0,013) | (0,015) | (0,006) | (0,004) |
| WA Exit LTV * | 0,019 | 0,063 | 0,057 | 0,017 | 0,025 |
| | (0,085) | (0,075) | (0,074) | (0,021) | (0,014) |
| Loan concentration Top 1 | 0,154 *** | 0,056 * | 0,027 | -0,025 ** | 0,017 |
| | (0,042) | (0,028) | (0,022) | (0,009) | (0,013) |
| Loan concentration Top 3 | -0,104 | -0,004 | -0,045 | -0,024 | -0,017 |
| | (0,066) | (0,026) | (0,029) | (0,013) | (0,010) |
| Number of Loans | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 ** |
| | (0,000) | (0,000) | (0,000) | (0,000) | (0,000) |
| Number of Borrowers | 0,000 | 0,000 | 0,000 | 0,000 * | 0,000 ** |
| | (0,000) | (0,000) | (0,000) | (0,000) | (0,000) |
| Borrower-to-loan ratio | 0,000 | 0,000 | 0,000 | 0,000 | 0,001 |
| | (0,001) | (0,001) | (0,001) | (0,000) | (0,000) |
| G-concentration Top 1 | 0,083 | -0,021 | -0,011 | 0,035 * | -0,009 |
| | (0,047) | (0,025) | (0,022) | (0,015) | (0,008) |
| % in GBR | -0,073 | 0,028 | 0,007 | -0,014 | 0,002 |
| | (0,048) | (0,024) | (0,019) | (0,008) | (0,011) |
| % in DEU | -0,047 | 0,030 | 0,010 | 0,001 | 0,003 |
| | (0,053) | (0,025) | (0,020) | (0,007) | (0,012) |
| % in FRA | -0,037 | 0,044 | 0,027 | 0,010 | -0,001 |
| | (0,044) | (0,023) | (0,018) | (0,013) | (0,013) |
| % in ITA | 0,173 * | 0,137 *** | 0,055 * | 0,006 | 0,001 |
| | (0,067) | (0,024) | (0,022) | (0,013) | (0,011) |
| % in NLD | -0,037 | 0,059 * | 0,013 | -0,012 | 0,000 |
| | (0,057) | (0,027) | (0,026) | (0,008) | (0,010) |
| P-concentration Top 1 | 0,016 | -0,017 | 0,021 | 0,023 | 0,006 |
| | (0,032) | (0,032) | (0,023) | (0,018) | (0,005) |
| Borrower-to-property ratio | 0,010 | 0,001 | -0,008 | 0,006 | 0,001 |
| | (0,024) | (0,012) | (0,011) | (0,008) | (0,002) |
| % of Specialist assets | 3,345 | 0,074 | -0,694 | -0,075 | -0,866 |
| | (4,277) | (4,091) | (3,035) | (1,277) | (0,804) |
| % Operating assets | 3,609 | 0,209 | -0,558 | 0,021 | -0,892 |
| | (4,276) | (4,084) | (3,024) | (1,278) | (0,810) |
| % of Offices | 3,380 | 0,058 | -0,660 | -0,066 | -0,883 |
| | (4,278) | (4,090) | (3,027) | (1,277) | (0,808) |
| % of Retail | 3,339 | 0,043 | -0,650 | -0,067 | -0,886 |
| | (4,276) | (4,087) | (3,026) | (1,276) | (0,807) |
| % of Industrial | 3,359 | 0,064 | -0,665 | -0,026 | -0,870 |
| | (4,279) | (4,088) | (3,030) | (1,278) | (0,807) |
| % of Mixed use | 3,388 | 0,053 | -0,625 | -0,009 | -0,866 |
| | (4,267) | (4,076) | (3,014) | (1,270) | (0,805) |
| % of Residential | 3,350 | 0,087 | -0,666 | -0,077 | -0,868 |
| | (4,276) | (4,081) | (3,029) | (1,277) | (0,806) |

| | | | | | |
|---|---|---|---|---|---|
| % of Other | 3,380 | -0,012 | -0,743 | -0,060 | -0,873 |
| | (4,275) | (4,081) | (3,030) | (1,277) | (0,803) |
| Vintage | 0,001 | -0,004 * | -0,002 | -0,001 | -0,001 |
| | (0,006) | (0,002) | (0,002) | (0,002) | (0,001) |
| Number of observations | 193 | 187 | 185 | 163 | 85 |
| R-squared | 0,497 | 0,510 | 0,485 | 0,406 | 0,599 |
| Adjusted R-squared | 0,422 | 0,434 | 0,404 | 0,298 | 0,429 |
| F Statistic | 6,60 | 6,71 | 5,99 | 3,75 | 3,53 |
| Durbin-Watson | 1,71 | 1,92 | 1,95 | 1,17 | 1,44 |

## TABLE 11: ESTIMATES OF THE CMBS TRANSACTION SUBORDINATION MODELS EXCLUDING LTV

The table reports ordinary least squares estimation results with the dependent variables AAA / AA / A / BBB / BB subordination levels at transaction cut-off date. Standard errors are in parentheses. *** for p<0.001; ** for p<0.01; * for p<0.05. In this model estimation all available variables except the WA LTV are included to test the significance of these variables in the determination of subordination levels. As indicated by An, Deng Sanders (2007) the WA LTV variable causes a multi-collinearity problem and therefore is excluded from model. The explanatory power is slightly lower compared to the model with all variables, but. The WA DSCR, WA Exit LTV, and loan concentration variables are now significant for the higher rated subordination levels. A time trend seems to be present for A subordination levels, although the size of the coefficient is minimal.

| | AAA subordination | AA subordination | A subordination | BBB subordination | BB subordination |
|---|---|---|---|---|---|
| Intercept | -1,825 | 11,463 | 11,635 | 2,183 | 2,688 |
| | (12,545) | (6,696) | (6,866) | (3,563) | (1,822) |
| WA DSCR | -0,053 ** | -0,045 ** | -0,036 *** | -0,021 *** | -0,002 |
| | (0,019) | (0,015) | (0,010) | (0,005) | (0,003) |
| WA Exit LTV * | 0,192 | 0,223 * | 0,182 ** | 0,038 | 0,015 |
| | (0,099) | (0,095) | (0,068) | (0,024) | (0,011) |
| Loan concentration Top 1 | 0,158 *** | 0,062 * | 0,037 | -0,020 * | 0,014 |
| | (0,042) | (0,028) | (0,026) | (0,009) | (0,012) |
| Loan concentration Top 3 | -0,135 * | -0,046 | -0,069 ** | -0,032 * | -0,013 |
| | (0,062) | (0,028) | (0,026) | (0,013) | (0,009) |
| Number of Loans | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 ** |
| | (0,000) | (0,000) | (0,000) | (0,000) | (0,000) |
| Number of Borrowers | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 ** |
| | (0,000) | (0,000) | (0,000) | (0,000) | (0,000) |
| Borrower-to-loan ratio | 0,000 | 0,000 | 0,000 | 0,000 | 0,001 |
| | (0,001) | (0,001) | (0,001) | (0,000) | (0,000) |
| G-concentration Top 1 | 0,112 * | 0,016 | 0,019 | 0,042 ** | -0,011 |
| | (0,044) | (0,030) | (0,022) | (0,015) | (0,008) |
| % in GBR | -0,086 | 0,004 | 0,001 | -0,018 * | 0,004 |
| | (0,046) | (0,029) | (0,019) | (0,008) | (0,011) |
| % in DEU | -0,032 | 0,030 | 0,026 | 0,001 | 0,004 |
| | (0,055) | (0,033) | (0,024) | (0,007) | (0,012) |
| % in FRA | -0,034 | 0,036 | 0,030 | 0,010 | 0,000 |
| | (0,044) | (0,029) | (0,023) | (0,014) | (0,012) |
| % in ITA | 0,148 * | 0,101 ** | 0,026 | 0,001 | 0,004 |
| | (0,070) | (0,034) | (0,028) | (0,014) | (0,010) |
| % in NLD | -0,036 | 0,048 | 0,012 | -0,014 * | 0,003 |
| | (0,056) | (0,034) | (0,030) | (0,007) | (0,010) |
| P-concentration Top 1 | 0,031 | -0,002 | 0,027 | 0,023 | 0,006 |
| | (0,034) | (0,033) | (0,023) | (0,018) | (0,006) |
| Borrower-to-property ratio | 0,010 | 0,001 | -0,017 | 0,005 | 0,001 |
| | (0,025) | (0,015) | (0,017) | (0,008) | (0,002) |
| % of Specialist assets | 4,703 | 0,850 | -0,607 | 0,130 | -0,936 |
| | (5,033) | (4,833) | (3,006) | (1,378) | (0,890) |
| % Operating assets | 4,906 | 0,932 | -0,541 | 0,214 | -0,956 |
| | (5,034) | (4,824) | (2,998) | (1,378) | (0,894) |
| % of Offices | 4,702 | 0,800 | -0,605 | 0,134 | -0,951 |
| | (5,034) | (4,830) | (3,002) | (1,376) | (0,893) |
| % of Retail | 4,656 | 0,783 | -0,592 | 0,132 | -0,951 |
| | (5,035) | (4,829) | (2,999) | (1,376) | (0,892) |
| % of Industrial | 4,700 | 0,820 | -0,603 | 0,176 | -0,944 |
| | (5,038) | (4,829) | (3,004) | (1,379) | (0,895) |
| % of Mixed use | 4,733 | 0,814 | -0,544 | 0,192 | -0,934 |
| | (5,020) | (4,815) | (2,985) | (1,369) | (0,891) |
| % of Residential | 4,667 | 0,825 | -0,613 | 0,123 | -0,935 |
| | (5,024) | (4,814) | (2,999) | (1,376) | (0,892) |
| % of Other | 4,691 | 0,724 | -0,691 | 0,128 | -0,938 |
| | (5,032) | (4,817) | (3,002) | (1,377) | (0,888) |

| | | | | | |
|---|---|---|---|---|---|
| Vintage | -0,001<br>(0,006) | -0,006 **<br>(0,002) | -0,005<br>(0,003) | -0,001<br>(0,002) | -0,001<br>(0,001) |
| Number of observations | 193 | 187 | 185 | 163 | 85 |
| R-squared | 0,443 | 0,410 | 0,314 | 0,388 | 0,572 |
| Adjusted R-squared | 0,363 | 0,322 | 0,211 | 0,281 | 0,400 |
| F Statistic | 5,56 | 4,69 | 3,05 | 3,64 | 3,34 |
| Durbin-Watson | 1,84 | 2,01 | 2,10 | 1,15 | 1,45 |

## TABLE 12: HISTORICAL WEIGHTED AVERAGE SUBORDINATION LEVELS OBSERVED IN THE SAMPLE

In this table I report the historical weighted average subordination levels on generalised rating level of the sample stratified on cut-off year. The subordination level for a certain tranche has been calculated by dividing the total amount of the tranches underlying the tranche by the total transaction amount and thus represents the percentage loss the transaction can handle before the mentioned tranche will suffer a loss. In contrary to observations by Sanders (1999), Riddiough and Chiang (2003) and recently Downing, Stanton and Wallace (2008), who found a declining trend of subordination levels in the US CMBS markets, no substantial declining trend is observed in the European CMBS market over the sample period 2000-2009. Although, when zooming in on the years with higher number of observations (2002-2007) a slight decrease, for at least the lower rated tranches, in subordination levels can be observed as Figure 8 shows. Please note the low number of observations in the first and last year within the Sample which can largely influence the calculated subordination levels. The low number of observations is due to the immaturity of the European CMBS market in the first years and low activity caused by the financial crisis in recent years.

| Year | AAA | AA | A | BBB | BB | B |
|---|---|---|---|---|---|---|
| 2000 | 22,4% | 17,1% | 10,3% | 2,2% | 1,9% | n.a. |
| 2001 | 22,8% | 16,0% | 26,7% | 3,7% | 0,3% | n.a. |
| 2002 | 22,9% | 20,1% | 10,7% | 5,9% | 0,1% | n.a. |
| 2003 | 26,5% | 18,6% | 10,1% | 3,5% | 0,2% | n.a. |
| 2004 | 26,2% | 19,6% | 9,2% | 1,0% | 0,2% | 0,0% |
| 2005 | 25,1% | 17,3% | 8,6% | 1,4% | 0,0% | n.a. |
| 2006 | 26,0% | 18,1% | 9,4% | 0,8% | 0,4% | 0,0% |
| 2007 | 22,4% | 14,4% | 7,9% | 1,1% | 0,5% | 0,6% |
| 2008 | 27,1% | 22,8% | 24,3% | 9,6% | 0,0% | n.a. |
| 2009 | 50,8% | n.a. | 25,8% | 23,9% | n.a. | n.a. |
| **Total** | **27,2%** | **16,4%** | **14,3%** | **5,3%** | **0,4%** | **0,1%** |