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ABS, MBS AND CDO COMPARED: AN EMPIRICAL ANALYSIS

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ABSTRACT

The capital market in which the asset-backed securities are issued and traded is composed of three main categories: ABS, MBS and CDOs. We were able to examine a total number of 3,951 loans (worth €730.25 billion) of which 1,129 (worth €208.94 billion) have been classified as ABS. MBS issues represent 2,224 issues (worth €459.32 billion) and 598 are CDO issues (worth €61.99 billion). We have investigated how common pricing factors compare for the main classes of securities. Due to the differences in the assets related to these securities, the relevant pricing factors for these securities should differ, too. Taking these three classes as a whole, we have documented that the assets attached as collateral for the securities differ between security classes, but that there are also important univariate differences to consider. We found that most of the common pricing characteristics between ABS, MBS and CDO differ significantly. Furthermore, applying the same pricing estimation model to each security class revealed that most of the common pricing characteristics associated with these classes have a different impact on the primary market spread exhibited by the value of the coefficients. The regression analyses we performed demonstrated econometrically that ABS, MBS, and CDOs are in fact different financial instruments.

Keywords: asset securitization, asset-backed securitisation, bank lending, default risk, risk management, spreads, leveraged financing.
JEL classification: G21, G24, G32

1. INTRODUCTION

Securitization is a relatively new technique developed to finance a collection of assets which by their very nature are non-tradable and therefore non-liquid. The central element of an asset securitization issue is the fact that repayment depends only or primarily on the assets and cash flows pledged as collateral to the issue, and not on the overall financial strengths of the originator (sponsor or parent company). In the context of this study, asset securitization is defined as the process in which assets are refinanced in the capital market by issuing securities sold to investors by a bankruptcy-remote special purpose vehicle (SPV). The primary objective of the SPV is to facilitate the securitization of the assets and to ensure that the SPV is established for bankruptcy purposes as a legal entity separate from the seller (Blum and DiAngelo 1997, p.244). Choudhry and Fabozzi (2004, p.5) mention that the capital market in which these securities are issued and traded consists of three main classes: asset-backed securities (ABS), mortgage-backed securities (MBS), and collateralized debt obligations (CDO). As a rule of thumb, securitization issues backed by mortgages are called MBS, and securitization issues backed by debt obligations are called CDO[1] (see Nomura, 2004, and Fitch Ratings, 2004). Securitization issues backed by consumer-backed products - car loans, consumer loans and credit cards, among others - are called ABS (see Moody's Investors Service, 2002).

Securitization was first introduced on U.S. mortgage markets in the 1970s. The market for mortgage-backed securities was boosted by the government agencies that endorsed these securities. In 1985, securitization techniques that had been developed in the mortgage market were initially applied to a class of non-mortgage assets - car loans. After the success of this initial transaction, securitization issues were backed by an increasingly diverse and ever-expanding array of assets, including corporate assets such as lease receivables and bank assets such as payments associated with corporate loans.

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[1] Ultimately, all debt obligations in a CDO portfolio can be classified as bonds or loans, although both types of debt come in various forms with their own unique characteristics. Generally speaking, bonds are fixed income, tradable, and relatively liquid debt obligations issued by an entity seeking external capital in debt markets, be it a sovereign, corporate or financial institution. Loans are less fungible instruments in comparison with bonds since they are generally less liquid, and therefore less tradable, and will usually be held by a smaller group of investors (lenders) than is the case with bonds (see Fitch Ratings, 2004).

Since then, the securitization market has grown to become one of the most prominent fixed income sectors in the U.S. and in fact one of the fastest evolving sectors around the world. Securitization can be found both in developed and in emerging countries (Standard & Poor's, 2006).

Given its increasing importance as a funding vehicle and risk management tool, it is not surprising that asset securitization has attracted considerable academic interest. According to Modigliani and Miller (1958), in perfect capital markets, a firm's financing decisions are irrelevant because they do not create firm value. Thus, in line with their propositions, it is irrelevant whether a firm adopts asset securitization or not. However, in modern economic views, there are sufficient theoretical rationalizations for a firm or organization to securitize their assets: in the light of signaling (Myers and Majluf, 1984), (Greenbaum and Thakor, 1987), (Riddiough, 1997), (Minton, Opler and Stanton, 1997), (Plantin, 2004); in the light of avoiding underinvestment (Benveniste and Berger, 1987), (James, 1988), (Stanton, 1995), (Sopranzetti, 1999); in the light of avoiding asset substitution (Lockwood, Rutherford and Herrera, 1996), (Thomas, 1999, 2001), and finally in the light of avoiding the costs of standard bankruptcy (Skarabot, 2001), (Gorton and Souleles, 2005), (Ayotte and Gaon, 2005). Ergo, even though asset securitization is costly and would not be undertaken in frictionless and complete markets, recent financial theory suggests that firms may benefit from asset securitization.

Several other streams of theoretical research address other asset securitization characteristics in addition to demonstrating that firms may benefit from securitization in the light of certain market imperfections. Although the vast majority of articles and working papers are based on theoretical rather than empirical studies, numerous recent theoretical breakthroughs in the analysis of securitization and its use have all yielded important insights into the observed structure and pricing features of asset securitization issues.

Key articles include theoretical studies carried out by Duffie and Gârleanu (2001), Jobst (2002, 2003), and Choudhry and Fabozzi (2003) on originating collateralized debt obligations; theoretical studies on special purpose vehicles and the impact on bankruptcy remoteness, carried out by Gorton and Souleless (2005) and Ayotte and Gaon (2005); an empirical study explaining launch spreads on structured bonds, performed by Firla-Cuchra (2005); descriptive studies of asset-backed securitization and its use, carried out by Schwarcz (1994) and Roever and Fabozzi (2003); a theoretical model proposed by Plantin (2004) in which tranching presents itself as the optimal structure; an empirical study carried out by Ammer and Clinton (2004) investigating the impact of credit rating changes on the pricing of asset-backed securities; theoretical studies on originating mortgage-backed securities performed by Childs, Ott and Riddiough (1996) and Oldfield (2000); an empirical study by Firla-Cuchra and Jenkinson (2006) investigating the determinants of tranching; descriptive studies by Jobst (2005a) on the regulatory treatment of asset securitization; a descriptive study on collateralized fund obligations performed by Stone and Zissu (2004), and finally a theoretical study by Cummins (2004) on the securitization of life insurance assets and liabilities.

To summarize this section, we believe that the above-mentioned studies provide us with a clear understanding of the motivations, structural considerations and pricing features of asset securitization. Generally speaking, the asset securitization market is composed of asset-backed securities (ABS), mortgage-backed securities (MBS) and collateralized debt obligations (CDO). Due to the differences in the assets related to these securities, the relevant pricing factors for these securities should differ, too. This finding raises the following two questions. *How do common pricing factors compare for the main classes of securities?* And, *to what extent are the main classes of securities priced by common factors?* The purpose of answering these questions is to provide extensive insight into the common pricing characteristics associated with these classes, and to elaborate on any substantial differences between them.

We propose to test the following two hypotheses. The *first* hypothesis states that the common pricing factors do not differ significantly in value between the main classes of securities.

The *second* hypothesis states that the primary market spreads associated with the main security classes are not influenced differently by common pricing factors.[2] In testing the first hypothesis, we used a parametric test - Student's t-test - to compare whether the distribution of the reported values for the security classes are significantly different. In testing the second hypothesis, a structural change test was used. The Chow test is a special test for structural change, also defined as an econometric test, to determine whether the coefficients in a regression model are equal in separate sub-samples (Chow, 1960). We concluded our analysis by examining the factors that impact the pricing of the securities. We used an ordinary least squares regression analysis to model the magnitude of the relationships between pricing variables and primary market spread, and we compared the results with the expectations.

In the following section, we shall discuss the results of our analyses. The remainder of this paper is organized as follows. In Section 2 the background information and hypotheses are discussed. Section 3 describes our data. In Section 4, we discuss our univariate analysis. In Section 5, we turn to our regression analysis and explore each common pricing variable in our high-information sample. Section 5, is also concerned with the common pricing features for different classes of asset securitization issues. Section 6 concludes this working paper.

[2] It is important to note that this study is based on *issuance spreads*. According to Gabbi and Sironi (2005), the use of secondary market spreads is to be avoided because loan spreads at issuance reflect actual loan prices rather than estimations derived from pricing matrices or dealers' quotes. Issuance spreads provide a more accurate measure of the actual cost of debt and of the risk premium demanded by investors.

2. BACKGROUND INFORMATION AND HYPOTHESES

Choudhry and Fabozzi (2004, p.5) mention that the capital market, in which the securities are issued and traded, is composed of three main categories: ABS, MBS, and CDOs. The capital market distinguishes between these classes of securities. As a rule of thumb, securitization issues backed by mortgages are called MBS, securitization issues backed by debt obligations are called CDO, and securitization issues backed by consumer-backed products are called ABS.

II. A. Hypothesis concerning differences in common pricing factors related to ABS, MBS, and CDOs

Due to the differences in the assets related to these securities, the relevant pricing factors for these securities should differ, too. This finding raises the following question: *how do common pricing factors compare for the main classes of securities?* The purpose of answering this question is to provide extensive insight into the common pricing characteristics associated with these classes, and to elaborate on any substantial differences between them. We propose the following hypothesis: the common pricing factors do not differ significantly in value between the main classes of securities. In testing *hypothesis 1* we used a parametric test - Student's t-test - to compare whether the distribution of the reported values for the security classes are significantly different.

II. B. Hypothesis related to what extent the main classes of securities are priced by common factors

The second research question is: *to what extent are the main classes of securities priced by common factors?* In pricing securities, the pricing characteristics may have a different impact on the primary market spread exhibited by the value of the coefficients. Also, the degree of the impact on the spread could be different by security class. For statistical analysis, the problem is therefore twofold. Various different variables determine spreads, and it may well be possible that the impact of these variables on the spread is different among and between security classes.

According to basic statistics, relevant pricing variables can be identified by their statistical significance, while the equality of the impact of each variable can be determined by comparing coefficient values. Overall, we hypothesize the following: the primary market spreads associated with the main security classes are not influenced differently by common pricing factors.

A structural change test was used for *hypothesis 2*. The Chow test is a special test for structural change, also defined as an econometric test to determine whether the coefficients in a regression model are equal in separate sub-samples. In reference to a paper presented by G.C. Chow (1960), "the standard F-test for the equality of two sets of coefficients in linear regression models" is called a Chow test (see Davidson and MacKinnon p. 375-376 for an explanation). In brief, the Chow test is an econometric test to determine whether the coefficients in two linear regressions on different data are equal (Chow, 1960). First, an ordinary least squares regression was run on the full sample, with the assumption that all issues have the same explanatory variables. We estimated a single, pooled regression as:

$$y_i = a_i + bx_{1i} + cx_{2i} + \varepsilon_i \qquad (1)$$

in which y_i is the primary market spread of an issue *i* and bx_{1i} and cx_{2i} represent the value of the pricing coefficients of issue *i*.

Second, coefficients from separate regressions for each security class were obtained. If we divide our data into two groups, we have:

$$y_{1i} = a_{1i} + b_1 x_{1i} + c_1 x_{2i} + \varepsilon_i \qquad (2)$$

$$y_{2i} = a_{2i} + b_2 x_{1i} + c_2 x_{2i} + \varepsilon_i \qquad (3)$$

in which y_{1i} is the primary market spread of an issue *i* associated with security class 1 (for example ABS) and $b_1 x_{1i} + c_1 x_{2i}$ represent the value of the pricing coefficients of the issue *i*, and in which y_{2i} is the primary market spread of an issue *i* associated with security class 2 (for example MBS) and $b_2 x_{1i} + c_2 x_{2i}$ represent the pricing coefficients of the issue *i*.

On the basis of residual sum of changes, an F-test of structural change can be computed (also called a Chow test).[3] The Chow test states that $a_1 = a_2$, $b_1 = b_2$, and $c_1 = c_2$. S_C the sum of squared residuals from the combined data, S_1 the sum of squares from the first group, and S_2 the sum of squares from the second group. N_1 and N_2 are the observations in each group and k is the total number of parameters (in this case 3). Then, the Chow test statistic would be: $((S_c - (S_1 + S_2)) / k) / ((S_1 + S_2) / (N_1 + N_2 - 2k))$. The test statistic follows the F distribution with k and $N_1 + N_2 - 2k$ degrees of freedom. The hypothesis claiming no structural change cannot be rejected when the computed F value stays below its critical level, and will be rejected when the F value exceeds the critical level.

Having documented to what extent the pricing variables for the different classes of securities show significant differences, we concluded our empirical analyses by examining the factors that impact the pricing of the securities.

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[3] The Chow test we performed is similar to the one presented in Kleimeier and Megginson (2001). The authors test the hypothesis that project finance and syndicated loans are equivalent financial securities priced in a single market. A Chow test of structural change was used to test this hypothesis. Their analysis illustrates that project finance and syndicated loans are in fact different financial instruments priced in segmented markets, with spreads on both loan types being influenced by various different factors and to different degrees by common factors.

We used an ordinary least squares regression analysis to model the magnitude of the relationships between pricing variables and the primary market spread, and we compared the results with the expectations as outlined in Section 3. Should *hypothesis 2* be accepted, regression would have to be run on one sample only in order to determine the pricing variables. In the case of a rejection of *hypothesis 2*, examining the coefficients will allow us to determine pricing variables for each security class separately.

3. DATA DESCRIPTION

The principal data source used in this study is formed by the data provided in Structured Finance International Magazine, published by Euromoney Institutional Investor Plc. Structured Finance International (hereafter: SFI) is recognized as one of the leading journals and news sources by the foremost market practitioners - issuers, investors, bankers and other service providers. In particular, SFI provides data on the volume and nature of securitization activities, as well as accurate and transparent league tables on the global capital markets spanning Asia, the Middle East, Europe, Africa and the Americas. This database contains detailed historical information on virtually the entire population of securitization of non-U.S. assets from January 1, 1999 through March 31, 2005. Our sample contains information on 2,427 ABS issues (worth €363.19 billion), 3,650 MBS issues (worth €715.21 billion) and 2,504 CDO issues (worth €316.72 billion) and we refer to this as our "full sample". Because the unit of observation is a single issue (single loan tranche), multiple issues (multiple loan tranches) from the same transaction appear as separate observations in our database – 765 ABS transactions (containing 2,427 issues), 895 MBS transactions (containing 3,650 issues) and 514 CDO transactions (containing 2,504 issues). Although comprehensive in many ways, our full sample has three limitations for our purposes. First, it provides detailed information on securitization transactions limited to non-U.S. assets and dated after 1998. Second, we do not have information measuring credit risk information of the originator, such as solvency, liquidity or leverage ratios. Third, some of the issues may lack key variables such as credit spread.

Since we wished to compare the common pricing characteristics associated with the main security classes and investigate to what extent are the main classes of securities priced by common factors, we selected in our sample those issues which have comparable pricing data expressed. This procedure has yielded a sub-sample of 3,951 loans (worth €730.25 billion) of which 1,129 (worth €208.94 billion) have been classified as ABS. MBS issues represent 2,224 issues (worth €459.32 billion) and 598 are CDO issues (worth €61.99 billion). We refer to this as our "high-information sample", while we call the larger dataset our "full sample". Our high-information sample includes issues with four A.) default and recovery risk characteristics (credit rating, loan to value, maturity, credit enhancement); seven B.) marketability characteristics (size of the tranche, size of transaction, number of tranches, number of lead managers, number of credit rating agencies, whether the issue is retained or not, and finally type of interest rate), and one C.) systemic risk characteristic (currency risk).

On average, we document a relatively high survival rate from the full sample to the high-information sample (52.2% for ABS, 64.4% for MBS and 27.8% for CDO). This is illustrated in Panels A, B and C of Table 1. Each Panel represents the characteristics of the full sample compared with the high-information sample by security class.

Insert Table 1 About Here

A comparison between the common variables in the full sample and the high-information sample in Panels A, B and C reveals that the high-information issues are not dissimilar to their counterparts in terms of loan spread, *A*.) *default and recovery risk* (credit rating, loan to value, maturity, credit enhancement), *B*.) *marketability* (size of the tranche, size of transaction, number of tranches, number of lead managers, number of credit rating agencies, retained interest, type of interest rate) and finally *C*.) *systemic characteristic* (currency risk).[4] So, we assume that any empirical results derived from the high-information samples can be generalized to the larger population including all issues.

A discussion of these *common pricing characteristics* (and expected impact on primary market) will follow below.

3.1 Primary Market Spread

The spread (primary market spread) represents the price for the risk taken on by the lender on the basis of information at the time of issue. In our sample, the spread is defined as the difference between the margins yielded by the security at issue above a corresponding benchmark. The benchmark is presented in basis points. For floating rate issues, the spread (in basis points) is reported as a margin above London Interbank Offered Rate (LIBOR) or Euro Interbank Offered Rate (EURIBOR). However, issues have been included in the sample based on The Australian Financial Markets Association's bank-bill reference rate (BBSW), the Hong Kong Interbank Offered Rate (HIBOR), and the Singapore Interbank Offered Rate (SIBOR). For fixed rate issues, the spread is represented in basis points over the closest benchmark of matching maturity, frequently reported as a margin above EURIBOR, LIBOR and SWAPS. According to Sorge and Gadanecz (2004), these measurements of the spread for floating and fixed rate issues have become standard in the loan pricing literature.

[4] For transaction size and number of tranches, we calculated the average and standard deviation - taking into account transaction size and number of tranches for each transaction individually.

Only various adjustments and refinements are applied in different studies in order to capture the comparability of pricing variables across floating and fixed rate issues in a better fashion (see Firla-Cuchra, 2005). However, since the spreads of all our issues are almost exclusively reported at an Interbank Offered Rate, we do not adjust for the risk difference between the benchmarks.

3.2 Expected Default and Recovery Risk Characteristics

The first set of explanatory variables affecting loan spread consists of default and recovery risk (group *A.*). The following factors used here represent default and recovery risk characteristics: *credit rating, loan to value, time to maturity and credit enhancement.* A discussion of these variables (and expected impact on primary market) will follow below.

The *credit rating* of a loan issue is an evaluation of the likelihood of a borrower defaulting on a loan. By including credit rating in our analysis, we can analyze the impact of default on a securitization issue. A better bond rating should result in lower spreads. This notion is empirically supported by Elton, Gruber, Agrawal and Mann (2001), Kleimeier and Megginson (2001), John, Lynch and Puri (2003), Firla-Cuchra (2005), and finally Gabbi and Sironi (2005), who all find credit rating statistically significant. credit rating should capture the difference in both issuers' creditworthiness and bonds' seniority and security structures. Needing a consistent rating classification, we used the ratings scales as employed by Gabbi and Sironi (2005) as shown in **Table 2**. This classification scheme consists of 21 rating scales for two rating agencies: Moody's and Standard & Poor's, to which we have added Fitch as the third rating agency.

As part of the process, we collected the credit rating class at the time of issuance. If a loan tranche had multiple ratings, we calculated the average of the given values, rounded off to the nearest absolute value, as the rating classification.[5]

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[5] Nomura (2003) reported that the National Economic Research Associates' study on structured finance ratings could not rule out the possibility of substantial performance differences among the rating agencies. Likewise, the summary of the study's findings reports that rating agencies agree with each other somewhat less often than might be expected. According to Nomura (2003), the study found the greatest agreement between Fitch and S&P, and the least agreement between Fitch and Moody's.

Insert Table 2 About Here

We used a set of seven credit rating dummy variables that correspond to credit rating: 1-2 (CR=1-2), 3-4 (CR=3-4), 5-6 (CR=5-6), 7-8 (CR=7-8), 9-10 (CR=9-10), 11-12 (CR=11-12), and 13-14 (CR=13-14). Credit rating classifications above B1/B+ (CR>14) are not available. Credit rating 1-2 (CR=1-2) is the omitted rating category: it has been dropped to avoid collinearity. A word of caution is needed here, as it is important to remember that the rating scales are inverse scales, so that spread *in*creases as rating *de*creases.

Given our desire to control for credit protection of all positions subordinate to a loan tranche, we included the *loan to value* ratio (cumulative level of subordination) in our analysis. In an asset securitization transaction, the senior-subordinated structure splits cash flows into many classes of notes, with each class, or loan tranche, having absolute priority in the cash flow over the more junior classes. This structure is layered, so that each position benefits from the credit protection of all the positions subordinated to it. Typical subordination levels are expressed as a percentage of the transaction's initial principal balance.

We shall illustrate this with the following example. Using a capital structure of two tranches - Class A Junior of €40 million and Class B Senior of €60 million - the originator might sell only Class B tranche. The investor would bear the risk that losses on the underlying portfolio exceed the cumulative subordination level of 40% (€40 million divided by the total of €100 million). If losses reached 40%, the Class A Junior tranche would be wiped out. Between 40% and 100%, each Euro loss on the underlying portfolio translates into Euro loss for the holder of the Class B Senior tranche.

To compute the subordination levels, we manually calculated the subordination level for each loan tranche in each transaction that contains more than one tranche. If a transaction contains one tranche only, the cumulative subordination level is 100% and no subordination exists.[6] We also required the size of all tranches in a transaction to be available: otherwise the subordination level could not be calculated.

We finally calculated the loan to value ratio as the value of a loan cumulated according to the priority structure divided by the total issue amount of the transaction. The expected coefficient sign is negative, as loans with a lower loan to value ratio (junior tranches) have a lower expected recovery rate in case of default than loans with a higher loan to value ratio (senior tranches) and therefore require a higher return. However, its statistical significance could be poor as the loan to value ratio is already reflected in the rating of a loan issue.

Time to maturity is measured in years and affects the bond's default risk premium (Merton, 1974). We calculated the time to maturity as the difference between the legal maturity date of the issue and the launch date. Three maturity dummy variables were constructed based on the maturity of the issue: lowmaturity, medmaturity and highmaturity. *Lowmaturity* is 1 if the issue matures in less than 5 years, *medmaturity* is 1 if the issue matures between 5 and 15 years, *highmaturity* is 1 if the loan matures after 15 years. Its expected sign cannot be determined clearly from either the theoretical or the empirical literature. Helwege and Turner (1998) argue that a positive coefficient is expected as longer maturity bonds require, ceteris paribus, a higher spread. On the other hand, Sarig and Warga (1989) find a negative relationship between maturity and loan spread. The empirical studies that examine maturity's impact on loan pricing show a significant positive coefficient but also an insignificant negative one. Gabbi and Sironi (2005) find a strong positive significant relationship between time to maturity and loan spread after controlling for credit rating. John, Lynch and Puri (2003) find a positive and significant relationship between high maturity loans (> 15 years) and loan spread, and a

[6] If the securitization is structured as a 'pass-through', there is only one class of bonds, and all investors participate proportionally in the net cash flows from the assets.

negative and significant relationship for low maturity loans (< 5 years), after controlling for credit rating. Medium maturity loans (5-15 years) form the omitted category. The authors argue that borrowers issuing short-term debt may face costly liquidation at maturity, motivating the borrower to choose longer-term debt. At the same time, lenders prefer short-term debt to control agency problems. As a result, borrowers are willing to incur, and lenders demand, higher spreads for loans with longer maturity (see Gottesman and Roberts, 2004).

Thus, one would expect a positive spread differential for high maturity loans (> 15 years) and a negative one for low maturity loans (< 5 years), relative to loans with a maturity between 5-15 years (mid maturity). Medium maturity loans is the omitted category: it has been dropped to avoid collinearity.

In our sample, issues with *credit enhancement* refer to issues with a third-party guarantee in the form of an insurance policy issued by one of the monoline insurance companies. Dummy variables take the value of 1 if a loan is guaranteed and zero otherwise. These providers guarantee (or wrap) the principal and interest payments of an issue. For each issue, we collected information whether or not the issue is guaranteed. According to Fabozzi and Roever (2003), for each class of securities in a given structure, the issuer evaluates the trade-off associated with the cost of enhancement versus the reduction in yield required to sell the security. Thus, a negative coefficient is expected. However, its statistical significance could be poor as credit enhancement is already reflected in the rating of the issue.

3.2 Expected Marketability Characteristics

The second set of explanatory variables affecting loan spread is marketability of the loan (group *B.*). The following factors used here represent marketability: *loan size, transaction size, number of tranches, number of lead managers, number of credit rating agencies, whether the issue is retained or not, and finally type of interest rate*.

A discussion of these variables (and expected impact on primary market) will follow below.

The *loan size* is the natural log of the face value of the loan tranche. A higher issue amount is generally believed to improve, ceteris paribus, secondary market liquidity. Larger issues are likely to be associated with less uncertainty, to be more liquid, and to have more public information available about them than smaller offerings.

Hence, we would expect larger issues to have lower spreads. Gabbi and Sironi (2005) and John, Lynch and Puri (2003) found a negative but not significant coefficient. Gabbi and Sironi (2005) explain that this result could be attributed to investors not expecting the liquidity to be affected by the size of the issue, or that investors tend to hold these securities to maturity and are therefore indifferent to their secondary market liquidity. This evidence is in contrast with the expectation that large issues have larger liquidity and suggests that large and small securities issued by the same borrower are close substitutes. Kleimeier and Megginson (2001) found that the influence of loan size on spread is insignificant for project finance loans but negative and significant for other loan samples. The authors explain that this negative relationship between size and loan spread could be due to economies of scale in arranging non-project finance loans. In line with this result, Firla-Cuchra (2005) found a negative and significant relationship between the *transaction size* and spread after controlling for credit rating.[7] The author argues that a positive price liquidity effect is related to the size of the entire issue.[8] Thus, we would expect to find a negative and significant impact of transaction size (the natural log of the transaction issue Euro equivalent amount) on the spread.[9] Overall, for loan size, no sign can be predicted with confidence.

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[7] The currency of the issue has to be analyzed carefully since the value of a securitization issue is often stated in foreign currency. In order to include the issues denominated in different currencies in the analysis, we converted them into Euros. The exchange rate used is the average rate of the year the issue was launched. This information was obtained from the Nederlandsche Bank.

[8] Firla-Cuchra (2005) found a consistently negative and significant impact of the loan size on the spread after controlling for credit rating. However, when the total issue size of the transaction is included in the regression model, the coefficient of the size of the loan becomes positive and significant, while the coefficient of the total transaction size is highly significant and negative. Unfortunately, the author does not provide a clear interpretation of how these results arose.

[9] The face value sum of all tranches for a given transaction.

Each transaction is divided into one or more tranches. For every issue in a given transaction, we documented the *number of tranches* for each transaction. We included number of tranches to analyze the impact of tranching on the spread. Firla-Cuchra and Jenkinson (2006) found a consistent and significant negative relationship between the number of tranches and the launch spread after controlling for credit rating.

They argue that tranching allows the issuer to take advantage of market factors such as greater investor sophistication and heterogeneous screening skills related to asymmetric information. Thus, a negative coefficient of number of tranches is expected.

The *number of lead managers* represents the number of financial institutions participating in the loan issuance management group. These include the lead manager, any co-lead manager, book runners and co-managers. We collected this information in order to analyze any differences in syndicate. A negative coefficient sign is expected, as this would indicate that a larger syndicate is able to achieve, ceteris paribus, a better result or lower loan spread. Gabbi and Sironi (2005) found a consistently positive relationship, but not significant. Firla-Cuchra (2005) found a weak negative significant coefficient. Therefore, no sign can be predicted with confidence.

The *number of rating agencies* represents the number of rating agencies involved in rating the issue. Since many larger credit rating agencies offer credit rating advisory services, this could create a potential conflict of interest, as the credit rating agency may feel obligated to provide the issuer with that given rating if the issuer follows its advice on structuring the offering (The Bond Market Association, 2002). Many institutional investors now prefer a debt issuance to have at least three ratings. Thus, a negative coefficient sign is expected - as this would indicate that a larger number of credit rating agencies involved in rating the issue is able to achieve, ceteris paribus, a more accurate rating, thereby reducing the potential conflict of interest and lowering the loan spread. However, its statistical significance could be poor as the number of credit rating agencies involved is already reflected in the rating of the loan issue.

The *retained subordinated interest* is a beneficial interest in a securitization transaction set up by the originator, absorbs the first losses on the whole loan and is inferior or in secondary position with regard to collection in the event of default (Childs, Ott and Riddiough, 1996). No clear theoretical a priori conclusion can be drawn as far as the expected coefficient sign of this variable is concerned. Other elements remaining equal, a negative sign would indicate that the originator is able to translate original ownership through a lower spread. On the other hand, a positive coefficient would indicate that the issue retained by the originator is related to an increase in risk.

We included *type of interest* rate to analyze the impact of fixed and floating interest rates on the spread. We collected information on whether the issue had a rate fixed for the life of the issue, or had an interest rate that fluctuated depending on the base interest rate (floating rate issue). We constructed two dummy variables based on the type of interest rate. *Fixed*: dummy variable taking the value of 1 if a loan is fixed–price, and zero otherwise. *Floating*: dummy variable taking the value of 1 if a loan is floating–price, and zero otherwise. Since the interest rate on a fixed rate issue does not change during the life of the loan, these notes do not fluctuate and are typically protected to avoid the risk of rising interest rates. We expect borrowers to raise funds at a higher spread through fixed-priced issues rather than through floating-priced issues. For this reason, a positive sign is expected for a fixed rate issue. Floating is the omitted category. However, statistical significance could be poor as the risk inherent to rising interest rates is already reflected in the rating of the loan issue.

3.4 Expected Systematic Characteristics

Systemic risk should control for the risk presented by a country where the assets are located and to pierce the local currency of a specific country that is not already incorporated into an issue rating. *Currency risk* is defined as the risk that is run if the currency in which the loan is repaid differs from the borrower's home country currency. Dummy variable taking the value of 1 if a loan is exposed to currency risk, and zero otherwise. Kleimeier and Megginson (2001) found the currency risk to be statistically highly significant and positive. However, after controlling for credit rating, the authors found a positive but insignificant coefficient. Thus, issues exposed to currency risk have higher spreads than issues not exposed to currency risk. However, an insignificant coefficient is expected since currency risk is already reflected in the credit rating of the issue.

All independent variables are discrete, with the exception of credit rating, loan to value, maturity, loan tranche size, transaction size, number of tranches, number of lead managers and number of credit rating agencies, all of which are continuous. The results for spread regressions are presented in the next section.

4. UNIVARIATE ANALYSIS

This section investigates *how common pricing factors compare for the main classes of securities.* The purpose is to provide extensive insight into the common pricing characteristics associated with these classes, and to elaborate on any substantial differences between them. We propose the following hypothesis: the common pricing factors do not differ significantly in value between the main classes of securities. We used a parametric test - Student’s t-test - to compare whether the distribution of the values reported for the security classes are significantly different, and thus whether the common pricing factors do not significantly differ in value between them.

Insert Table 3 About Here

The numbers in Panel C of **Table 3** are t-statistics, and almost all of the pair-wise comparisons indicate statistically significant differences between the common pricing variables associated with the security classes ABS, MBS and CDO. These differences may explain why the capital market distinguishes between these classes of securities. Below, we shall discuss the main findings included in **Table 3**.[10]

The relative pricing of asset securitization issues shows that average (median) *spreads* are statistically and significantly lower for MBS, with 75.7 basis points (45.0 basis points), than they are for ABS, with 99.2 basis points (50.0 basis points), and CDO, with 162.4 basis points (95.0 basis points). Furthermore, CDOs are more than twice as likely to have *currency risk* involved compared with MBS (39.8% versus 17.2%), and even more than three times compared with ABS (39.8% versus 13.3%). This finding suggests that CDOs more frequently contain a mismatch between the originators' home country currency and the currency of loan repayment. One obvious interpretation is that the collateral of CDOs is more diverse and is frequently originated in multiple countries, as compared with the underlying assets related to ABS and MBS.

MBS and ABS on average tend to be less risky than their CDO counterparts. This is also confirmed by the *credit rating class.* Since credit rating and spread tend to have an inverse relationship, it is obvious that the average credit rating class for MBS (4.0) and for ABS (3.9) is significantly lower than the credit rating for CDOs (4.6). Most observers would have predicted that MBS loans have lower spreads, since loan repayment is frequently backed by large amounts of commercial or residential properties that are relatively liquid and make the issue less risky. CDO collaterals, however, consist of bonds, loans or similar assets, and are considered to be relatively illiquid. Additionally, if we compare the average spread exhibited by ABS, MBS and CDO in our study with the average spread exhibited by all syndicated loans in the study by Kleimeier and

[10] Because data are available for only a limited number of observations, sample sizes occasionally drop for some variables.

Megginson (2001), we notice that ABS (99.2 basis points) and MBS (75.7 basis points) have a lower average spread in comparison with the spread for all syndicated loans (134 basis points).[11] CDOs (162.4 basis points) have a higher average spread in comparison with the average of all syndicated loans, and are therefore considered to be more risky.

On the one hand, spread level and credit rating class provide direct evidence of the riskiness of an asset securitization issue, but on the other hand *the number of rating agencies* and *the number of managers* involved also provide (indirect) evidence of the riskiness of the loan - or at least an indication of the difficulty to underwrite the issue. The average number (median) of participating lead managers for MBS is 1.6 (1) and is significantly larger than the average of 1.4 (1) for ABS and 1.2 (1) for CDOs. CDOs have the lowest average number of arranging banks, which could be explained by the fact that CDOs exclusively involve their own active asset managers with the purpose of managing the underlying portfolio. The need for a higher number of arranging banks would therefore be lower.

MBS have 4.2 (median 3.0) rating agencies involved, which is significantly higher than the 3.8 (3.0) agencies for ABS and 3.7 (3.0) agencies for CDOs. It is difficult to explain why MBS issues have such a relatively high number of agencies involved, since these account for a large share of the capital markets (Nomura, 2006). One possible explanation could be the prepayment risk related to the underlying collateral. Because of this risk, MBS issues tend to be more difficult to rate, and more rating agencies need to be involved to convince investors to participate in the MBS.

The MBS class exhibits the largest average (median) *transaction size* of €747.1 million (€596.0 million) followed by CDO and ABS with an average (median) transaction size of €616.1 million (€358.8 million) and €475.1 million (€331.4 million) respectively. The *cumulative subordination level* in each transaction is layered, so that each position benefits from the credit protection of all the positions subordinated to it. We found that ABS has the highest average (median) loan to value level with 18.0%

[11] Kleimeier and Megginson (2001) compare the characteristics of a sample of 4,956 project finance loans (worth $634 billion) to comparable samples of non-project finance loans, all of which are drawn from a comprehensive sample of 90,784

(6.7%), followed by CDO with 17.8% (10.0%) and MBS with 14.1% (4.5%). Additionally, we found that the average of the cumulative subordination level is higher compared with the median across all classes. This could mean that tranching (splitting cash flows into separate loan tranches) is more extensive at the senior level of a securitization structure.

MBS exhibit the largest (median) *loan tranche size*, amounting to €197.5 million (€48.5 million): an average €70.3 million more than the average tranche size exhibited by CDOs, and €47.2 million more than the average loan tranche size exhibited by ABS. All are significantly different. Average MBS tranche size, however, is relatively large: similar in size to an average loan tranche of all syndicated credits. Kleimeier and Megginson (2001) report that all syndicated loans have an average (median) tranche size of $203 million ($70 million). Since ABS and CDO report an average tranche size of €150.3 (€40.5 million) and €127.2 (€25.0 million) respectively, these tranche sizes tend to be substantially smaller than the average of all syndicated credits. This is reinforced by the observation that in a typical securitization transaction more classes of tranches are issued. They participate differently in the asset cash flows, and thus reduce the size of each loan tranche. In a typical ABS transaction, for example, the average *number* (median) *of tranches per transaction* is 3.2 (2.0): higher than the average number of 1.7 tranches for all syndicated credits. Closer analysis reveals that the assets underlying an asset securitization transaction may benefit from tranching to a larger degree, because of the screening ability inherent to a more homogeneous asset pool (DeMarzo, 2005): the more information-sensitive (regarding screening ability) the underlying assets are, the greater the benefits become (see Riddiough, 1997).

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syndicated loans (worth $13.2 trillion). All syndicated loans include: project finance loans, corporate control loans, capital structure loans, fixed asset-based loans, and general corporate purpose loans.

Average MBS tranche size *matures* just over 27.7 years, which is a long period if we compare this with the average 11.3 and 15.1 years for ABS and CDO respectively. Still, the asset securitization issues, as indicated by the standard deviation, exhibit significant heterogeneity with respect to maturity. For example, average standard deviation for maturity of MBS is 14.0 years; for ABS this is 9.8 years, and for CDOs the standard deviation reports 18.4 years. Mortgages in general are considered to have a long maturity. For instance, the most common type of residential mortgage loan is a 30-year loan. The difference can be explained by the fact that certain types of assets underlying an asset securitization structure lend themselves more easily for issues with longer maturity levels. In general, the payoff profile of the underlying assets is closely related to the maturity of the issues.

Finally, ABS are four times more likely to be *fixed rate* credits than MBS (41.4% versus 12.1%), and almost twice as likely to be *fixed rate* credits with respect to CDOs (41.4% versus 26.1%). Locking in a specific rate, in general, eliminates a major source of cash flow uncertainty. In particular, one would expect MBS to have a relatively higher percentage of fixed rate issues since MBS report the highest average maturity (27.7 years) and the issuance of fixed rate securities would eliminate a major source of cash flow uncertainty inherent to a longer maturity. Nevertheless, floating rate issues tend to offer more flexibility due to the prepayment option in most mortgage loans: mortgage loan borrowers generally have the right to prepay their loans at any time without penalty. For example, when interest rates increase, mortgage loan borrowers may be given an incentive to repay their loan. The originator is able to use these loan repayments to redeem the principal of the outstanding securities, thereby eliminating a major source of cash flow uncertainty. As a result, the need is reduced to issue fixed rate securities in the first place.

Before proceeding to Section 5 in which we analyze the impact of the common pricing features on primary market spread by security class, we should briefly summarize the results of our univariate comparison. This section investigates how common pricing factors compare for the main classes of securities.

The purpose is to provide insight into the common pricing characteristics associated with these classes, and to elaborate on any substantial differences between them. We found that most of the common pricing characteristics between ABS, MBS and CDO in fact differ significantly, and therefore we reject the hypothesis which states that the common pricing factors among the main classes of securities do *not* differ significantly in value.[12] Taking the classes as a whole, we have documented that the assets attached as collateral for the securities differ between security classes, but that there are also important univariate differences to consider. We documented, for example, that:

(1) ABS and MBS on average tend to be less risky than their CDO counterparts. Both MBS and ABS have a significantly lower spread, a significantly higher credit rating and a significantly lower currency risk in comparison with CDOs;

(2) MBS are far more likely to be floating rate rather than fixed rate credits in comparison with ABS and CDOs;

(3) MBS show a significantly larger transaction size than ABS and CDOs;

(4) MBS have significantly longer maturity levels than ABS and CDOs.

The payoff profile of the mortgages lends itself more easily for issues with longer maturity, and therefore MBS report almost twice the average maturity in comparison with ABS and CDOs. In addition, we also found support for the assumption that assets underlying an asset securitization transaction may benefit from tranching to a larger degree in comparison with all syndicated credits.

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[12] Table 3, Panel C shows that all of the pair-wise comparisons indicate statistically significant differences at the 5% level, except: credit rating class between ABS and MBS, loan to value between ABS and CDO, transaction size between ABS and CDO, and finally retained interest between ABS and CDO, and MBS and CDO.

This could be explained by the screening ability inherent to a more homogeneous asset pool. Nevertheless, this result merits future study. Overall, our results indicate that the common pricing characteristics differ significantly in value between the main security classes, and therefore we would expect the impact on pricing to be security-specific. A natural follow-up of this study is an investigation into the *extent* to which the main security classes are priced by common factors.

5. REGRESSION ANALYSIS

This section investigates to what extent *the main classes of securities are priced by common factors*. Its purpose is to analyze the impact of the common pricing features on primary market spread by security class. We propose a second hypothesis: the primary market spreads associated with the main security classes are not influenced differently by common pricing factors. To test *hypothesis 2* we start by analyzing the Chow statistics, which we shall briefly explain in four steps. *First*, one ordinary least squares regression was run on the common pricing variables (independent variables) and the primary market spread (dependent variable), under the assumption that all security classes have the same explanatory variables. We adjusted for heteroscedasticity using the methodology proposed by White (1980).[13] *Second*, coefficients from separate regressions were obtained for each security class, and thus we ran three regressions: one for ABS, one for MBS and one for CDO. *Three*, based on the residual sum of changes of each regression, an F-test of structural change could then be computed (also called a Chow test). In step *four*, *hypothesis 2* cannot be rejected when the computed F value remains smaller than its critical level, and it will be rejected when the F value exceeds the critical level. Should *hypothesis 2* be accepted, one regression only will then be run to determine the impact of the pricing variables on the primary market spread. In the case of a rejection of *hypothesis 2*, we shall examine the relationship between the pricing variables and the spread for each security class separately for comparison.

[13] The Chow test assumes well-behaved error terms to test significant differences in the estimated equations.

The specification of the initial model is:

$$\begin{aligned} SPREAD_i = {} & \alpha + ß_1\, CREDIT\ RATING_i + ß_2\, LOAN\ TO\ VALUE_i + ß_3 \\ & MATURITY_i + ß_4\, ENHANCEMENT_i + ß_5\, LOAN\ SIZE_i + ß_6 \\ & TRANSACTION\ SIZE_i + ß_7\, \#\ TRANCHES_i + ß_8\, \#\ LEAD \\ & MANAGERS_i + ß_9\, \#\ RATING\ AGENCIES_i + ß_{10}\, RETAINED_i + \\ & ß_{11}\, TYPE\ INTEREST\ RATE_i + ß_{12}\, CURRENCY\ RISK_i + \varepsilon_i \end{aligned} \quad (4)$$

5.1 Chow test

We used a Chow test to investigate whether the primary market spreads associated with the main security classes are influenced differently by common pricing factors. The Chow test is a particular test for structural change, also defined as an econometric test, to determine whether the coefficients in a regression model are the same in separate sub-samples. **Table 4** shows to what extent the main classes of securities are priced by common factors.

Insert Table 4 About Here

Hypothesis 2 cannot be rejected when the computed F value remains smaller than its critical level, and will be rejected when the F value exceeds the critical value. The Chow test statistics in **Table 4** are all higher than the critical levels, so we must reject *hypothesis 2.*

Thus, the primary market spreads associated with the main security classes are influenced differently by common pricing factors.[14] Following our analysis, we may conclude that ABS, MBS and CDOs are distinct financial instruments.

In the following section, we shall discuss the relationship between pricing variables and primary market spread for each security class separately for comparison.

5.2 Regression results

In this subsection, we examine the determinants of primary market spreads using an ordinary least squares regression framework, with spread as the dependent variable and the common pricing factors as the independent variables. Initial regression results of the three models are reported in **Table 5**. F statistics on whether coefficients are jointly different from zero as well as adjusted R^2 are reported at the bottom end of the table.

Insert Table 5 About Here

Overall, the model performs relatively well. The adjusted R square is just over 0.65 for our ABS sample: 0.75 for MBS and 0.78 for our CDO sample respectively. This indicates that the model explains a significant proportion of the spread over the sample period.

Table 5 shows that all CR (CR 3-14) dummies are statistically significant, most frequently at the 1% level. The pattern of most credit rating dummy variables indicates that spreads rise when ratings worsen. These results are as predicted, and make intuitive sense. However, the impact of a typical credit rating on the spread differs substantially from security class to security class. For example, the average spread increase for CDOs relative to MBS is substantially lower across the higher rating categories (CR 3-4), and dramatically higher across the lower rating categories (CR 9-14) in Regression #2 and #3.

[14] The test statistic follows the F distribution with k and $N_1 + N_2 - 2k$ degrees of freedom.

One interpretation of this finding is that CDOs may be more exposed to higher levels of distressed assets, dramatically increasing the risk from the higher to the lower rating categories. Overall, all rating dummies are statistically significant with the expected sign, but do not report very similar coefficients for the three sub-samples. Clearly, credit rating does not provide an unbiased estimate to determine spreads.

While finding a consistently significant, negative relationship between the ENHANCEMENT dummy variable and the spread for CDOs is not surprising, the dispersion in coefficient values definitely is. The presence of credit enhancement reduces the spread on CDOs by almost 62 basis points. No other security class exhibits this degree of sensitivity to third-party guarantee in the form of an insurance policy issued by one of the monoline insurance companies. The existence of a negative relationship between credit enhancement and spread for CDOs is in contrast with the positive and insignificant relationship between credit enhancement and spread for ABS and MBS. One interpretation is that CDOs take advantage of the yield differential between the assets in a CDO portfolio and the cost of funding the CDO. These structures typically use a much wider range of collateral in comparison with ABS and MBS, including for example a combination of leveraged loans, high-yield bonds, and investment grade corporate bonds. Since these assets are often already in default, or are traded at prices that are considered distressed levels, the increased market volatility of these assets produces structures with greater credit enhancement potential for the long-term investor. As a result, the impact of credit enhancement on the primary market spread tends to be higher for CDOs in comparison with ABS and MBS, after controlling for credit rating. In other words, CDOs should benefit to a larger degree from the additional credit enhancement, because of the riskiness of the underlying assets, than what was originally implied in their rating.

Our findings with respect to RETAINED can be viewed in a similar context, because retained subordinated interest is also considered a credit enhancement instrument, be it internal. We found that CDOs are the most sensitive to the retained dummy variable, reducing the spread by an average of 92 basis points, be it insignificant. ABS and MBS both report small and insignificant values.

LOAN SIZE behaves differently in our samples. Whereas loan spread and loan size are significantly and positively related for ABS issues, they have a significant negative relationship for CDO issues, and an insignificant relationship for MBS issues. This evidence could explain why large and small MBS issues are close substitutes. However, for ABS, this evidence may support illiquidity in the form of a downward-sloping demand curve. The negative relationship between loan size and spread for CDOs means that, on average, larger issues are associated with a price premium. These findings also merit greater in-depth analysis than we can provide here, considering the fact that ABS and CDOs exhibit a wide variety of assets attached as collateral for the security. Nevertheless, these results are still surprising.

TRANSACTION SIZE has a significantly negative relationship with spreads for ABS and MBS regressions at the 1% level, and an insignificant negative relationship for CDOs. One could interpret a significant negative relationship between transaction size and spread as evidence of a positive price liquidity effect related to the size of the entire issue.

TRANCHES (the number of tranches) has an insignificant relationship with spread across all security classes. We did not find any support that allows the issuers to exploit market factors to their advantage via tranching. The insignificance could suggest that the effect of tranching on the spread is already reflected in the size of the loan tranche or the credit rating class of the issue.

The dummy variables # LEAD MANAGERS and # RATING AGENCIES behave differently for ABS and MBS than for CDO. Whereas spread and number of lead managers are significantly and negatively related for ABS and MBS, they have a significant positive relationship for CDOs. The coefficient value for lead managers indicates that booking a loan with one additional lead manager involved reduces average ABS spread by 6.6 basis points, reduces average MBS loan spread by 4.2 basis points, and increases average CDO spread by 23.2. While a clear interpretation of these results is difficult to provide, one explanation could be found in the difference between the evaluation criteria used by investors and capital markets for CDOs in comparison with ABS and MBS. CDOs exclusively have their own active asset managers involved with

the purpose of managing the underlying portfolio, whereas CDOs on average are exposed to higher risk and may be more subject to temporary imbalances between cash inflows and outflows. The need for a higher number of banks in arranging a CDO would be smaller (see **Table 3**).

However, a potential conflict of interest between asset managers and investors could arise. As a result, the number of credit rating agencies involved in rating CDOs would be able to achieve, ceteris paribus, a more accurate rating, thereby reducing the potential conflict of interest and lowering the spread. This is true in our analysis, as the coefficient value for the number of credit rating agencies indicates that booking a loan tranche with one additional credit rating agency involved decreases average spread by 12.3 for CDOs, and increases the average spread by 6.5 basis points for MBS. Both of these are significant. The average ABS increase is not significant.

The LOWMATURITY dummy showed a significant, negative relationship with spread for CDOs, while we found a positive and insignificant relationship for ABS and MBS. No other security category has anything near this sensitivity to short-term debt. This finding suggests that CDOs with a maturity of less than 5 years reduce the spread significantly with 51 basis points in comparison with an issue with a maturity between 5 to 15 years. Since, on average, collateral of CDOs is considered more risky, lenders could prefer short-term debt to control for the increased collateral volatility, thereby demanding a lower premium than what was implied in the credit rating of the particular issue.

HIGHMATURITY has a significant, positive relationship with spread for ABS issues, and a negative relationship for MBS (weakly significant) and CDOs (insignificant). One obvious interpretation is that investors in ABS demand an additional premium for issues with a maturity longer than 15 years. Thus, long-tenor ABS are prohibitively more expensive. This finding suggests that borrowers are willing to incur, and lenders demand, higher spreads for ABS with longer maturity, after controlling for credit rating. This finding also merits greater in-depth analysis into the nature of the assets than we can provide here.

Of the remaining variables, the relationship between LOAN TO VALUE and spread are negative and insignificant, as expected. The expected coefficient sign of loan to value is negative, as loans with a lower loan to value ratio (lower tranches) have a lower expected recovery rate in case of default than loans with a higher loan to value ratio (higher tranches) and therefore require a higher return. However, statistical significance is poor, as loan to value is most likely already reflected in the rating of a loan issue.

The CURRENCY RISK dummy has a significant, positive relationship with the spread for ABS and CDOs after controlling for credit rating. This finding suggests that issues exposed to currency risk have higher spreads than other issues not exposed to currency risk - by 39 basis points for ABS and by up to 32 basis points for CDOs. We find an insignificant, negative relationship for MBS issues.

FIXED has a strong positive relationship with spread for ABS and MBS, and a negative insignificant one for CDO. This result can easily be explained since the interest on these notes does not fluctuate and the notes are typically protected to avoid the risk of rising interest rates. This indicates that ABS and MBS borrowers on average have to pay an extra risk premium through fixed priced issues in comparison with floating-priced issues: by almost 45 basis points for ABS and 24 basis points for MBS.

The negative and insignificant relationship for CDOs could have two explanations. First, it could result from the fact that CDOs are especially attractive for fixed income investors who want diversified high-yield bonds without any interest sensitivity. Second, the performance of a typical CDO, in comparison with ABS and MBS, depends to a greater degree on the manager's trading ability. Therefore, fixed rate investors prefer to hold a fixed rate bond with no interest rate sensitivity, because the market value of the security is driven solely by collateral performance.

5.3 Regression results: conclusions

Subsection 5.2 investigated the extent to which the main classes of securities are priced by common factors. The purpose was to analyze the impact of common pricing features on primary market spread by security class. We were able to examine a total number of 3,951 loans (worth €730.25 billion), of which 1,129 (worth €208.94 billion) were classified as ABS. MBS issues represent 2,224 issues (worth €459.32 billion) and 598 are CDO issues (worth €61.99 billion). We saw that the Chow test statistics were all higher than the critical levels, and therefore we rejected the hypothesis that the primary market spreads associated with the main security classes are not influenced differently by common pricing factors. The regression analyses we performed demonstrated econometrically that ABS, MBS and CDOs are in fact different financial instruments. Applying the same pricing estimation model to each security class revealed that the common pricing characteristics associated with these classes have a different impact on the primary market spread exhibited by the value of the coefficients. We documented, for example, that:

(1) the impact of a typical credit rating on the spread differs substantially from security class to security class;

(2) credit rating does not provide an unbiased estimate in the determination of spreads;

(3) CDOs tend to be more exposed to higher levels of distressed assets - thereby dramatically increasing the risk from the higher to the lower rating categories;

(4) CDOs are much more sensitive to third-party guarantee than what was implied in their rating in comparison with ABS and MBS;

(5) Lenders tend to offer a higher discount for short-term CDOs in comparison with short-term ABS and MBS, after controlling for credit rating;

(6) long-tenor ABS are prohibitively more expensive than their MBS and CDO counterparts.

A major contribution lies in the fact that the existence of substantial differences between security classes in the impact of common pricing variables on the spread could indicate that these securities are priced differently. Investment banks in charge of structuring the technical features of certain issues may find the estimates a useful tool concerning the size of each variable's impact on the issuance spread by security class.

6. CONCLUSION

Choudhry and Fabozzi (2004, p.5) mention that the capital market in which the securities are issued and traded is composed of three main categories: ABS, MBS and CDOs. The capital market distinguishes between these classes of securities. Due to differences in assets related to these securities, the relevant pricing factors for these securities should differ, too. We were able to examine a total of 3,951 loans (worth €730.25 billion) of which 1,129 (worth €208.94 billion) were classified as ABS. MBS issues represent 2,224 issues (worth €459.32 billion) and 598 are CDO issues (worth €61.99 billion).

We have investigated how common pricing factors compare for the main classes of securities. We found that most of the common pricing characteristics exhibited by ABS, MBS and CDOs differ significantly, and therefore we rejected the hypothesis that the common pricing factors do not differ significantly in value between the main classes of securities.

Taking these classes as a whole, we have documented that the assets attached as collateral for the securities differ between security classes, but that there are also important univariate differences to consider. Furthermore, we saw that the Chow test statistics were all higher than the critical levels, and therefore we rejected the hypothesis that the primary market spreads associated with the main security classes are not influenced differently by common pricing factors. Applying the same pricing estimation model to each security class revealed that most of the common pricing characteristics associated with these classes have a different impact on the primary market spread exhibited by the value of the coefficients. The regression analyses we performed demonstrated econometrically that ABS, MBS and CDOs are in fact different financial instruments.

The substantial differences we found between security classes regarding the impact of common pricing variables on the spread indicate that these securities are indeed priced differently. As such, our results form an important contribution to current research and to activities in the work field, as the estimates concerning the size of each variable's impact on the issuance spread by security class may stand investment banks in good stead in structuring the technical features of certain issues.

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TABLE 1

Common pricing characteristics of asset securitization issues in the full sample compared with those in the high-information sample

Panel A: ABS

(1) Variable of interest	(2) ABS full sample			(3) ABS high-information sample			(4) Surv. Rate
	Number	Mean	Std. Dev.	Number	Mean	Std. Dev.	
primary market spread (bp)	1,472	99.2	133.1	1,129	94.1	120.7	76.7%
credit rating class [1-21 weak]	1,939	3.9	3.5	1,129	4.2	3.5	58.2%
loan to value (%)	1,556	18.0%	24.1%	1,129	20.2%	25.2%	72.9%
time to maturity (years)	2,118	11.3	9.8	1,129	13.9	9.9	53.3%
issues with credit enhancement	2,427	7.6%	-	1,129	9.0%	-	46.5%
loan tranche size (Euro millions)	2,417	150.3	305.1	1,129	179.8	294.5	46.7%
transaction size (Euro millions)	765	475.1	640.1	269	644.6	720.8	35.2%
number of tranches	765	3.2	3.1	269	3.5	2.4	35.2%
number of lead managers	2,417	1.4	0.7	1,129	1.5	0.7	46.7%
number of credit rating agencies	2,207	3.8	0.8	1,129	4.0	0.7	51.2%
retained interest	2,427	4.9%	-	1,129	1.7%	-	46.5%
loans with fixed rate	2,034	41.4%	-	1,129	22.7%	-	55.5%
loans with floating rate	2,034	58.6%	-	1,129	77.3%	-	55.5%
loans with currency risk	2,234	13.3%	-	1,129	14.7%	-	50.5%

Panel B: MBS

(1) Variable of interest	(2) MBS full sample			(3) MBS high-information sample			(4) Surv. Rate
	Number	Mean	Std. Dev.	Number	Mean	Std. Dev.	
primary market spread (bp)	2,767	75.7	83.6	2,224	75.2	79.3	80.4%
credit rating class [1-21 weak]	3,333	4.0	3.5	2,224	3.9	3.3	66.7%
loan to value (%)	3,159	14.1%	21.6%	2,224	15.0%	-	70.6%
time to maturity (years)	3,068	27.7	14.0	2,224	28.9	13.5	72.5%
issues with credit enhancement	3,650	1.8%	-	2,224	1.9%	-	60.9%
loan tranche size (Euro millions)	3,621	197.5	372.3	2,224	198.0	312.1	61.4%
transaction size (Euro millions)	895	747.1	711.0	407	801.2	627.4	45.5%
number of tranches	895	4.1	2.7	407	4.2	2.7	45.5%
number of lead managers	3,617	1.6	0.8	2,224	1.6	0.8	61.5%
number of credit rating agencies	3,392	4.2	0.7	2,224	4.3	0.7	65.6%
retained interest	3,650	3.8%	-	2,224	1.4%	-	60.9%
loans with fixed rate	2,998	12.1%	-	2,224	7.5%	-	74.2%
loans with floating rate	2,998	87.9%	-	2,224	92.5%	-	74.2%
loans with currency risk	3,568	17.2%	-	2,224	21.2%	-	62.3%

Table 1: Common pricing characteristics of asset securitization issues in the full sample compared with those in the high-information sample *(continued)*

Panel C: CDO

(1) Variable of interest	(2) CDO full sample			(3) CDO high-information sample			(4) Surv. Rate
	Number	Mean	Std. Dev.	Number	Mean	Std. Dev.	
primary market spread (bp)	1,453	162.4	167.6	598	162.8	175.5	41.2%
credit rating class [1-21 weak]	1,900	4.6	3.7	598	5.4	3.9	31.5%
loan to value (%)	1,953	17.8%	21.2%	598	18.6%	20.5%	30.7%
time to maturity (years)	1,895	15.1	18.4	598	15.7	15.9	31.6%
issues with credit enhancement	2,504	1.0%	-	598	1.2%	-	23.9%
loan tranche size (Euro millions)	2,490	127.2	453.4	598	97.8	458.0	24.0%
transaction size (Euro millions)	514	616.1	1,028.6	47	923.6	1,346.8	9.1%
number of tranches	514	4.9	3.1	47	4.5	2.8	9.1%
number of lead managers	2,469	1.2	0.7	598	1.3	0.5	24.2%
number of credit rating agencies	2,086	3.7	0.7	598	4.1	0.7	28.7%
retained interest	2,504	4.0%	-	598	1,0%	-	23.9%
loans with fixed rate	1,836	26.1%	-	598	14.2%	-	32.6%
loans with floating rate	1,836	73.9%		598	85.8%	-	32.6%
loans with currency risk	1,248	39.8%	-	598	40.1%	-	47.9%

Column 1 represents the common pricing variables. Column 2 gives number, mean and standard deviation associated with each common pricing variable in *the full sample*. Column 3 presents number, mean and standard deviation associated with each common pricing variable in *the high-information sample*. Column 4 presents the survival rate for each variable. The survival rate is calculated as the number of issues in the high-information sample divided by the number of issues in the full sample.

TABLE 2

Credit rating scales

	Rating agency		
	Moody's	Standard & Poor's	Fitch
Value			
1	Aaa	AAA	AAA
2	Aa1	AA+	AA+
3	Aa2	AA	AA
4	Aa3	AA-	AA-
5	A1	A+	A+
6	A2	A	A
7	A3	A-	A-
8	Baa1	BBB+	BBB+
9	Baa2	BBB	BBB
10	Baa3	BBB-	BBB-
11	Ba1	BB+	BB+
12	Ba2	BB	BB
13	Ba3	BB-	BB-
14	B1	B+	B+
15	B2	B	B
16	B3	B-	B-
17	Caa1	CCC+	CCC+
18	Caa2	CCC+	CCC+
19	Caa3	CCC-	CCC-
20	-	CC	CC
21	-	D	D

TABLE 3

Univariate statistics – pricing features associated with the main security classes compared

Panel A: Univariate analysis – continuous variables

(1) Variable of interest	(2) Security class		
	ABS	MBS	CDO
primary market spread (bp)			
Number	1,472	2,767	1,453
Mean	99.2	75.7	162.4
Median	50.0	45.0	95.0
Min.	-55	-5	-2
Max.	1,400.0	708.0	875.0
Std.dev.	133.1	83.6	167.6
credit rating class [1-21 weak]			
Number	1,939	3,333	1,900
Mean	3.9	4.0	4.6
Median	1.0	3.0	3.0
Min.	1.0	1.0	1.0
Max.	16.0	15.0	16.0
Std.dev.	3.5	3.5	3.7
loan to value (%)			
Number	1,556	3,159	1,953
Mean	18.0%	14.1%	17.8%
Median	6.7%	4.5%	10.0%
Min.	0.0%	0.0%	0.0%
Max.	97.3%	99.9%	100.0%
Std.dev.	24.1%	21.6%	21.2%
time to maturity (years)			
Number	2,118	3,068	1,895
Mean	11.3	27.7	15.1
Median	7.2	31.2	9.1
Min.	0.04	0.50	0.05
Max.	61.0	90.1	99.1
Std.dev.	9.8	14.0	18.4
loan tranche size (Euro millions)			
Number	2,417	3,621	2,490
Mean	150.3	197.5	127.2
Median	40.5	48.5	25.0
Min.	0.07	0.01	0.10
Max.	6,413.7	4,750.0	10,812.0
Std.dev.	305.1	372.3	453.4

Table 3: Univariate statistics – pricing features associated with the main security classes compared (*continued*)

Panel A: Univariate analysis – continuous variables *(continued)*

(1) Variable of interest	(2) Security class		
	ABS	MBS	CDO
transaction size (Euro millions)			
Number	765	895	514
Mean	475.1	747.1	616.1
Median	331.4	596.0	358.8
Min.	0.0	2.3	0.0
Max.	7,307.0	6,637.2	10,812.4
Std.dev.	640.1	711.0	1,028.6
number of tranches			
Number	765	895	514
Mean	3.2	4.1	4.9
Median	2.0	4.0	5.0
Min.	1.0	1.0	1.0
Max.	21.0	19.0	28.0
Std.dev.	3.1	2.7	3.1
number of lead managers			
Number	2,417	3,619	2,469
Mean	1.4	1.6	1.2
Median	1.0	1.0	1.0
Min.	1.0	1.0	1.0
Max.	5.0	7.0	8.0
Std.dev.	0.7	0.8	0.7
number of credit rating agencies			
Number	2,207	3,392	2,086
Mean	3.8	4.2	3.7
Median	3.0	3.0	3.0
Min.	1.0	2.0	2.0
Max.	6.0	6.0	6.0
Std.dev.	0.8	0.7	0.7

Panel A provides a univariate analysis for the full sample of asset securitization issues categorized by security class (continuous variables). Column 1 represents the common pricing variables. Column 2 presents the values associated with each variable.

TABLE 3

Univariate statistics – pricing features associated with the main security classes compared (*continued*)

Panel B: Univariate analysis – dummy variables

(1) Variable of interest	(2) Security class		
	ABS	MBS	CDO
credit enhancement			
N. of issues for which data are available	2,427	3,650	2,504
N. of issues for which dummy = 1	185	64	25
% of total available data	7.6%	1.8%	1.0%
retained issue			
N. of issues for which data are available	2,427	3,650	2,504
N. of issues for which dummy = 1	119	138	99
% of total available data	4.9%	3.8%	4.0%
fixed rate issue			
N. of issues for which data are available	2,034	2,998	1,836
N. of issues for which dummy = 1	843	362	479
% of total available data	41.4%	12.1%	26.1%
currency risk			
N. of issues for which data are available	2,234	3,568	1,248
N. of issues for which dummy = 1	298	613	497
% of total available data	13.3%	17.2%	39.8%

Panel B provides a univariate analysis for the full sample of asset securitization issues categorized by security class (dummy variables). Column 1 represents the common pricing variables. Column 2 presents the values associated with each variable.

Table 3: Univariate statistics – pricing features associated with the main security classes compared (*continued*)

Panel C: Two-sample t-tests assuming unequal variances

(1) Variable of interest	(2) Security class		
	ABS versus MBS	ABS versus CDO	MBS versus CDO
primary market spread (bp)	6.15	-11.27	-18.52
credit rating class [1-21 weak]	-1.32 #	-6.17	-13.53
loan to value (%)	5.55	0.43 #	9.08
time to maturity (years)	-49.63	-7.99	6.40
credit enhancement (0/1)	-10.10	11.54	2.56
loan tranche size (Euro millions)	-5.35	2.13	2.11
transaction size (Euro millions)	-5.01	-1.58 #	-4.83
number of tranches	-6.25	-9.52	-6.02
number of lead managers	-6.89	11.20	-5.29
number of credit rating agcencies	-15.82	-6.11	-5.66
retained interest (0/1)	2.08	1.62 #	-0.34 #
fixed rate issue (0/1)	23.61	10.25	-11.82
currency risk (0/1)	-4.01	-16.96	-14.86

Panel C presents significance tests for the differences in values between security classes. # indicates that the common pricing variables do not differ significantly between the two security classes at the 5% significance level. All other common pricing values are statistically and significantly different at the 5% level or higher.

Source: Structured Finance International.

TABLE 4

Chow test for differences in pricing factors coefficients

	ABS	MBS	CDO
ABS	-		-
MBS	11.78	-	-
CDO	8.54	23.92	-

TABLE 5: DETERMINANTS OF ASSET SECURITIZATION ISSUES – ABS, MBS AND CDO COMPARED (SOURCE: STRUCTURED FINANCE INTERNATIONAL)

Variable	ABS issues Reg. #1	MBS issues Reg. #2	CDO issues Reg. #3
CONSTANT	23.42	166.22 *	363.38 *
	(0.39)	(7.37)	(3.19)
CR = 3 and 4	39.71 *	30.79 *	21.43 *
	(5.53)	(9.96)	(2.52)
CR = 5 and 6	78.33 *	57.37 *	49.17 *
	(10.32)	(17.43)	(4.47)
CR = 7 and 8	143.49 *	109.02 *	96.26 *
	(9.11)	(8.46)	(6.78)
CR = 9 and 10	191.54 *	130.59 *	163.25 *
	(18.58)	(28.68)	(11.88)
CR = 11 and 12	448.16 *	360.10 *	413.16 *
	(15.16)	(23.75)	(14.32)
CR = 13 and 14	446.14 *	345.90 *	547.45 *
	(4.29)	(8.74)	(21.56)
LOAN TO VALUE	-2.75	-4.27	-7.72
	(-0.25)	(-1.54)	(-0.41)
LOWMATURITY	11.75	7.50	-51.11 *
	(0.68)	(1.06)	(-3.13)
HIGHMATURITY	19.35 *	-4.94 ***	-4.71
	(3.32)	(-1.90)	(-0.60)
ENHANCEMENT	3.56	3.95	-61.70 *
	(0.58)	(1.06)	(-3.83)
LOAN SIZE	29.08 *	4.17	-25.73 *
	(5.19)	(1.91)	(-2.68)
TRANSACTION SIZE	-31.98 *	-21.44 *	-11.78
	(-3.21)	(-6.99)	(-0.91)
# TRANCHES	0.04	0.23	1.78
	(0.07)	(0.75)	(1.09)
# LEAD MANAGERS	-6.6 **	-4.24 *	23.23 *
	(-2.21)	(-2.96)	(2.72)
# RATING AGENCIES	8.88	6.49 *	-12.25 *
	(1.40)	(3.94)	(-2.14)
FIXED	44.89 *	23.95 *	-6.36
	(8.37)	(5.15)	(-0.57)
RETAINED	8.95	-2.32	-92.12
	(0.58)	(-0.23)	(-1.08)
CURRENCY RISK	39.23 *	-0.29	31.80 *
	(3.77)	(-0.13)	(4.32)
Number of observations	1,129	2,224	598
Adjusted R^2	0.65	0.75	0.78
F	114.27	361.08	119.33

The dependent variable is defined as the difference between the margins yielded by the security at issue above a corresponding benchmark in basis points. The independent variables are as follows: CR (credit rating), set of rating dummy variables that correspond to credit rating 1-2 (CR=1-2), 3-4 (CR=3-4), 5-6 (CR=5-6), 7-8 (CR=7-8), 9-10 (CR=9-10), 11-12 (CR=11-12), and 13-14 (CR=13-14); LOAN TO VALUE is the subordination level expressed as a percentage of the transaction's initial principal balance; LOWMATURITY is 1 if the issue matures in less than 5 years; HIGHMATURITY is 1 if the loan matures after 15 years; ENHANCEMENT as dummy variable takes the value of 1 if the issue has a third-party guarantee in the form of an insurance policy issued by one of the monoline insurance companies; LOAN SIZE is the natural log of the issue amount in millions of Euros; TRANSACTION SIZE is the natural log of the size of the transaction in Euro millions; # TRANCHES is the number of tranches per transaction; # LEAD MANAGERS is the number of managers representing the number of financial institutions participating in the loan issuance management group; # RATING AGENCIES is the number of rating agencies involved in rating the loan at the time of issuance; FIXED has a dummy of 1 if the loan issue has a rate that is fixed for the life of the loan, zero if the loan has an interest rate that fluctuates depending on the base interest rate (floating rate issue); RETAINED is the retained subordinated interest as a beneficial interest in a securitization transaction by the originator; CURRENCY RISK is a dummy variable that takes the value of 1 if currency risk occurs. The table shows the coefficients and t-statistics, corrected for heteroscedasticity, in parentheses. *, ** and *** denote significance at the 1%, 5% and 10% level.