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A Comparative Analysis of Ex Ante Credit Spreads: Structured Finance versus Straight Debt Finance

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ABSTRACT

Structured finance (SF) – project finance (PF) loans and asset securitization (AS) bonds – and straight debt finance (SDF) – corporate bonds (CB) – transactions are priced in segmented capital markets. Credit spreads are higher for PF loans than they are for AS and CB issues. SF and SDF credit spreads are directly related to default and currency risks, while the slope of the yield curve impacts negatively the credit spreads. The loan to value ratio proves positively related to PF loans and negatively related to AS bonds, while the number of banks has a negative impact on the credit spread for AS and CB issues. PF loan credit spreads and fees are shown to be complements rather than supplements. Borrowers from the U.K. raise funds in PF and CB markets at a higher credit spread and the impact of country risk on the credit spread is positive for PF and CB issues. The 2007/2008 financial crisis have imposed a significant impact on credit spreads. The average credit spread has increased 329.1 bps for PF loans, 206.5 bps for AS bonds, and 220.3 bps for CB issues during the crisis period. Finally, a robust hump-shaped relationship between credit spread and maturity is found for PF loans while a linear positive relationship remains strongly significant for CB.

KEYWORDS:

loan and bond pricing, structured finance, straight debt finance, project finance, asset securitization, corporate bonds, financial crisis, term structure of credit spreads.

A COMPARATIVE ANALYSIS OF EX ANTE CREDIT SPREADS: STRUCTURED FINANCE VERSUS STRAIGHT DEBT FINANCE

1. Introduction

In general, debt capital markets are roughly composed of two major types of financial instruments or transactions: straight debt finance and structured finance transactions. *Structured finance refers to the design of financial products or instruments based on the use of flexible tools to meet, as closely as possible, the requirements of the originator or owner of an asset (or pool of assets) and the needs of investors. Thus, structured finance encompasses all financial arrangements helping to efficiently (re)finance a specified pool of assets beyond the scope of on-balance sheet financing products or instruments.*[1] According to Caselli and Gatti (2005) and Fabozzi, et al. (2006) asset securitization, project finance, structured lease and leveraged corporate acquisition activities (mostly LBOs), are all different forms of structured finance.

We can highlight two core economic benefits provided by structured finance. The first relates to the fact that structured finance enables the financing of a specific asset class when established forms of external finance are unavailable for a particular financing need. The second economic benefit is the reduction in the cost of funding.[2] If the benefits of the reduced cost of funding are greater than the cost of the credit enhancement mechanisms, making use of a structured basis – a transaction that is specifically structured using an SPV and is secured by ring-fencing assets producing cash flows solely for supporting the transaction – is advantageous for sponsors.

Although the academic literature analyzing the credit spread of corporate bonds (CB) – used as a proxy for straight debt finance (SDF) transactions – is vast and growing, research on structured finance (SF) bonds and loans credit spread is scant. We rely on asset securitization (AS) bonds and project finance (PF) loans as proxies for SF transactions. Empirical studies on the price determinants of PF loans and AS bonds are very limited, but a few can still be found.

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[1] This definition stems from the literature, as well as from the evidence which emerges from the observation of the practices of international and domestic intermediaries that compete in structured finance business area. Interesting studies on both theoretical and empirical literature in relation to structured finance include Caselli and Gatti (2005), Davis (2005), Fabozzi et al. (2006), Jobst (2007), Cherubini and Della Lunga (2007), Fabozzi and Kothari (2007), and Criado and Rixtel (2008).

[2] Caselli and Gatti (2005), Fabozzi, et al. (2006), and Tavakoli (2008), among others, point out the reduction of funding costs as one of the major economic motivations of structured finance transactions. The same intuition is presented by Davidson et al. (2003), Roever and Fabozzi (2003), Fabozzi, et al. (2006), Jost (2006), and Fabozzi and Kothari (2007) for asset securitization. According to Esty (2003) and Gatti (2005), the use of project finance may enable sponsors to obtain a reduction in the net cost of financing.

Kleimeier and Megginson (2000) compare the spread and the common pricing factors of PF loans with other syndicated loans and show that PF loans are significantly different from any other types of syndicated loans, with longer maturities, more frequent third-party guarantees, and lower spreads. They also conclude that a third-party guarantee significantly reduces PF loan spreads, while PF loan pricing is not a positive function of maturity and loan size. In turn, Sorge and Gadanecz (2008) compare the term structure of *ex ante* PF credit spreads with non-PF loans and bonds and detect that, whereas credit spreads for both investment-grade and speculative-grade bonds other than PF are a positive linear function of maturity, in PF loans the term structure of credit spreads is 'hump-shaped'. Further evidence on pricing of PF loans is provided by Corielli, et al. (2010), who demonstrate that lenders rely upon the network of nonfinancial contracts as a mechanism to control agency costs and project risks. Blanc-Brude and Strange (2007) argue that, in a PF transaction, lenders should price any risk that is not explicitly managed through contracts. Syndication is also presented as playing a role in driving the credit spreads in PF loans. Esty and Megginson (2000, 2003) show a positive relationship between syndicate size (and concentration) and loan pricing. On the contrary, Kleimeier and Megginson (2000) and Sorge and Gadanecz (2008) report that the presence of larger syndicates reduces credit spreads. With respect to AS, Vink and Thibeault (2008) examine how common pricing factors compare for ABS, MBS and CDO. They find that not only the common pricing factors differ significantly between the main classes of issues but also that ABS, MBS and CDO are influenced differently by common pricing factors.

To our knowledge, no full-scale empirical study of SF in Western Europe has yet been published, namely studying the impact of the 2007/2008 crisis and the subsequent European sovereign debt crisis, on the credit spread of loans and bonds. Despite its use on a worldwide basis and several decades of history, a number of key issues regarding the specific risk determinants of SF, *vis-a-vis* SDF, remain largely unresolved. In particular, recent research has suggested that PF loans might be fundamentally different from other syndicated loans and bond issues [e.g., Kleimeier and Megginson (2000), Hainz and Kleimeier (2003), and Sorge and Gadanecz (2008)]. We believe our study is the first to investigate how credit spread and common pricing factors compare between SF and SDF transactions. A sample of loans – 2,859 PF loans – and bonds – 599 AS bonds and 20,977 CB – issued by Western European borrowers between January 1st, 2000 and December 31st, 2011 has been used in the study. PF and AS transactions typically consist of several tranches funding the same SPV. Therefore, the unit of observation is a single issue or a single loan tranche.

If SF transactions allow the reduction of funding costs when compared with traditional sources of funds, then the rates charged on SF transactions should be lower than the rates charged on SDF transactions. Due to the difference in underlying risks, the relevant pricing factors for these two types of debt instruments should also differ. This raises three questions: (1) *How common pricing factors compare*

between SF and SDF transactions (or tranches)? (2) *Is the credit spread on SF transactions (or tranches) significantly different to the credit spread on SDF transactions (or tranches)*? And (3) *to what extent are SF and SDF transactions (or tranches) priced by common factors*? These questions lead us to test three hypotheses. First, we intend to argue that not only the credit spread but even the common pricing factors differ significantly between SF and SDF transactions. The third hypothesis states that the credit spreads associated with SF and SDF transactions are influenced differently by common pricing factors.

Additionally, the 2007/2008 financial crisis played a significant role in the failure of numerous businesses, due to a decline in consumer wealth, and a downturn in economic activity, contributing to the European sovereign debt crisis. This fact raises one final question: *Is the credit spread on SF transactions (or tranches) significantly affected by the 2007/2008 financial crisis?* We aim thus testing a fourth hypothesis with the purpose of studying the impact of the global financial crisis and the subsequent European sovereign debt crisis on SF credit spreads and pricing factors in Western Europe. We therefore examine whether the credit spread changes across time, by considering a pre-crisis period from January 1st, 2000 through to September 14th, 2008, and a crisis period from September 15th, 2008 through to December 31st, 2011.

The relative pricing of SF versus SDF issues is one of the most important findings presented in our univariate analysis. Average credit spreads are statistically and significantly higher for PF loans (198.3 bps) than they are for AS bonds (148.9 bps) and CB (157.6 bps). On the contrary, average credit spreads for AS and CB issues do not differ significantly. We also find that most of the common pricing characteristics differ significantly, not only between SF and SDF issues but also among SF transactions. All pair-wise comparisons indicate statistically significant differences in value, with the exception of credit spread, tranche size, and currency risk between AS and CB issues. The financial crisis does have a significant impact on SF and SDF credit spreads. The evidence strongly supports the assumption that the average credit spread is statistically and significantly higher for PF loans (329.1 bps versus 136.9 bps), AS bonds (206.5 bps versus 143.5 bps), and CB (220.3 bps versus 125.5) during the crisis period. Additionally, the 2007/2008 financial crisis and the subsequent European sovereign debt crisis have a substantial impact on the common pricing factors of loan and bond transactions. We corroborate these findings in our regression analysis, after controlling for other microeconomic and macroeconomic pricing factors.

We conclude that PF, AS, and CB issues are not priced in a single integrated market. Rejecting our third hypothesis also means that we cannot estimate the full sample of loans and bonds in a single regression. Hence, we examine the determinants of credit spreads for each type of issue using an OLS regression framework. Although some variable coefficients have the expected features, others are not in line with the theoretical and the empirical literature. For instance, although currency risk coefficients for

AS and CB issues have the expected features, our findings for PF loans are different from those presented in the empirical literature [Kleimeier and Megginson (2000)] – currency risk dummy variable has a positive impact on the credit spread.

Given the controversy in the literature regarding the term structure of credit spreads for speculative-grade issuers and even the empirical puzzle of the term structure of PF loans, we also analyze the term structure of credit spreads for SF transactions compared to SDF transactions. We identify several economic *rationales* that might explain why we should expect a different shape for the term structure of credit spreads for SF *vis-a-vis* SDF transactions. For PF loans, a robust hump-shaped relationship between credit spread and maturity is found. A linear positive relationship between credit spread and maturity remains strongly significant for CB issues while it appears insignificant for AS bonds.

This paper is organized as follows. Section 2 details the research questions and presents the methodology. It also describes the Dealscan and DCM Analytics databases used in this study. The basic characteristics for the full and high-information samples of SF *versus* SDF transactions are also presented here. In section 3, the financial characteristics of SF issues are compared with the sample of SDF bonds. We also study the impact of the financial crisis on credit spreads and pricing factors. Section 4 examines the extent to which SF and SDF transactions are priced by common factors. We begin by presenting the methodology and discussing the sets of micro and macro variables and their expected impact on the credit spread. Next, we present the regression analyses results. Section 5 examines the economics underlying the term structure of SF and SDF credit spreads. Section 6 concludes the study.

2. Hypotheses and Data Description

2.1. Hypotheses and Methodology

The four questions raised in the previous section help us to develop the following hypotheses with respect to SF credit spreads:[3]

Hypothesis 1: The pricing factors of SF credit spreads do not differ significantly in relevance from the pricing factors of SDF credit spreads.

Hypothesis 2: The credit spread on SF is lower than or equal to the credit spread on SDF.

Hypothesis 3: The impact of pricing factors on credit spread do not differ significantly between SF and SDF transactions.

Hypothesis 4: After controlling for macroeconomic conditions and loan characteristics, the 2007/2008 financial crisis does not have a significant impact on SF credit spreads.

[3] We use the issuance credit spread (or the tranche spread at closing). Kleimeier and Megginson (2000), Blanc-Brude and Strange (2007), Vink and Thibeault (2008), Sorge and Gadanecz (2008), and Gatti, et al. (2013) among others, use the same variable.

The purpose of testing the first and second hypotheses is to provide extensive insight into the common characteristics and pricing factors associated with SF and SDF financial instruments and to elaborate on any substantial differences between them. In testing Hypotheses 1 and 2 we use a parametric test (*Student's t-test*) for continuous variables and a non-parametric test (*Fisher's exact test*) for dummy variables, to compare whether the distribution of the reported values for SF and SDF tranches are significantly different.

The third hypothesis states that various different variables determine the credit spread, and it may well happen that the impact of these variables on the credit spread is different between SF and SDF transactions. Furthermore, the degree of impact on the spread could differ from one financial instrument class to another. In testing Hypothesis 3, a structural change test is used. To implement the Chow test [Chow (1960)] we first run one ordinary least squares regression on the common pricing variables (independent variables) and the credit spread (dependent variable), under the assumption that all types of issues (PF loans, AS bonds and CB issues) have the same explanatory variables. Then, coefficients from separate regressions are obtained from each type of issue, and we run thus three regressions: one for PF loans, one for AS bonds, and one for CB. Based on the residual sum of changes of each regression, an *F*-test of structural change is computed (also called a Chow test). Finally, Hypothesis 3 will be rejected if the computed *F* value exceeds the critical value, and will be accepted if the *F* value remains smaller than its critical level. Should Hypothesis 3 be accepted, examining the coefficients will allow us to determine loan pricing factors for AS, PF, and CB issues; i.e., a regression test will be run on one sample only to determine the pricing variables. If it is the case that Hypothesis 3 is rejected, regressions on AS, PF, and CB will be run to examine the relationship between the pricing variables and the credit spread for each type of debt issue, separately, for comparison.

The purpose of answering the fourth question is to provide extensive insight into the impact of the financial crisis and the subsequent European sovereign debt crisis on SF (and SDF) credit spreads. This is of further relevance once there is a broad consensus about the important role played by SF transactions, especially asset securitization, in the development and propagation of the 2007/2008 financial crisis.[4] As IMF (2008a) suggests, "*... the proliferation of new complex structured finance products, markets, and business models exposed the financial system to a funding disruption and breakdown in confidence*" and that particular products "*... exacerbated the depth and duration of the crisis by adding uncertainty relating to their valuation as the underlying fundamentals deteriorated.*" Considering this, since the second half of 2008 a flight to quality might have left many investors and intermediaries in the Western European countries credit-rationed. Hence, SF borrowers and lenders might have also changed their

[4] See, among others, IMF (2008b), Benmelech and Dlugosz (2009), Brunnermeier (2009), and Demyanyk and Van Hemert (2011).

attitude towards SF in terms of pricing and compensation. We are therefore examining whether the credit spreads change over time, by considering a pre-crisis period from January 1, 2000 through to September 14, 2008, and a crisis period from September 15, 2008 (Lehman Brothers' bankruptcy filing date) through to December 31, 2011.

2.2. Data Description

Our sample consists of individual loans and bond offers extracted from DealScan and DCM Analytics databases, respectively. DCM Analytics database (formerly Bondware database) is compiled by Dealogic and offers comprehensive information of debt securities issued on the debt capital markets. DealScan database is provided by Thomson Reuters LPC, a market information provider of individual deal information on the global syndicated loan markets. Information is available on the micro characteristics of the loan and bond offers (e.g., transaction and tranche size, maturity, currency, pricing, rating, type of interest rate) and of the borrowers (e.g., name, nationality, industry sector). The reason for using two databases is that we require information about the pricing characteristics of SF and SDF transactions. In fact, while DCM Analytics provides very detailed information regarding CB (used as a proxy for SDF transactions) and AS, Dealscan has particularly rich data about PF loans. We use AS and PF transactions as proxies for SF instruments.[5]

These databases contain detailed historical information on virtually the entire population of bond securities (DCM Analytics) and syndicated loans (DealScan) issued in the international capital markets from January 1st, 2000 through to December 31st, 2011. Although the database extracted from DCM Analytics contains information on several types of bonds, we include only those with a deal type code of "corporate bond-investment-grade", "corporate bond-high yield", "asset-backed security", and "mortgage-backed security".[6] Bond tranches classified either as fixed rate bonds, with coupon rate information, or variable rate bonds, with both spread and index information were included in the data. For variable rate bonds, only those quoted on the following indices were included: Euribor, Euro Libor, USD Libor, and GBP Libor. While Dealscan database contains historical information about syndicated loans and related banking instruments, we examine only loans with a deal specific purpose code of "project finance". We also require, for both databases, that the Borrower/Issuer country belongs to Western

[5] As pointed out in section 1, one can identify four types of SF instruments: PF, AS, structured leasing (SL), and leveraged acquisitions (mainly LBOs). We rely on PF and AS as SF instruments because: (i) there is no public information on SL transactions; and (ii) LBOs can be implemented without an SPV to facilitate the transaction, which is a key element of SF transactions.

[6] We exclude bond issues which have a deal type code of 'Medium-Term Note', 'Non-Us Agency', 'Covered Bonds', and 'Collateralized-Debt Obligation'. Perpetual bonds and bonds with additional features such as step-up, caps, or floors were also excluded from the database. Due to the important role played by CDOs in the 2007/2008 financial crisis – CDOs based on MBS linked to the subprime market were negatively affected inflicting enormous losses on investors – and as CDO issues are frequently backed by ABS and MBS, we decided to exclude CDOs from our AS dataset.

Europe and that the tranche size (in Euro millions) be available.[7] After applying these screens, we are able to examine a total of 24,435 debt issues (worth Euro 6,297.8 billion).[8] Our sample contains information on 599 AS issues (worth Euro 179.1 billion) – of which 430 issues (worth Euro 106.3 billion) have a deal type code of ABS and 169 issues (worth Euro 72.9 billion) have a deal type code of MBS, 20,977 CB issues (worth Euro 5,786.5 billion), and 2,859 PF issues (worth Euro 332.1 billion). We refer to this as our 'full sample'.[9]

Table 1 presents basic characteristics for the full sample of PF, AS, and CB issues. Significant differences are revealed between both SF and SDF issues, as well as between the two categories of SF issues. One of the most remarkable findings is how much larger AS and CB tranches are than PF tranches. These issues have mean values of 299 Euro millions (M€) and 276 M€, respectively, compared with 116 M€ for PF issues. Thus, as regards tranche size, AS securities are similar to SDF securities. This can be explained by the fact that both transactions involve the offer of securities in the capital markets, while syndicated loans are the prominent form of funding for project finance investments.

Table 1

According to the average maturity (years) variable, the three types of loans are substantially different financing instruments. The average maturity of PF loans, 13.6 years, is significantly lower that of the AS bonds full sample (20.9 years), but considerably longer than that of the CB full sample (5.3 years). Additionally, compared to AS and CB samples, PF loans involve more than twice the number of banks in the transaction. Furthermore, AS and CB transactions are more likely to be exposed to currency risk when compared to the PF full sample.

The most remarkable similarity between SF instruments is how frequently PF loans and AS bonds are issued with guarantees (96.9% and 100%, respectively). This largely meets the standard characteristics of PF and AS. Contrary to the traditional CB, where it is the ability of the issuer to generate sufficient cash flows to repay the debt obligation that determines the risks of the transaction, in AS the source of repayments shift from the cash flows of the issuer to the cash flows generated by the securitized assets and/or a third party guarantor, in case of default. In a PF transaction, the financing is structured with as little recourse as possible to the sponsor, while at the same time providing sufficient

[7] We consider the following countries as pertaining to Western Europe: Austria; Belgium; Cyprus; Denmark; Finland; France; Germany; Greece; Iceland; Ireland; Italy; Luxemburg; the Netherlands; Norway; Portugal; Spain; Sweden; Switzerland; and the United Kingdom.

[8] We verify with Thomson Reuters that our PF sample refers to loans made to a vehicle company and with Dealogic that our AS sample refers to securities sold to investors by bankruptcy-remote special purpose vehicles (SPVs).

[9] As the unit of observation is a single issue or a single loan tranche, multiple issues from the same transaction or deal appear as separate observations in our database.

credit support through collaterals or third party guarantees, so that lenders will be satisfied with the credit risk.

2.3. Loans and Bonds Pricing Samples

Since we wish to determine whether SF instruments are more or less expensive for borrowers/sponsors than SDF securities, and to compare the common pricing characteristics associated with PF, AS and CB issues, we select from our full sample those issues that have complete data on credit spread. This screen has yielded a "high-information" sub-sample of 12,080 loans (worth 4,962,996 M€), of which 1,090 (worth 158,487 M€) have been classified as PF loans, AS bonds represent 439 issues (worth 140,733 M€), and 10,551 are CB issues (4,663,777 M€). Our high-information samples include issues with five (A) default and recovery risk characteristics (credit rating, loan to value, time to maturity, tranches with guarantee, and country risk); nine (B) marketability characteristics (tranche size, number of tranches, number of bookrunners, number of banks, type of interest rate, tranches to U.K. borrowers, tranches to financial institutions, and, finally, management fee); and one (C) systematic risk characteristic (tranches with currency risk).

On average, we document a relatively high survival rate from the full sample to the high-information sample (54.7% for PF loans, 75.2% for AS bonds, and 54.3% for CB). This is presented in Tables 2, 3, and 4. A comparison of the common variables in the full samples and in the high-information samples reveals that the high-information issues are not dissimilar to their counterparties in terms of credit spread (remain the same), default and recovery risk characteristics, marketability characteristics, and systematic risk characteristic. Therefore, we assume that any empirical results derived from the high-information sub-samples can be extended to the larger population of all issues. Table 1 to 4 present several variables of interest. Although most of these are self-explanatory, a few of them will require definition.

Tables 2,3, and 4

The *credit spread* corresponds to the price for the risk associated with the financing instrument, on the basis of available information, at the time of issue. For PF loans, the credit spread represents the spread paid by the borrower over 3-month Euribor or 3-month Libor.[10] For bonds, the spread is defined as the margin yielded by the security at issue above a corresponding currency treasury benchmark with a comparable maturity. None of these measures are perfect proxies for the credit risk associated with loans

[10] All of our 1,090 available observations on PF loans credit spread are floating rate issues.

and bonds. In particular, the spread over Euribor or Libor does not represent the full economic cost of credit. Loans and bonds also carry fees that can be related to creditworthiness and performance.[11]

Considering the scarcity of secondary market prices and the absence of borrowers' rating data, the spread over Euribor or Libor for loans and the margin yielded by the security at time of issue above a comparable risk-free government security for bonds, have become standard pricing measures in the literature. Even for AS bonds, we exclude secondary market spreads, because of the relatively poor liquidity of the secondary market for these securities. The comparability of our pricing variables across loans and bonds can be improved by making the following adjustment:[12] while in PF loans the benchmark priced off Euribor or Libor is a three-month interbank rate, bonds typically carry a spread over a benchmark government security (e.g., German Treasury Bonds). Therefore, there is a difference between the two benchmarks represented by different credit risk levels involving unsecured short-term bank risk and a risk-free government rate. Following the approach of Thomas and Wang (2004) and Sorge and Gadanecz (2008), we adjust for the risk difference of the bond and loan benchmarks by adding to the Euribor or Libor spread of the PF loans the difference between the three-month Euro Libor and the three-month German Treasury bill at the time when the loans were granted.[13]

Credit rating evaluates the capacity of the borrower to repay interest and principal on time as promised. Since we need a consistent rating classification scheme, we use the rating scales as shown in Table 5. This classification scheme consists of 22 rating scales for two rating agencies: Standard & Poor's (S&P) and Moody's. Loan and bond ratings are based on the S&P and Moody's bank loan rating at close. If missing, S&P and Moody's senior debt ratings at close are used. If both ratings are available, the average rating is calculated and used.[14] *Country risk* is approximated by Standard & Poor's country credit rating at close and converted as presented in Table 5. Thus, this variable measures from 1 for the countries with the lowest risk to 22 for the countries of highest risk. Other measures of country risk are available and have been used in other studies – such as the monthly data compiled by the International

[11] As pointed out by Sorge and Gadanecz (2008), "*…additional pricing factors, such as commitment fees, underwriting fees, participation fees, and utilization fees are typically charged during loan syndications and indeed during the whole lifetime of the loan.*" Additionally, the bond issue also carries fees, namely up-front fees.

[12] Despite the adjustment, we are aware that the comparability between loans and bonds has some drawbacks, including that most bonds are fixed rate while loans are priced over a floating rate, and that bonds and loans may have quite different covenants. In section 4, we include dummies in our baseline regressions that attempt to control for these differences.

[13] The average difference is 31 basis points and has a standard deviation of 44 basis points during our sample period. Additionally, as loans are priced over a three month rate while bonds tend to be priced off longer-term benchmarks, we will include as additional control in our regression analysis (section 4) the slope of the Euro swap curve as the difference between the 5 year Euro swap rate and the 3-month Libor at the time of the signing of the loan or issuing the bonds.

[14] This classification scheme follows the approach proposed by Sorge and Gadanecz (2008) and Gatti, et al. (2013).

Country Risk Guide (ICRG) or the country risk rank provided by Euromoney magazine. The use of S&P's country rating is justified by its strong correlation with these alternative measures.[15]

Table 5

Loan to value ratio represents the ratio of the tranche size to the transaction size of a given loan or bond issue. This variable is included in our analysis because we intend to control for credit protection of all positions taken by lenders. To compute loan to value ratios, we manually calculated the weight of each loan or bond tranche in each transaction that contains more than one tranche. If the transaction contains one tranche only, the loan to value ratio is 100%. As will be discussed more fully bellow, this variable should have an important role in SF instruments. For example, in an AS transaction, each senior class has absolute priority in the cash flow over the more junior classes – subordination credit enhancement mechanism. As junior classes are typically smaller than the senior ones, we find lower loan to value ratios for these tranches.

The credit spread on SF and SDF is modeled as a function of microeconomic variables. Additionally, we control for the macroeconomic conditions (e.g., level of interest rates, volatility, and slope of the yield curve). The data on macroeconomic variables are obtained from DataStream. We linked the macroeconomic variables and the microeconomic information contained in the loans (DealScan) and bonds (DCM Analytics) databases on the active date (PF loans) or issue date (AS and CB issues). The main problem in choosing a set of variables for each type of issue is the requirement that each set must be meaningful for PF, AS, and CB issues. Several variables were available for the three types of financing instruments used, which allows us to directly compare the main pricing factors for SF and SDF instruments.[16]

3. Financial Characteristics of SF versus SDF transactions

This section provides a full-length statistical analysis of SF versus SDF lending in Western Europe. We start by comparing the financial characteristics of PF loans with the sample of AS bonds, as well as with our CB sample. Univariate tests of significance differences between PF, AS, and CB issues are also presented. Finally, non-parametric tests are used to compare whether the values reported for each variable are significantly different in pre-crisis and crisis periods.

[15] Erb, Harvey, and Viskanta (1996) find that S&P's and Moody's ratings have a 90% rank-order correlation with the IRCG financial rating. Corielli, et al. (2010) present a high correlation (0.902) between S&P ratings and Euromoney country risk scores.

[16] We identified the possible variables to use as instruments for the credit spread based on the available literature [in particular, Kleimeier and Megginson (2000), Altunbas and Gadanecz (2004), Sorge and Gadanecz (2008), Vink and Thibeault (2008), and Gatti, el al. (2013)], and furthermore the opinions collected during verbal discussions with top investment banks confirms our choices.

3.1. Univariate Analysis

In the univariate analysis we examine how credit spread and common pricing factors compare for the three types of financing instruments. The purpose is to provide insight into the common pricing characteristics associated with SF and SDF instruments. In short, the first two hypotheses (Hypothesis 1 and Hypothesis 2) are tested with respect to SF and SDF pricing. Table 7 provides *t-tests* and *Fisher's exact tests* comparing the values of each variable in AS bonds full sample with the corresponding values in the PF loans full sample; the values of each variable in AS bonds full sample with the corresponding values in the CB full sample; and the values of each variable in PF loans full sample with the corresponding values in the CB full sample. The numbers are *t*-statistics for continuous variables and *p*-values for dummy variables. Almost all of the pair-wise comparisons indicate statistically significant differences between the common pricing variables associated with PF, AS, and CB issues.

The relative pricing of SF (PF and AS issues) *versus* SDF (CB issues) issues is one of the most important findings detailed in Tables 6 and 7. Average credit spreads are statistically and significantly higher for PF loans (198.3 bps) than they are for AS bonds (148.9 bps) and CB (157.6 bps). On the contrary, average credit spreads for AS and CB issues do not differ significantly at 5% significance level. Therefore, we accept only the hypothesis that the credit spread on SF is lower than or equal to the credit spread on SDF for AS issues (Hypothesis 2). Our findings diverge from those presented by Hu and Cantor (2006) and Maris and Segal (2002), which state that securitization securities credit spreads have been higher than corporate bond credit spreads. If we compare the average spread exhibited in Table 6 with the average spread exhibited by PF loans and all syndicated loans in the study of Kleimeier and Megginson (2000), we notice that PF loans in Western Europe have higher average spread (198.3 bps *versus* 130 bps) and that PF, AS, and CB issues have higher average spread in comparison with the spread for all syndicated loans (134 bps). Even if we compare the average credit spread for PF loans exhibited in our study without the adjustment for the risk difference of the bond and loan benchmarks (31 bps during our sample period) we continue to notice that PF loans in Western Europe have a higher average credit spread (167.3 bps *versus* 130 bps). However, based on recent samples Corielli, et al. (2010) and Gatti, et al. (2013) find a similar average spread for PF loans (171.8 bps and 169.18 bps, respectively). Vink and Thibeault (2008) present lower average spread for ABS (99.2 bps) and MBS (73.9 bps) in comparison with the average credit spread for AS bonds (148.9 bps) exhibited in our study.

Tables 6 and 7

The average credit rating for AS (4.3) and CB (4.9) issues is significantly lower than the credit rating for PF loans (7). This may suggest that PF transactions are more risky than other types of lending. However, this can reflect the country rating, since PF loan borrowers are, on average, located in far riskier countries than in the case of any other issue category. The average country rating for PF borrowers (2.1)

is significantly higher than the corresponding value for AS bonds (1.3) and CB (1.4). Despite a similar average country rating presented for AS bonds and CB they are statistically and significantly different at the 5% level or higher. When comparing SF with SDF tranches, we conclude that the average credit rating for AS bonds is significantly lower than the average credit rating for CB issues.

The observed level of management fees and the number of participating banks do provide indirect evidence that PF lending may be considered relatively more risky than other types of lending. The average level of management fees for PF loans (49 bps) is significantly higher than the level for AS (33.1 bps) and CB (22.7 bps) issues. The average number of banks participating in PF loans is 6.9 and is significantly larger than the average of 2.4 for AS bonds and 2.9 for CB. These findings suggest that banks wish to increase the number of institutions participating in a PF credit of a given size in order to spread risks over a large number of banks. AS bonds have the lowest average number of bookrunners (1.4), which differ significantly (at 5% significance level) from the average number of bookrunners in CB (1.6) and PF (2.1) issues.

PF lending exhibits the lowest average tranche size of 116.2 M€, an average 182.9 M€ and 159.7 M€ less than the average tranche size exhibited by AS and CB issues, respectively. This can be explained by the fact that PF is typically loan based or buy-and-hold project bond based. However, the average tranche size exhibited by AS bonds do not differ significantly at 5% significance level from the average tranche size exhibited by CB. If we compare the average tranche size exhibited in Table 6 for AS bonds with the average loan tranche presented by Vink and Thibeault (2008), we notice that it is relatively large when compared to 150.3 M€ and 209.6 M€ for ABS and MBS, respectively. The same pattern is observed when we compare AS and CB issues average tranche size in our study with the average tranche size of $203 million verified for all syndicated loans reported by Kleimeier and Megginson (2000).

Currency risk clearly suggests that AS bond issues are often similar to CB issues, but otherwise fundamentally different financial instruments from PF loans. PF loans in Western Europe are much less likely to be subject to currency risk (11% for PF loans *versus* 31.4% and 33.2% for AS and CB issues, respectively).[17] Most of the non-price variables detailed in Table 6 clearly suggest that PF, AS, and CB issues are fundamentally different financial instruments. A far lower fraction of CB issues are arranged for U.K. borrowers (13.5%) than for PF loans (21.2%) and AS bonds (48.7%). CB issues are much more likely to go to borrowers/issuers in financial industry (80.8%) than SF transactions (0.4% for PF loans and 74.1% for AS bonds). Additionally, a significantly larger number of tranches per transaction are issued in a CB transaction. In a typical CB transaction, the average number of tranches per transaction is

[17] If we compare the percentage of PF loan tranches subject to currency risk exhibited in Table 6, 11%, with the percentage exhibited in Gatti, et al. (2013), 47%, we notice that PF loans in Western Europe are much less likely to be subject to currency risk.

18.4, which is larger than the average number of 2.9 for PF loans and 4.5 for AS bonds. However, this number requires further analysis. The average number of tranches in the CB high-information sample (Table 4) falls significantly to 1.8, while it remains similar for PF (3) and AS (4.2) issues. Thus, considering the average number of tranches in high-information samples we can conclude that the assets underlying an asset securitization transaction may benefit from tranching to a larger degree.

An AS tranche of average size matures over just 20.9 years, which is a long period if we compare it with the average 13.6 and 5.3 years for PF and CB tranches, respectively.[18] Still, AS issues, as indicated by the standard deviation, exhibit significant heterogeneity with respect to maturity. For example, average standard deviation for maturity of AS issues is 14.8 years, while it is 9.3 and 5.9 years for PF and CB issues, respectively. The difference can be explained by the fact that certain types of assets underlying an AS structure have long maturities (e.g., residential mortgage loans). In general, the cash flow profile of the underlying assets is closely related to the maturity of the SF transactions. Finally, a significantly larger fraction of CB issues are fixed rate (79%) than the full sample of PF loans (1.4%) and the full sample of AS bonds (24.9%).

Before proceeding to the next section, we will briefly summarize the results of our univariate comparison between SF and SDF issues. We found that most of the common pricing characteristics in fact differ significantly, not only between SF and SDF issues but also among SF transactions. Table 7 shows that all pair-wise comparisons indicate statistically significant differences in value, with the exception of credit spread, tranche size, and currency risk between AS and CB issues. Therefore, we reject the hypothesis (Hypothesis 1) that pricing factors of SF credit spreads do not differ significantly in relevance from the pricing factors of SDF credit spreads. Additionally, we also found that the common pricing characteristics among SF tranches (PF loans and AS bonds) do differ significantly. Considering the financial instruments studied as a whole, we have documented that the warranties and transaction structures differ between the three types of loan issues, but that there are also important univariate differences to consider, namely: (1) PF loans' average credit spreads are statistically and significantly higher than they are for AS and CB issues and we thus reject the Hypothesis 2; (2) Both AS and CB issues have a significant higher tranche size in comparison with PF loans; (3) AS bonds have much longer average maturity and are more likely to be arranged for U.K. borrowers than PF and CB issues; (4) PF lending may be considered relatively more risky because either the average level of management fee or the average number of banks participating are significantly larger than the average for AS and CB issues; (5) PF loans in Western Europe are much less likely to be subject to currency risk and borrowers are, on average, located in far riskier countries than in the case of any other issue category; and (6) CB issues are

[18] The mean loan maturity of PF loans is 8.6 and 8.7 years in Kleimeier and Megginson (2000) and Gatti, et al. (2013), respectively. A higher average maturity of 10.5 years is presented by Corielli, et al. (2010).

more likely to be fixed rate rather than floating rate operations, when compared with AS and PF transactions.

We will examine loan pricing to a greater extent in section 4, when we employ OLS regression to determine what factors influence SF and SDF instruments' credit spreads. However, our results indicate that the common pricing characteristics differ significantly in value between the three types of loan issues. Therefore, we would expect the impact on pricing to be loan-specific.

3.2. The impact of the Financial Crisis on Credit Spreads and Pricing Factors

Until 2008, SF loan and bond issues had been progressively growing (in volume), yet the 2007/2008 global financial crisis and the subsequent European sovereign debt crisis led to a drop in sponsor/issuer interest. Similar to sponsors/issuers, lenders might have also changed their attitude in terms of pricing and compensation. We are therefore investigating whether our univariate results are robust over time considering a pre-crisis period from January 1, 2000 and September 14, 2008, and a crisis period from September 15, through December 31, 2011.[19]

We hypothesize (Hypothesis 4) that, after controlling for macroeconomic conditions and loan characteristics, the financial crisis does not impact significantly on SF credit spreads. Thus, it is important to understand if the 2007/2008 financial crisis and the subsequent European sovereign debt crisis impact significantly not only on credit spread but also on the common pricing factors of loans and bonds. We use a non-parametric test (Wilcoxon *z*-test for continuous variables and Fisher's exact test for dummy variables) to compare whether the values reported for each variable are significantly different in the two periods. Table 8 provides *z-tests* comparing the values for two sub-samples: pre-crisis period sub-sample and crisis period sub-sample. The numbers are *z*-statistics and almost all of the pair-wise comparisons indicate that equality of means for continuous variables can be rejected for PF, AS, and CB issues. The only exceptions are the average credit rating for PF loans and AS bonds, the average loan to value for AS bonds, and the average management fee for CB. Similar findings are presented in Table 9 for dummy variables, which strongly support that, the proportion of tranches for which dummy = 1 differ significantly between the two sub-samples. The exceptions are the guarantee for PF loans, fixed rate issue for PF loans and AS bonds, and financial institutions for PF loans.

Tables 8 and 9

The evidence regarding credit spread strongly supports the assumption that the average credit spread is statistically and significantly higher for PF loans (329.1 bps *versus* 136.9 bps), AS bonds (206.5 bps *versus* 143.5 bps), and CB (220.3 bps *versus* 125.5) during the crisis period. Thus, we reject the hypothesis (Hypothesis 4) that the crisis do not impact significantly on SF credit spread. These simple

[19] September 15, 2008 is the Lehman Brothers' bankruptcy filing date, commonly regarded as the major milestone of the 2007-2008 global financial crisis.

sample analyses, however, do not allow us to control for other microeconomic and macroeconomic pricing factors. We thus proceed, in section 4, with regression analyses where we can take these factors directly into account.

Contrary to PF loans, AS and CB average maturities and tranche sizes have increased significantly during the crisis period. However, it is important to notice that the market for AS has gone through a structural change. During the crisis banks have underwritten their own securitization programs to use them as a guarantee for obtaining resources in the auctions of the European Central Bank; i.e., to create collateral for repo transactions.

Taking the remaining variables, we are able to document the following important findings: (1) CB issues have a significant higher credit rating during the crisis period in comparison with the pre-crisis period; (2) during the crisis period, loans and bonds in Western Europe are located in far riskier countries;[20] (3) PF issues are more likely to have a higher average number of tranches and bookrunners during the crisis period than during the pre-crisis period, when compared with AS bonds; (4) during the financial crisis period, all types of issues were much less likely to be subject to currency risk; and (5) during the crisis period issuers belonging to the financial industry increased their use of SF instruments, namely AS bonds, as compared with SDF instruments: 72.1% of the AS tranches were issued by financial institutions during the pre-crisis period, which compare to 100% in the crisis period (85.5% *versus* 62.7% for CB).

4. The Determinants of Credit Spreads for SF and SDF transactions

In this section, we subject the various high-information samples detailed in Tables 2, 3, and 4 to OLS regression analysis. Our purposes for employing OLS regression are four-fold. First, we intend to determine which of the variables have significant and independent effect on credit spreads once the effects of other variables are accounted for. We hypothesized (Hypothesis 3) that the impact of pricing factors on credit spread does not differ significantly between SF and SDF transactions. Thus, we start our analysis by determining if SF and SDF transactions are priced in the same way, which is equivalent to testing whether PF, AS, and CB issues are priced in segmented or integrated capital markets. Second, we aim to determine whether SF transactions are more or less expensive than SDF transactions, after controlling for other factors (Hypothesis 2). Third, we intend to determine whether the 2007/2008 financial crisis impacted significantly on SF credit spreads – again, after controlling for other microeconomic and macroeconomic pricing factors (Hypothesis 4). Finally, the term structure of SF, as

[20] This can be explained by the European sovereign debt crisis, which has made it difficult or impossible for some countries to re-finance their government debt without the assistance of third parties.

well as of SDF transactions appears as a particular puzzle.[21] Therefore, we aim to analyze the pricing of our cross section dataset of loan and bond issues within a multivariate regression framework, focusing on the relationship between credit spread and maturity, while controlling for other relevant micro and macro risk factors that affect also the credit spread.

The academic literature contains numerous loan pricing studies, both theoretical and empirical. Compared with the large amount of empirical studies on CB credit spreads, research on AS bond and PF loan credit spreads has been scant. Some of the more recent papers on CB price determinants include Duffie and Singleton (1999), Elton, et al. (2001), Collin-Dufresne, et al. (2001), Hull et al. (2004), and Gabbi and Sironi (2005). An important stream of the literature analyzes the relationship between spread and maturity. Empirical studies include Jones et al. (1984), Fons (1987), Sarig and Warga (1989), Helwege and Turner (1999), Duffie and Singleton (2001), and Sorge and Gadanecz (2008). Empirical analyses on AS bonds pricing are presented in Rothberg et al. (1989), Maris and Segal (2002), Ammer and Clinton (2004), Firla-Cuchra (2005), Gorton and Souleles (2005), Hu and Cantor (2006), Vink and Thibeault (2008), and Buscaino et al. (2012). Empirical studies on the pricing of PF loans include Esty and Megginson (2000, 2003), Kleimeier and Megginson (2000), Esty (2004), Harjoto, et al. (2006), Blanc-Brude and Strange (2007), Sorge and Gadanecz (2008), Corielli, et al. (2010), and Gatti, et al. (2013). The loan and bond pricing tests we perform are most similar to those presented in Kleimeier and Megginson (2000), Sorge and Gadanecz (2008), and Vink and Thibeault (2008), and Corielli, et al. (2010).

We estimate the determinants of loans and bonds pricing using the model described in equation [1]. The dependent variable is the *credit spread*, in basis points, and the independent variables are those presented and described in Table 10. We employ standard OLS regression techniques and adjust for heteroskedasticity using the methodology proposed by Huber (1967) and White (1980).[22] The specification of the initial model is:

[21] For PF loans, Kleimeier and Megginson (2000) conclude that PF loan pricing is not a positive function of maturity. Sorge and Gadanecz (2008) study this apparent absence of a clear relationship between spreads and maturity in PF loans and show that the term structure of credit spreads is 'hump-shaped'. Regarding CB, several authors [Duffie and Singleton (2001) and Sorge and Gadanecz (2008)] argue that, on average, the term structure of credit spreads for investment grade bonds appears upward-sloping. However, the literature has been more controversial regarding the term structure of credit spreads for non-investment grade bonds – Sarig and Warga (1989) and Fons (1987) find downward-sloping term structures of credit spreads for non-investment grade bonds.

[22] We use the Huber-White-sandwich estimator of the variance of the linear regression estimator. The names Huber and White refer to the seminal references for this estimator: Huber (1967) and White (1980). For further discussion of this subject see Froot (1989) and Baum (2006).

$$\begin{aligned} Credit\ spread_i = {} & \alpha + \beta_1 Log\ transaction\ size_i + \beta_2 Log\ loan\ to\ value_i + \beta_3 Maturity_i \\ & + \beta_4 Number\ of\ tranches_i + \beta_5 Number\ of\ banks_i + \beta_6 Country\ risk_i \\ & + \beta_7 Currency\ risk_i + \beta_8 U.K.borrowers_i + \beta_9 Crisis_i + \beta_{10} Risk\ free\ rate_i \\ & + \beta_{11} Volatility_i + \beta_{12} EUSA5y - Libor3m_i + \beta_{13} Commercial_i + \beta_{14} Industrial_i \\ & + \beta_{15} Utilities_i + \beta_{16} Transportation_i + \beta_{17} Government + \beta_{18} Other + \varepsilon_i \end{aligned} \quad [1]$$

For *credit spread*, we first estimate a complete model using all independent variables presented in equation [1] and six new models, each including one key additional variable at a time, to test the influence of each one on the dependent variable. Thus, the following variables will be included separately in our regression models: (i) *Rating* and *Management fee* due to their limited number of observations; (ii) *Upfront fee* because it is available for PF loans only; (iii) *Collateral* because it is available for AS bonds only; and (iv) *Fixed rate* and *Callable* because they are available for AS and CB issues only. Table 10 gives an overview of the variables and their expected sign, taking into consideration the existing theoretical and empirical literature.

Table 10

4.1. Determinants of Credit Spreads for the High-Information SF and SDF Samples

A Chow test of structural change is used to investigate whether the credit spreads associated with SF and SDF issues are influenced differently by common pricing factors (Hypothesis 3). In essence, we are testing whether the pricing factors used in equation [1] are significant in both SF and SDF transactions and, if so, whether they have the same coefficient values. When running the OLS regressions for computing Chow statistics we adjusted for heteroskedasticity using the methodology proposed by Huber (1967) and White (1980). Hypothesis 3 has to be rejected because the Chow test statistics in Table 11 are all higher than the critical levels. The credit spread associated with PF, AS, and CB issues are influenced differently by common pricing factors. From our analysis, we conclude that: (i) SF and SDF transactions are distinct financial instruments; and (ii) PF loans and AS bonds are financial instruments influenced differently by common pricing factors. Hence, they are not priced in a single integrated market and we cannot estimate the full sample of loans and bonds in a single regression. This means also that we cannot directly test whether the spread on SF is lower than or equal to the credit spread on SDF (Hypothesis 2) by including a PF and an AS dummy variable in a regression of a sample of all types of financing transactions.

Table 11

Considering that we reject Hypothesis 3, next we examine the determinants of credit spreads for each type of issue using OLS regression framework. Table 12 presents the results of estimating equation [1] using each of the three high-information samples discussed in section 2. The regression intercepts for each type of loan issue show – although a direct comparison is not possible since some of the variables

are omitted because of collinearity –, as pointed out in the univariate analysis (Table 6), the highest credit spread for PF loans in Western Europe when compared to AS and CB issues. This result, coupled with the univariate test results (Table 7) shows that PF loans have significantly higher credit spreads than AS and CB issues. These findings are contrary to those of Kleimeier and Megginson (2000), who find that PF loans have significantly lower spreads than other syndicated loans (corporate control; capital structure; and general corporate purpose). However, this is in line with the prediction of Fabozzi et al. (2006) and Gatti (2008), who present higher costs of borrowing when compared to conventional financing as one of the major disadvantages of project finance – they are costly to set up, take a long time to execute, and are highly restrictive once in place.

Table 12

The second line of Table 12 details the influence of *transaction size* on credit spread, which is insignificant for AS but negative and significant for PF and CB. This suggests that increasing the transaction size by 100 M€ will reduce the required credit spread by 89.89 basis points (bps) and 40.53 bps for PF loans and CB, respectively. One could interpret this significant negative relationship between transaction size and credit spread as evidence of a positive price liquidity effect related to the size of the entire issue. *Loan to value ratio* behaves differently for PF loans than for AS bonds. Whereas spread and loan to value are significantly, positively related for PF loans, they have a significant negative relationship for AS bonds. These results are in line with the expected coefficient sign for PF and AS issues. AS bonds demonstrate a larger coefficient compared to PF loans, which means that lenders associate an increase in the loan to value ratio with a significant reduction of credit risk for these types of securities.

Whereas credit spread and *maturity* are significantly, negatively related for CB issues, they show an insignificant relationship for PF and AS issues. The coefficient value indicates that issuing a CB, with an original maturity one year longer than the median, decreases credit spread by 1.12 bps. Similarly, the *number of tranches* has an insignificant relationship with credit spread across SF transactions, but significant for CB issues. Thus, we do not find any evidence that issuers exploit market factors to their advantage via tranching of AS bonds. For CB issues, as expected, riskier transactions imply a higher number of tranches as each investor is available to constitute a lower share in their portfolio; i.e., an issuer will benefit from more tranches in the transaction especially in the situation of a higher degree of information asymmetry.

The variable *number of banks* behaves differently for PF loans as compared with for AS and CB issues. Whereas credit spread and number of banks are significantly and positively related for PF loans, they have a significantly negative relationship for AS and CB issues. The need for a higher number of banks in arranging a PF transaction can possibly be associated with an increase in risk and thus an extra

premium is demanded. For AS and CB issues, a larger number of banks involved is able to lower the spread once investors associate a larger number of banks with an increase in the certification of the transaction.

The *country risk* variable is significantly positive for PF loans, indicating that lending to a borrower located in a country with a rating of BB+ (BB+=11) *versus* one with a rating of AAA (AAA=1) will increase loans credit spread by 77.80 bps. Contrary to what we expected, based on empirical literature [Kleimeier and Megginson (2000)], *currency risk* dummy has a significant, positive relationship with the credit spread for PF loans. This finding for Western European PF transactions suggests that a mismatch in the currency of the borrower's home country and the currency of the PF loan repayment, significantly increases the rate charged on an average loan by 38.11 bps. We expected *U.K. borrowers* to raise funds at a lower spread compared to borrowers from continental Europe. However, U.K. borrowers' dummy variable is significantly positive for both PF and CB issues, indicating that lending to a borrower located in U.K. *versus* one in Continental Europe will increase credit spreads by 49.85 bps and 17.49 bps for PF and CB issues, respectively.

As expected, the 2007/2008 financial *crisis* and the subsequent European sovereign debt crisis have imposed a significant increase in credit spreads of all the types of financing. A transaction with the issue date or active date belonging to the crisis period will have a higher average credit spread of 174.01 bps, 121.25 bps, and 77.41 bps for PF, AS, and CB issues, respectively.

The *risk free rate* has an insignificant relationship with AS bond credit spreads, but a significantly negative relationship with PF loan credit spreads. Our findings for PF loans differ from those of Blanc-Brude and Strange (2007), who find for a sample of EU and UK PPPs that risk-free rate variable proves to have no statistically significance on the pricing of PF tranches. Credit spread and the slope of the Euro swap curve – *EUSA5y-Libor3M* –are significantly and negatively related for SF transactions; i.e., a steeper Euro swap curve is associated with lower credit spreads. This suggests that SF credit spreads contain strong systematic risk components. On the contrary, the relationship between credit spreads and the slope of the Euro swap curve is insignificant for SDF transactions. Our results are in line with those of Hu and Cantor (2006), but contrary to those of Sorge and Gadanecz (2008). The variable *volatility* behaves differently for PF loans than for AS and CB issues. Whereas credit spread and volatility are significantly and positively related for AS and CB issues, they have an insignificant relationship for PF loans. In the presence of higher volatility, AS and CB issuers will pay a higher return.

The last six variables are dummy variables resulting from the categorical variable *sector*. The control group includes financial institutions. Thus, the interpretation of the coefficients for sector dummy variables (*Commercial*, *Industrial*, *Utilities*, *Transportation*, *Government*, and *Other*) occurs with reference to that omitted variable. We discover, in line with Corielli et al. (2010), that sector does not

influence the level of credit spreads in PF transactions. While the *commercial* dummy variable has a significantly positive relationship with AS bond credit spreads, *industrial*, *utilities*, and *transportation* dummy variables have insignificant coefficients. This means that in model [1b] the predicted credit spread is approximately 108.80 bps higher for issuers belonging to the commercial sector than in the financial industry. For CB issues, and with the exception of the *government* dummy variable, all other sector dummy variables have predicted credit spreads higher than those for the financial industry.

DealScan and DCM Analytics databases provide varying information about individual loans and bond issues, respectively. Depending upon factors such as sector, nationality of borrower, the facility type for PF loans and factors such as deal type, sector, issuer nationality, and issue type for AS and CB issues, databases provide varying amounts of information. Thus, information on credit rating, fee level, type of interest rate, if the bond is callable, and collateral is available only for some of the transactions belonging to our high-information sub-samples. Rather than restrict ourselves to analyzing a single sample with all of this information available – which, e.g., yield a sample size of less than 39 loans for PF transactions –, we study and compare several different PF, AS, and CB sub-samples, grouped on the basis of the availability of key data items.

4.2. The Impact of Credit Risk on SF and SDF Credit Spreads

It is difficult to obtain credit risk information for PF loans. This is because the information about the credit rating for PF loans at closing date provided by DealScan is scant when compared with the credit rating information provided by DCM Analytics database for AS and CB issues. Models [2a], [2b], and [2c] present loan pricing regression results for a sample of 39 PF loans, 364 AS bonds, and 8,686 CB with a credit rating at closing date from either S&P or Moody's.[23] We compare these results with those obtained from the estimation of equation [1], using each of the three high-information samples (models [1a], [1b], and [1c]). Table 13 shows exactly the results expected; i.e., the higher the credit risk of the borrower or issuer the higher the credit spread. A one unit increase in credit *rating* (corresponding to a downgrade from AAA to AA+) is associated with an increase of 7.37 bps, 27.44 bps, and 29.06 bps in PF, AS, and CB issues credit spread, respectively. The inclusion of a direct measure of credit risk has a considerable impact on the regressions intercept, causing a reduction of 154.00 bps for PF loans, 100.17 bps for AS bonds, and 220.92 bps for CB.

Table 13

Considering SDF (CB) issues, model [2c] yields an adjusted R^2 value of 0.43, which compares with a value of 0.21 for model [1c]. This shows, as referred virtually by all of the empirical studies on

[23] We estimated models [2a], [2b], and [2c] using a rating scale – we reclassified the S&P's ratings into five categories ranging from best to default – like the one proposed by Corielli, et al. (2010) and the results remain largely the same.

CB, that credit ratings are one of the most important determinants of CB credit spreads. Comparing the results presented in model [2c] with those presented in model [1c], important differences either in significance and size of the coefficients can be pointed out, namely: (1) the coefficients on *log transaction size*, *U.K. borrowers*, and *industrial* and *transportation* dummy variables become insignificant; (2) *currency risk* and *government* dummy variable become significantly and positively related with credit spread, while the slope of the Euro swap curve – *EUSA5y-Libor3M* – significantly reduces a CB issue credit spread; (3) the sign of the impact of the time to *maturity* on credit spread changes between regressions; i.e., in model [1c] maturity is significantly negative and becomes significantly positive in model [2c] – for CB issues with rating, a one-year increase in maturity is associated with a 1 bps increase in credit spread; and (4) a change in coefficient sign also takes place for *commercial* and *utilities* dummy variables; i.e., when controlling for rating, issuers belonging to the commercial and utilities industry pay lower credit spreads than issuers in the financial industry.

For PF loans (model [2a]), the coefficient of the *risk free rate* remains significantly and negatively related to credit spread. Coefficients on *log transaction size*, *log loan to value*, *number of banks*, *country risk*, *currency risk*, *crisis*, and *EUSA5y-Libor3M* become insignificant. Thus, the credit spread is basically explained by credit risk and level of interest rate, the last ones roughly reflecting the monetary policy. It is also important to notice that this change in coefficients is also related to the significant reduction in the number of observations between models [1a] and [2a] – from 1,029 to 39 observations –, which implies that significant precaution is needed in the analysis of the results for PF loans when we include the rating variable. Each of these regressions explains a non-trivial fraction of the total variation in observed PF loan spreads, yielding adjusted R^2 values of 0.51 and 0.67.

Results in estimating model [2b] show that variables *number of banks* and *EUSA5y-Libor3M* significantly reduce the credit spread. The coefficients on *log loan to value* and on *crisis* and *commercial* dummy variables become insignificant, while *volatility* and *transportation* dummy variable both are significantly and positively related to credit spread. The adjusted R^2 value increases from 0.19 to 0.46 ([1b] *versus* [2b]). Our findings are in line with empirical studies, which found *rating* to be one of the most important determinants of AS bond credit spreads.

4.3. The Impact of Fees on SF and SDF Credit Spreads

Credit spreads are not the only measure of risk premium, because loans and bonds also carry fees that can be related to creditworthiness and performance. In the syndication market (PF loans) two types of fees are usually charged by lenders: (i) commitment or annual fees; and (ii) participation or upfront fees. In the bond market a type of fee is usually charged by underwriters: management fees, which are paid annually. Thus, we use the following two variables to capture the impact of fees on SF and SDF credit

spreads: (i) *management fee* (management fees for AS and CB issues and commitment or annual fees for PF loans); and (ii) *upfront fees* (only available for PF loans).

Models [3a], [3b], and [3c] of Table 14 present the results of our loan and bond pricing regressions for three sub-samples of 125, 37, and 1,334 PF, AS, and CB issues, respectively. These regressions examine whether loan and bond credit spreads and fees are complements or substitutes. For PF and CB issues, the coefficients on the *management fee* variable are significantly positive, suggesting that fees and spreads are complements. On average, each additional basis point increase in the management fee increases the credit spread by 0.85 bps and 0.51 bps for PF and CB issues, respectively. The logical interpretation of this finding for PF loans is that banks are enticed to participate in riskier loans by being offered both higher fees and higher spreads. Regarding CB transactions, banks increase their effort to underwrite riskier securities if the management fee they receive over the life of the transaction increases. Not surprisingly, including management fees in the regressions also reduces significantly the regression intercept, although it remains positive in both cases. Additionally, the model for PF loans (model [3a]) also has by far the highest explanatory power (adjusted R^2 value of 0.70) on any of the estimations presented in Tables 12, 13, and 14.

The coefficient of the management fee is insignificant for AS transactions. This makes sense because in an AS transaction (i) banks are usually the originator; i.e., banks sell the assets to a separate entity (SPV), which then issues securities; and (ii) the originator retains the servicing function and thus receives the servicing fee. With the exception of the commercial dummy variable, all of the other variables in AS bonds management fee regression are insignificant. However, the results must be taken with caution, as we verify a significant reduction in the number of observations between models [1b] and [3b] – from 439 to 37 observations.

Table 14 ‹

Only two variables in the PF loans management fee sample model remain significantly related with credit spread (model [1a] *versus* model [3a]). As it has frequently been the case, dummy variable *crisis* is significantly, positively related to credit spread. Moreover, the slope of the Euro swap curve – *EUSA5y-Libor3M* – significantly reduces a PF loan credit spread. The coefficient of the *number of tranches*, however, is significantly, positively related to spread.

In CB issues management fee model (model [3c]), the variables' *log transaction size*, *crisis*, *volatility*, and *commercial*, *industrial* and *other* dummy variables remain statistically significant in explaining the credit spread. The coefficient of the *number of tranches* and *U.K. borrowers*, *utilities* and *transportation* dummy variables become insignificant, while the coefficients of the *country risk*, *currency risk* (both with a positive sign), and *EUSA5y-Libor3M* (with a negative sign) become statistically significant. As usual, the coefficient of the time to *maturity* changes its sign; i.e., when controlling for

management fees, maturity significantly increases the CB issues credit spread. Finally, the coefficient of the *number of banks* becomes significantly, positively related to credit spread.

The upfront fee is a fee paid by a borrower to a bank syndicate for syndicating a loan in a PF transaction. Credit spreads and fees are usually complements or substitutes in syndicated loans; i.e., arrangers are usually 'paid' by spreads and fees. Model [4a] in Table 15 presents loan pricing regression results for a sample of 196 PF loans with information on upfront fee. It is worth noting that for PF loans both *management fee* and *upfront fees* are very significantly and positively correlated with credit spreads, which supports the idea that risk is priced jointly through spreads and fees. These findings are consistent to those presented by Blanc-Brude and Strange (2007) and by Gatti, et al. (2013). Again, model [4a] has a relatively significant explanatory power, yielding an adjusted R^2 value of 0.66.

Table 15

4.4. The Impact of Bonds' Specific Variables on Credit Spreads

There are specific variables that can only be included in regression models for bond credit spreads. Collateral is a dummy variable available only for AS bonds. Similarly, callable and fixed rate are variables available only for AS and CB issues. Thus, these variables cannot be included in the model for PF loans since they are only meaningful in the context of bond issues. Models [5b] and [6c] in Table 16 present loan pricing regression results for a sample of 364 and 6,139 AS and CB issues, respectively.

Table 16

As expected, we find a significantly negative coefficient for the *collateral* dummy variable. This means that MBS (i.e., securities backed by mortgages) have an average credit spread lower than ABS (i.e., securities backed by consumer-backed products) by 47.37 bps. One interpretation is that the collateral of MBS is less diverse and subject to less price volatility than the collateral of ABS. Likewise, the existence of a mortgage reduces the expected loss in a scenario of default.

Although insignificant for AS bond issues, *fixed rate* and *callable* dummy variables have a strong positive relationship with credit spreads for CB issues. Regarding the fixed rate dummy variable, the result for CB issues can clearly be easily explained since the coupon rates on these bonds do not fluctuate and are typically protected to avoid the risk of rising interest rates. This indicates that CB borrowers on average have to pay an extra risk premium on fixed coupon rate issues in comparison with floating rate issues by 29.24 bps. The introduction of a call option in a CB issue increases the credit spread by 50.68 bps. Thus, an issuer has to pay a premium to have the right to redeem the bond before the bond maturity.

With regard to model [5b], the results are in line with the expected coefficient signs for all the variables that significantly affect AS bond credit spreads; i.e., the *volatility*, *rating* and *transportation* dummy variable are significantly and positively related with credit spread, while variables *EUSA5y-Libor3M* and *collateral* significantly reduce AS bond credit spreads. Fifteen variables in the CB sub-

sample model remain significantly related with credit spread (model [6c]). While variables' *log transaction size*, *number of tranches*, *volatility*, *rating*, *credit accessibility*, and *U.K. borrowers*, *crisis*, *fixed rate*, *callable*, *government* and *other* dummy variables are significantly, positively related to credit spread, the *number of banks* and *commercial*, *industrial* and *utilities* dummy variables significantly reduces a CB issue credit spread. Models [5b] and [6c] have, by far, the highest explanatory power, yielding an adjusted R^2 value of 0.48 and 0.55 for AS and CB issues, respectively.

4.5. The Impact of the Financial Crisis on SF and SDF Credit Spreads

In order to test the impact of the 2007/2008 financial crisis and the subsequent European sovereign debt crisis on SF credit spreads, we hypothesize (Hypothesis 4) that after controlling for macroeconomic conditions and loan characteristics, the financial crisis does not have a significant impact on SF credit spreads. Our purpose is to examine whether our results are robust over time by considering a pre-crisis period from January 1, 2000 and September 14, 2008, and a crisis period from September 15, 2008 through to December 31, 2011.

Model [1a] – Table 17 – for both pre-crisis and crisis period shows exactly the results expected; i.e., PF loans credit spreads have increased significantly during the crisis period. The split of our PF loans sample has a considerable impact on the regressions intercept, causing an increase of 342.96 bps between pre-crisis and crisis sub-samples. The coefficients of the *log transaction size*, *risk free rate* and *EUSA5y-Libor3M* remain (when comparing regression results for pre-crisis and crisis sub-samples) significantly, negatively related to credit spread. Similarly, the coefficient of the *U.K. borrowers* remains significantly, positively related to credit spread. It is important to notice that all the referred coefficients increased their values. Coefficient of *maturity*, *number of banks*, *currency risk* and *volatility* become insignificant. Finally, variables' *log loan to value*, *country risk* and *industrial* and *utilities* dummy variables become significantly, positively related to credit spread. Thus, we can identify a change in the type of factors that explain PF loan credit spreads, from marketability factors (maturity and number of banks) to default factors (loan to value and country risk). The statistical significance of log loan to value might be explained by the fact that a higher loan to value ratio means greater risk for lenders since that loan constitutes a larger share in their loan portfolio. Additionally, during the crisis period banks lost balance sheet capacity to lend. The significant and positive relationship between country risk and credit spread during the crisis period is not a surprise, since rating agencies downgraded sovereign bond ratings from several Western European countries (e.g., Belgium, Greece, Ireland, Italy, Portugal, and Spain).

Table 17 ;

For AS bonds (model [2b] for pre-crisis and crisis sub-samples), none of the coefficients are statistically significant for the crisis period. This can be explained by the significant reduction in the number of observations of model [2b] for crisis period *vis-a-vis* model [2b] for pre-crisis period.

Unfortunately, the small number of observations for AS transactions during the crisis period does not allow for an in-depth analysis. We believe that this result presents an important opportunity for future research.

With respect to SDF (CB) issues (model [2c]), the coefficients of *maturity*, *currency risk*, *volatility*, *utilities* dummy variable, and *rating* remain statistically significant, while the coefficients of the *number of banks*, *EUSA5y-Libor3M*, and *other* dummy variables become insignificant. On the contrary, *commercial* and *industrial* dummy variables become significantly, negatively related with credit spread, which means that during the crisis period issuers in the financial sector pay higher credit spreads than in commercial and industrial sectors. A change in coefficient signs takes place for four variables. As for PF loans, variables of *U.K. borrowers* and *country risk* are significantly and positively related to CB issue credit spreads during the crisis period. *Log transaction size* variable becomes significantly, positively related to credit spread while the *number of tranches* become significantly, negatively related to credit spread. The change in sign for transaction size and number of tranches could be explained by a liquidity shortfall in financial markets. The critical phase of the 2007/2008 financial crisis manifested a shortage of liquidity, which was reflected in a fall in asset prices below their long run fundamental price and a deterioration in external financing conditions. U.K. borrowers' dummy variable becomes significantly, positively related to CB issue credit spreads during the crisis period because the resulting liquidity problems strongly affected U.K. financial institutions, which issued almost 50% of all CB issued in the U.K. during this period.

Based on our regression analysis, we again reject hypothesis 4, as the 2007/2008 financial crisis and the subsequent European sovereign debt crisis does have a significant impact on PF and CB issues credit spread. Thus, the financial crisis substantially influences the explanatory power of the regressions, as well as the coefficients of the macro and micro pricing factors (in sign and in significance) both for SF and SDF transactions.

5. The Term Structure of SF and SDF Transactions

In contrast to SDF, for which credit spreads are a positive linear function of maturity, the term structure of PF loans is somewhat an empirical puzzle. For example, Sorge and Gadanecz (2008) detect that, whereas credit spreads for both investment-grade and speculative-grade bonds, other than for project finance, are a positive linear function of maturity, in PF loans the term structure of credit spreads is 'hump-shaped'. Even for CB, the empirical literature has been controversial regarding the term structure of credit spreads for non-investment grade bonds. Regarding AS, empirical research [Vink and Thibeault (2008)] find an insignificant (for ABS) or significant negative relationship (for MBS and CDOs) between spread and maturity.

As presented in section 3, time to maturity differs significantly between PF, AS, and CB issues at the 5% significance level. An AS tranche of average size matures just over 20.9 years, which is a long period if we compare this with the average 13.6 and 5.3 years for PF and CB tranches, respectively. SF transactions are thus characterized by much longer maturities compared to other forms of financing. This raises the following question: *are longer maturities perceived by lenders as a risk per se?* Answering this question is crucial to understand the peculiar nature of credit risk in SF; i.e., given the characteristics of SF transactions, *should we expect the term structure of credit spreads for SF issues to behave differently from that of SDF issues?*

Based on presented regression results for SF and SDF issues in section 4, a linear positive relationship between credit spread and maturity appears strongly significant for SDF transactions (CB issues) – see models [2c] and [3c] –, in line with the intuition that lenders should get a higher remuneration for being exposed to risk for a longer period of time, and insignificant for SF transactions (PF loans and AS bonds) – see models [1a], [2a], [3a], [4a], [1b], [2b], [3b], and [5b]. Thus, our main conclusion so far is that, when controlled for other micro and macro risk factors, a linear positive relationship between spread and maturity shows up as very significant for SDF transactions. This is demonstrated in Graphs 1 and 2. For SF transactions, the empirical results reported in other studies lead us to verify the hypothesis of a hump-shaped term structure of credit spreads for PF loans and a negative relationship for AS bonds. We therefore augment our baseline multiple regression (equation [1]) with non-linear maturity components.

Table 18 reports regression results where the natural logarithm of maturity – *log maturity* – is included as an additional regressor in the models to test for the presence of any non-linear effects of maturity on credit spread form for SDF and SF samples.[24] The results show that both the explanatory power of regressions, as well as the coefficients on the macro and micro pricing factors (in sign and in significance) are largely the same for AS and CB issues (models [7b] and [7c]), as in the original specifications. However, considering PF loans, the explanatory power (adjusted R^2) increases significantly from model [1a] to [7a] – from 0.51 to 0.63. For PF loans, a robust hump-shaped relationship between credit spread and maturity is found, as plotted in Graphs 3 and 4. Our findings are similar to those presented by Sorge and Gadanecz (2008), who show a hump-shaped term structure of credit spreads for PF loans. In PF, projects usually start by generating revenues after a relatively long construction period. As loan repayment relies primarily on the project's cash flows, obtaining credit for longer maturities might be critical to ensure a project's financial viability. This short-term liquidity risk may explain why a standard upward-sloping relationship between maturity and credit spread do not apply

[24] We have also attempted alternative quadratic and square-root specifications, but the results were not significant for this work and therefore are not reported.

to PF, as is the case for CB. Additionally, project lenders usually exercise a much more active control and supervision over the project's advancement in PF transactions.

Table 18

In model [7b] the logarithmic term turns out insignificant for AS bonds, which is in line with our previous results and with the relationship between credit spread and maturity plotted in Graph 5. If we analyze the augmented component-plus-residual plot shown in Graph 6 – based on model [7b] – we can conclude that there is a negative relationship, although not significant, between credit spread and maturity. Further empirical analysis of this question would be beneficial, by using a database with a higher number of observations.[25] The insignificant linear relationship between credit spread and maturity can be easily explained by the intrinsic characteristics of AS transactions. Contrary to traditional secured bonds, where the ability of the originator (or issuer) to generate sufficient cash flows to service the debt determines the risks of the transaction, in securitization the source of repayments/funds shifts from the cash flows of the issuer to the assets and cash flows pledged as collateral to the issue. Therefore, the maturity of the securities issued in an AS transaction typically matches the maturity of the assets used as collateral. Finally, the negative slope of the straight line in Graph 6 can be explained by the term structure of credit spreads shown by different AS instruments. Certain types of assets underlying an AS structure adjust more easily to issues with longer maturity levels. An MBS tranche of average size has a maturity of 30.31 years and an average credit spread of 115.64 bps, compared with a maturity of 17.29 years and to a credit spread of 162.01 bps for ABS.

6. Summary and Conclusions

This study compared the financial characteristics of structured finance (SF) – project finance (PF) loans and asset securitization (AS) bonds – and straight debt finance (SDF) – corporate bonds (CB) – transactions by means of a comparative statistical and econometric analysis of credit spreads for a large cross section of Western European loans and bonds closed between January 1st, 2000 and December 31st, 2011. Our 'full sample' contained information about 599 AS issues (worth Euro 179.1 billion), 20,977 CB issues (worth Euro 5,786.5 billion), and 2,859 PF tranches (worth Euro 332.1 billion). We found that PF loans have higher credit spreads (198.3 bps) than AS bonds (148.9 bps) and CB (157.6 bps) and that average credit spreads for AS and CB issues do not differ significantly. We also found that the pricing factors of SF credit spreads differ significantly when compared with the pricing factors of SDF credit spreads. Both AS and CB issues have a significant higher tranche size in comparison with PF loans and AS bonds have much longer average maturity and are more likely to be arranged for U.K. borrowers than

[25] We have also run model [7b] for ABS and MBS sub-samples and we find interaction terms of maturity with credit spread to be insignificant in both linear and non-linear specifications.

PF and CB issues. PF loans in Western Europe may be considered relatively more risky, are much less likely to be subject to currency risk and borrowers are, on average, located in far riskier countries than in the case of any other issue category. CB issues are more likely to be fixed rate rather than floating rate credits and less likely to be guaranteed.

Loan pricing regression analyses revealed that SF and SDF transactions are not priced in a single integrated market; i.e., the regression analyses performed suggest that SF and SDF are in fact different instruments. Table 10 summarizes our findings. We found, e.g., that credit spreads rise when ratings worsen for PF, AS, and CB issues. Similarly, transactions with currency risk have higher credit spreads for SF as well as for SDF and the slope of the Euro swap curve impacts negatively on the credit spread of all types of debt issues. PF loan credit spreads are higher when a borrower belongs to U.K. and to a country with higher credit risk, and loan credit spreads and fees are shown to be complements rather than supplements. The transaction size and the level of interest rates significantly reduces PF loan credit spreads. The level of volatility in capital markets proves positively related to AS and CB issue credit spreads, while the number of banks participating has a negative impact on credit spreads. Borrowers belonging to financial industry raise funds in AS market at lower credit spreads and CB issue credit spreads are positively influenced by management fee, the country credit rating and the number of tranches. Finally, the type of collateral in an AS transaction determines the credit spread.

The 2007/2008 financial crisis and the subsequent European sovereign debt crisis does have a significant impact on SF and SDF credit spreads as well as on the common pricing factors of loan and bond issues. The average credit spread has increased 329.1 bps for PF loans, 206.5 bps for AS bonds, and 220.3 bps for CB issues during the crisis period. Credit rating proves the most important pricing factor for AS securities at launch during pre-crisis period. We can identify a change in the type of factors that explain PF loan credit spreads, from marketability factors to default factors between pre-crisis and crisis period. The change in the type of factors that explain CB credit spreads can also be explained by a liquidity shortfall in financial markets during the crisis period.

We have also analyzed the term structure of credit spreads for SF transactions compared to SDF transactions. For PF loans, a robust hump-shaped relationship between credit spread and maturity was found. The logarithmic term turned out insignificant for AS bonds and a linear positive relationship between credit spread and maturity remained strongly significant for CB issues. Our results and analysis help to explain why maturity, which is a major systematic driver of the cost of debt in SDF transactions, only has a marginal linear effect on the credit spread of SF transactions.

This study contributes to the available literature in several ways. First, to the best of our knowledge, this is the first work studying how common pricing factors compare between SF and SDF transactions. This gap in the literature is due to a lack of reliable data concerning the structure of AS

transactions. In this study, we overcome this problem by simultaneously using two databases: DealScan and DCM Analytics.

Second, the present work adds new insights to the banking literature on loan pricing. By concluding that the existence of substantial differences between SF and SDF transactions in the impact of common pricing variables on credit spread, we can state that these transactions are priced differently. The investment banks in charge of structuring the technical features of certain PF and AS issues may find the estimates a useful tool concerning the size of each variable's impact on credit spreads and how they compare to SDF transactions, mainly after the 2007/2008 financial crisis.

Third, we contribute to the literature available on financial crises. The 2007/2008 financial crisis and the subsequent European sovereign debt crisis significantly influences the explanatory power of the regressions, as well as the coefficients of the macro and micro pricing factors (in sign and in significance). From our regression analyses, we can also conclude that, in SDF lending, borrowers typically specify the amount of debt they are seeking, and their creditworthiness becomes the main determinant of loan spreads. By contrast, when an SF transaction is arranged by investment banks, the goal is to come up with the most efficient mix of maturities, spreads, tranches, warrantees, and other credit enhancement mechanisms to manage what lenders perceive to be the risk and the probability of default. This means that for SF transactions, mainly in AS issues, credit rating becomes the most important pricing factor for this asset class when launched. Our findings are in line with those of, e.g., Fender and Mitchell (2005), who argue that the increasing complexity of SF products creates incentives to rely more heavily on ratings than for other financing instruments, which is usually presented as one of the principal shortcomings of AS with regard to the 2007/2008 financial crisis.

Finally, the present work points to the need to rethink the way banking regulation treats PF loans. Considering that we find a hump-shaped relationship between credit spread and maturity, a linear maturity adjustment to capital requirements – credit risk is usually viewed as increasing with maturity – might be less applicable to PF loans. Hence, regulatory capital arbitrage could induce banks to concentrate their loan portfolio on short-term *vis-a-vis* long-term project finance transactions, which might not be necessarily safer.

Bibliography

Altunbas, Y. and B. Gadanecz, 2004. Developing Country Economic Structure and the Pricing of Syndicated Credits, *The Journal of Development Studies* 40, 143-173.

Ammer, J., and N. Clinton, 2004. The Impact of Credit Rating Changes on the Pricing of Asset-Backed Securities, in *Structured Credit Products: Pricing, Rating, Risk Management and Basel II*, W. Perraudin (editors), Risk Books.

Baum, Christopher, 2006. *An Introduction to Modern Econometrics Using Stata*, College Station, Texas: Stata Press.

Benmelech, E., and J. Dlugosz, 2009. The Alchemy of CDO Credit Ratings, *Journal of Monetary Economics* 56, 617-634.

Blanc-Brude, F., and R. Strange, 2007. How Banks Price Loans to Public Private Partnerships: Evidence from the European arkets, *Journal of Applied Corporate Finance* 19, 94-106.

Brunnermeier, Markus, 2009. Deciphering the Liquidity and Credit Crunch 2007–2008, *Journal of Economic Perspectives* 23, 77–100.

Buscaino, V., S. Caselli, F. Corielli, and S. Gatti, 2012. Project Finance Collateralised Debt Obligations: An Empirical Analysis of Spread Determinants, *European Financial Management* 18, 950-969.

Caselli, S. and S. Gatti, 2005. *Structured Finance: Techniques, Products and Market*, Springer Berlin.

Cherubini, U. and G. Della Lunga, 2007. *Structured Finance, the Object Oriented Approach*, John Wiley & Sons, Inc.

Chow, Gregory, 1960. Tests of Equality between Sets of Coefficients in Two Linear Regressions, *Econometrica* 28, 591-605.

Collin-Dufresne, P., R. Goldstein, and J. Martin, 2001. The Determinants of Credit Spread Changes, *Journal of Finance* 56, 2177-2207.

Corielli, F., S. Gatti, and A. Steffanoni, 2010. Risk Shifting through Nonfinancial Contracts: Effects on Loan Spreads and Capital Structure of Project Finance Deals, *Journal of Money, Credit and Banking* 42, 1295-1320.

Criado, S., and A. Rixtel, 2008. *Structured Finance and the Financial Turmoil of 2007-2008: An Introductory Overview*, Bank of Spain Occasional Paper No. 0808.

Davidson, A., A. Sanders, L. Wolff, and A. Ching, 2003. *Securitization: Structuring and Investment Analysis*, Wiley & Sons, Inc., Hoboken, New Jersey.

Davis, Henry, 2005. The Definition of Structured Finance: Results from a Survey, *Journal of Structured Finance* 11, 5-10.

Demyanyk, Y., and O. Van Hemert, 2011. Understanding the Subprime Mortgage Crisis, *Review of Financial Studies* 24, 1848-1880.

Duffie, D., and K. Singleton, 1999. Modeling Term Structures of Defaultable Bonds, *Review of Financial Studies* 12, 687-720.

Duffie, D., and K. Singleton, 2001. *Credit risk for financial institutions: management and pricing*, Graduate School of Business, Stanford University.

Elton, E., M. Gruber, D. Agrawal, and C. Mann, 2001. Explaining the Rate Spread on Corporate Bonds, *Journal of Finance* 56, 247-277.

Erb, C, C. Harvey, and T. Viskanta, 1996. Political Risk, Economic Risk and Financial Risk, *Financial Analysts Journal* 52, 28-46.

Esty, Benjamin, 2003. The Economic Motivations for Using Project Finance, Boston: Harvard Business School publishing.

Esty, Benjamin, 2004. When Do Foreign Banks Finance Domestic Projects? New Evidence on the Importance of Legal and Financial Systems, Working Paper, Harvard Business School.

Esty, B., and W. Megginson, 2000. Syndicate Structure as a Response to Political Risk in the Project Finance Loan Market, Boston: Harvard Business School.

Esty, B., and W. Megginson, 2003. Creditor Rights, Enforcement, and Debt Ownership Structure: Evidence from the Global Syndicated Loan Market, *Journal of Financial and Quantitative Analysis* 38, 37-59.

Fabozzi, F., H. Davis, and M. Choudhry, 2006. *Introduction to Structured Finance*, Wiley Finance.

Fabozzi, F. and V. Kothari, 2007. Securitization: The Tool of Financial Transformation, Working Paper No. 7, Yale ICF.

Fender, I., and J. Mitchell, 2005. Structured Finance: Complexity, Risk and the Use of Ratings, *BIS Quarterly Review*, June, 67-79.

Firla-Cuchra, M., 2005. Explaining Launch Spreads on Structured Bonds, Working Paper, Oxford University.

Fons, Jerome, 1987. The Default Premium and Corporate Bond Experience, *Journal of Finance* 42, 81-97.

Froot, Kenneth, 1989. Consistent Covariance Matrix Estimation with Cross-Sectional Dependence and Heteroskedasticity in Financial Data, *Journal of Financial and Quantitative Analysis* 24, 333-355.

Gabbi, G., and A. Sironi, 2005. Which Factors Affect Corporate Bonds Pricing? Empirical Evidence from Eurobonds Primary Market Spreads, *European Journal of Finance* 11, 59-74.

Gatti, Stefano, 2005. Project Finance, in *Structured Finance: Techniques, Products and Market*, Stefano Caselli and Stefano Gatti (editors), 37-93, Berlin: Springer.

Gatti, Stefano, 2008. *Project Finance in Theory and Practice – Designing, Structuring, and Financing Private and Public Projects*, Academic Press Advanced Finance Series.

Gatti, S., S. Kleimeier, W. Megginson, and A. Steffanoni, 2013. Arranger Certification in Project Finance, *Financial Management* 42, 1-40.

Gorton, G., and N. Souleles, 2005. Special Purpose Vehicles and Securitization, Working paper 11190, National Bureau of Economic Research (NBER).

Hainz, C. and S. Kleimeier, 2003. Political Risk in Syndicated Lending: Theory and Empirical Evidence Regarding the Use of Project Finance, LIFE Working Paper, 03-014.

Harjoto, M., D. Mullineaux, and H. Yi, 2006. A Comparison of Syndicated Loan Pricing at Investment and Commercial Banks, *Financial Management* 35, 49-70.

Helwege, J., and C. Turner, 1999. The Slope of the Credit Yield Curve for Speculative-grade Issuers, *Journal of Finance* 54, 1869-1884.

Hu, J., and R. Cantor, 2006. The Relationship between Issuance Spreads and Credit Performance of Structured Finance Securities, *Journal of Fixed Income* 16, 5-20.

Huber, Peter, 1967. The Behavior of Maximum Likelihood Estimates under Nonstandard Conditions, in *Proceedings of the Fifth Berkeley Symposium on Mathematical Statistics and Probability* 1, 221-233, Berkeley, CA: University of California Press.

Hull, J., M. Predescu, and A. White, 2004. The Relationship between Credit Default Swap Spreads, Bond Yields, and Credit Rating Announcements, *Journal of Banking and Finance* 28, 2789-2811.

IMF, 2008a. Global Financial Stability Report: Containing Systemic Risks and Restoring Financial Soundness, April, International Monetary Fund.

IMF, 2008b. The Recent Financial Turmoil—Initial Assessment, Policy Lessons, and Implications for Fund Surveillance, April, International Monetary Fund.

Jobst, Andreas, 2006. What is Structured Finance? *The Securitization Conduit* 8, 1-9.

Jobst, Andreas, 2007. A Primer on Structured Finance, *Journal of Derivatives and Hedge Funds* 13,199-213.

Jones, E., S. Mason, and E. Rosenfeld, 1984. Contingent Claims Analysis of Corporate Capital Structures: An Empirical Investigation, *Journal of Finance* 39, 611-625.

Kleimeier, S., and W. Megginson, 2000. Are Project Finance Loans Different from Other Syndicated Credits? *Journal of Applied Corporate Finance* 13, 75-87.

Maris, S., and W. Segal, 2002. Analysis of Yield Spreads on Commercial Mortgage-Backed Securities, *Journal of Real Estate Research* 23, 235-252.

Roever, W. and F. Fabozzi, 2003. A Primer on Securitization, *Journal of Structured and Project Finance* 9, 5–20.

Rothberg, J., F. Nothaft, and S. Gabriel, 1989. On the Determinants of Yield Spreads between Mortgage Pass-Through and Treasury Securities, *Journal of Real Estate Finance and Economics* 2, 301-315.

Sarig, O., and A. Warga, 1989. Some Empirical Estimates of the Risk Structure of Interest Rates, *Journal of Finance* 44, 1351-1360.

Sorge, M., and B. Gadanecz, 2008. The Term Structure of Credit Spreads in Project Finance, *International Journal of Finance and Economics* 13, 68-81.

Tavakoli, Janet, 2008. *Structured Finance Collateralized & Debt Obligations: New Developments in Cash & Synthetic Securitization*, John Wiley & Sons, Inc.

Thomas, H., and Z. Wang, 2004. The Integration of Bank Syndicated Loans and Junk Bond Market, *Journal of Banking and Finance* 28, 299-329.

Vink, D., and A. Thibeault, 2008. ABS, MBS, and CDO Pricing Comparisons: An Empirical Analysis, *Journal of Structured Finance* 14, 27-45.

White, Halbert, 1980. A Heteroskedasticity-consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity, *Econometrica* 48, 817-830.

Table 1: Basic characteristics for the full sample of Project Finance loans, Asset Securitization bonds, and Corporate Bonds

Variable of interest	Project Finance Loans	Asset Securitization Bonds	Corporate Bonds
Number of tranches	2,859	599	20,977
Total volume, Euro millions	332,114	179,132	5,786,532
Tranche size, Euro millions			
Average	116	299	276
Minimum	0.045	0.050	0.017
Maximum	3,800	22,298	7,763
Average maturity, years	13.6	20.9	5.3
Tranches with guarantee (%)	96.9	100.0	2.1
Tranches with currency risk (%)	11.0	31.4	33.2
Tranches to U.K. borrowers (%)	21.2	48.7	13.5
Tranches to financial institutions (%)	0.428	74.1	80.8
Average number of banks	6.9	2.4	2.9

Table 2: Common pricing characteristics of Project Finance (PF) loans in the full sample compared with those in the high-information sample

Variable of interest	PF Loans full sample			PF Loans high-information sample			Survival Rate
	Number	Mean	Std. Dev.	Number	Mean	Std. Dev.	
Credit spread (bps)	1,090	198.3	138.5	1,090	198.3	138.5	100.0%
Credit rating [1-22 weak]	80	7.0	3.9	46	6.3	4.3	58%
Loan to value (%)	2,859	47.3%	39.4%	1,090	47.9%	38.4%	38%
Time to maturity (years)	2,573	13.6	9.3	1,060	13.9	9.1	41%
Tranches with guarantee	2,270	96.9%	-	764	94.2%	-	34%
Tranche size, Euro millions	2,859	116.2	225.9	1,090	145.4	240.7	38%
Number of tranches	2,845	2.9	1.7	1,080	3.0	1.7	38%
Number of bookrunners	955	2.1	1.9	461	2.2	2.0	48%
Number of banks	2,829	6.9	6.7	1,078	8.9	7.6	38%
Tranches with fixed rate	1,110	1.4%	-	1,090	0.0%	-	98%
Tranches with floating rate	1,110	98.6%	-	1,090	100.0%	-	98%
Tranches with currency risk	2,859	11.0%	-	1,090	11.5%	-	38%
Country risk [1-22 weak]	2,859	2.1	1.7	1,090	2.0	1.6	38%
Tranches to U.K. borrowers	2,859	21.2%	-	1,090	19.4%	-	38%
Tranches to financial institutions	2,805	0.4%	-	1,078	0.5%	-	38%
Management fee (bps)	140	49.0	34.4	130	50.8	34.9	93%

Table 3: Common pricing characteristics of Asset Securitization (AS) bonds in the full sample compared with those in the high-information sample

Variable of interest	AS Bonds full sample			AS Bonds high-information sample			Survival Rate
	Number	Mean	Std. Dev.	Number	Mean	Std. Dev.	
Credit spread (bps)	439	148.9	167.4	439	148.9	167.4	100.0%
Credit rating [1-22 weak]	497	4.3	3.5	364	4.3	3.6	73%
Loan to value (%)	599	36.4%	35.6%	439	39.4%	36.5%	73%
Time to maturity (years)	599	20.9	14.8	439	21.3	15.3	73%
Tranches with guarantee	599	100.0%	-	439	100.0%	-	73%
Tranche size, Euro millions	599	299.1	1,070.4	439	320.6	1,189.6	73%
Number of tranches	599	4.5	2.7	439	4.2	2.6	73%
Number of bookrunners	599	1.4	0.7	439	1.4	0.8	73%
Number of banks	599	2.4	1.9	439	2.5	1.9	73%
Tranches with fixed rate	599	24.9%	-	439	27.1%	-	73%
Tranches with floating rate	599	75.1%	-	439	72.9%	-	73%
Tranches with currency risk	599	31.4%	-	439	31.7%	-	73%
Country risk [1-22 weak]	599	1.3	0.9	439	1.4	0.9	73%
Tranches to U.K. borrowers	599	48.7%	-	439	39.9%	-	73%
Tranches to financial institutions	599	74.1%	-	439	76.8%	-	73%
Management fee (bps)	48	33.1	26.9	37	35.8	28.4	77%

Table 4: Common pricing characteristics of Corporate Bonds (CB) in the full sample compared with those in the high-information sample

Variable of interest	CB full sample			CB high-information sample			Survival Rate
	Number	Mean	Std. Dev.	Number	Mean	Std. Dev.	
Credit spread (bps)	10,551	157.6	193.3	10,551	157.6	193.3	100.0%
Credit rating [1-22 weak]	16,080	4.9	2.7	8,693	5.5	3.0	54%
Loan to value (%)	20,977	61.8%	45.4%	10,551	87.4%	27.2%	50%
Time to maturity (years)	20,977	5.3	5.9	10,551	6.9	5.9	50%
Tranches with guarantee	20,977	2.1%	-	10,551	3.7%	-	50%
Tranche size, Euro millions	20,977	275.9	439.5	10,551	442.0	517.0	50%
Number of tranches	20,575	18.4	29.8	10,545	1.8	3.3	51%
Number of bookrunners	20,973	1.6	1.2	10,549	2.1	1.5	50%
Number of banks	20,973	2.9	3.4	10,549	3.7	3.5	50%
Tranches with fixed rate	20,977	79.0%	-	10,551	67.9%	-	50%
Tranches with floaing rate	20,977	21.0%	-	10,551	32.1%	-	50%
Tranches with currency risk	20,977	33.2%	-	10,551	22.6%	-	50%
Country risk [1-22 weak]	20,977	1.4	1.2	10,551	1.8	1.5	50%
Tranches to U.K. borrowers	20,977	13.5%	-	10,551	16.9%	-	50%
Tranches to financial institutions	20,977	80.8%	-	10,551	67.3%	-	50%
Management fee (bps)	2,235	22.7	18.9	1,334	21.4	19.2	60%

Table 5: Credit rating scales

Rating agency		Value
Standard & Poor's	Moody's	
AAA	Aaa	1
AA+	Aa1	2
AA	Aa2	3
AA-	Aa3	4
A+	A1	5
A	A2	6
A-	A3	7
BBB+	Baa1	8
BBB	Baa2	9
BBB-	Baa3	10
BB+	Ba1	11
BB	Ba2	12
BB-	Ba3	13
B+	B1	14
B	B2	15
B-	B3	16
CCC+	Caa1	17
CCC	Caa2	18
CCC-	Caa3	19
CC	Ca	20
SD	C	21
D	-	22

Table 6: Univariate statistics - pricing features associated with Loans and Bonds compared

Variable of interest	Type of loan issue			Variable of interest	Type of loan issue		
	PF	AS	CB		PF	AS	CB
Univariate analysis - continuous variables							
Credit spread (bps)				**Number of tranches**			
Number	1,090	439	10,551	Number	2,845	599	20,575
Mean	198.3	148.9	157.6	Mean	2.9	4.5	18.4
Min.	9.2	-220.4	-213.8	Min.	1	1	1
Max.	2,042.7	1,098.9	1,651.5	Max.	10	12	99
Std. Dev.	138.5	167.4	193.3	Std. Dev.	1.7	2.7	29.8
Credit rating [1-22 weak]				**Number of bookrunners**			
Number	80	497	16,080	Number	955	599	20,973
Mean	7	4.3	4.9	Mean	2.1	1.4	1.6
Min.	1	1	1	Min.	1	1	0
Max.	16	17	21	Max.	15	5	21
Std. Dev.	3.9	3.5	2.7	Std. Dev.	1.9	0.7	1.2
Loan to value (%)				**Number of banks**			
Number	2,859	599	20,977	Number	2,829	599	20,973
Mean	47.3%	36.4%	61.8%	Mean	6.9	2.4	2.9
Min.	0.07%	0.01%	0.05%	Min.	1	1	1
Max.	100.0%	100.0%	100.0%	Max.	51	14	50
Std. Dev.	39.4%	35.6%	45.4%	Std. Dev.	6.7	1.9	3.4
Time to maturity (years)				**Country risk [1-22 weak]**			
Number	2,573	599	20,977	Number	2,859	599	20,977
Mean	13.6	20.9	5.3	Mean	2.1	1.3	1.4
Min.	0.03	0.22	0.21	Min.	1	1	1
Max.	42.9	85.9	100.1	Max.	11	6	20
Std. Dev.	9.3	14.8	5.9	Std. Dev.	1.7	0.9	1.2
Tranche size (Euro millions)				**Management fee (bps)**			
Number	2,859	599	20,977	Number	140	48	2,235
Mean	116.2	299.1	275.9	Mean	49.0	33.1	22.7
Min.	0.05	0.05	0.02	Min.	0.8	2.0	0.0
Max.	3,800	22,298	7,763.2	Max.	200.0	100.0	200.0
Std. Dev.	225.9	1,070.4	439.5	Std. Dev.	34.4	26.9	18.9
Univariate analysis - dummy variables							
Guarantee				**Currency risk**			
N. of issues with data available	2,270	599	20,977	N. of issues with data available	2,859	599	20,977
N. of issues with dummy = 1	2,200	599	449	N. of issues with dummy = 1	315	188	6,967
% of total available data	96.9%	100.0%	2.1%	% of total available data	11.0%	31.4%	33.2%
Floating rate issue				**U.K. borrowers**			
N. of issues with data available	1,110	599	20,977	N. of issues with data available	2,859	599	20,977
N. of issues with dummy = 1	1,094	450	4,400	N. of issues with dummy = 1	2,253	292	2,836
% of total available data	98.6%	75.1%	21.0%	% of total available data	21.2%	48.7%	13.5%
Fixed rate issue				**Financial institutions**			
N. of issues with data available	1,110	599	20,977	N. of issues with data available	2,805	599	20,977
N. of issues with dummy = 1	16	149	16,577	N. of issues with dummy = 1	12	444	16,952
% of total available data	1.4%	24.9%	79.0%	% of total available data	0.4%	74.1%	80.8%

Table 7: Tests of significance for the difference in values among PF, AS and CB issues

Variable of interest	Type of loan issue		
	AS versus PF	AS versus CB	CB versus PF
Continuous variables: two-sample *t*-tests assuming unequal variances			
Credit spread (bps)	-5.47	-1.06 #	-8.85
Credit rating [1-22 weak]	-5.70	-3.77	-4.68
Loan to value (%)	-6.67	-17.11	18.19
Time to maturity (years)	11.75	25.84	-43.92
Tranche size (Euro millions)	4.16	0.53 #	30.70
Number of tranches	12.94	-59.35	73.65
Number of bookrunners	-9.44	-6.43	-7.18
Number of banks	-30.14	-6.22	-30.78
Country risk [1-22 weak]	-16.70	-2.72	-21.66
Management fee (bp)	-3.28	2.68	-8.99
Dummy variables: Fisher's exact test (p-values)			
Guarantee (0/1)	0.000	0.000	0.000
Fixed rate issue (0/1)	0.000	0.000	0.000
Currency risk (0/1)	0.000	0.356 *	0.000
U.K. borrowers (0/1)	0.000	0.000	0.000
Financial institutions (0/1)	0.000	0.000	0.000

For continuous variables, # indicates that the values do not differ significantly between the two loan issues at the 5% significance level. For dummy variables, * indicates that the proportion of tranches for which dummy = 1 does not differ significantly between the issue class.

Table 8: The impact of the global financial crisis on the characteristics of PF, AS, and CB tranches: continuous variables

Variable of interest	Type of loan issue											
	Project Finance				Asset Securitization				Corporate Bonds			
	Number	Mean	Std. Dev.	Wilcoxon z-test	Number	Mean	Std. Dev.	Wilcoxon z-test	Number	Mean	Std. Dev.	Wilcoxon z-test
Continuous variables												
Credit spread (bps)												
pre-crisis	742	136.9	97.9	-23.87 ***	401	143.5	156.7	-2.44 **	6,981	125.5	197.6	-44.90 ***
crisis	348	329.1	120.5		38	206.5	250.3		3,570	220.3	167.6	
Credit rating [1-22 weak]												
pre-crisis	65	6.9	4.3	-0.40	465	4.3	3.5	0.93	12,353	4.8	2.4	-9.89 ***
crisis	15	7.6	2.2		32	4.0	4.1		3,727	5.4	3.2	
Loan to value (%)												
pre-crisis	1,449	48.7%	39.3%	2.54 **	555	35.7%	35.4%	-1.52	16,673	55.6%	47.0%	-38.93 ***
crisis	1,410	45.8%	39.4%		44	45.5%	36.5%		4,304	86.1%	27.0%	
Time to maturity (years)												
pre-crisis	1,288	14.1	9.5	2.75 ***	555	20.5	14.6	-2.65 ***	16,673	5.0	5.4	-30.58 ***
crisis	1,285	13.0	8.9		44	26.7	16.0		4,304	6.8	7.2	
Tranche size (Euro millions)												
pre-crisis	1,449	124.0	231.3	5.71 ***	555	240.6	509.6	-3.26 ***	16,673	235.7	395.2	-29.20 ***
crisis	1,410	108.2	219.9		44	1,035.9	3,462.4		4,304	431.3	553.3	
Number of tranches												
pre-crisis	1,437	2.9	1.6	-1.88 *	555	4.6	2.8	5.35 ***	16,278	22.9	32.0	37.63 ***
crisis	1,408	3.0	1.7		44	2.5	0.7		4,297	1.5	1.1	
Number of bookrunners												
pre-crisis	723	1.9	1.4	-3.99 ***	555	1.4	0.7	2.36 **	16,669	1.4	0.8	-44.55 ***
crisis	232	2.7	2.8		44	1.2	0.7		4,304	2.5	1.9	
Number of banks												
pre-crisis	1,437	8.0	7.1	10.76 ***	555	2.5	1.9	5.46 ***	16,669	2.8	3.4	-24.79 ***
crisis	1,392	5.7	6.1		44	1.3	0.7		4,304	3.4	3.3	
Country risk [1-22 weak]												
pre-crisis	1,449	1.8	1.4	-13.05 ***	555	1.3	0.8	-7.65 ***	16,673	1.3	1.0	-20.51 ***
crisis	1,410	2.5	1.8		44	2.3	1.6		4,304	1.8	1.8	
Management fee (bps)												
pre-crisis	107	40.8	23.1	-4.83 ***	48	33.1	26.9	-	2,009	22.3	17.9	-0.47
crisis	33	75.7	49.0		0	-	-		226	25.8	25.9	

This table reports statistics for characteristics of PF, AS, and CB issues which are separated into two sub-samples: pre-crisis period and crisis period.

The number of observations are reported in the column 'Number' and the standard deviation in column 'Std. Dev.'. ***, **, * indicate that equality of means can be rejected at the 1%, 5%, and 10% significance level, respectively.

Table 9: The impact of the financial crisis on the characteristics of PF, AS, and CB tranches: dummy variables

Variable of interest	Type of loan issue											
	Project Finance				Asset Securitization				Corporate Bonds			
	Number	Number (d=1)	% of total	Fisher's exact test	Number	Number (d=1)	% of total	Fisher's exact test	Number	Number (d=1)	% of total	Fisher's exact test
Dummy variables												
Guarantee												
pre-crisis	888	866	97.5%	0.214	555	555	100.0%	-	16,673	322	1.9%	0.000 *
crisis	1,382	1,334	96.5%		44	44	100.0%		4,304	127	3.0%	
Fixed rate issue												
pre-crisis	749	7	0.9%	0.057	555	143	25.8%	0.101	16,673	13,113	78.6%	0.008 *
crisis	361	9	2.5%		44	6	13.6%		4,304	3,464	80.5%	
Currency risk												
pre-crisis	1,449	186	12.8%	0.002 *	555	186	33.5%	0.000 *	16,673	5,631	33.8%	0.001 *
crisis	1,410	129	9.1%		44	2	4.5%		4,304	1,336	31.0%	
U.K. borrowers												
pre-crisis	1,449	369	25.5%	0.000 *	555	286	51.5%	0.000 *	16,673	2,047	12.3%	0.000 *
crisis	1,410	237	16.8%		44	6	13.6%		4,304	789	18.3%	
Financial institutions												
pre-crisis	1,438	4	0.3%	0.255	555	400	72.1%	0.000 *	16,673	14,255	85.5%	0.000 *
crisis	1,367	8	0.6%		44	44	100.0%		4,304	2,697	62.7%	

The number of observations are reported in the column 'Number' and the number of issues with dummy = 1 in column 'Number (d=1)'.

* indicates that there is a statistically significant relationship between the dummy variable and the global financial crisis.

Table 10: Definition of variables, expected sign, and findings

Name	Description	Expected Sign			Findings		
		PF	AS	CB	PF	AS	CB
Dependent variable:							
Credit spread	For loans: Libor spread plus difference between three-month Libor and three-month German Treasury yield at the time of the signing of the loan. For bonds: spread at issue over comparable risk-free government security with a comparable maturity.						
Independent variables:							
Microeconomic independent variables							
Log transaction size	Natural log of the loan or bond transaction size. Transaction size is converted into Euro millions when necessary.	- / I	-	?	- / I	I	?
Log loan to value	Natural log of the loan to value ratio, which represents the ratio of the tranche size to the transaction size of a given loan or bond.	+	- / I	+	+ / I	- / I	NA
Maturity	Maturity of loan or bond, in years.	?	- / I	?	HS	I	+
Number of tranches	The number of tranches for each transaction.	+	-	+	I / +	I / -	+
Number of banks	The number of financial institutions participating in the loan or bond issuance.	?	- / I	-	+ / I	-	-
Currency risk	Dummy equal to 1 for loans that are denominated in a currency different from the currency in the borrower's home country. Dummy equal to 1 for bonds that are denominated in a currency different from the currency in the deal's nationality.	-	+	+	+	+ / I	+
U.K. borrowers	Dummy equal to 1 if the borrower/issuer belongs to U.K.	-	-	-	+	I / -	+
Sector	Dummies equal to 1 if loan or bond finances a borrower/issuer in a certain industry. For each of the following industry groups, a dummy is created: commercial, industrial, utilities, transportation, government, and other. The control group includes financial institutions.	?	+	?	I	+	?
Rating	Loan and bond rating based on the S&P and Moody's rating at close. If missing for loans, S&P and Moody's senior debt rating at close are used. If both rating are available, the average rating is calculated. The rating is converted as follows: AAA=Aaa=1, AA+=Aa1=2, and so on until D=22.	+	+	+	+	+	+
Management fee	Fees (in bps) that are periodically paid to the bank syndicates.	+	+	+	+	I	+
Upfront fee	A fee (in bps) paid by a borrower to a bank or a syndicate of banks for arranging a PF loan.	+	NA	NA	+	NA	NA
Collateral	Dummy equal to 1 if an AS bond is backed by mortgages and 0 otherwise.	NA	-	NA	NA	-	NA
Fixed rate	Dummy equal to 1 if a loan or bond is fixed price and 0 otherwise.	+	+	+	NA	I	+
Callable	Dummy equal to 1 if the bond has a call option and 0 otherwise.	NA	+	+	NA	I	+
Independent variables:							
Macroeconomic independent variables							
Country risk	S&P's country credit rating at close. The rating is converted as follows: AAA=1, AA+=2, and so on until D=22.	+	?	+	+	I	I / +
Crisis	Dummy equal to 1 if the issue date belongs to the crisis period and 0 otherwise.	+	+	+	+	+ / I	+
Risk free rate	The three-month German Treasury bill at the time of the signing of the loan or issuing the bonds - a proxy for the general level of interest rates.	I	+	+	-	I	NA
Volatility	The Chicago Board Options Exchange Volatility Index (VIX). VIX reflects a market estimate of future volatility.	+	+	+	I	+	+
EUSA5y-Libor3M	The slope of the Euro swap curve. Obtained as the difference between the five-year Euro swap rate and the 3-month Libor rate.	?	-	-	-	-	-

The following characters mean: – = negative impact on the credit spread | + = positive impact on the credit spread | I = insignificant impact on the credit spread | ? = sign cannot be clearly determined from either the theoretical or empirical literature | NA = information about this variable is not available | HS = hump-shaped.

Table 11: Chow test for differences in pricing factor coefficients

Type of loan issue	PF	AS	CB
PF	-	-	-
AS	6.62	-	-
CB	37.67	6.77	-

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

Table 12: Regression analyses of the determinants of credit spreads

Dependent variable: Credit spread (bps)	[1a] All PF Loans	[1b] All AS Bonds	[1c] All CB
Independent variables:			
Intercept	257.66 ** (9.43)	113.44 * (2.37)	81.57 ** (7.78)
Log transaction size	-19.52 ** (-4.93)	-6.75 (-1.52)	-8.80 ** (-6.43)
Log loan to value	4.37 * (2.04)	-40.91 ** (-5.48)	
Maturity	0.51 (1.67)	-0.72 (-1.52)	-1.12 ** (-3.87)
Number of tranches	-1.02 (-0.56)	-3.08 (-0.95)	19.62 ** (36.87)
Number of banks	1.42 ** (3.87)	-9.36 ** (-2.58)	-1.63 ** (-3.47)
Country risk	7.78 ** (2.91)	-12.80 (-1.04)	0.46 (0.29)
Currency risk	38.11 ** (2.88)	16.95 (0.79)	3.01 (0.60)
U.K. borrowers	49.85 ** (5.23)	10.39 (0.46)	17.49 ** (3.41)
Crisis	174.01 ** (16.26)	121.25 * (2.43)	77.41 ** (15.43)
Risk free rate	-0.16 ** (-4.46)	0.12 (1.28)	
Volatility	0.49 (1.64)	2.25 * (2.13)	2.06 ** (9.91)
EUSA5y-Libor3M	-0.46 ** (-7.41)	-0.45 ** (-3.30)	-0.02 (-0.60)
Commercial		101.80 ** (3.28)	102.44 ** (17.20)
Industrial	10.29 (1.14)	57.95 (1.56)	98.75 ** (19.30)
Utilities	12.92 (1.41)	-16.49 (-0.42)	20.66 ** (4.17)
Transportation	14.33 (1.39)	128.94 (1.88)	68.80 ** (5.94)
Government	7.18 (0.31)		14.93 (0.38)
Other			163.47 ** (5.83)
Number of observations	1,029	439	10,543
Adjusted R^2	0.51	0.19	0.21
F	90.00	6.55	238.24

Table 12 presents an OLS regression analysis of the determinants of loans and bonds credit spread for SF (PF and AS) and SDF (CB) samples.The *t*-statistics reported in parentheses are based on heteroskedasticity-consistent standard errors. ** and * indicate that the reported coefficient is statistically significant at the 1% and 5% level, respectively.

The following variables were omitted because of collinearity: (i) *commercial* and *other* dummy variables in estimating model [1a]; and (ii) *log loan to value* and *risk free rate* in estimating model [1c]. *Government* and *other* dummy variables do not exist for AS transactions.

Table 13: Regression analyses of the determinants of credit spreads – the impact of credit risk

Dependent variable: Credit spread (bps)	[1a] All PF Loans	[2a] PF Loans with rating	[1b] All AS Bonds	[2b] AS Bonds with rating	[1c] All CB	[2c] CB with rating
Independent variables:						
Intercept	257.66 ** (9.43)	103.66 (1.08)	113.44 * (2.37)	13.27 (0.31)	81.57 ** (7.78)	-139.35 ** (-14.39)
Log transaction size	-19.52 ** (-4.93)	16.81 (1.13)	-6.75 (-1.52)	3.74 (0.92)	-8.80 ** (-6.43)	0.75 (0.58)
Log loan to value	4.37 * (2.04)	10.44 (1.32)	-40.91 ** (-5.48)	0.79 (0.10)		
Maturity	0.51 (1.67)	-0.59 (-0.69)	-0.72 (-1.52)	-0.36 (-0.67)	-1.12 ** (-3.87)	1.00 ** (4.60)
Number of tranches	-1.02 (-0.56)	7.68 (1.32)	-3.08 (-0.95)	2.39 (0.86)	19.62 ** (36.87)	23.97 ** (9.10)
Number of banks	1.42 ** (3.87)	0.32 (0.26)	-9.36 ** (-2.58)	-8.24 * (-2.10)	-1.63 ** (-3.47)	-1.65 ** (-4.35)
Country risk	7.78 ** (2.91)	-13.97 (-1.48)	-12.80 (-1.04)	-4.99 (-0.74)	0.46 (0.29)	-2.04 (-1.51)
Currency risk	38.11 ** (2.88)	4.24 (0.19)	16.95 (0.79)	35.36 (1.96)	3.01 (0.60)	27.46 ** (6.64)
U.K. borrowers	49.85 ** (5.23)		10.39 (0.46)	-10.10 (-0.53)	17.49 ** (3.41)	6.43 (1.58)
Crisis	174.01 ** (16.26)	78.50 (1.30)	121.25 * (2.43)	33.70 (0.74)	77.41 ** (15.43)	86.53 ** (20.73)
Risk free rate	-0.16 ** (-4.46)	-0.33 * (-2.24)	0.12 (1.28)	-0.03 (-0.31)		
Volatility	0.49 (1.64)		2.25 * (2.13)	2.42 ** (2.81)	2.06 ** (9.91)	2.98 ** (17.88)
EUSA5y-Libor3M	-0.46 ** (-7.41)	-0.45 (-1.98)	-0.45 ** (-3.30)	-0.52 ** (-4.35)	-0.02 (-0.60)	-0.16 ** (-6.31)
Commercial			101.80 ** (3.28)	25.01 (0.99)	102.44 ** (17.20)	-17.93 ** (-3.82)
Industrial	10.29 (1.14)	39.82 (24.51)	57.95 (1.56)	27.34 (0.99)	98.75 ** (19.30)	0.69 (0.17)
Utilities	12.92 (1.41)	16.60 (0.57)	-16.49 (-0.42)	-55.51 (-1.52)	20.66 ** (4.17)	-39.93 ** (-8.59)
Transportation	14.33 (1.39)		128.94 (1.88)	110.02 ** (3.64)	68.80 ** (5.94)	12.16 (1.47)
Government	7.18 (0.31)	28.77 (0.52)			14.93 (0.38)	25.68 * (2.20)
Other					163.47 ** (5.83)	69.91 ** (3.42)
Rating		7.37 ** (2.99)		27.44 ** (8.65)		29.06 ** (43.11)
Number of observations	1,029	39	439	364	10,543	8,686
Adjusted R^2	0.51	0.67	0.19	0.46	0.21	0.43
F	90.00	6.60	6.55	11.45	238.24	261.21

Table 13 presents the results of an OLS regression analysis of determinants of loan pricing credit spreads for the PF, AS, and CB high-information samples and the sub-samples created using the data available on rating.

The *t*-statistics reported in parentheses are based on heteroskedasticity-consistent standard errors. ** and * indicate that the reported coefficient is statistically significant at the 1% and 5% level, respectively.

The following variables were omitted because of collinearity: (i) *U.K. borrowers*, *volatility*, *commercial*, *transportation* and *other* in estimating model [2a]; and (ii) *log loan to value* and *risk free rate* in estimating model [2c]. *Government* and *other* dummy variables do not exist for AS transactions.

Table 14: Regression analyses of the determinants of credit spreads – the impact of management fee

Dependent variable: Credit spread (bps)	[1a] All PF Loans	[3a] PF Loans with management fee	[1b] All AS Bonds	[3b] AS Bonds with management fee	[1c] All CB	[3c] CB with management fee
Independent variables:						
Intercept	257.66 ** (9.43)	123.38 ** (3.60)	113.44 * (2.37)	-257.06 (-0.91)	81.57 ** (7.78)	10.45 (0.59)
Log transaction size	-19.52 ** (-4.93)	-13.00 (-1.97)	-6.75 (-1.52)	49.66 (1.18)	-8.80 ** (-6.43)	-11.17 ** (-4.67)
Log loan to value	4.37 * (2.04)	1.33 (0.27)	-40.91 ** (-5.48)	39.33 (1.72)		
Maturity	0.51 (1.67)	0.75 (0.99)	-0.72 (-1.52)	0.84 (0.30)	-1.12 ** (-3.87)	3.63 ** (7.42)
Number of tranches	-1.02 (-0.56)	12.02 ** (2.88)	-3.08 (-0.95)	-6.37 (-0.60)	19.62 ** (36.87)	10.07 (1.87)
Number of banks	1.42 ** (3.87)	1.15 (1.32)	-9.36 ** (-2.58)	-16.55 (-1.95)	-1.63 ** (-3.47)	1.53 ** (3.32)
Country risk	7.78 ** (2.91)	-7.21 (-1.93)	-12.80 (-1.04)		0.46 (0.29)	10.40 ** (5.39)
Currency risk	38.11 ** (2.88)	5.02 (0.21)	16.95 (0.79)	109.20 (1.83)	3.01 (0.60)	21.81 ** (4.44)
U.K. borrowers	49.85 ** (5.23)	19.71 (1.02)	10.39 (0.46)		17.49 ** (3.41)	-2.37 (-0.38)
Crisis	174.01 ** (16.26)	177.94 ** (8.48)	121.25 * (2.43)		77.41 ** (15.43)	127.29 ** (8.29)
Risk free rate	-0.16 ** (-4.46)		0.12 (1.28)			
Volatility	0.49 (1.64)		2.25 * (2.13)		2.06 ** (9.91)	1.86 ** (5.25)
EUSA5y-Libor3M	-0.46 ** (-7.41)	-0.24 * (-2.54)	-0.45 ** (-3.30)	0.11 (0.22)	-0.02 (-0.60)	-0.09 ** (-2.98)
Commercial			101.80 ** (3.28)	248.55 ** (2.84)	102.44 ** (17.20)	70.56 ** (8.81)
Industrial	10.29 (1.14)	12.55 (0.82)	57.95 (1.56)	-130.38 (-1.79)	98.75 ** (19.30)	56.23 ** (10.05)
Utilities	12.92 (1.41)	6.96 (0.41)	-16.49 (-0.42)	-10.24 (-0.17)	20.66 ** (4.17)	2.58 (0.27)
Transportation	14.33 (1.39)	-13.58 (-0.75)	128.94 (1.88)	-71.68 (-0.60)	68.80 ** (5.94)	16.65 (0.67)
Government	7.18 (0.31)	-5.82 (-0.09)			14.93 (0.38)	
Other					163.47 ** (5.83)	121.17 ** (3.37)
Management fee		0.85 ** (3.17)		1.84 (1.35)		0.51 ** (2.74)
Number of observations	1,029	125	439	37	10,543	1,334
Adjusted R^2	0.51	0.70	0.19	0.37	0.21	0.40
F	90.00	18.56	6.55	2.75	238.24	32.82

Table 14 presents the results of an OLS regression analysis of the determinants of loan pricing credit spreads for the PF, AS, and CB high-information samples and the sub-samples created using the data available on management fee. The *t*-statistics reported in parentheses are based on heteroskedasticity-consistent standard errors. **, * indicate that the reported coefficient is statistically significant at the 1% and 5% level, respectively.

The following variables were omitted because of collinearity: (i) *risk free* rate, *volatility* and *commercial* and *other* dummy variables in estimating model [3a]; (ii) *country risk*, *U.K.* borrowers, *crisis*, *risk free rate*, and *volatility* in estimating model [3b]; and (iii) *log loan to value*, *risk free rate*, and *government* dummy variable in estimating model [3c]. *Government* and *other* dummy variables do not exist for AS transactions.

Table 15: Regression analyses of the determinants of credit spreads – the impact of upfront fee on PF loan credit spreads.

Dependent variable: Credit spread (bps)	[1a] All PF Loans	[3a] PF Loans with management fee	[4a] PF Loans with upfront fee
Independent variables:			
Intercept	257.66 ** (9.43)	123.38 ** (3.60)	89.13 ** (3.18)
Log transaction size	-19.52 ** (-4.93)	-13.00 (-1.97)	0.30 (0.06)
Log loan to value	4.37 * (2.04)	1.33 (0.27)	-0.08 (-0.02)
Maturity	0.51 (1.67)	0.75 (0.99)	0.83 (1.77)
Number of tranches	-1.02 (-0.56)	12.02 ** (2.88)	2.08 (0.68)
Number of banks	1.42 ** (3.87)	1.15 (1.32)	-0.98 * (-2.05)
Country risk	7.78 ** (2.91)	-7.21 (-1.93)	2.89 (0.91)
Currency risk	38.11 ** (2.88)	5.02 (0.21)	-6.78 (-0.59)
U.K. borrowers	49.85 ** (5.23)	19.71 (1.02)	39.27 ** (3.92)
Crisis	174.01 ** (16.26)	177.94 ** (8.48)	131.57 ** (7.10)
Risk free rate	-0.16 ** (-4.46)		
Volatility	0.49 (1.64)		
EUSA5y-Libor3M	-0.46 ** (-7.41)	-0.24 * (-2.54)	-0.33 ** (-5.43)
Commercial			
Industrial	10.29 (1.14)	12.55 (0.82)	6.79 (0.38)
Utilities	12.92 (1.41)	6.96 (0.41)	-1.91 (-0.11)
Transportation	14.33 (1.39)	-13.58 (-0.75)	-32.99 (-1.68)
Government	7.18 (0.31)	-5.82 (-0.09)	-22.53 (-0.90)
Other			
Management fee		0.85 ** (3.17)	
Upfront fee			0.74 ** (8.57)
Number of observations	1,029	125	196
Adjusted R^2	0.51	0.70	0.66
F	90.00	18.56	25.76

Table 15 presents the results of an OLS regression analysis of the determinants of loan pricing credit spreads for the PF high-information sample and two sub-samples created using data available on management fee and upfront fee. The *t*-statistics reported in parentheses are based on heteroskedasticity-consistent standard errors. **, * indicate that the reported coefficient is statistically significant at the 1% and 5% level, respectively.
The following variables were omitted because of collinearity in estimating model [4a]: *risk free* rate, *volatility* and *commercial* and *other* dummy variables.

Table 16: Regression analyses of the determinants of credit spreads – the impact of collateral, fixed rate and callable on AS and CB issues credit spread.

Dependent variable: Credit spread (bps)	[5b] AS with rating, collateral, fixed rate and callable	[6c] CB with rating, credit accessibility, fixed rate and callable
Independent variables:		
Intercept	22.34 (0.60)	-254.90 ** (-24.60)
Log transaction size	2.76 (0.71)	13.34 ** (11.45)
Maturity	0.16 (0.26)	0.26 (0.97)
Number of tranches	1.37 (0.49)	25.87 ** (8.53)
Number of banks	-4.51 (-1.17)	-2.05 ** (-3.80)
Country risk	-8.06 (-1.21)	2.33 (1.71)
Currency risk	27.21 (1.50)	1.25 (0.29)
U.K. borrowers	-9.61 (-0.48)	21.08 ** (4.45)
Crisis	31.82 (0.88)	33.85 ** (4.38)
Volatility	2.73 ** (3.51)	1.53 ** (5.50)
EUSA5y-Libor3M	-0.50 ** (-4.42)	-0.05 (-1.53)
Commercial	19.12 (0.69)	-47.60 ** (-7.72)
Industrial	26.61 (0.89)	-24.22 ** (-4.33)
Utilities	-65.45 (-1.72)	-64.43 ** (-10.78)
Transportation	103.77 ** (3.03)	-9.19 (-0.90)
Government		49.16 * (2.30)
Other		52.66 * (2.28)
Rating	27.24 ** (10.42)	29.19 ** (37.00)
Credit accessibility		0.83 ** (10.27)
Collateral	-47.37 ** (-2.68)	
Fixed rate	-26.93 (-1.13)	29.24 ** (8.79)
Callable	-15.89 (-1.08)	50.68 ** (9.54)
Number of observations	364	6,139
Adjusted R^2	0.48	0.55
F	11.57	223.82

Table 16 presents the results of an OLS regression analysis of the determinants of loan pricing credit spreads for AS and CB sub-samples created using the data available on collateral for AS transactions and on fixed rate and callable for both AS and CB issues.

The *t*-statistics reported in parentheses are based on heteroskedasticity-consistent standard errors. **, * indicate that the reported coefficient is statistically significant at the 1% and 5% level, respectively.

Variables *risk free rate* and *log loan to value* were omitted because of collinearity in estimating model [6c]. These variables were also omitted in estimating regression [5b] because they are not relevant in explaining AS bonds credit spread.

Table 17: Regression analyses of the determinants of credit spreads - the impact of the financial crisis

Dependent variable: Credit spread (bps)	[1a] All PF Loans | pre-crisis period	[1a] All PF Loans | crisis period	[2b] AS Bonds with rating | pre-crisis period	[2b] AS Bonds with rating | crisis period	[2c] CB with rating | pre-crisis period	[2c] CB with rating | crisis period
Independent variables:						
Intercept	203.26 ** (6.96)	546.22 ** (11.44)	-6.98 (-0.17)	609.12 (1.83)	-27.04 * (-2.25)	-249.28 ** (-13.30)
Log transaction size	-15.34 ** (-3.35)	-21.36 ** (-2.75)	3.98 (0.91)	-30.11 (-0.83)	-15.10 ** (-8.87)	28.30 ** (17.11)
Log loan to value	2.03 (0.92)	10.98 * (2.50)	1.91 (0.16)	-18.31 (-0.60)		
Maturity	1.05 ** (2.97)	-0.74 (-1.12)	-0.48 (-0.88)	4.85 (1.77)	0.92 ** (3.35)	1.17 ** (3.34)
Number of tranches	1.35 (0.62)	-2.44 (-0.62)	2.86 (1.00)	-141.20 (-1.81)	32.37 ** (10.72)	-12.11 ** (-3.13)
Number of banks	1.44 ** (3.99)	0.86 (0.75)	-9.46 * (-2.35)	-1.06 (-0.02)	-2.11 ** (-5.50)	-1.27 (-1.70)
Country risk	1.71 (0.94)	12.91 ** (2.70)	-0.77 (-0.11)	-39.16 (-1.49)	-14.34 ** (-13.59)	8.93 ** (4.72)
Currency risk	30.31 * (2.44)	52.83 (1.49)	29.44 (1.64)	-164.36 (-0.73)	38.03 ** (7.66)	12.95 * (2.12)
U.K. borrowers	36.27 ** (4.15)	60.90 ** (2.78)	-3.81 (-0.20)	-165.67 (-1.10)	-14.40 ** (-2.98)	32.45 ** (4.87)
Risk free rate	-0.14 ** (-3.51)	-0.71 ** (-4.36)	-0.01 (-0.03)	1.18 (1.39)		
Volatility	1.91 * (2.27)	-0.25 (-0.48)	1.73 (1.83)		3.74 ** (14.30)	3.37 ** (11.74)
EUSA5y-Libor3M	-0.46 ** (-5.59)	-0.87 ** (-5.20)	-0.38 ** (-2.62)		-0.25 ** (-8.86)	-0.08 (-1.49)
Commercial			14.47 (0.60)		-1.83 (-0.36)	-50.80 ** (-5.71)
Industrial	0.48 (0.05)	48.82 * (2.46)	18.97 (0.71)		4.52 (1.08)	-26.63 ** (-3.31)
Utilities	4.42 (0.37)	38.26 ** (2.80)	-58.21 ** (-1.55)		-28.20 ** (-4.83)	-72.31 ** (-9.45)
Transportation	1.16 (0.10)	38.71 (1.36)	98.98 ** (3.98)		15.96 (1.64)	-17.28 (-1.37)
Government	-5.11 (-0.18)	68.99 (1.96)			23.58 * (2.03)	
Other					53.26 ** (6.77)	41.27 (1.20)
Rating			30.38 ** (10.05)	-1.93 (-0.22)	25.61 ** (29.30)	38.02 ** (36.57)
Number of observations	702	327	334	30	5,594	3,092
Adjusted R^2	0.11	0.27	0.52	0.23	0.35	0.53
F	8.49	7.77	15.38	1.87	155.09	145.10

Table 17 presents the results of an OLS regression analysis of determinants of loan pricing credit spreads for the PF, AS, and CB sub-samples created by considering a pre-crisis period from January 1st, 2000 through September 14th, 2008, and a crisis period from September 15th, 2008 through December 31st, 2011.

The *t*-statistics reported in parentheses are based on heteroskedasticity-consistent standard errors. **, * indicate that the reported coefficient is statistically significant at the 1% and 5% level, respectively.

The following variables were omitted because of collinearity: (i) *commercial* and *other* dummy variables in estimating model [1a], either in pre-crisis period and crisis period; (ii) *volatility* and *EUSA5y-Libor3M* and all *sector* dummy variables in estimating model [2b] for the crisis period; and (iii) *log loan to value* and *risk free rate* for both periods and *government dummy variable* for crisis period in estimating model [2c]. The rating variable was omitted because it would cause a significant reduction in the number of observations in estimating model [1a] (36 and 3 observations for the pre-crisis and the crisis period, respectively).

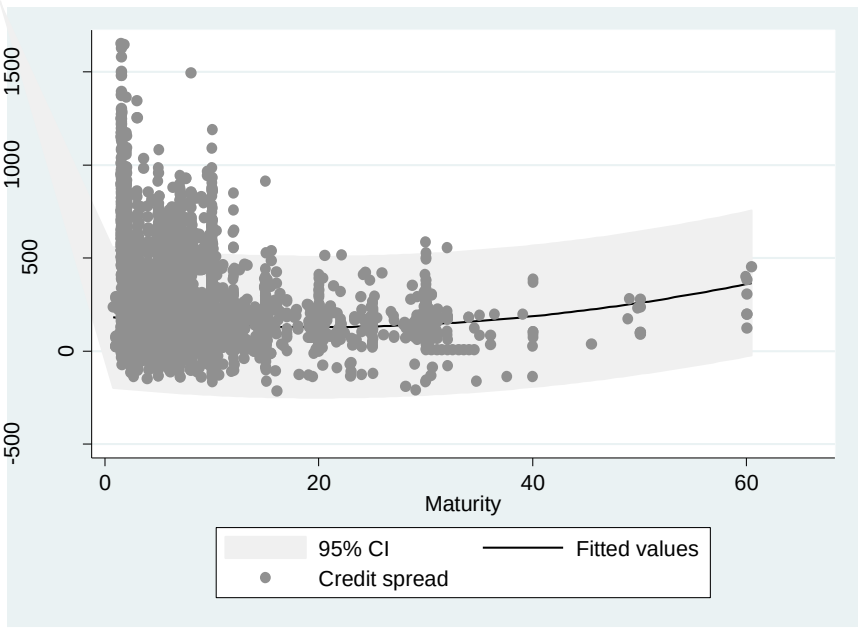
Table 18: Regression analyses of the term structure of credit spreads

Dependent variable: Credit spread (bps)	[1a] All PF Loans	[7a] All PF Loans with log maturity	[2b] AS Bonds with rating	[7b] AS Bonds with rating and log maturity	[2c] CB with rating	[7c] CB with rating and log maturity
Independent variables:						
Intercept	257.66 ** (9.43)	228.31 ** (9.69)	13.27 (0.31)	34.71 (0.69)	-139.35 ** (-14.39)	-127.95 ** (-10.33)
Maturity	0.51 (1.67)	-1.72 ** (-2.60)	-0.36 (-0.67)	0.23 (0.23)	1.00 ** (4.60)	2.04 ** (4.68)
Log Maturity		21.47 ** (3.54)		-13.55 (-0.83)		-11.04 * (-2.22)
Log transaction size	-19.52 ** (-4.93)	-17.53 ** (-5.12)	3.74 (0.92)	4.11 (1.01)	0.75 (0.58)	0.67 (0.52)
Log loan to value	4.37 * (2.04)	2.57 (1.27)	0.79 (0.10)	0.89 (0.12)		
Number of tranches	-1.02 (-0.56)	-1.19 (-0.68)	2.39 (0.86)	2.83 (1.05)	23.97 ** (9.10)	23.57 ** (9.12)
Number of banks	1.42 ** (3.87)	1.22 ** (3.32)	-8.24 * (-2.10)	-8.21 * (-2.10)	-1.65 ** (-4.35)	-1.55 ** (-4.09)
Country risk	7.78 ** (2.91)	8.32 ** (3.35)	-4.99 (-0.74)	-5.23 (-0.77)	-2.04 (-1.51)	-2.20 (-1.62)
Currency risk	38.11 ** (2.88)	36.70 ** (2.81)	35.36 (1.96)	31.28 (1.68)	27.46 ** (6.64)	27.46 ** (6.64)
U.K. borrowers	49.85 ** (5.23)	52.64 ** (5.64)	-10.10 (-0.53)	-6.30 (-0.32)	6.43 (1.58)	6.44 (1.58)
Crisis	174.01 ** (16.26)	175.83 ** (16.59)	33.70 (0.74)	37.16 (0.81)	86.53 ** (20.73)	85.91 ** (20.05)
Risk free rate	-0.16 ** (-4.46)	-0.16 ** (-4.54)	-0.03 (-0.31)	-0.02 (-0.26)		
Volatility	0.49 (1.64)	0.44 (1.51)	2.42 ** (2.81)	2.36 ** (2.71)	2.98 ** (17.88)	2.97 ** (17.89)
EUSA5y-Libor3M	-0.46 ** (-7.41)	-0.45 ** (-8.43)	-0.52 ** (-4.35)	-0.52 ** (-4.44)	-0.16 ** (-6.31)	-0.16 ** (-6.13)
Commercial			25.01 (0.99)	22.90 (0.90)	-17.93 ** (-3.82)	-16.88 ** (-3.56)
Industrial	10.29 (1.14)	9.98 (1.12)	27.34 (0.99)	25.80 (0.93)	0.69 (0.17)	1.77 (0.43)
Utilities	12.92 (1.41)	6.34 (0.81)	-55.51 (-1.52)	-58.11 (-1.59)	-39.93 ** (-8.59)	-38.77 ** (-8.14)
Transportation	14.33 (1.39)	13.12 (1.32)	110.02 ** (3.64)	109.56 ** (3.74)	12.16 (1.47)	13.94 (1.66)
Government	7.18 (0.31)	8.56 (0.37)			25.68 * (2.20)	27.60 * (2.53)
Other					69.91 ** (3.42)	71.75 ** (3.52)
Rating			27.44 ** (8.65)	27.56 ** (8.74)	29.06 ** (43.11)	29.21 ** (43.56)
Number of observations	1,029	1,029	364	364	8,686	8,686
Adjusted R^2	0.51	0.63	0.46	0.46	0.43	0.43
F	90.00	87.18	11.45	11.06	261.21	257.06

Model [7a] is similar to model [1a] adding the logarithmic of maturity. Rating variable was omitted either because of collinearity or because of the significant reduction in the number of observations (from 1,029 to 39) that it would impose.

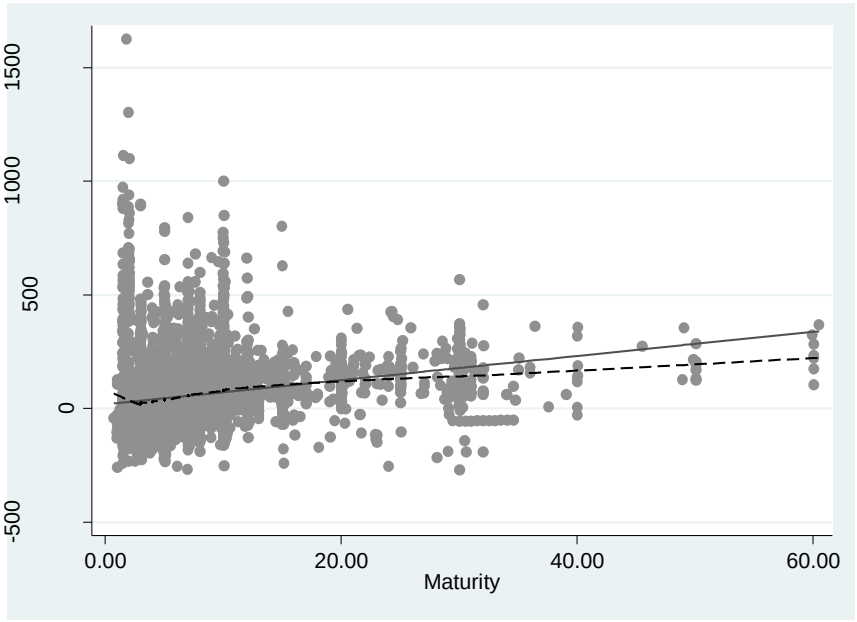
The *t*-statistics reported in parentheses are based on heteroskedasticity-consistent standard errors. **, * indicate that the reported coefficient is statistically significant at the 1% and 5% level, respectively.

Graph 1: Credit spread *versus* maturity with confidence bands: CB



Graph 1 plots credit spread against maturity, it plots the prediction from a quadratic regression and adds the confidence interval on the basis of the standard error of forecast.

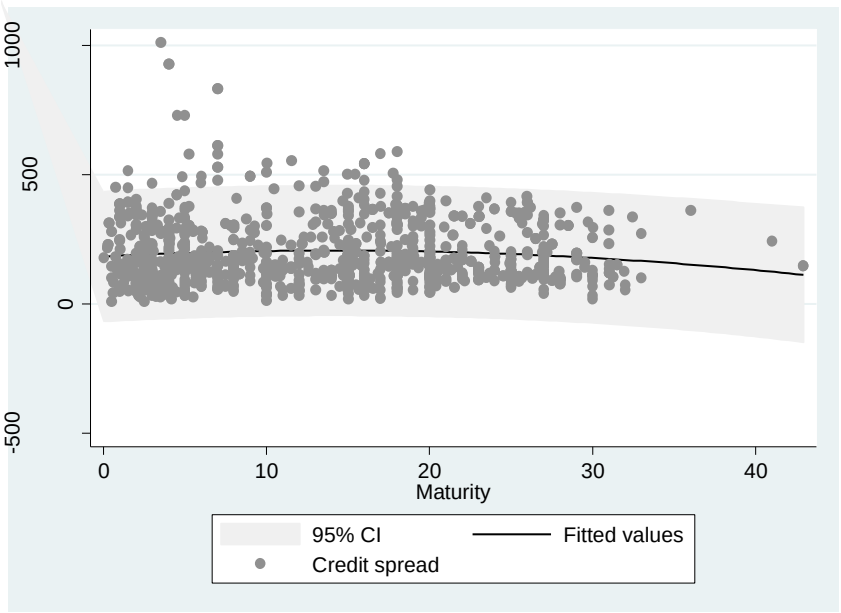
Graph 2: Term structure of credit spreads for CB



Graph 2 presents the augmented component-plus-residual plot based on regression [7c] and depicts the partial relationship between CB credit spread and maturity, once all other micro and macro factors have been controlled for.

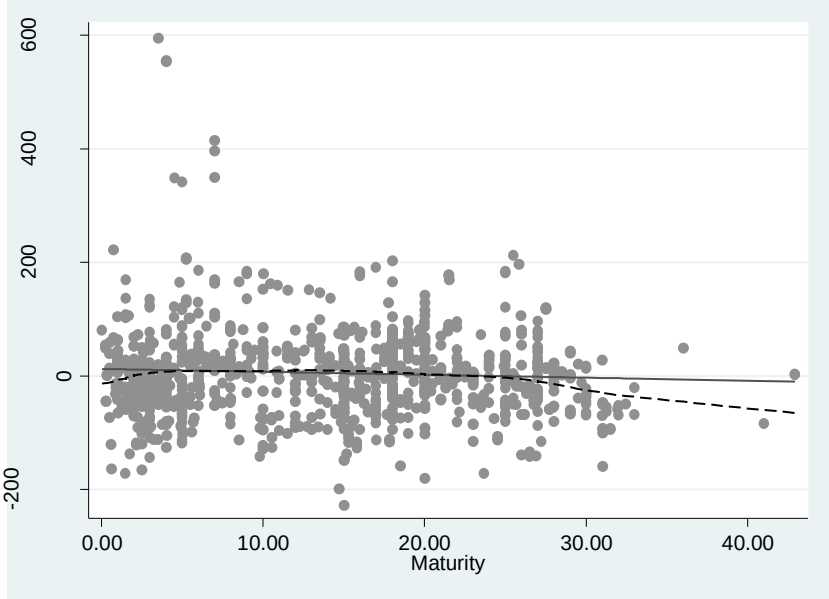
The straight line in Graph 2 corresponds to the regression model. The curved line reflects the fitting process based on non-parametric regression called local weighted scatterplot smoothing (lowess).

Graph 3: Credit spread *versus* maturity with confidence bands: PF loans



Graph 3 plots credit spread against maturity, it plots the prediction from a quadratic regression and adds the confidence interval on the basis of the standard error of forecast.

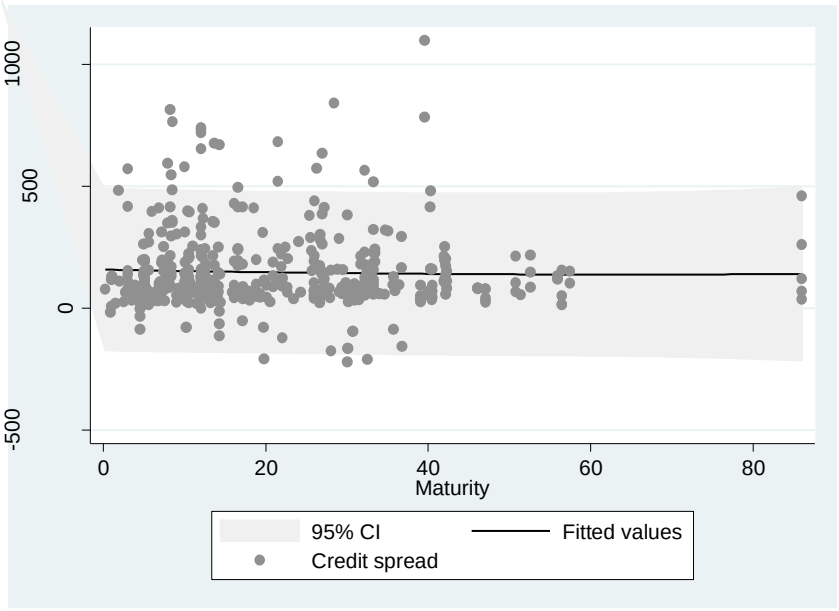
Graph 4: Term structure of credit spreads for PF loans



Graph 4 presents the augmented component-plus-residual plot based on regression [7a] and depicts the partial relationship between PF loans credit spread and maturity, once all other micro and macro factors have been controlled for.

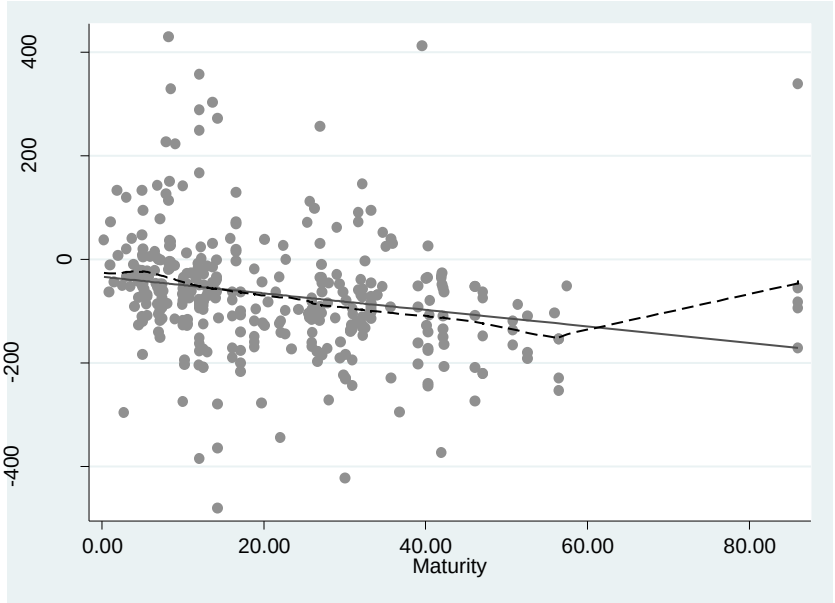
The straight line in Graph 4 corresponds to the regression model. The curved line reflects the fitting process based on non-parametric regression called local weighted scatterplot smoothing (lowess).

Graph 5: Credit spread *versus* maturity with confidence bands: AS Bonds



Graph 5 plots credit spread against maturity, it plots the prediction from a quadratic regression and adds the confidence interval on the basis of the standard error of forecast.

Graph 6: Term structure of credit spreads for AS bonds



Graph 6 presents the augmented component-plus-residual plot based on regression [7b] and depicts the partial relationship between AS loans credit spread and maturity, once all other micro and macro factors have been controlled for.

The straight line in Graph 6 corresponds to the regression model. The curved line reflects the fitting process based on non-parametric regression called local weighted scatterplot smoothing (lowess).