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

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Abstract

We study the financial characteristics of structured finance (SF), either project finance loans or asset securitization bonds, and straight debt finance (SDF) – corporate bonds – transactions by means of a comparative analysis of *ex ante* credit spreads for a large cross-section of 24,435 Western European loans and bonds during the 2000-2011 period. We find that SF and SDF transactions are priced in segmented capital markets. Credit spreads are higher for project finance loans than they are for asset securitization and corporate bond issues. On the contrary, average credit spreads for asset securitization and corporate bond issues do not differ significantly. Credit rating proves the most important pricing factor for asset securitization and corporate bonds. The 2007/2008 financial crisis imposed a significant impact on credit spreads and pricing process. The average credit spread has increased 192.2 bps for project finance loans, 63.0 bps for asset securitization bonds, and 94.8 bps for corporate bond issues during the crisis period. A robust hump-shaped relationship between credit spread and maturity is found for project finance loans while a linear positive relationship remains strongly significant for corporate bonds. Finally, our results are in line with security design literature. The design and issuance of different classes of securities with different degrees of seniority reduces monitoring costs.

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Abstract

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

JEL classification: F34; G01; G12; G21; G32

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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 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 (SF).

In an economy *à la* Modigliani and Miller's (1958), SF transactions would not exist, as they would offer no advantages over straight debt alternatives; i.e., in a world of perfect and liquid financial markets, where asymmetric information is not an issue, tranching or the act of encapsulating an initiative or a pool of assets in an *ad hoc* organization would not add value and a firm's financing structure would be irrelevant. Thus, the existence of market imperfections, including asymmetric information, agency conflicts, market incompleteness, and market segmentation, can explain tranching, 'off-balance sheet financing' and the benefits of SF transactions.[2] In this revised framework, structured financing may matter, because it creates value by minimizing the net costs associated with market imperfections.

The literature on SF suggests two core economic motivations for originating a financing transaction under a structured model.[3] The first relates to the fact that SF enables the financing of a particular asset class when established forms of external finance are unavailable for a particular financing need. The second economic benefit is a reduction in funding costs, when the benefits of the reduced cost of funding are greater than the cost of the required credit enhancement. Finnerty (1988), Caselli and Gatti (2005), *Fabozzi et al.* (2006), and Tavakoli (2008), among others, point out that making use of a

[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, Davis, and Choudhry (2006), Jobst (2007), Cherubini and Della Lunga (2007), and Fabozzi and Kothari (2007).

[2] Tranching means the creation of multiple types of securities backed by the firm's (or by the underlying asset pool, when considering securitization) assets and is considered one of the most important features that distinguishes SF instruments from traditional debt products. See, e.g., DeMarzo (2005) for further details.

[3] See, among others, Esty (2003), Esty and Megginson (2003), Caselli and Gatti (2005), DeMarzo (2005), Fender and Mitchell (2005), Fabozzi, *et al.* (2006), Tavakoli (2008), Gorton and Metrick (2013), and references therein.

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 – reduces the cost of funding. The same intuition is presented by Davidson, Sanders, Wolff, and Ching (2003), Roever and Fabozzi (2003), Jost (2006), and Fabozzi and Kothari (2007) for asset securitization. Securitization offers a low cost and credible way for information about the firm's receivables to be produced and provided to investors. Similarly, Esty (2003) and Caselli and Gatti (2005) argue that the use of project finance may enable sponsors to obtain a reduction in the net cost of financing. Project finance creates value by resolving agency problems, reducing asymmetric information costs, and improving risk management [Brealey, Cooper, and Habib (1996), Esty (2003, 2004a, 2004b), and Corielli, Gatti, and Steffanoni (2010)].

The existing literature on security design also supports this idea; i.e., optimal contractual arrangements derived in the financial contracting literature are mechanisms used to resolve different types of conflicts of interest or asymmetric information problems that arise in agency relationships between economic agents [Sannikov (2013)]. Allen and Gale (1988) suggest that successful SF instruments allocate cash flows to the investors who value them the most, allowing securities to be held in their most efficient form. Lacker (1990), Allen and Winton (1995), Hart and Moore (1995), and Winton (1995) provide interesting results on how different levels of seniority of debt contract can mitigate agency problems. Lacker (1990) and Winton (1995) models can be applied to explain some features of asset securitization transactions, in which two or more tranches are issued with different degrees of seniority among investors. Regarding adverse selection considerations, Diamond (1993), Winton (1995), and Glaeser and Kallal (1997) argue that the design and issuance of different classes of securities with different degrees of seniority – structuring – reduces monitoring costs. Boot and Thakor (1993), Riddiough (1997), DeMarzo and Duffie (1999), and DeMarzo (2005) show that a financial institution can reduce asymmetric information costs by pooling assets and issuing different types of securities against the pool of cash flows. Similarly, Fulghieri and Lukin (2001) argue that in securitization the originator may prefer to issue a security with 'high information sensitivity' if he intends to maintain a residual equity position in the pool of assets.

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 straight debt finance (SDF) transactions. Due to the difference in underlying risks, the relevant pricing factors for these two types of debt instruments should also differ. This idea is corroborated by recent research, which suggests that project finance loans might be fundamentally different from other syndicated loans and bond issues [Kleimeier and Megginson (2000) and Sorge and Gadanecz (2008)]. This raises three questions: (1) *How do common pricing factors compare between SF and SDF transactions*? (2) *Is the credit spread on SF transactions significantly different to the credit spread on SDF transactions*? And (3) *to what extent*

are SF and SDF transactions priced by common factors? These questions lead us to test three hypotheses. First, we intend to argue that not only the *ex ante* credit spreads but even the common pricing factors differ significantly between SF and SDF transactions. Second, we hope to answer if SF structures are sufficiently good at overcoming agency problems, and/or at reducing asymmetric information costs. The third hypothesis states that the credit spreads associated with SF and SDF transactions are influenced differently by common pricing factors.

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. Additionally, it has somewhat tarnished the previously prevailing positive image of structured finance, particularly asset securitization, as a process to help remedy deficiencies in financial markets, arising from incomplete capital allocation [e.g., IMF (2008b), Benmelech and Dlugosz (2009), and Brunnermeier (2009)]. This raises one additional question: *Is the credit spread on SF and SDF transactions significantly affected by the 2007/2008 financial crisis?* This question leads us to test a fourth hypothesis with the purpose of studying the impact of the financial crisis and the subsequent European sovereign debt crisis on SF and SDF 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.

Finally, the term structure of SF, as well as of SDF transactions appears as a particular puzzle. For project finance loans, Kleimeier and Megginson (2000) conclude that project finance 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 project finance loans and show that the term structure of credit spreads is 'hump-shaped'. Regarding corporate bonds, several authors [e.g., Jones, Mason, and Rosenfeld (1984), Sarig and Warga (1989), 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 – Fons (1987), Sarig and Warga (1989), and Helwege and Turner (1999) find downward-sloping term structures of credit spreads for non-investment grade bonds. Regarding securitization, empirical research [Vink and Thibeault (2008)] finds an insignificant (for ABS) or significant negative relationship (for MBS and CDO) between spread and maturity. Considering that SF transactions are characterized by much longer maturities compared to other forms of financing, we raise one final 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? This question leads us to test a fifth hypothesis with the purpose of studying the impact of maturity on SF and SDF credit spreads.

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. We believe our study is the first to investigate how *ex ante* credit spread and common pricing factors compare between SF and SDF transactions. A sample of loans – 2,859 project finance loans – and bonds – 599 asset securitization bonds and 20,977 corporate bonds – issued by Western European borrowers between January 1st, 2000 and December 31st, 2011 has been used in the study. We rely on asset securitization bonds and project finance loans as proxies for SF transactions and on corporate bonds as a proxy for SDF transactions. Project finance and asset securitization transactions typically consist of several tranches funding the same special purpose vehicle (SPV). Therefore, the unit of observation is a single issue or a single loan tranche.

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 project finance loans (198.3 bps) than they are for asset securitization bonds (148.9 bps) and corporate bonds (157.6 bps). On the contrary, average credit spreads for asset securitization and corporate bond 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 asset securitization and corporate bond 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 economically and statistically higher for project finance loans (329.1 bps *versus* 136.9 bps), asset securitization bonds (206.5 bps *versus* 143.5 bps), and corporate bonds (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 micro and macroeconomic pricing factors.

We conclude that SF and SDF transactions are not priced in a single integrated market. Moreover, even project finance and asset securitization issues are priced in segmented capital markets. Accepting 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 empirical literature (e.g., currency risk coefficient for project finance loans).

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 project finance loans, we find a robust hump-shaped relationship between credit spread and maturity. On the contrary, a linear positive relationship between credit spread and maturity remains strongly significant for corporate bond issues while it appears insignificant for asset securitization bonds.

This paper is organized as follows. Section 2 reviews the literature on SF, details the research questions and presents the methodology. Section 3 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 4, 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 5 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 6 provides robustness checks using alternative and rearranged variables. We also check whether our results are affected by potential endogeneity problems. Section 7 concludes the study.

2. Background Information and Hypotheses

2.1. Structured Finance

SF is related to the design of financial instruments based on the use of contracting tools and mechanisms to meet, as closely as possible, the different requirements and needs of borrowers and investors. Thus, SF encompasses all financial arrangements helping to efficiently (re)finance a specified pool of assets beyond the scope of on-balance sheet financing [Cherubini and Della Lunga (2007), Fabozzi and Kothari (2007), and Jobst (2007)]. As poited out by Leland (2007), SF "*... typically refers to the transfer of a subset of a company´s assets (an "activity") into a bankruptcy-remote corporation or other special purpose vehicle or entity (SPV/SPE).*"

In an SF transaction, the requirements of the owner of the assets or cash flows refer to liquidity, funding, risk transfer, efficient risk allocation, favorable capital, tax and accounting treatment, or other needs. Instruments are usually designed, namely in terms of covenants, warrantees, corporate structure, contracts, and trusts, to achieve segregation of those assets or cash flows from the originator or sponsor of the transaction. Additionally, credit enhancement mechanisms are implemented (e.g., the use of warrantees to enhance recoveries and tranching to define risk attachment points). In brief, there are three main specificities of SF. First, the critical role played by the vehicle company; i.e., the recipient of the raised funds is a separate entity from the party or parties sponsoring the transaction, which plays an

important role in the segmentation of cash flows and risks in a form proving more attractive for investors, through a structuring process.[4] Secondly, the high level of leverage, and finally, the centrality of prospective cash flow in order to evaluate the feasibility of the operation.

Prior research has identified the following main categories of SF transactions: (*i*) asset securitization;[5] (*ii*) project finance;[6] (*iii*) structured leasing;[7] and (*iv*) leveraged acquisitions, namely Leveraged Buy-Outs (LBOs)[8] [Roever and Fabozzi (2003), Caselli and Gatti (2005), Davis (2005), Gorton and Souleles (2005), and Fabozzi *et al*. (2006)]. As referred, in our study we rely on project finance (PF) loans and asset securitization (AS) bonds as proxies for SF transactions.

PF is the process of financing a specific economic unit that the sponsors create, in which creditors share much of the venture's business risk and funding is obtained strictly for the project itself. Often used for capital-intensive facilities and utilities, it is commonly used to segregate the credit risk of the project – by creating a legally independent project company – from that of its sponsors so that lenders, investors, and other parties will appraise the project strictly on its own merits. The allocation of specific project risks to those parties best able to manage them is one of the key comparative advantages of PF [Brealey *et al.* (1996), Esty (2004b), Caselli and Gatti (2005), and Fabozzi *et al.* (2006)].

AS means a process by which an entity pools together its interest in identifiable future cash flows, transfers the claims on those future cash flows to another entity that is specifically created for the sole purpose of holding those financial claims, and then issue negotiable securities to be placed into the market. Contrary to the traditional secured bonds, where it is the ability of the originator (or issuer) to generate sufficient cash flows to reimburse the debt that determines the risks of the transaction, in AS the source of repayments/funds shifts from the cash flows of the issuer to the cash flows generated by the securitized assets and/or a third party that guarantees the payments whenever cash flows become insufficient [Fabozzi *et al.* (2006) and Vink and Thibeault (2008)]. Securitization securities are issued as subordinated, negotiable contingent claims (tranches) with varying seniority and maturity, backed by the credit payment performance of securitized assets. The markets for the securities issued through securitization are composed of three main classes [Blum and DiAngelo (1997) and Kothari (2006)]: asset-backed securities (ABS), mortgage-backed securities (MBS), and collateralized debt obligations (CDOs).

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[4] For similar viewpoint see Caselli and Gatti (2005), Davis (2005), Akbiyikli *et al*. (2006), and Leland (2007).

[5] For further details see, e.g., Davidson *et al.* (2003), Roever and Fabozzi (2003), Kothari (2006), Jobst (2007), Tavakoli (2008), Gorton and Metrick (2013), and references therein.

[6] For further discussion see, e.g., Brealey *et al.* (1996), Kleimeier and Megginson (2000), Esty (2003, 2004a, 2004b), Caselli and Gatti (2005), Blanc-Brude and Strange (2007), Gatti (2008), and references therein.

[7] For a comprehensive account of theoretical and empirical literature on structured leasing see, among others, Slovin, Sushka, and Polonchek (1990), Caselli and Gatti (2005), Fabozzi *et al*. (2006), and Deo (2009).

[8] For further discussion see, e.g., Arzac (2005), Caselli and Gatti (2005), Kaplan and Strömberg (2009), Rosenbaum and Pearl (2009), and Guo *et al*. (2011).

Securities backed by mortgages are called MBS, securities backed by debt obligations are called CDOs, and securities backed by consumer-backed products are called ABS.

To analyze the motivations for using SF instruments, first and foremost it is crucial to understand why they create value. SF can create value by reducing the net costs associated with market imperfections. The literature on SF suggests several economic motivations for originating a financing transaction under a structured model.[9] First, it enables the financing of a unique asset class that (*i*) previously may have been financed only by traditional borrowing methods; or (*ii*) could not be financed at all without SF. SF thus plays a critical role as a new and diverse source of funding. The second economic benefit lies in cost reduction, when the benefits of the reduced cost of funding are greater than the cost of the required credit enhancement. The third advantage refers to maintaining the sponsors' financial flexibility by creating vehicle companies (SPVs) designated to take on the initiative, helping sponsors to protect their own credit standing and future access to financial markets, by improving or maintaining financial and regulatory ratios. Additionally, SF transactions allow originators or sponsors to transfer the risk of assets or liabilities and to carry out additional business without expanding their balance sheet. SF also contributes to improving operational and informational market efficiency, reducing agency costs, and reducing information asymmetries. Finally, it also allows the issuer to leverage up, compared to senior unsecured debt, and to increase tax shields/savings.

Despite the previously mentioned economic benefits for sponsors and investors, SF transactions also have disadvantages, especially when used inappropriately. SF transactions are fairly complex and involve a significant amount of cash flow evaluation, due diligence, negotiation, and legal procedures. Consequently, structuring such a deal is more costly than corporate financing. Moreover, it can be said that there is a broad consensus that securitization played an important role in the development and propagation of the 2007-2008 financial crisis.[10] One can thus identify the following problems related to the use of SF transactions:[11] (*i*) complexity; (*ii*) off-balance sheet treatment; (*iii*) asymmetric information problems; (*iv*) agency problems; (*v*) higher transaction costs; and (*vi*) wealth expropriation.

2.2. Hypotheses and Methodology

The five questions raised in the previous section as well as the literature review help us to develop the following hypotheses with respect to SF credit spreads:[12]

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[9] See, among others, Greenbaum and Thakor (1987), Oldfield (1997), Esty (2003), Caselli and Gatti (2005), DeMarzo (2005), Fender and Mitchell (2005), Akbiyikli *et al.* (2006), Fabozzi *et al.* (2006), Leland (2007), Tavakoli (2008), and Gorton and Metrick (2013), and references therein.

[10] See, among others, IMF (2008a, 2008b), Benmelech and Dlugosz (2009), and Brunnermeier (2009).

[11] See, e.g., Caselli and Gatti (2005), Fabozzi *et al.* (2006), Gorton (2009), and Gorton and Metrick (2013).

[12] We use the issuance credit spread (or the tranche spread at closing). Kleimeier and Megginson (2000), Gabbi and Sironi (2005), Blanc-Brude and Strange (2007), Vink and Thibeault (2008), Sorge and Gadanecz (2008), and Gatti, Kleimeier, Megginson, and Steffanoni (2013) among others, use the same variable.

Hypothesis 1: The pricing factors of SF credit spreads differ significantly 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 differs significantly between SF and SDF transactions.

Hypothesis 4: After controlling for macroeconomic conditions and loan characteristics, the 2007/2008 financial crisis did have a significant impact on SF and SDF credit spreads.

Hypothesis 5: After controlling for microeconomic and macroeconomic pricing factors, the term structure of credit spreads for SF issues do not behave differently from that of SDF issues.

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 corporate bonds (CB) – have the same explanatory variables. Then, coefficients from separate regressions are obtained from each type of issue, yielding 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). Hypothesis 3 will be accepted if the computed F value exceeds the critical value, and will be rejected if the F value remains smaller than its critical level. Should Hypothesis 3 be rejected, 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 accepted, 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.[13] 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 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 1st, 2000 through to September 14th, 2008, and a crisis period from September 15th, 2008 (Lehman Brothers' bankruptcy filing date) through to December 31st, 2011.

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 project finance loans, the purpose of answering the fifth question is to analyze the term structure of credit spreads for SF transactions compared to SDF transactions.

3. Data and Sample Selection

3.1. 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 as proxies for SF transactions.[14]

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[13] Besides the fact that asset securitization instruments are complex vis-à-vis SDF transactions, two major problems are commonly pointed out, underlying the roots of the 2007-2008 credit crunch: (*i*) asymmetric information problems; and (*ii*) agency problems. See, among others, IMF (2008a, 2008b), Benmelech and Dlugosz (2009), Brunnermeier (2009), and Demyanyk and Van Hemert (2011).

[14] As pointed out in section 1, one can identify four types of SF transactions: PF, AS, structured leases (SL), and leveraged acquisitions (mainly LBOs). We rely on PF and AS as proxies for SF transactions 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 an SF transaction.

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".[15] We include bond tranches classified either as fixed rate bonds (with coupon rate information) or variable rate bonds (with both spread and index information). 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 Europe and that the tranche size (in Euro millions) be available.[16] After applying these screens, we are able to examine a total of 24,435 debt issues (worth Euro 6,297.8 billion).[17] 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'.[18]

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, with regards to 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.

****** Insert Table 1 about here ******

[15] 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.

[16] 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.

[17] 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).

[18] 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.

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 third-party guarantees (96.9% and 100%, respectively). This largely meets the standard characteristics of PF and AS transactions. 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 credit support through collaterals or third party guarantees, so that lenders will be satisfied with the credit risk.

3.2. Loans and Bonds Pricing Samples

Since we wish to determine whether SF instruments are more or less expensive for borrowers 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, 439 as AS bonds (worth 140,733 M€), and 10,551 as CB issues (4,663,777 M€). Our high-information samples include issues with five default and recovery risk characteristics (credit rating, loan to value, time to maturity, tranches with guarantee, and country risk); nine 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 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).[19] Therefore, we assume that any empirical results derived from the high-information sub-samples can be extended to the larger population of all issues. Tables 2 and 3, our high-information samples, include several variables of interest. Although most of these are self-explanatory, a few of them require definition.

[19] 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. In the interest of space we do not show the results. The results are available from the authors.

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. 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 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.[20]

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:[21] 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.[22]

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 2. 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 rating at the time

[20] 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.

[21] 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 - all of our 1,090 available observations on PF loans credit spread are floating rate issues -, 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.

[22] 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 5) 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.

of issuing the bond or closing the loan.[23] *Country risk* is approximated by Standard & Poor's country credit rating at close and converted as presented in Table 2. 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 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.[24]

****** Insert Table 2 about here ******

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, the so-called 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., the level of interest rates, the market volatility, and the slope of the Euro 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.[25] An overview of the variables and their expected impact on *ex ante* credit spreads, taking into consideration the existing literature, is provided in section 5.

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

[24] 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.

[25] We identified the possible variables to use as instruments for the credit spread based on the available literature [in particular, Kleimeier and Megginson (2000), Gabbi and Sironi (2005), Longstaff, Mithal, and Neis (2005), Chen, Lesmond, and Wei (2007), Sorge and Gadanecz (2008), Vink and Thibeault (2008), Corielli *et al.* (2010), Flannery, Nikolova, and Öztekin (2012), and Gatti *el al.* (2013)]. Furthermore, the opinions collected during verbal discussions with top investment banks confirm our choices.

4. 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 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.

4.1. 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, Hypothesis 1 and Hypothesis 2 are tested with respect to SF and SDF pricing. Table 4 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 figures in the table 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 3 and 4. Average credit spreads are economically and statistically 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.[26] 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 3 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*

[26] Even when we split the samples into pre-crisis and crisis period (see Table 5), we find – using the Wilcoxon *z*-test – that the average credit spreads are significantly higher for PF loans than they are for AS and CB issues.

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.

****** Insert Tables 3 and 4 about here ******

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 same pattern is presented by Kleimeier and Megginson (2000) when comparing PF loans with other syndicated loans. 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 different at the 5% level or greater. When comparing SF with SDF bonds, 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 (49.0 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 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€, less than the 182.9 M€ and 159.7 M€ 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 does not differ significantly at the 5% significance level from the average tranche size exhibited by CB issues. If we compare the average tranche size exhibited in Table 3 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 sizes 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 (11.0% for PF loans *versus* 31.4% and 33.2% for AS and CB issues,

respectively).[27] Most of the non-price variables detailed in Table 3 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 come from borrowers/issuers in the 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 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 falls significantly to 1.8, while it remains similar for PF (3) and AS (4.2) issues. Additionally, the average loan to value ratio – the ratio of the tranche size to the transaction size – for AS bonds (36.4%) and PF loans (47.3%) is significantly lower than the loan to value ratio for CB (61.8%). Thus, we can conclude that SF transactions 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.[28] Still AS issues, as indicated by the standard deviation, exhibit significant heterogeneity with respect to maturity. For example, 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%) compared to the full sample of PF loans (1.4%) and 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 4 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 accept Hypothesis 1 that pricing factors of SF credit spreads differ significantly from the pricing factors of SDF credit spreads. Additionally, we also find 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

[27] If we compare the percentage of PF loan tranches subject to currency risk exhibited in Table 3, 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.

[28] 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).

of loan issues, but that there are also important univariate differences to consider, namely: (*i*) PF loans' average credit spreads are significantly higher than they are for AS and CB issues; (*ii*) Both AS and CB issues have a significant higher tranche size in comparison with PF loans; (*iii*) AS bonds have much longer average maturity and are more likely to be arranged for U.K. borrowers than PF and CB issues; (*iv*) 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; (*v*) PF loans 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 (*vi*) CB issues are more likely to be fixed rate rather than floating rate operations, when compared with AS and PF tranches.

We will examine loan pricing to a greater extent in section 5, when we employ OLS regression to determine what factors influence SF and SDF transactions' 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.

4.2. 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), however 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 1st, 2000 through to September 14th, 2008, and a crisis period from September 15th, 2008 through to December 31st, 2011.[29]

We hypothesize (Hypothesis 4) that, after controlling for macroeconomic conditions and loan characteristics, the financial crisis impact significantly on SF and SDF 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 5 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 issues. Similar findings are presented in Table 6 for dummy variables, which strongly support that, the proportion of tranches for which dummy =

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

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.

****** Insert Tables 5 and 6 about here ******

The evidence regarding credit spread strongly supports the assumption that the average credit spread is significantly higher for PF loans (329.1 bps *versus* 136.9 bps), AS bonds (206.5 bps *versus* 143.5 bps), and CB issues (220.3 bps *versus* 125.5) during the crisis period. Thus, we accept the hypothesis that the crisis impact significantly on SF and SDF credit spreads. These simple sample analyses, however, do not allow us to control for other micro and macro pricing factors. We thus proceed, in section 5, with regression analyses where we can take these factors directly into account.

Contrary to PF loans, AS bonds and CB issues 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. Additionally, our result regarding the average credit rating for AS bonds is a bit puzzling. Anecdotal evidence tends to suggest that AS bonds issued during the crisis period may be of higher quality due to the increasing scrutiny and tight credit rationing. We do not support this idea since we accept the null hypothesis of equality of means for credit rating.

Taking the remaining variables, we are able to document the following important findings: (*i*) CB issues have a significantly lower credit rating during the crisis period in comparison with the pre-crisis period; (*ii*) during the crisis period, loans and bonds in Western Europe are located in far riskier countries;[30] (*iii*) 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; (*iv*) during the crisis period, all types of issues were much less likely to be subject to currency risk; and (*v*) 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, compared to 100% in the crisis period (85.5% *versus* 62.7% for CB).

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

In this section, we subject the various high-information samples 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 differs significantly between SF and SDF transactions. Thus, we start our analysis by determining if SF and SDF

[30] 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.

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 and SDF credit spreads – again, after controlling for other micro and macro pricing factors (Hypothesis 4). Finally, the term structure of SF, as well as of SDF transactions appears as a particular puzzle. 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 (Hypothesis 5).

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. Virtually all of the empirical studies on CB credit spreads have found credit ratings to be one of its most important determinants. Some of the more recent papers include Duffie and Singleton (1999), Collin-Dufresne, Goldstein, and Martin (2001), Elton, Gruber, Agrawal, and Mann (2001), Hull, Predescu, and White (2004), Gabbi and Sironi (2005), and Longstaff *et al.* (2005). In searching for determinants of CB credit spreads, researchers also found other factors to be important, like liquidity [Longstaff *et al.* (2005), Chen *et al.* (2007), and Bao, Pan, and Wang (2011)], systematic risk [Collin-Dufresne *et al.* (2001) and Elton *et al.* (2001)], incomplete accounting information [Flannery et *al.* (2012)], leverage [Flannery *et al.* (2012)], and taxes [Elton *et al.* (2001)]. Market variables, like the level of interest rates, the slope of the yield curve, and market volatility, also have a significant impact on CB credit spreads [Campbell and Taksler (2003) and Krishnan, Ritchken, and Thomson (2005)]. An important stream of the literature analyzes the relationship between spread and maturity. Several authors [e.g., Jones *et al.* (1984), Sarig and Warga (1989), 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 [e.g., Fons (1987), Sarig and Warga (1989), and Helwege and Turner (1999)].

Referring to AS bonds, Rothberg, Nothaft, and Gabriel (1989) argue that liquidity and credit risk significantly affect the pricing of pass-through securities. Maris and Segal (2002) study the determinants of credit spread on CMBS and find that (*i*) default probability, (*ii*) tranche size, (*iii*) transaction size, and (*iv*) year influence CMBS credit spreads. Ammer and Clinton (2004) find that rating downgrades are accompanied by negative returns and widening spreads. Firla-Cuchra (2005) argues that credit rating is the most important pricing factor for this asset class at issue. This idea is corroborated by Gorton and Souleles (2005), Hu and Cantor (2006), Vink and Thibeault (2008), and Buscaino, Caselli, Corielli, and

Gatti (2012). 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.

Concerning PF loans, Kleimeier and Megginson (2000) find that PF loan spreads are directly related to variables such as country risk, the use of covenants in the loan contract, and project leverage. In their paper, they 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. Sorge and Gadanecz (2008) 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 also plays 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. Esty (2004a) shows that both legal and financial systems influence the pricing of PF loans. Gatti *et al.* (2013) show that certification can create economic value by reducing loan spreads.

We estimate the determinants of loans and bonds pricing using the model described in equation [1]. The dependent variable is the *ex ante credit spread*, in basis points, and the independent variables are those presented and described in Table 7, which gives an overview of the variables and their expected sign, taking into consideration the existing empirical literature.

****** Insert Table 7 about here ******

We employ standard OLS regression techniques and adjust for heteroskedasticity using the methodology proposed by Huber (1967) and White (1980).[31] The specification of the initial model is:

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

[31] 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).

5.1. 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 is accepted because the Chow test statistics in Table 8 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.

****** Insert Table 8 about here ******

Considering that we accept Hypothesis 3, next we examine the determinants of credit spreads for each type of issue using OLS regression framework. Table 9 presents the results of estimating equation [1] using each of the three high-information samples discussed in section 3. 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 in estimating model [1a] –, as pointed out in the univariate analysis (Tables 3), 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 4), 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 PF transactions; i.e., they are costly to set up, take a long time to execute, and are highly restrictive once in place.

****** Insert Table 9 about here ******

The second line of Table 9 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 44.35 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 and CB issues. Whereas

spread and loan to value are significantly, positively related for PF loans, they have a significant negative relationship for AS and CB transactions. 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 AS securities.

While 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 mean, decreases credit spread by 1.14 bps. However, this will be the subject of further analysis because our robustness checks (section 6) appear to confirm that maturity may be an endogenous variable in the pricing of CB and PF loans. 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. While credit spread and number of banks are positively, significantly 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, to the extent that the U.K. financial market is more developed and deeper than the continental Europe financial market. 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 19.39 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 128.24 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. For CB issues, as expected, the higher the general level of interest rates the higher the credit spread. Our findings for PF loans differ from those of Blanc-Brude and Strange (2007), who find for a sample of EU and UK Public-Private Partnerships that risk-free rate variable proves to have no statistically significance on the pricing of PF tranches. As we expected, 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. Credit spread and volatility are significantly and positively related for AS and CB issues, but they have an insignificant relationship for PF loans. In the presence of higher volatility, AS and CB issuers will pay a higher return. These findings are in line with those presented by Chen *et al.* (2007) and Flannery *et al.* (2012) for CB.

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, borrower nationality, 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, pointed out by several authors as the most important pricing factor for AS and CB tranches at issue, is available only for some of the transactions belonging to our high-information sub-samples. Next we study the determinants of *ex ante* credit spreads for the PF, AS, and CB sub-samples created using data available on rating.

5.2. 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. 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 10 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 7.14 bps, 27.44 bps, and 29.27 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 213.51 bps for PF loans, 100.17 bps for AS bonds, and 218.77 bps for CB.

****** Insert Table 10 about here ******

Considering SDF (CB) issues, model [2c] yields an adjusted R^2 value of 0.44, which compares with a value of 0.22 for model [1c]. This shows, as referred virtually by all of the empirical studies on 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: (*i*) the coefficients on *log transaction size*, *U.K. borrowers*, and *industrial* and *transportation* dummy variables become insignificant; (*ii*) *currency risk* (as we expected) and *government* dummy variable become significantly and positively related with credit spread; (*iii*) 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], as we expected based on empirical literature – for CB issues with rating, a one-year increase in maturity is associated with a 1.10 bps increase in credit spread; (*iv*) the sign of the impact of the *log loan to value* on credit spread also changes between regressions – in model [1c] the loan to value ratio is significantly negative and becomes significantly positive in model [2c], which is in line with the existing literature; (*v*) a change in coefficient sign takes place for *EUSA5y-Libor3M* variable – for CB issues with rating, as expected based on empirical literature, the slope of the Euro swap curve significantly reduces a CB issue credit spread; and (*vi*) a change in coefficient sign also takes place for *commercial* and *utilities* dummy variables – when controlling for rating, issuers belonging to the commercial and utilities industry pay lower credit spreads than issuers in the financial industry.

Results in estimating model [2b] show, as we expected based on the existing empirical literature, that variables *number of banks* and *EUSA5y-Libor3M* significantly reduce the credit spread. The

coefficients on *log loan to value* and *commercial* dummy variables become insignificant, while *volatility* and *transportation* dummy variable both are significantly and positively related to credit spread. However, the change in significance of the coefficient on *log loan to value* is of little importance to the extent that the loan to value ratio tends to be similar per rating class. The inclusion of a direct measure of credit risk has a considerable impact on the significance of the coefficient on *crisis*. Contrary to what we expected, credit spread and crisis show an insignificant relationship for AS bonds. This can be explained by the significant reduction in the number of observations between pre-crisis and crisis period sub-samples – from 334 to 30 observations (see 4.3). As the result of the credit crunch precipitated by the subprime mortgage crisis the market for AS bonds was very weak in the crisis period. Additionally, banks have issued government guaranteed bonds and underwritten their own securitization programs to use them as a guarantee for obtaining resources in the two ECB covered bond purchase programmes, implemented from the second half of 2009.[32] 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.

For PF loans (model [2a]), *industrial* dummy variable becomes significantly and positively related with credit spread. Coefficients on *log transaction size*, *log loan to value*, *number of banks*, *country risk*, *currency risk*, *U.K. borrowers*, *crisis*, *risk free rate*, and *EUSA5y-Libor3M* become insignificant. Thus, the credit spread is basically explained by credit risk. 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.

5.3. 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 and SDF credit spreads, we hypothesize (Hypothesis 4) that after controlling for macroeconomic conditions and loan characteristics, the financial crisis did have a significant impact on SF and SDF credit spreads. Our purpose is to examine whether our results are robust over 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.

Model [1a] – Table 11 – 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-*

[32] Under Covered Bond Purchase Programme, the Eurosystem made outright purchases of covered bonds to the nominal value of Euro 60 billion and Euro 40 billion, respectively. See Beirne *et al.* (2011) for further details.

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).

****** Insert Table 11 about here ******

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. 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*, *EUSA5y-Libor3M*, *utilities* dummy variable, and *rating* remain statistically significant, while the coefficients of *log loan to value*, *number of banks* 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 five 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* and *risk free rate* 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 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 find further evidence in favor of 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 influenced 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.

5.4. The Term Structure of SF and SDF Transactions

As presented in section 4, 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. We intend to determine whether longer maturities are perceived by lenders as a risk per se; i.e., if the term structure of credit spreads for SF issues behave differently from that of SDF issues (Hypothesis 5).

Based on presented regression results for SF and SDF issues in section 5, a linear positive relationship between credit spread and maturity appears strongly significant for SDF transactions (CB issues) – see model [2c] –, 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], [1b], and [2b]. Thus, our main conclusion so far is that, when controlling 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 [Sorge and Gadanecz (2008] and a negative relationship for AS bonds [Vink and Thibeault (2008)]. We therefore augment our baseline multiple regression (equation [1]) with non-linear maturity components.

Table 12 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.[33] 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 [3b] and [3c]), as in the original specifications. However, considering PF loans, the explanatory power (adjusted R^2) increases significantly from model [1a] to [3a] – from 0.51 to 0.63. For PF loans, a robust hump-shaped

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

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 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.

****** Insert Table 12 about here ******

In model [3b] the logarithmic maturity 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 [3b] – 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.[34] 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. Robustness Checks

6.1. Endogeneity

We subsequently wish to check whether our results are affected by potential endogeneity of maturity. We could conceive the case of riskier borrowers only being able to obtain shorter-maturity PF loans or to issue shorter-maturity bonds; i.e., in fact, the choices of maturity and credit spread may be co-determined. To perform this robustness check, we follow the approach in Wu (1973), also described in Davidson and MacKinnon (2004). We first run one auxiliary regression where maturity is expressed as a

[34] We have also run model [3b] 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.

function of all exogenous microeconomic and macroeconomic variables. We save the residuals and add to the list of independent variables in order to re-estimate our main regression models. More precisely, we estimate models [1a], [2b], and [2c] adding the residuals obtained from our auxiliary regression. We find that residuals are significant (at the 5% significance level) for PF loans and CB issues. In other words, we reject the null of no endogeneity of maturity for PF loans and CB issues but not in the case of AS bonds. This is consistent with the findings by Helwege and Turner (1999) and Sorge and Gadanecz (2008) for bonds but contrary with the findings by Sorge and Gadanecz (2008) for PF loans. Concerning AS bonds, since the maturity of the securities issued in an AS transaction is so closely tied to the maturity of the assets used as collateral, maturity can be considered as a pre-determined variable at the pricing stage.

PF is by nature characterized by endogeneity problems [Esty (2004b), Corielli *et al.* (2010), and Gatti *et al.* (2013)] since SPV directors manage a large set of variables simultaneously. Considering that PF projects usually start by generating revenues after a relatively long construction period, obtaining credit for longer maturities and with affordable credit spreads might be critical to ensure a project's financial viability. Regarding CB, bonds with longer maturities tend to be more risky, because predictability of future cash flows weakens with horizon. Therefore, investors usually demand higher premium for longer term bonds [Jones *et al*. (1984), Sarig and Warga (1989), and Sorge and Gadanecz (2008)]. As a result, the trade-off between spread and maturity is also taken into consideration for CB issues. We can thus assume that both credit spread and maturity are determined simultaneously once negotiations for the financial package begin.

The structure so defined is then estimated by instrumental variables, and the choice of instruments is checked by using the Sargan test [Sargan (1958)].[35] In such a test, the residuals from a 2SLS regression are regressed on all the exogenous variables. Considering that PF loans and CB issues are priced in segmented capital markets (see section 5) we use different instruments for each type of transaction. We use models [1a] and [2c] where credit spread is modeled as a function of microeconomic and macroeconomic variables and the endogenous regressor maturity is instrumented with the following factors excluded from the equations: (*i*) *tranche size* and *year* for PF loans; (*ii*) and *number of bookrunners* and *year* for CB.

We identified the possible variables to use as instruments based on opinions collected during verbal discussions with top investment banks, and the literature confirms our choices [see, e.g., Daniels, Ejara, and Vijayakumar (2010)]. The 2007-2008 financial crisis and the subsequent European sovereign debt crisis manifested a shortage of liquidity, which was reflected in a maturity reduction for both loans and bonds. The year might thus affect maturity since during the crisis period banks/investors lost balance

[35] Sargan test is a test of overidentifying restrictions that allows us to assess the adequacy of the selected instruments. For further discussion of this subject see Baum (2006).

sheet capacity to lend, particularly for longer periods. The debt maturity literature regarding CB [Diamond (1991), Berger, Espinosa-Vega, Frame, and Miller (2005), and Bali and Skinner (2006)] emphasizes the importance of information asymmetry in the debt maturity decision for corporate firms. Hence, a larger number of bookrunners involved is able to increase maturity once investors associate a larger number of bookrunners with an increase in the certification of the transaction. Finally, for PF loans, it is feasible to associate maturity with tranche size. Larger tranches might imply lower maturities since they constitute a larger share in lenders' loan portfolio.

The *F* statistic reported in Table 13 is significant for models [4a] and [4c], which means that the additional instruments have significant explanatory power for maturity. In addition to the requirement that instrumental variables be correlated with maturity, the instruments must also be uncorrelated with the structural error term. Both Sargan's test statistics are insignificant at the 5% test level, which means that our structural models are specified correctly.

****** Insert Table 13 about here ******

The augmented regressions reported in Table 13 provide consistent estimates of the coefficients, confirming our main results reported in Table 10. Comparing the results presented in model [4a] with those presented in model [1a], small differences in significance of the coefficients can be pointed out, namely: (*i*) the coefficients on *log loan to value* and *U.K. borrowers* dummy variable become insignificant; (*ii*) contrary to what we expected based on empirical literature, the *number of tranches* becomes significantly and negatively related with credit spread. Results in estimating model [4c] show that variables *U.K. borrowers* (as we expected), *industrial and transportation dummy variables* significantly reduce the credit spread. The coefficients on *government* and *other* dummy variables become insignificant, while the *log transaction size* is significantly and positively related to credit spread.

Finally, we also check if the choices of credit risk (*rating*) and credit spread may be co-determined. We follow the same approach and we find no evidence of endogeneity bias for PF, AS, and CB issues. This seems to suggest that if credit spreads and maturity appears co-determined for PF and CB transactions, the same does not hold for credit spreads and credit risk.

6.2. Up-front and Management Fees

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. As an additionally robustness check, we wish to test the sensitivity of our results to the inclusion of two variables in order 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). Our baseline models (equation [1]) were thus re-estimated after adding these variables.

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. 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.

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. It is worth noting that for PF loans both *management fee* and *upfront fees* are 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).

6.3. Additional Sensitivity Tests

We have performed a number of additional robustness checks that further control for a number of contractual features that are different between loans and bonds as well as for adjustments to our rating and country risk variables.

First, we test the sensitivity of our results to the inclusion of 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. We can argue, therefore, the possibility that introducing such variables might affect our results. Our models [2b] and [2c] were thus re-estimated after adding *collateral*, *callable*, and *fixed rate* dummy variables for AS bonds and *callable* and *fixed rate* dummy variables for CB issues. 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 51.72 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 49.70 bps. The introduction of a call option in a CB issue increases the credit spread by 55.55 bps. Thus, an issuer has to pay a premium to have the right to redeem the bond before the bond maturity.

Second, we test the sensitivity of the results reported in models [2a], [2b], and [2c] adjusting our 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). Additionally, we also replace the country risk with the Euromoney country risk scores.

Overall, these additional sensitivity tests further confirm the robustness of our results. Our estimates remain unchanged when we adjust our rating scale as proposed by Corielli *et al*. (2010) and use the Euromoney country risk scores, and appear robust to the inclusion of variables controlling for specific contractual features of AS bonds and CB issues.

7. Summary and Conclusions

This study compared the financial characteristics of structured finance (SF), either project finance loans or asset securitization bonds, and straight debt finance (SDF) – corporate bonds – transactions by means of a comparative statistical and econometric analysis of *ex ante* 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 asset securitization issues (worth Euro 179.1 billion), 20,977 corporate bond issues (worth Euro 5,786.5 billion), and 2,859 project finance loans (worth Euro 332.1 billion).

We found that project finance loans have higher credit spreads (198.3 bps) than asset securitization bonds (148.9 bps) and corporate bonds (157.6 bps) and that average credit spreads for asset securitization and corporate bond issues do not differ significantly. Despite determinants and impacts of different managerial decisions can be more transparently observed through SPVs than in corporate finance settings [see, e.g., Shah and Thakor (1987) and Leland (2007)], this result evidences that project finance transactions do not enable sponsors to obtain a reduction in the cost of funding. However, it is important to notice that a firm's rational value maximizer manager/owner should choose between project financing and corporate financing, based on the cost of capital efficiency of the available financing alternatives. The decision either to go with a project finance transaction or with a corporate bond issue, should be based on the trade-off between the composite cost of capital of the project finance and the sponsor's, and the sponsor's overall cost of capital after the corporate bond issue. This idea is corroborated by Leland (2007), which argues that "… keeping activities separate offers the advantage of

optimizing the separate capital structures…" allowing for greater leverage and financial benefits. Cheaper financing for assets that remain in the firm and preserving core firm financial assets are two commonly cited justifications for project finance.

We also found that the pricing factors of SF credit spreads differ significantly when compared with the pricing factors of SDF credit spreads. Both asset securitization and corporate bond issues have a significant higher tranche size in comparison with project finance loans and asset securitization bonds have much longer average maturity and are more likely to be arranged for U.K. borrowers than project finance and corporate bond issues. Project finance 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. Corporate bond 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 7 summarizes our findings. We found, as we expected based on empirical literature, that credit spreads rise when ratings worsen for project finance, asset securitization, and corporate bond issues. Similarly, the slope of the Euro swap curve impacts negatively on the credit spread of all types of debt issues. Project finance loan credit spreads are higher when there is a mismatch in the currency of the borrower's home country and the currency of the PF loan repayment, a borrower belongs to a country with higher credit risk, and a higher number of banks participate in the transaction. Project finance loan credit spreads and fees are shown to be complements rather than supplements. The transaction size and the level of interest rates significantly reduce project finance loan credit spreads. The level of volatility in capital markets proves positively related to asset securitization and corporate bond issue credit spreads, while the number of banks participating has a negative impact on credit spreads. The loan to value ratio has a significant negative relationship with credit spread across asset securitization bonds and borrowers belonging to financial industry raise funds in asset securitization market at lower credit spreads. Corporate bond issue credit spreads are positively influenced by management fee, the risk free rate, the loan to value ratio, the number of tranches, and currency risk. Finally, the type of collateral in an asset securitization transaction and the type of the interest rate and if the bond is callable in a corporate bond issue determine 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 192.2 bps for project finance loans, 63.0 bps for asset securitization bonds, and 94.8 bps for corporate bond issues during the crisis period. Credit rating proves the most important pricing factor for asset securitization securities at launch during pre-crisis

period. We can identify a change in the type of factors that explain project finance loan credit spreads, from marketability factors to default factors between pre-crisis and crisis period. The change in the type of factors that explain corporate bond 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 project finance loans, a robust hump-shaped relationship between credit spread and maturity was found. The logarithmic maturity term turned out insignificant for asset securitization bonds and a linear positive relationship between credit spread and maturity remained strongly significant for corporate bond issues. Our results and analysis help to explain why maturity, which is a major systematic driver of the cost of debt in SDF, only has a marginal linear effect on the credit spread of SF transactions.

Our findings hold after controlling for a number of contractual features that are different between loans and bonds, for adjustments to our rating and country risk variables, and are robust to endogeneity bias of maturity.

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 asset securitization 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 project finance and asset securitization 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 influence 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 asset securitization 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 argues 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 asset securitization with regard to the 2007/2008 financial crisis.

Fourth, the present work points to the need to rethink the way banking regulation treats project finance 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 project finance 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.

Finally, our results are in line with security design literature. SF transactions, based on extensively contractual and security design, allow the reduction of the net costs associated with market imperfections, namely agency problems and asymmetric information. Considering that (*i*) the average loan to value ratio is significantly lower for SF transactions, and (*ii*) the average number of tranches is significantly higher for this type of transactions, we can conclude that SF transactions may benefit from tranching to a larger degree. Accordingly to Lacker (1990), Diamond (1993), Winton (1995), and Glaeser and Kallal (1997), in asset securitization the design and issuance of different classes of securities with different degrees of seniority reduces monitoring costs. Our results corroborate these findings, as credit spread and loan to value have a significant negative relationship for AS bonds.

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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: Breakdown by credit rating of tranche size and credit spread variables

Credit Rating (S&P's / Moody's)	Value	Project Finance Loans		Asset Securitization Bonds		Corporate Bonds	
		Average Tranche Size (Euro millions)	Average Credit Spread (bps)	Average Tranche Size (Euro millions)	Average Credit Spread (bps)	Average Tranche Size (Euro millions)	Average Credit Spread (bps)
AAA / Aaa	1	242.8	121.7	466.7	63.6	336.5	73.2
AA+ / Aa1	2			107.8	82.3	436.9	103.7
AA / Aa2	3	70.0	124.4	860.6	103.7	263.3	95.6
AA- / Aa3	4	107.3	80.0	75.2	111.8	394.5	117.3
A+ / A1	5	37.2		31.2	121.9	300.5	93.3
A / A2	6	89.7	77.4	120.3	157.0	275.9	112.6
A- / A3	7	339.6	174.5	164.4	109.3	406.6	122.5
BBB+ / Baa1	8	264.8	154.9	116.2	217.0	514.0	164.9
BBB / Baa2	9	320.9	150.4	65.0	212.1	456.3	203.1
BBB- / Baa3	10	248.0	150.5	50.8	304.6	417.3	250.5
BB+ / Ba1	11			36.0	597.3	522.2	383.7
BB / Ba2	12			44.5	413.0	463.1	414.9
BB- / Ba3	13	199.8	232.1	67.4	579.8	319.8	440.2
B+ / B1	14	827.3				404.2	573.8
B / B2	15	700.0		21.7	572.9	301.5	604.3
B- / B3	16	700.0	205.9			250.2	637.0
CCC+ / Caa1	17			607.5	215.6	313.9	709.3
CCC / Caa2	18					140.0	740.1
CCC- / Caa3	19					203.6	810.9
CC / Ca	20					64.2	811.3
SD / C	21					153.7	638.2
D / -	22						
N/A	-	112.4	200.8	172.2	200.7	78.0	246.2
Total		116.2	198.3	299.1	148.9	275.9	157.6

N/A means that information about credit rating is not available.

Table 3: 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 4: 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 5: 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 6: 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 7: Definition of variables, expected sign, and findings

Variable	Description	Empirical Literature	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.	Eichengreen & Mody (1998, 2000) | Kleimeier & Megginson (2000) | Maris & Segal (2002) | Campbell & Taksler (2003) | Firla-Cuchra (2005) | Gabbi & Sironi (2005) | Blanc-Brude & Strande (2007) | Chen *et al.* (2007) | Sorge & Gadanecz (2008) | Vink & Thibeault (2008) | Buscaino *et al.* (2009) | Gatti et al. (2013) |	- / 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.	Vink & Thibeault (2008) |	+	-	+	+ / I	-	+
Maturity	Maturity of loan or bond, in years.	Sarig & Warga (1989) | Helwege & Turner (1999) | He *et al.* (2000) | Kleimeier & Megginson (2000) | Duffie & Singleton (2001) | Campbell & Taksler (2003) | Chen *et al.* (2007) | Blanc-Brude & Strande (2007) | Sorge & Gadanecz (2008) | Vink & Thibeault (2008) | Corielli *et al.* (2010) | Gatti *et al.* (2013) |	?	- / I	?	HS	I	+
Number of tranches	The number of tranches for each transaction.	Firla-Cuchra & Jenkinson (2006) | Vink & Thibeault (2008) |	+	-	+	I / -	I	+
Number of banks	The number of financial institutions participating in the loan or bond issuance.	Strahan (1999) | Esty & Megginson (2000, 2003) | Kleimeier & Megginson (2000) | Guner (2006) | Gupta *et al.* (2008) | Sorge & Gadanecz (2008) | Vink & Thibeault (2008) |	?	- / 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.	Kleimeier & Megginson (2000) | Vink & Thibeault (2008) | Corielli *et al.* (2010) | Gatti *et al.* (2013) |	- / I	+	+	+	I	+
U.K. borrowers	Dummy equal to 1 if the borrower/issuer belongs to U.K.		-	-	-	+ / I	I	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.	Kleimeier & Megginson (2000) | Sorge & Gadanecz (2008) | Corielli *et al.* (2010) | Gatti *et al.* (2013) |	?	+	?	I	I / +	?
Rating	Loan and bond rating based on the S&P and Moody's rating at close; i.e., at the time of issuing the bond or closing the loan. The rating is converted as follows: AAA=Aaa=1, AA+=Aa1=2, and so on until D=22.	Duffie & Singleton (1999) | Kleimeier & Megginson (2000) | Collin-Dufresne *et al.* (2001) | Elton *et al.* (2001) | Hull *et al.* (2004) | Firla-Cuchra (2005) | Gabbi & Sironi (2005) | Gorton & Souleles (2005) | Longstaff *et al.* (2005) | Hu & Cantor (2006) | Chen *et al.* (2007) | Vink & Thibeault (2008) | Buscaino *et al.* (2009) |	+	+	+	+	+	+

(Continued)

Table 7: Definition of variables, expected sign, and findings

(continued)

Variable	Description	Empirical Literature	Expected Sign			Findings		
			PF	AS	CB	PF	AS	CB
Independent variables:								
Microeconomic independent variables								
Management fee	Fees (in bps) that are periodically paid to the bank syndicates.	Kleimeier & Megginson (2000) | Blanc-Brude & Strande (2007) | Gabbi & Sironi (2005) |	+	+	+ / I	+	I	+
Upfront fee	A fee (in bps) paid by a borrower to a bank or a syndicate of banks for arranging a PF loan.	Blanc-Brude & Strande (2007) | Kleimeier & Megginson (2000) | Gatti *et al.* (2013) |	+	NA	NA	+	NA	NA
Collateral	Dummy equal to 1 if an AS bond is backed by mortgages and 0 otherwise.	Gorton & Souleles (2005) | Fabozzi *et al.* (2006) | Vink & Thibeault (2008) |	NA	-	NA	NA	-	NA
Fixed rate	Dummy equal to 1 if a loan or bond is fixed price and 0 otherwise.	Sorge & Gadanecz (2008) | Vink & Thibeault (2008) |	+	+	+	NA	I	+
Callable	Dummy equal to 1 if the bond has a call option and 0 otherwise.	Davidson *et al.* (2003) | Fabozzi *et al.* (2006) | Kothari (2006) |	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.	Kleimeier & Megginson (2000) | Corielli *et al.* (2010) | Gatti *et al.* (2013) |	+	?	+	+	I	I
Crisis	Dummy equal to 1 if the issue date belongs to the crisis period and 0 otherwise.	Benmelech & Dlugosz (2009) | Brunnermeier (2009) | Jobst (2009) | Gatti *et al.* (2013) |	+	+	+	+	+ / 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.	Scott & Smith (1986) | Eichengreen & Mody (1998) | Blanc-Brude & Strande (2007) | Flannery *et al.* (2012) |	I	+	+	-	I	+
Volatility	The Chicago Board Options Exchange Volatility Index (VIX). VIX reflects a market estimate of future volatility.	Krishnan *et al.* (2005) | Chen *et al.* (2007) | Flannery *et al.* (2012) |	+	+	+	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.	Campbell & Taksler (2003) | Krishnan *et al.* (2005) | Hu & Cantor (2006) | Chen *et al.* (2007) | Sorge & Gadanecz (2008) | Flannery *et al.* (2012) |	?	-	-	-	-	-

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 | NA = information about this variable is not available | HS = hump-shaped.

Table 8: 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 9: 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 **	113.44 *	21.24
	(9.43)	(2.37)	(1.85)
Log transaction size	-19.52 **	-6.75	-9.63 **
	(-4.93)	(-1.52)	(-7.15)
Log loan to value	4.37 *	-40.91 **	-45.02 **
	(2.04)	(-5.48)	(-7.02)
Maturity	0.51	-0.72	-1.14 **
	(1.67)	(-1.52)	(-3.91)
Number of tranches	-1.02	-3.08	12.36 **
	(-0.56)	(-0.95)	(13.31)
Number of banks	1.42 **	-9.36 **	-2.04 **
	(3.87)	(-2.58)	(-4.11)
Country risk	7.78 **	-12.80	0.32
	(2.91)	(-1.04)	(0.20)
Currency risk	38.11 **	16.95	-5.53
	(2.88)	(0.79)	(-1.08)
U.K. borrowers	49.85 **	10.39	19.39 **
	(5.23)	(0.46)	(3.76)
Crisis	174.01 **	121.25 *	128.24 **
	(16.26)	(2.43)	(15.93)
Risk free rate	-0.16 **	0.12	0.22 **
	(-4.46)	(1.28)	(7.26)
Volatility	0.49	2.25 *	1.71 **
	(1.64)	(2.13)	(8.03)
EUSA5y-Libor3M	-0.46 **	-0.45 **	0.10 **
	(-7.41)	(-3.30)	(2.93)
Commercial		101.80 **	94.58 **
		(3.28)	(15.29)
Industrial	10.29	57.95	92.63 **
	(1.14)	(1.56)	(17.48)
Utilities	12.92	-16.49	12.63 *
	(1.41)	(-0.42)	(2.37)
Transportation	14.33	128.94	65.88 **
	(1.39)	(1.88)	(5.66)
Government	7.18		24.34
	(0.31)		(0.63)
Other			164.91 **
			(5.86)
Number of observations	1,029	439	10,543
Adjusted R^2	0.51	0.19	0.22
F	90.00	6.55	240.95

Table 9 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: *commercial* and *other* dummy variables in estimating model [1a]. *Government* and *other* dummy variables do not exist for AS transactions.

Table 10: 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 **	44.15	113.44 *	13.27	21.24	-197.53 **
	(9.43)	(0.38)	(2.37)	(0.31)	(1.85)	(-17.64)
Log transaction size	-19.52 **	4.56	-6.75	3.74	-9.63 **	1.55
	(-4.93)	(0.27)	(-1.52)	(0.92)	(-7.15)	(1.22)
Log loan to value	4.37 *	12.72	-40.91 **	0.79	-45.02 **	31.83 **
	(2.04)	(1.52)	(-5.48)	(0.10)	(-7.02)	(4.17)
Maturity	0.51	-0.95	-0.72	-0.36	-1.14 **	1.10 **
	(1.67)	(-0.99)	(-1.52)	(-0.67)	(-3.91)	(5.05)
Number of tranches	-1.02	10.72	-3.08	2.39	12.36 **	36.89 **
	(-0.56)	(1.73)	(-0.95)	(0.86)	(13.31)	(8.03)
Number of banks	1.42 **	0.18	-9.36 **	-8.24 *	-2.04 **	-1.97 **
	(3.87)	(0.14)	(-2.58)	(-2.10)	(-4.11)	(-4.99)
Country risk	7.78 **	-15.27	-12.80	-4.99	0.32	-2.15
	(2.91)	(-1.09)	(-1.04)	(-0.74)	(0.20)	(-1.60)
Currency risk	38.11 **	-8.52	16.95	35.36	-5.53	28.61 **
	(2.88)	(-0.30)	(0.79)	(1.96)	(-1.08)	(7.04)
U.K. borrowers	49.85 **	46.73	10.39	-10.10	19.39 **	6.66
	(5.23)	(0.88)	(0.46)	(-0.53)	(3.76)	(1.64)
Crisis	174.01 **	44.82	121.25 *	33.70	128.24 **	117.21 **
	(16.26)	(0.68)	(2.43)	(0.74)	(15.93)	(20.17)
Risk free rate	-0.16 **	-0.29	0.12	-0.03	0.22 **	0.12 **
	(-4.46)	(-1.75)	(1.28)	(-0.31)	(7.26)	(5.34)
Volatility	0.49	2.13	2.25 *	2.42 **	1.71 **	2.77 **
	(1.64)	(0.79)	(2.13)	(2.81)	(8.03)	(16.68)
EUSA5y-Libor3M	-0.46 **	-0.12	-0.45 **	-0.52 **	0.10 **	-0.09 **
	(-7.41)	(-0.36)	(-3.30)	(-4.35)	(2.93)	(-2.79)
Commercial			101.80 **	25.01	94.58 **	-16.75 **
			(3.28)	(0.99)	(15.29)	(-3.57)
Industrial	10.29	92.54 *	57.95	27.34	92.63 **	1.41
	(1.14)	(2.15)	(1.56)	(0.99)	(17.48)	(0.34)
Utilities	12.92	81.03	-16.49	-55.51	12.63 *	-38.00 **
	(1.41)	(1.48)	(-0.42)	(-1.52)	(2.37)	(-8.16)
Transportation	14.33		128.94	110.02 **	65.88 **	12.27
	(1.39)		(1.88)	(3.64)	(5.66)	(1.49)
Government	7.18	10.78			24.34	30.89 **
	(0.31)	(0.17)			(0.63)	(2.66)
Other					164.91 **	69.49 **
					(5.86)	(3.48)
Rating		7.14 **		27.44 **		29.27 **
		(2.82)		(8.65)		(43.35)
Number of observations	1,029	39	439	364	10,543	8,686
Adjusted R^2	0.51	0.68	0.19	0.46	0.22	0.44
F	90.00	5.98	6.55	11.45	240.95	247.81

Table 10 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*) *commercial* and *other* dummy variables in estimating model [1a]; and (*ii*) *commercial*, *transportation* and *other* dummy variables in estimating model [2a]. *Government* and *other* dummy variables do not exist for AS transactions.

Table 11: 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 **	546.22 **	-6.98	609.12	-82.59 **	-226.40 **
	(6.96)	(11.44)	(-0.17)	(1.83)	(-6.35)	(-10.97)
Log transaction size	-15.34 **	-21.36 **	3.98	-30.11	-14.28 **	28.53 **
	(-3.35)	(-2.75)	(0.91)	(-0.83)	(-8.48)	(17.29)
Log loan to value	2.03	10.98 *	1.91	-18.31	25.46 **	-10.46
	(0.92)	(2.50)	(0.16)	(-0.60)	(2.60)	(-0.85)
Maturity	1.05 **	-0.74	-0.48	4.85	1.05 **	1.12 **
	(2.97)	(-1.12)	(-0.88)	(1.77)	(3.81)	(3.18)
Number of tranches	1.35	-2.44	2.86	-141.20	42.16 **	-17.18 *
	(0.62)	(-0.62)	(1.00)	(-1.81)	(7.90)	(-2.21)
Number of banks	1.44 **	0.86	-9.46 *	-1.06	-2.54 **	-1.38
	(3.99)	(0.75)	(-2.35)	(-0.02)	(-6.35)	(-1.87)
Country risk	1.71	12.91 **	-0.77	-39.16	-14.40 **	9.22 **
	(0.94)	(2.70)	(-0.11)	(-1.49)	(-13.55)	(4.86)
Currency risk	30.31 *	52.83	29.44	-164.36	38.22 **	12.94 *
	(2.44)	(1.49)	(1.64)	(-0.73)	(7.81)	(2.12)
U.K. borrowers	36.27 **	60.90 **	-3.81	-165.67	-13.49 **	32.83 **
	(4.15)	(2.78)	(-0.20)	(-1.10)	(-2.81)	(4.92)
Risk free rate	-0.14 **	-0.71 **	-0.01	1.18	0.15 **	-0.19 **
	(-3.51)	(-4.36)	(-0.03)	(1.39)	(6.12)	(-3.24)
Volatility	1.91 *	-0.25	1.73		2.88 **	3.47 **
	(2.27)	(-0.48)	(1.83)		(11.19)	(12.25)
EUSA5y-Libor3M	-0.46 **	-0.87 **	-0.38 **		-0.12 **	-0.16 **
	(-5.59)	(-5.20)	(-2.62)		(-3.37)	(-2.61)
Commercial			14.47		0.22	-50.19 **
			(0.60)		(0.04)	(-5.66)
Industrial	0.48	48.82 *	18.97		5.06	-26.82 **
	(0.05)	(2.46)	(0.71)		(1.20)	(-3.34)
Utilities	4.42	38.26 **	-58.21 **		-25.48 **	-72.74 **
	(0.37)	(2.80)	(-1.55)		(-4.40)	(-9.50)
Transportation	1.16	38.71	98.98 **		17.37	-16.28
	(0.10)	(1.36)	(3.98)		(1.82)	(-1.29)
Government	-5.11	68.99			28.15 *	
	(-0.18)	(1.96)			(2.39)	
Other					53.50 **	41.12
					(5.99)	(1.20)
Rating			30.38 **	-1.93	25.77 **	37.94 **
			(10.05)	(-0.22)	(29.47)	(36.58)
Number of observations	702	327	334	30	5,594	3,092
Adjusted R^2	0.11	0.27	0.52	0.23	0.36	0.53
F	8.49	7.77	15.38	1.87	127.12	128.84

Table 11 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*) *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 12: Regression analyses of the term structure of credit spreads

Dependent variable: Credit spread (bps)	[1a] All PF Loans	[3a] All PF Loans with log maturity	[2b] AS Bonds with rating	[3b] AS Bonds with rating and log maturity	[2c] CB with rating	[3c] CB with rating and log maturity
Independent variables:						
Intercept	257.66 **	228.31 **	13.27	34.71	-197.53 **	-187.61 **
	(9.43)	(9.69)	(0.31)	(0.69)	(-17.64)	(-15.21)
Maturity	0.51	-1.72 **	-0.36	0.23	1.10 **	1.88 **
	(1.67)	(-2.60)	(-0.67)	(0.23)	(5.05)	(4.41)
Log Maturity		21.47 **		-13.55		-8.43
		(3.54)		(-0.83)		(-1.76)
Log transaction size	-19.52 **	-17.53 **	3.74	4.11	1.55	1.49
	(-4.93)	(-5.12)	(0.92)	(1.01)	(1.22)	(1.16)
Log loan to value	4.37 *	2.57	0.79	0.89	31.83 **	31.49 **
	(2.04)	(1.27)	(0.10)	(0.12)	(4.17)	(4.14)
Number of tranches	-1.02	-1.19	2.39	2.83	36.89 **	36.44 **
	(-0.56)	(-0.68)	(0.86)	(1.05)	(8.03)	(8.03)
Number of banks	1.42 **	1.22 **	-8.24 *	-8.21 *	-1.97 **	-1.89 **
	(3.87)	(3.32)	(-2.10)	(-2.10)	(-4.99)	(-4.80)
Country risk	7.78 **	8.32 **	-4.99	-5.23	-2.15	-2.27
	(2.91)	(3.35)	(-0.74)	(-0.77)	(-1.60)	(-1.67)
Currency risk	38.11 **	36.70 **	35.36	31.28	28.61 **	28.61 **
	(2.88)	(2.81)	(1.96)	(1.68)	(7.04)	(7.04)
U.K. borrowers	49.85 **	52.64 **	-10.10	-6.30	6.66	6.65
	(5.23)	(5.64)	(-0.53)	(-0.32)	(1.64)	(1.64)
Crisis	174.01 **	175.83 **	33.70	37.16	117.21 **	116.00 **
	(16.26)	(16.59)	(0.74)	(0.81)	(20.17)	(20.17)
Risk free rate	-0.16 **	-0.16 **	-0.03	-0.02	0.12 **	0.12 **
	(-4.46)	(-4.54)	(-0.31)	(-0.26)	(5.34)	(5.38)
Volatility	0.49	0.44	2.42 **	2.36 **	2.77 **	2.76 **
	(1.64)	(1.51)	(2.81)	(2.71)	(16.68)	(16.66)
EUSA5y-Libor3M	-0.46 **	-0.45 **	-0.52 **	-0.52 **	-0.09 **	-0.09 **
	(-7.41)	(-8.43)	(-4.35)	(-4.44)	(-2.79)	(-2.77)
Commercial			25.01	22.90	-16.75 **	-15.94 **
			(0.99)	(0.90)	(-3.57)	(-3.37)
Industrial	10.29	9.98	27.34	25.80	1.41	2.24
	(1.14)	(1.12)	(0.99)	(0.93)	(0.34)	(0.54)
Utilities	12.92	6.34	-55.51	-58.11	-38.00 **	-37.13 **
	(1.41)	(0.81)	(-1.52)	(-1.59)	(-8.16)	(-7.80)
Transportation	14.33	13.12	110.02 **	109.56 **	12.27	13.63
	(1.39)	(1.32)	(3.64)	(3.74)	(1.49)	(1.63)
Government	7.18	8.56			30.89 **	32.24 **
	(0.31)	(0.37)			(2.66)	(2.90)
Other					69.49 **	70.89 **
					(3.48)	(3.55)
Rating			27.44 **	27.56 **	29.27 **	29.39 **
			(8.65)	(8.74)	(43.35)	(43.69)
Number of observations	1,029	1,029	364	364	8,686	8,686
Adjusted R^2	0.51	0.63	0.46	0.46	0.44	0.44
F	90.00	87.18	11.45	11.06	247.81	238.60

Model [3a] 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.

The following variables were omitted because of collinearity: *commercial* and *other* dummy variables in estimating models [1a] and [3a]. *Government* and *other* dummy variables do not exist for AS transactions.

Table 13: Robustness checks: endogeneity of maturity

Dependent variable: Credit spread (bps)	[1a] All PF Loans (OLS)	[4a] All PF Loans (2SLS)	[2c] CB with rating (OLS)	[4c] CB with rating (2SLS)
Independent variables:				
Intercept	257.66 **	203.83 **	-197.53 **	-394.77 **
	(9.43)	(5.91)	(-17.64)	(-4.91)
Maturity	0.51	9.01 *	1.10 **	23.92 **
	(1.67)	(2.44)	(5.05)	(2.60)
Log transaction size	-19.52 **	-26.51 **	1.55	3.99 *
	(-4.93)	(-4.30)	(1.22)	(2.39)
Log loan to value	4.37 *	-12.35	31.83 **	51.90 **
	(2.04)	(-1.69)	(4.17)	(3.47)
Number of tranches	-1.02	-12.04 *	36.89 **	37.07 **
	(-0.56)	(-2.18)	(8.03)	(4.43)
Number of banks	1.42 **	2.21 **	-1.97 **	-3.04 **
	(3.87)	(3.46)	(-4.99)	(-3.81)
Country risk	7.78 **	6.60 *	-2.15	2.55
	(2.91)	(1.97)	(-1.60)	(1.05)
Currency risk	38.11 **	65.34 **	28.61 **	44.33 **
	(2.88)	(3.03)	(7.04)	(4.47)
U.K. borrowers	49.85 **	3.16	6.66	-56.91 *
	(5.23)	(0.14)	(1.64)	(-2.09)
Crisis	174.01 **	177.94 **	117.21 **	157.60 **
	(16.26)	(11.96)	(20.17)	(8.02)
Risk free rate	-0.16 **	-0.19 **	0.12 **	0.19 **
	(-4.46)	(-3.76)	(5.34)	(4.23)
Volatility	0.49	0.33	2.77 **	3.46 **
	(1.64)	(0.79)	(16.68)	(9.29)
EUSA5y-Libor3M	-0.46 **	-0.48 **	-0.09 **	-0.09 *
	(-7.41)	(-5.92)	(-2.79)	(-2.05)
Commercial			-16.75 **	-85.96 **
			(-3.57)	(-2.94)
Industrial	10.29	3.17	1.41	-30.34 *
	(1.14)	(0.25)	(0.34)	(-2.04)
Utilities	12.92	10.97	-38.00 **	-184.60 **
	(1.41)	(0.96)	(-8.16)	(-3.04)
Transportation	14.33	12.72	12.27	-84.33 *
	(1.39)	(0.86)	(1.49)	(-2.02)
Government	7.18	9.53	30.89 **	-71.29
	(0.31)	(0.40)	(2.66)	(-0.84)
Other			69.49 **	-4.09
			(3.48)	(-0.09)
Rating			29.27 **	30.55 **
			(43.35)	(30.36)
Number of observations	1,029	1,029	8,686	8,686
Fit/Test of Over Identification[a]	0.51	0.38	0.44	0.95
		(0.537)		(0.329)
F[b]	90.00	7.34	247.81	5.99
		(0.000)		(0.002)

Table 13 presents the results of 2SLS regressions on credit spreads for PF and CB transactions.

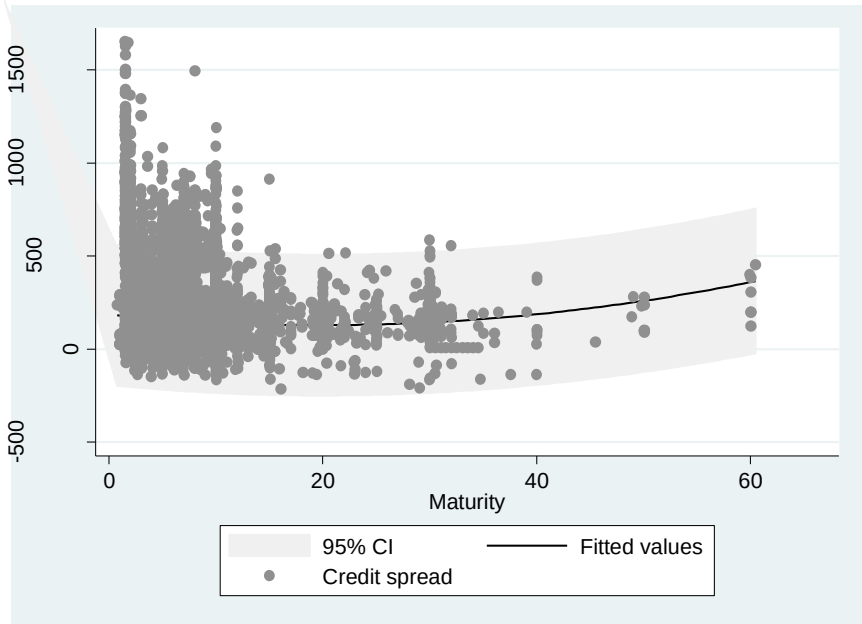
The *t*-statistics reported in parentheses are based on heteroskedasticity-consistent standard errors. **, * indicate that the reported coefficient is statistically significant at the 1% and 5% level, respectively.

The following variables were omitted because of collinearity: *commercial* and *other* dummy variables in estimating models [1a] and [4a].

[a] Adjusted R^2 for the OLS regressions, and a test of over identification for the instrumental-variables (IV) regressions [Sargan (1958)] with the *p*-value in parentheses.

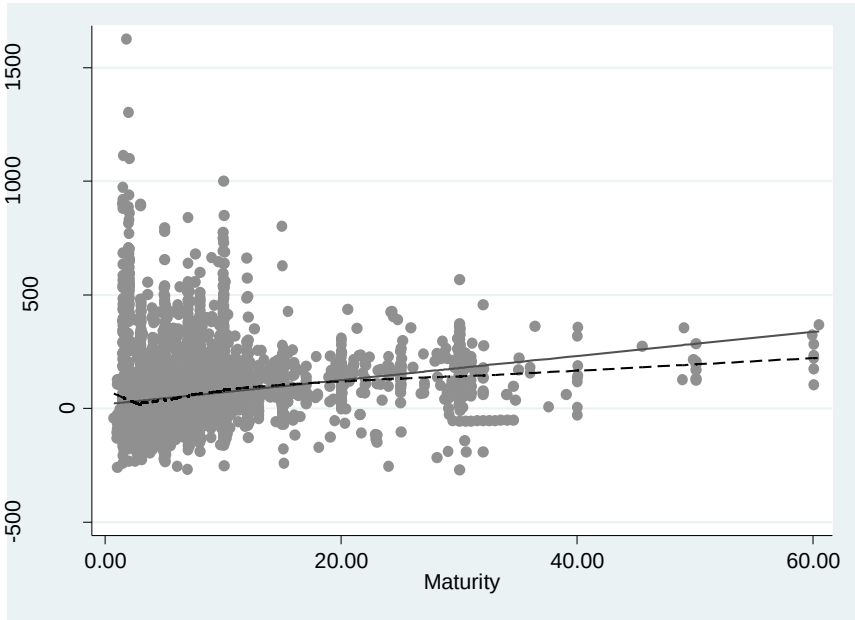
[b] *F* test for the OLS regressions, and a *F* statistic for the joint significance of the coefficients on the additional instruments (PF loans: tranche size and year; CB: number of bookrunners and year) with the *p*-value in parentheses.

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.

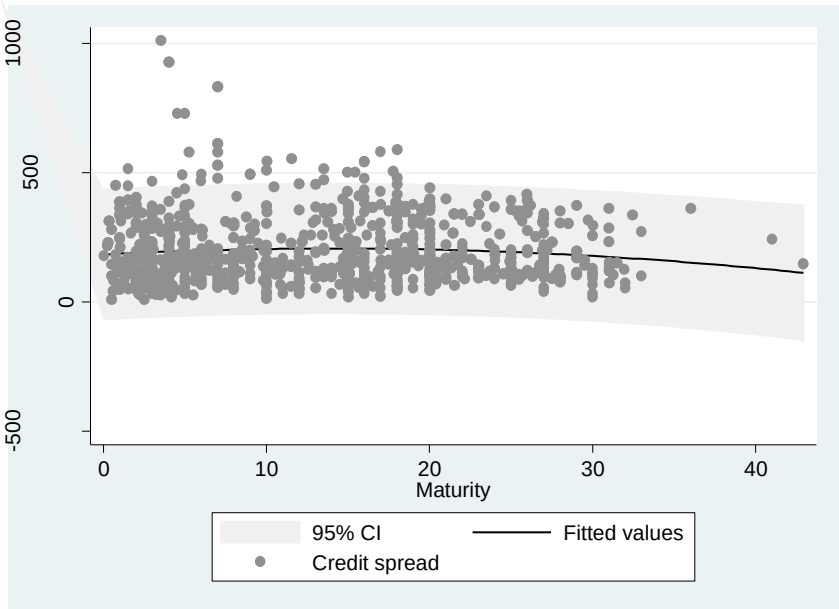
Graph 2: Term structure of credit spreads for CB



Graph 2 presents the augmented component-plus-residual plot based on regression [3c] and depicts the partial relationship between CB credit spread and maturity, once all other micro and macro factors have been controlled for.

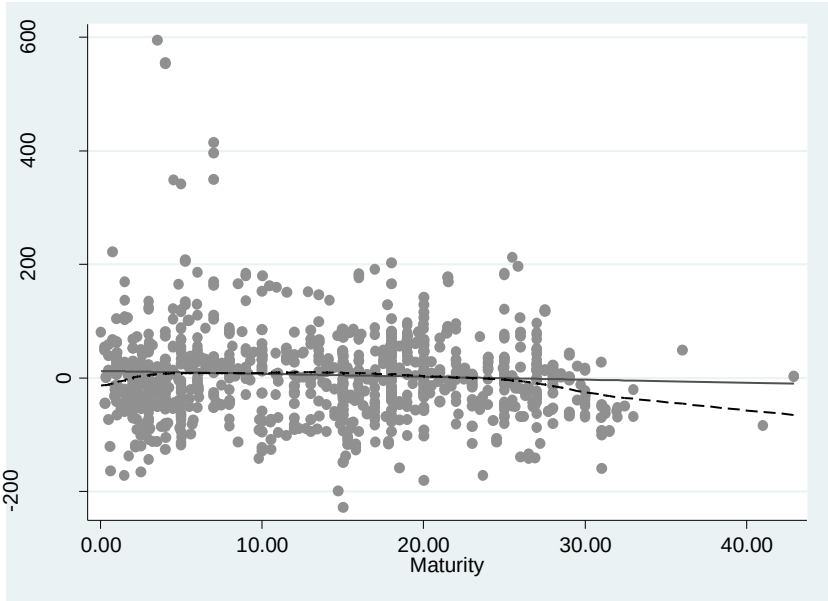
The straight line in Graph 2 corresponds to the regression model. The curved line reflects the fitting process based on non-parametric regression called local weighted scatterplot smoothing (lowess).

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.

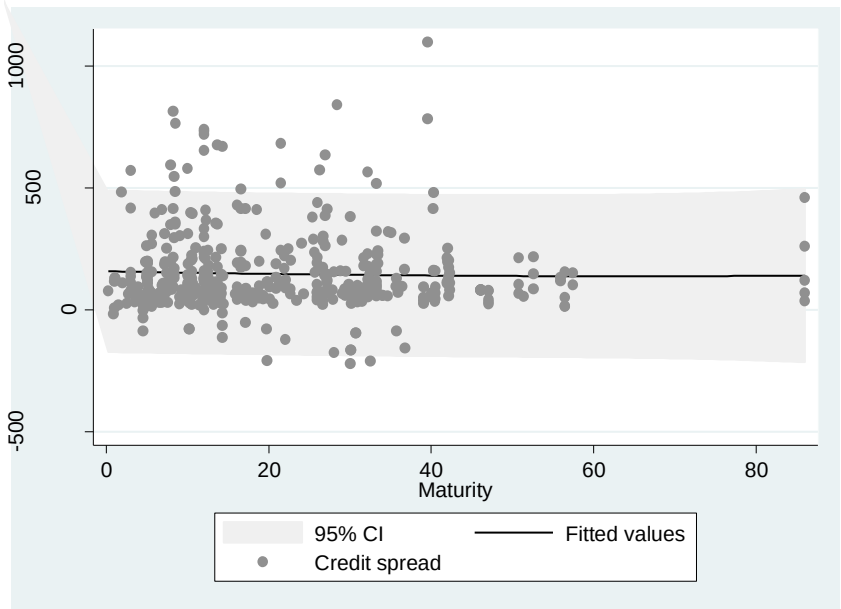
Graph 4: Term structure of credit spreads for PF loans



Graph 4 presents the augmented component-plus-residual plot based on regression [3a] and depicts the partial relationship between PF loans credit spread and maturity, once all other micro and macro factors have been controlled for.

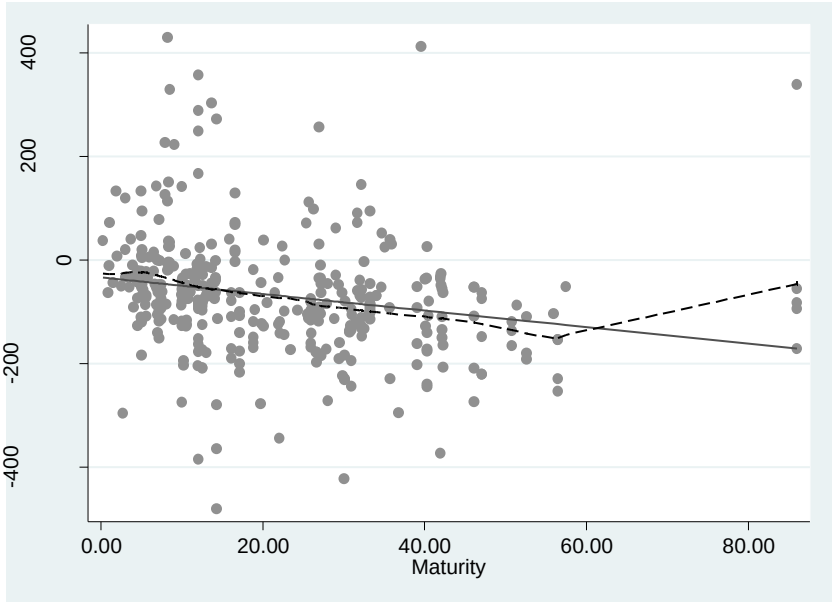
The straight line in Graph 4 corresponds to the regression model. The curved line reflects the fitting process based on non-parametric regression called local weighted scatterplot smoothing (lowess).

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 [3b] 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).