UNIVERSIDADE CATÓLICA PORTUGUESA

The Pricing of Project Finance Bonds:

An empirical analysis of spread determinants

Danielle Cruz Navi dos Santos

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Danielle Cruz Navi dos Santos

Under the supervision of

João Filipe Monteiro Pinto

Católica Porto Business School
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Resumo

Project Finance (PF) desempenha um papel importante como técnica alternativa de financiamento para projetos de capital intensivo. Esta dissertação visa contribuir para a literatura existente sobre PF, nomeadamente sobre o pricing de PF bonds, área qual é escassa. Segundo sabemos, existe apenas um estudo empírico sobre os determinantes dos spreads, efetuado para uma amostra de títulos emitidos em mercados emergentes.

Investigamos empiricamente as variáveis contratuais e de mercado que explicam os spreads de crédito das obrigações emitidas para financiar operações de PF, de forma transversal e ao longo do tempo, controlando por fatores macroeconómicos. Comparamos os spreads de crédito e os seus determinantes entre obrigações emitidas em PF e obrigações emitidas diretamente pelas empresas, as designadas corporate bonds. Finalmente, examinamos como a crise financeira de 2007-2008 e a subsequente crise da dívida soberana na Europa afetam os spreads de crédito de obrigações emitidas em PF. Usando uma amostra de 763 obrigações de PF e 46.433 corporate bonds comparáveis, emitidas globalmente entre 1993 e 2020, concluímos que as primeiras são emitidas com spreads de crédito significativamente mais altos, em média 34,3 bps. Embora a análise estatística sugere maiores spreads de crédito em tempos de crise, não encontramos evidências empíricas de uma relação significativa entre o período de crise e o aumento dos spreads de crédito, para ambos tipos de obrigações. Além disso, mostramos que, embora os ratings sejam os fatores de precificação mais importantes na determinação dos spreads, estes também dependem de características contratuais e macroeconómicas.

Palavras-chave: financiamento de projetos; project finance bonds; spreads de crédito; corporate bonds

Abstract

Project Finance (PF) plays a major role as an alternative financing technique to fund capital-intensive projects. This dissertation aims to add to the existing literature on PF bonds as there are very few published papers on this field. As to our knowledge, there is only one empirical study on PF bonds pricing for a sample of bonds of the emerging markets.

We empirically investigate the observable variables that explains PF bond (at issuance) credit spreads cross-sectionally and over time, controlling for macroeconomic factors, as well as contractual characteristics that arguably affect credit spreads. We compare the credit spreads and pricing of PF and corporate finance (CF) to analyze the main differences in terms of pricing determinants. Finally, we examine whether the 2007-2008 financial crisis and the subsequent European sovereign debt crisis significantly impacts PF bond credit spreads. By using a cross-section of 763 PF bonds and 46,433 comparable CF bonds globally issued between 1993 and 2020, we find the PF bonds are issued with significantly higher credit spreads than CF bonds, 34.3 bps on average. Although the statistical analysis suggests higher credit spreads in period of crisis, we did not find empirical evidence of a significant relationship between the period of crisis and the increase in credit spreads, for both types of bonds. In addition, we show that although credit ratings are the most important pricing factors for both PF and CF bonds at issuance, investors rely on other contractual and macroeconomic characteristics beyond these ratings.

Keywords: project finance; project finance bonds; credit spreads; corporate bonds

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Introduction

Natural resources and infrastructure investments are essential to the sustained economic growth of any nation. The need for distribution of electricity, oil fields, transportation, mining, telecommunications, water and information technology services is continuous, considering global economic growth, population growth, fast urbanization and globalization.

At the same time the global financial crisis has resulted in strict supervision on banks, making loans become highly regulated than ever before, resulting in limited access to conventional long-term bank loans to finance these projects. Consequently, it is important to develop alternative financing sources to complement existing ones. The project finance (PF) bond market arises as a new financing instrument to fund these capital-intensive projects, such as roads, power plants, airports in developing countries (Dailami and Hauswald, 2003).

The regulatory reforms of bank capital requirements (Basel III Capital Accord) and rigorous monitoring and disclosure also promote for the rise of new financing instruments as regulatory costs increased significantly, leading to higher costs to the project sponsors, who will have to consider such costs in the project's internal rate of return. In the bond market, firms can reduce the cost of PF deals enabling sponsors to minimize the cost of funding. PF is a type of structured finance[1] transactions, which points out the use of off-balance-sheet debt arrangements to reduce the costs related to financial distress and bankruptcy (Pinto and Alves, 2019).

For this reason, the use of bond capital markets to finance large-scale projects is also a way to expand the investor base for private debt funding of projects. In

[1] Structured finance typically concerns to off-balance-sheet contractual arrangements designed to finance a sole project or a specific group of assets, establishing bankruptcy-remote corporations or other SPEs to implement the transaction. Structured financing includes project finance, asset securitization, structured leases, and leveraged corporate acquisition activities. See Caselli and Gatti (2005), Fabozzi et al. (2006), Jobst (2007), Leland (2007), and Gorton and Metrick (2013).

addition, the creative legal structure of these securities such as the covenants and guarantees that support the transaction, have been valuable characteristics for investors as they mitigate risks and provide contractual protection to bondholders. Furthermore, PF bonds provide an opportunity for institutional investors to participate in infrastructure projects through securities that can offer higher returns (Dailami and Hauswald, 2003).

The PF market has grown from less than $10 billion per year in the late 1980s to almost $220 billion in 2001 (Esty, 2002a). The number of active participants in global PF markets has considerably increased, as a variety of worldwide lenders and sponsors are more familiarized and become active participants. In fact, the market is an economically relevant growing financial market segment, although largely unexplored (Pinto and Alves, 2019). According to the Global Project Finance Review data of Thomson Reuters, in 2018 the market reached $282.7 billion, representing an increase of 21.7% from the record volume achieved in 2017. The power sector remains as the most active sector in 2018, with an amount of $137.6 billion representing 48.7% of the market activity.

The PF bonds similar with the corporate financing (CF) bonds. However, due to the difference in underlying risks, there are financial, economic and analytical differences between the two segments that deserve further research attention. The projects to be implemented and their attributes demand a much more careful analysis of the venture, as well as of the deal´s economic and legal structures. Thus, PF bondholders are mostly experienced institutional investors, such as insurance companies and pension funds (Dailami and Hauswald, 2003).

Why should we study PF bonds? Firstly, PF is an increasingly important financing tool used practically worldwide. Secondly, despite there are several papers analyzing PF deals and the pricing of PF loans (Dailami and Leipziger (1998), Pollio (1998), Kleimeier and Megginson (2000), Esty (2000), Dailami and Hauswald (2003), Blanc-Brude and Strange (2007), Dailami and Hauswald (2007), Dalaimi

Sorge and Gadanecz (2008), Corielli et al. (2010) , Gatti et al. (2013), Pinto and Alves (2016), Pinto and Marques (2019)) there are very few papers on the PF bond field. As far as we know, there is only one empirical study on project bonds pricing for a sample of emerging markets bonds (Dailami and Hauswald (2003)). In this sense, this study is important because it presents a detailed analysis of the PF market, in terms of size, industrial and country distribution, contractual characteristics, and most active sponsors and leading banks. Additionally, presents an in-depth analysis of PF credit spreads and pricing processes and how they compare with a worldwide sample of CF bonds.

The literature that studies the determinants of CF bond credit spreads is large (e.g., Collin-Dufresne et al., 2001; Elton et al., 2001; Campbell and Taksler, 2003; Hull et al., 2004; Titman et al., 2004; Longstaff et al. 2005; Gabbi and Sironi, 2005; Chen et al., 2007; Bao et al., 2011; Flannery et al., 2012) and finds credit rating as the main explanatory variable. Hence, this work aims to find if the same argumentation is suitable for PF bonds.

The main objective of this work is to study the pricing of PF bonds and compare with that of comparable CF bonds, determining which factors determine bonds´ primary market pricing, identifying all the specific features that make those financial assets highly suitable for large capital-intensive projects and the features that differentiate them bonds from similar CF bonds. Therefore, we analyze a sample of 763 PF bonds and 46,433 similar CF bonds issued between 1993 and 2020. All the contractual information that we crossed with other data source comes from DCM Analytics.

We begin our analysis examining the characteristics of both PF and CF bonds and we find the PF bonds are issued with significantly higher credit spreads than CF bonds, 34.3 bps on average. Then, we analyze the determinants of issuance credit spreads and we show that although credit ratings are the most important pricing factors for both PF and CF bonds at issuance, investors rely on other contractual and

macroeconomic characteristics beyond these ratings. Furthermore, we investigate if credit spreads are significantly affected during the period of crisis. Contrary to what we expected, we find a insignificant relationship between the period of crisis and the increase in spreads for both bond types.

This work is organized as follows. Chapter 1 reviews literature on the determinants of the pricing of PF loans and CF bonds. The second chapter introduces the research questions. Then, in a more practical way, the third chapter introduces the econometric model used, describes the chosen data and variables. The fourth chapter presents preliminary analysis of the characteristics of the PF bonds and CF bonds with comparative tables. In the fifth chapter the empirical results are presented and discussed. A conclusion closes the study.

1. Literature Review

1.1 What is Project Finance?

Project finance (hereafter PF) is a financing mechanism used by a project investor (the sponsor) to create a separate legal project company and designate specific assets and cash flows to this new project company to be apart from his own company's balance sheet. The sponsor provides equity and the special purpose company (SPC or SPV) raises limited or non-recourse debt to carry out a specific business operation for a finite period. In other words, through a PF mechanism, capital for capital-intensive projects can be raised. The project lenders rely exclusively upon the future cash flows of the project for repayment, without recourse to the equity investors (Kleimeier and Megginson, 2000; Zhang, 2005; Hoffman, 2007). In fact, the structure is especially attractive to the private sector as companies can finance large projects off-balance sheet, reducing the project's impact on the cost of the shareholders' existing debt and debt capacity. Thus, PF allows the firm to segregate asset risk in a

special purpose company where it has limited ability to inflict collateral damage on the sponsoring firm.

The SPV´s obligations are apart from those of the equity investors and the debt is secured on project's cash flows. The financing will be a merger of equity (the sponsors) and debt agents, which is usually in the form of syndicated bank loans, not bonds, and is non-recourse to the sponsors (Esty, 2004b). In terms of equity ownership, the typical SPV has from one to three sponsors commonly privately held (Esty, 2003). The sponsors will carry project losses ahead of debt, given that the distribution to the equity investors are always subordinated to the debt repayments. Debt is secured by a contractual payment schedule and a debt payment reserve account that is used on a monthly basis, to accumulate funds to pay principal installment and interest of each period (Yescombe, 2007). Thus, lenders can offer PF loans with low credit margins as the risk is low. In fact, lenders have no advantages, as lenders' returns are fixed, while returns on equity can be improved by generating more value in the project (Yescombe, 2007).

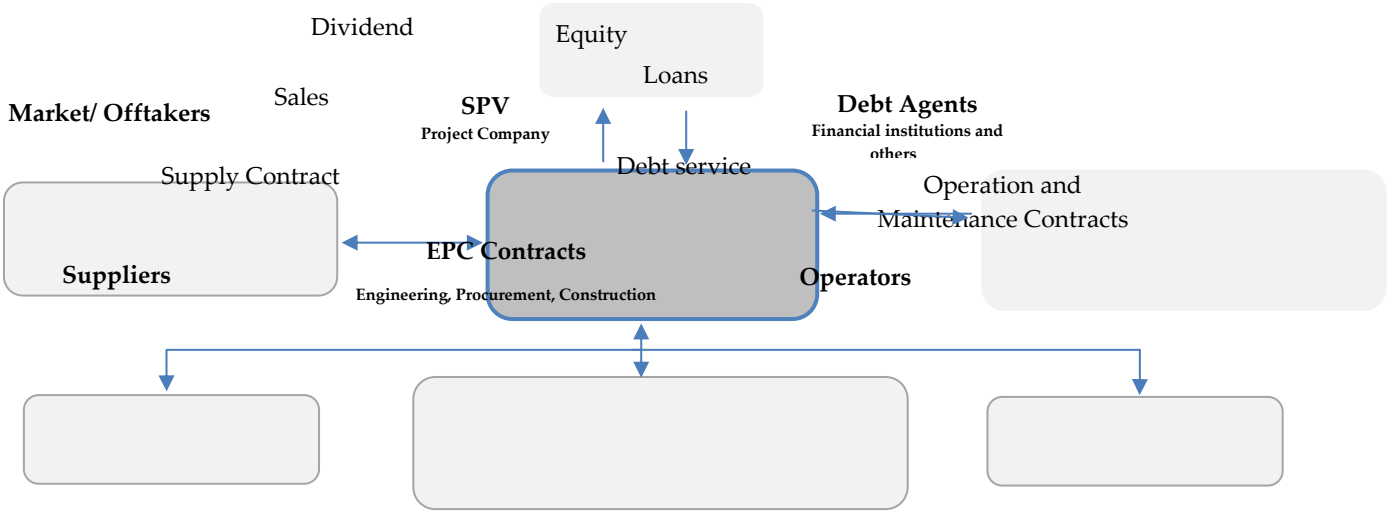
An important aspect of PF is the transference of the risks above mentioned from the project company to subcontractor or covered by an insurance contract. The project company includes many contracts and financial arrangements which determine all the operation management of the PF, including the purchase agreements in which the purchaser of the resource, is committed to consume upcoming goods whereas the counterparty, the project company is committed to sell all of the future production from the project. These arrangements intend to assign every major risk affecting the project to the party that is best able to evaluate and control that risk (Yescombe, 2007). They are negotiated prior to project development, which will become the means of production of resources sold under the contract

(Brealey, Cooper, and Habib, 1996). Besides, most lenders require the purchase agreements as a condition to the loan approval.

The Figure 1 shows a PF structure. From the figure it can be seen that a PF involves many parties (15 or more parties) organized in a complex scheme, from input supplier to output buyer through 40 or more contracts. Because of this, PF is also referred to as 'contract finance' (Esty, 2003, 2004b). The transaction is designed to limit information asymmetries, diminish risks between borrowers and lenders as well as mitigate agency conflicts (Pinto and Alves, 2019).

As shown in Figure 1, besides the sponsors and lenders or debt agents, there are contractors, suppliers, major customers, and a host government. Usually, the Project Company will need to obtain a concession from the host government to build a power plant or a rail, or to operate a telecommunication station. In addition, the government may also need to set a new regulatory framework, ensure currency convertibility, and provide environmental authorizations (Brealey, Cooper, and Habib, 1996).

Figure 1: Project Finance Loans Structure



Indeed, the project company have highly leveraged capital structures, concentrated equity ownership and concentrated debt ownership (primarily bank funding rather than bonds) (Yescombe, 2007). The concentrated debt ownership is an incentive to lending banks spend significant resources to evaluate the project and monitor its progress continuously. Based on such a contract scheme, PF simplifies the renegotiation of the debt whereas the project company faces any troubles in servicing it. On the other hand, the dispersed nature of bond ownership reduces the incentives of bond investors to evaluate and monitor the progress of the project, needing much effort to take concerted action in case of covenants are breached or need any change. In fact, when construction phase is completed and the project is operational, lenders have less incentives for monitoring and bond financing can be often used to replace existing bank debt (Brealey, Cooper, and Habib, 1996).

The Project Company cash flow reliability is at the heart of the PF technique, as project cash flows are the only basis for repaying the loan (Gatti, 2008). Thus, the lender's risk assessment has to be based on the financial impact that a specific risk may have on the project's viability and the likelihood of it actually happening. Banks also control any change on project arrangements as it may impact the risk balance of the project company. The PF risk allocation approach drives attention to the specific risks rather than relying on any guarantees that public authority or sponsors could offer. Therefore, project sponsors and lenders usually undertake a detailed due diligence and risk assessment process throughout the bidding and negotiation phases (Yescombe, 2007). In addition, the lender´s requirement of relevant equity investment is a prerequisite to access debt, as well as standard covenants related to minimum cover ratios (Yescombe, 2007).

1.2 The Financial Economics of Project Finance

It is pertinent to question the reason for firms choosing PF as it takes longer and costs more to structure an SPV than to finance the project on-balance sheet. Therefore, project financing must bring significant compensatory benefits to offset the incremental costs and time of the transaction (Esty,2003).

Past theoretical literature argue that PF features are designed in order to: i) reduce underinvestment by minimizing the presence of information asymmetry between borrowers and lenders, and adverse selection problems affecting borrowing decisions (Shah and Thakor, 1987; Kensinger and Martin, 1988). In this sense, Esty (2000, 2003) and Corielli et al. (2010) show that PF can help to reduce underinvestment problem as the segregation of a subset of assets from the sponsoring firm makes the initial credit decisions easier which would be more difficult when compared with corporate financing; ii) mitigate agency costs problems between ownership and control, and owners and related parties (Berkovitch and Kim, 1990; John and John, 1991; Flannery, 1986; Esty, 2003, 2004b; An and Cheung, 2010); iii) mitigate conflicts in terms of shareholders rights, equity ownership and governance by large shareholders (Esty and Megginson, 2003); iv) increase tax savings (Shah and Thakor, 1987; Kensinger and Martin, 1988; John and John, 1991; Chemmanur and John, 1996); v) preserve the sponsors financial flexibility (Nevitt and Fabozzi, 2001; Gatti, 2008); vi) avoid the opportunity cost of underinvestment in positive NPV projects due to overhang of debt problems and/or managerial risk aversion (Stulz, 1984) and vii) improve risk management (Brealey et al., 1996; Esty, 2003).

Researchers (Shah and Thakor (1987), Kensinger and Martin (1988), John and John (1991), Chemmanur and John (1996), Nevitt and Fabozzi (2001), and Esty (2003)) studied the advantages and disadvantages of PF in firm's capital structure perspective. Shah and Thakor (1987) argue that by using PF, the sponsors increase

the value of some of the projects as they can have higher optimal leverage than conventional financing and present cost reduction as the main benefit of PF. In this sense, John and John (1991) present the increase in the value of interest tax shields when compared with corporate debt financing. Similarly, Chemmanur and John (1996) point out that SPVs' leverage depends on the benefits of corporate control. According to Kensinger and Martin (1988) riskier projects should be project-financed to reduce signaling costs. Similar, Nevitt and Fabozzi (2001) argue that firms can maintain their financial flexibility when segregating a financing operation. By segregating the asset in a SPV structure, the sponsors are less exposed to the risk of contamination, the situation in which a failing asset drags the healthy sponsoring firm into distress. Lastly, the conjunction of high leverage and extensive contracting restricts managerial discretion (Esty, 2003).

From the sponsor perspective, there are a few economic consequences of using PF. Firstly, by segregating a specific asset or a pool of assets of the balance sheet of the sponsoring firm, PF can reduce the amount of assets subject to costs related to financial distress and bankruptcy, thus reducing the cost of debt (Corielli et al, 2010). Secondly, the sponsoring firm can invest in a large project without substantial impact on its own balance sheet or creditworthiness. Therefore, it does not impact sponsors' ability to access additional financing in the future (Pinto and Alves, 2019). Authors like Shah and Thakor (1987), John and John (1991), Nevitt and Fabozzi (2001), and Gatti (2008) claimed that when applying PF technique, sponsoring firms can shield their credit rating and preserve their key financial ratios.

Nevertheless, despite the advantages outlined above, a PF transaction can still increase the risk of existing on-balance-sheet creditors as the PF transaction is structured through segregation of a subset of firms' assets and transfer to bankruptcy-remote corporation (the SPV). Hence, the sponsor creditors have no

access to these new project's cash flows. Therefore, this effect may increase the risk perception of existing creditors if sponsors choose to use PF to fund the projects with the highest NPV (Pinto and Alves, 2019).

The transaction/issuance cost (the time-spending to setting up the contractual structure and implementing adequate due diligence) can make it unattractive for smaller deals. Esty (2004a) pointed out that a PF deal is expensive to structure, it takes time to set up, and it is highly restrictive formerly in place. In a similar way, Gatti (2008) argues that setting up a PF deal is more costly than CF. Nevertheless, Blackwell and Kidwell (1988) present evidence showing that larger debt issues benefit from economies of scale when compared to issuance costs. An and Cheung (2010) provide a theoretical model concluding that as larger the capital amount required to fund the project, more likely it is that firms will choose to use PF. Pinto and Alves (2019), moreover, found evidence that borrowers choose to use PF when issuing large amounts of debt. Notwithstanding the counter-intuitive features of PF, when compared to CF, according to Esty (2004b) and Bonetti et al. (2010), in practice, inferred additional costs are more than compensated by the advantages that comes from the reduction in the net financing costs, risk management and off-balance sheet financing; i.e., in practice, project financing attributes fit together very coherently and symbiotically and can reduce the net financing costs associated with large capital investments (Esty, 2004b; Gatti, 2008; Pinto and Alves, 2019).

Mills and Newberry (2005) empirically examined the extent to which firms use off-balance and found that U.S. firms with lower credit ratings and higher leverage are more probable to use structured leases, R&D limited partnerships and asset securitization. Lemmon et al. (2014) found that U.S. securitization users mostly in the middle of the credit quality distribution and they argued that firms use securitization to deleverage, also suggesting that securitization reduces firms'

financing costs. Hainz and Kleimeier (2012) studied a sample of non-U.S. borrowers and found evidence that political risk and creditor rights are positively correlated with the use of PF. The authors also found a negative relationship between the industry's leverage ratio and the use of PF. In a similar way, Subramanian and Tung (2016) found that PF is more likely in countries with weaker laws and weaker creditor rights.

More Recently, Pinto and Alves (2019), used a sample of syndicated deals located in OECD countries to examine the choice of PF deals. They found that the choice of companies supports only the hypothesis that PF technique can be used to overcome debt overhang problems for projects in the utilities' industry, used by firms that employ both project financing and corporate financing, thus called the "switchers". Besides, their findings support PF as mechanism used to reduce costs associated with asymmetric information problems, so that sponsors choose PF transactions when they want to mitigate informational costs associated with liquidity risk incited by debt refinancing. They found evidence that PF allows borrowers funding with longer maturities and that firms, which use PF, are less profitable and that transaction cost considerations lead switchers to resort to PF for issuing new debt. Furthermore, results show that public firms choose PF to raise higher amounts of debt to economize on scale and funding cost reduction (Pinto and Alves, 2019).

1.3 Project Finance Credit Spreads

According to Lewellen (1971), the cost of debt for PF is frequently more expensive than corporate debt. The spreads can be 50 to 400 bps (basis points) more because creditors cannot rely on the cross-collateralized cash flows and assets the way they can with corporate debt.

The academic literature includes several studies about the pricing of PF loans, namely Dailami and Leipziger (1998), Pollio (1998), Kleimeier and Megginson (2000), Esty (2000), Dailami and Hauswald (2003), Blanc-Brude and Strange (2007), Dailami and Hauswald (2007), Sorge and Gadanecz (2008), Corielli et al. (2010) , Gatti et al. (2013), Pinto and Alves (2016), Pinto and Marques (2019).

Dailami and Leipziger (1998) and Kleimeier and Megginson (2000) argue that maturity does not have a significant impact on project loan spread. Dailami and Leipziger (1998) work empirically on determinants of the spread within the foreign currency loans for large projects in developing countries. They developed a model considering macroeconomic variables and specific project´s variables. The authors conclude that the spread depends on the lender's perspective of the overall risk involved, bearing in mind the existence of guarantees and country risk factors. Besides, they conclude that lenders require higher spreads in countries with high inflation and particularly in the case of projects in the transportation industry.

Pollio (1998), based on a sample of 123 projects using PF scheme and 207 others using CF, finds that average loans spreads in PF deals is 101 bps, which is higher in 32 bps compared with average spreads of conventional loans. The author finds that the spread is positively related with country risk and negatively related with the existence of guarantees and currency risk. Additionally, the author explains the negative relationship between exchange rate risk and spread arguing that banks will usually require the borrower to cover for the risk as a condition of loan approval. So, by eliminating currency risk, the sponsors will benefit from a lower spread.

Kleimeier and Megginson (2000) find that PF loans have lower spreads than most comparable non-PF loans and find relevant differences between PF loans and

other syndicated type loans. They argue that PF loans have larger maturities and are most often have fixed interest rate and have lower spreads compared with other syndicated loans. This suggests that the contractual features and risk management presented in PF reduces the default risk, then the cost of funding. In fact, the evidence supports the argumentation that the structure of PF reduces significant agency problems and improve the control of projects with relatively transparency. Additionally, they find that average PF loans come from riskier countries (countries that have higher political and economic risks) to fund infrastructures development projects. Besides, the authors also studied the determinants of the loan spread. They find that PF loans are significantly related with country risk, existence of covenants and the level of project´s leverage.

Corielli et al. (2010) using a sample of 1093 PF loans closed between 1993 and 2003, show that the absence of a network of nonfinancial contracts (NFCs) organized by the SPV with the third parties, increases the spread by 19 bases points (bps) meanwhile it causes a drop of 0.8 points in the debt - to - equity ratio for the deals. Hence, the sponsors must deal with a trade-off between higher leverage and lower cost of external funding. Corielli et al. (2010) and Gatti et al. (2013), empirically show the certification of a prestigious lead arranging bank lowers the spread of PF loans comparing with loans arranged by less prestigious banks.

Pinto et al. (2016), analyzing a sample of 210,273 syndicated loans including 10,950 PF loans, closed between 2000 and 2014, and comparing financial characteristics of PF loans to those of non-PF loans, find that the most common pricing characteristics diverge significantly between the two studied classes. They test the effect of eleven contract characteristics and five macroeconomic variables on PF loan spreads and control for industry fixed effects. The variables deal size have a significant negative impact on the spread of PF loans. Regarding maturity, and

contrary to Kleimeier and Megginson (2000), who find insignificant the relationship with maturity, Pinto et al. (2016) finds negative impact of the maturity on spread of PF loans.

Kleimeier and Megginson (2000) and Sorge and Gadanecz (2008) argue that PF loans are fundamentally different from other debt instruments given the differences of underlying risks. Sorge and Gadanecz (2008), based on a sample of 31,521 loans (including PF and other syndicated loans) and CF bonds closed between 1993-2001 in emerging countries, find a hump-shaped relationship between spread and maturity for PF loans. This non-linear relationship is justified by the time spending between the construction phase and the beginning of cash flow´s generation.

Pinto et al. (2016) find evidence that loan size has significantly positive impact on spreads on Western European PF loan deals, suggesting that an increase of tranche size would increase the spread for the Western European borrowers, as a higher loan size to deal size ratio means higher risk to the lenders. Pinto et al. (2016) also find that, the number of banks involved in the deal has also significant negative impact for the Western European PF deals sample. A higher number of banks involved may lower the spread because of monitoring efforts. Besides, it means that a higher number of banks will share default risk. Additionally, the authors find evidence that spread and fixed rate are significantly positive related to PF loans deals of US borrowers. Differently than the finds of Blanc-Brude and Strange (2007), Pinto et al. (2016) find the risk-free rate has a significantly negative relationship with PF loan spreads in Western Europe, meaning that the higher the interest rates, the lower the spread. Hu and Cantor (2006), Sorge and Gadanecz (2008) and Pinto et al. (2016) find the spread and the yield curve slope are significantly negative related to PF loans extended to borrowers in both the U.S. and Western Europe. That is, a

steeper yield curve is associated with lower credit spreads. Finally, Pinto et al. (2016) find evidence that spread, and market volatility are significantly negative related to extended PF loans and there is an insignificant relationship between spread and credit rating for PF deals in the U.S. market.

Regarding industry, Kleimeier and Megginson (2000) find that most PF deals (by volume) are made to borrowers in the Commercial & Industrial, Utilities, and Transportation industries. Corielli et al. (2010), based on a sample of PF loans deals closed between January 1998 and May 2003, show that the largest share of loans was granted to electricity/power and other energy utilities (about 52% of the total value), followed by telecommunications (28%) and transportation (14%). This finding is consistent with the common understanding that PF is used primarily to fund tangible-asset-rich and capital-intensive projects.

1.4 Project Finance Bonds

PF bonds are public or private bond issues designed to fund a specific project without recourse (or with limited recourse) to the sponsors, where future cash flows that the project generates will be used to pay off coupons and for amortization of the principal value of the obligations. Therefore, as previously discussed, the project must have an independent legal entity, through the establishment of a special purpose vehicle (SPV) or special purpose company (SPC) responsible for issuing bonds, whose assets, contracts and cash flows are separate from those project's sponsors (EURONEXT, 2019).

Usually these bonds are used to finance major projects and infrastructures from their early stages. They are commonly known as Green Field projects, whose issuance process in the market is subject to certain procedures that lead to a series of

actions, including: (i) the setting-up of an SPV or partnership / project; (ii) the preparation of technical reports relating to the market, insurance and other relevant documents, which are subsequently requested by rating agencies; (iii) credit rating or bond rating development; and (iv) the writing of the marketing offer and presentation circular (Rossi, Stepic, and Alerassool, 2015). Indeed, the complexity of project finance use, in terms of designing and structuring the transaction and writing the required documentation, infers in higher transaction costs if compared to conventional financing, the negotiation of the financing and operating agreements is time-consuming, and are highly restrictive once in place (Pinto and Alves, 2019).

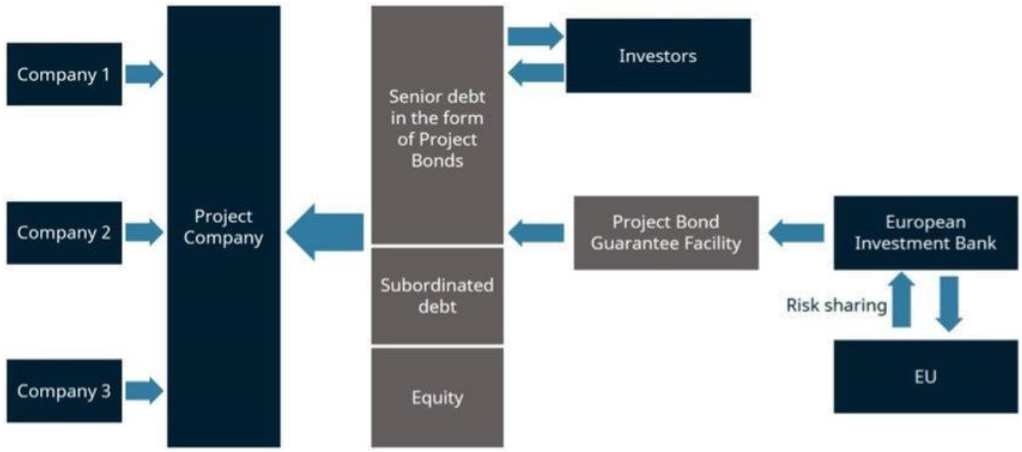
In comparison with the known CF bonds, "the dissimilarities primarily stem from the underlying economics of the borrower" (Dailami and Hauswald, 2003). In the CF bond market, the security is issued against the company's general creditworthiness considering all company´s underlying assets and all the cash flow that it generates. Whereas in the PF bond market there is a lack of risk diversification as the issuer raises funds to finance a specific project whose cash flows are the unique source to meet all the financial obligations and pay investors. Thus, if the project fails and the single source of cash flow come to an end, the issue experiences a liquidity crisis that can lead to bonds' default. For this reason, the investors in PF bonds are very cash flow quality oriented and demand much more careful analysis of the price factors that determine the underlying economics of the projects (Dailami and Hauswald, 2003).

Among the advantages of PF bonds over bank financing through PF is the fact that they allow for longer maturities (about 20 years). In certain situations, the breadth of PF bonds maturities allows the obligation to be amortized upon completion of the project. Usually they are fixed rate bonds, with fixed coupon payment and they allow a wide range of participants to invest in the project,

including institutional investors. In addition, they are flexible regarding the necessary procedures that allow for quick execution of operations and short-term fundraising. However, PF bonds also present some risks and drawbacks, such as high costs in the preparation and its issuance, by collecting the total amount of funding from the outset, accruing interest or accumulating coupons on the total amount of funds raised since then. Furthermore, there is a need to obtain at least one or two credit ratings, depending on the type of project and the volume of funds to be achieved. Moreover, the market liquidity risk allows investors to undo their position by selling the bond on the secondary market. Another disadvantage is the impossibility to amortize the principal volume of bonds prior to the date stipulated at the time of their issuance (Rossi et al., 2015).

Despite being a real alternative to traditional PF, PF bonds have not been extensively used in Europe in recent years, so the European Union (EU) and the European Investment Bank (EIB) have devised a financial instrument to facilitate debt collection by private promoters in infrastructure projects to be developed through design or through public-private collaboration. This operation consists of injecting funds into the project or its contingent commitment subordinated to senior debt, protecting it from credit risk and increasing its creditworthiness. Thus, it was intended to improve access to financing for SPV by providing them with PF bond issuance capacity (Rossi et al., 2015).

Figure 2: Structure of the Europe 2020 Project Bond Initiative



Source: Illustration adapted from IOSCO. Market-based long-term financing solutions for SMEs and infrastructure. Madrid: International Organization of Securities Commissions, 2014.

In a simplified diagram, presented in Figure 2, "the new instrument of the Project Bond Initiative (PBI) developed jointly by the EU and EIB was established with the aim of relaunching and revitalizing the PB market in Europe" (Rossi, Stepic, and Alerassool, 2015) instead of using traditional bank lending, the Project Company could raise the senior debt through PB issues. Bond investors would buy the securities if an investment grade credit rating was granted. In this initiative, the EIB signed a cooperation agreement with European Commission sharing the risk to finance infrastructure projects. The EIB would provide a loan or guarantee to the Project Company in order to raise the likelihood of timely repayment of principal and interest to bondholders during the lifetime of the bonds - therefore reducing the credit risk of these bonds. In addition, the facility guarantee could cover all the risks concerned to cash flow generation. Once used the facility would take the form of subordinated debt to be repaid by the Project Company over time after the reimbursement of senior debt, but prior to payments to equity and related financing (shareholder loans, other subordinated loans).

There is only one study related to ours. Dailami and Hauswald (2003), collected a sample of 105 emerging market PF bonds issued between January 1993 and March 2002, analyzed the pricing (at issuance spreads over US Treasuries) determinants of these bonds. They find that legal and regulatory obstacles have relevant and positive impact on spread, which underline the great importance of legal framework for access to external financing. Regarding the bond characteristics, Dailami and Hauswald (2003) find that maturity and credit rating are the most significant determinant on PF bond credit spreads. Also, they analyzed project type and find that water and transportation projects have larger spreads than other projects, which could be explained by asset-specificity, demand risk and any other specific risk involved. Their analysis suggests that the contractual features with covenant's protection, are not enough to overcome negative surprises of the host country's legal, political and financial framework. Therefore, investors take into consideration the quality of the institutional environment.

According to our data, the first PF bond issuance was originated by the Malaysian state-owned oil and gas company - Petronas in 1993, with the following characteristics: (i) transaction size of $500 million; (ii) fixed rate; (iii) 10 years maturity; and (iv) launching rating of A+, awarded by S&P review. An SPV of Petroliam Nasional Berhad, named Petronas Capital Limited, was established to promote exploration of offshore areas with water depths of 200 meters or more. Thus, Petronas introduced the "deepwater" production-sharing contract in 1993 and signed its first deep water contract with Mobil. In terms of volume, the largest issuance is originated by China's largest power supplier, state-owned State Grid Corp in 2010, with a deal volume of $4.39 billion. State Grid Corporation is responsible for the construction and operation of power grid infrastructure predominantly in Northern China. Also, the Mexico City Airport Trust (NAFIN) has issued $4 billion of green bonds to finance a new international airport in Mexico

City. They are backed by a securitization drawing from passenger charges at the existing International Airport Benito Juarez, and the planned replacement airport once it becomes operative. Table 1 presents key details of the 15 largest PF bonds arranged since 1993. These are listed by the total value of the deal.

Table 1: Financial details of the 15 largest project finance bond issues since 1993

Bond Launch Date	Issuer name Sponsor Name	Country	Industry	Transaction Size [$ Million]	Maturity [years]	Spread to benchmark [bps]	Currency	Issue type
fev-10	State Grid Corp of China	China	Utility & Energy	4.394,38	15,00	NA	Local	Fixed rate
dez-09	State Grid Corp of China	China	Utility & Energy	2.929,12	10,00	NA	Local	Fixed rate
set-09	State Grid Corp of China	China	Utility & Energy	2.928,13	10,00	NA	Local	Fixed rate
dez-11	State Grid Corp of China	China	Utility & Energy	2.364,18	15,00	NA	Local	Fixed rate
set-17	Mexico City Airport Trust	Mexico	Transportation	4.000,00	29,86	275,0	USD	Fixed rate
set-16	Mexico City Airport Trust Grupo Aeroportuario de la Ciudad de Mexico SA de CV	Mexico	Transportation	2.000,00	30,09	325,0	USD	Fixed rate
mar-11	National Iranian Oil Co - South F	Iran	Oil & Gas	3.862,38	4,03	NA	EUR	Fixed rate
out-17	Abu Dhabi Crude Oil Pipeline LI Abu Dhabi National Oil Co	United Arab Emirates	Oil & Gas	3.037,00	30,00	NA	USD	Fixed rate
dez-07	NGPL PipeCo LLC Myria Acquisition LLC	Australia	Utility & Energy	3.000,00	29,98	310,0	USD	Fixed rate
ago-10	China National Petroleum Corp -	China	Oil & Gas	2.948,11	15,00	NA	Local	Fixed rate
jul-09	Shenhua Group Corp Ltd China Energy Investment Corp Ltd	China	Mining	2.927,19	5,00	NA	Local	Fixed rate
out-16	Electricite de France SA - EDF EDF Renewables	France	Utility & Energy	2.803,16	20,00	171,9	Local	Fixed rate
abr-17	Cheniere Corpus Christi Holding Cheniere Energy Inc	United States	Utility & Energy	2.750,00	7,91	NA	Local	Fixed rate
ago-05	Ras Laffan Liquefied Natural Ga	Qatar	Oil & Gas	2.250,00	22,14	130,0	USD	Fixed rate
jul-09	Ras Laffan Liquefied Natural Ga Qatar Petroleum - QP	Qatar	Oil & Gas	2.230,00	10,19	325,0	USD	Fixed rate
set-18	Sasol Financing USA LLC Sasol Ltd	South Africa	Oil & Gas	2.250,00	10,00	345,0	USD	Fixed rate
nov-19	Apple Inc - Apple's Green Bond Apple	United States	nputers & Electro	2.215,21	12,00	81,0	EUR	Fixed rate
nov-15	Jimah East Power Sdn Bhd - Coa Tenaga Nasional Bhd	Malaysia	nstruction/Build	2.100,09	23,0	NA	Local	Fixed rate
nov-06	Sabine Pass LNG LP Cheniere Energy Inc	United States	Oil & Gas	2.032,00	10,00	294,0	USD	Fixed rate
out-07	Pemex Project Funding Master T Petroleos Mexicanos - PEMEX	Mexico	Oil & Gas	2.000,00	27,65	150,0	USD	Fixed rate

Table 1 provides information on the largest fifteen PF bond issued between June 1993 and January 2020.

1.3 Corporate Bonds

CF bonds are fixed-income financial instruments, issued over the long term by a company, government or public institutions, with a certain type of interest rate and an expected interest payment date and principal reimbursement date. Through a bond, the debtor or borrower agent undertakes to pay the lender or investor a coupon rate over a given period, usually quarterly, semi-annually or annually, and the nominal amount when due. The destination of the funds obtained is used to finance part of the fixed assets, restructure debt or working capital (Laroza, 2015).

In this sense, there are different types of bonds, such as CF bonds, structured bonds, subordinated bonds, and convertible bonds. In brief, it is stated that CF bonds are issued by companies to raise funds to finance their activities and investment projects. They are attractive to companies as they are not necessarily backed by specific guarantees. That is, their issuers can design them according to the characteristics that fit and flow with their own funding requirements and according to a demand study of such instruments (Duffee, 1998).

The credit spread of CF bonds is defined in various ways by different authors. However, the most common definition is "the margin yielded by the security at issue above a corresponding currency treasury benchmark with a comparable maturity (option adjusted spread)" (Pinto and Santos, 2019). Regarding the yield curve, much of the financial literature uses the treasury yield curve, since it consists of risk-free and highly liquid securities.

The major determinants of CF bond spreads are maturity, liquidity[2] (Bao, Pan, and Wang, 2011; Chen, Lesmond, and Wei, 2007; Longstaff et al., 2005) and credit risk (Collin-Dufresne, Goldstein, and Martin, 2001; Elton et al., 2001). However, in addition to these, other factors explain the spread differences, and these include redemption or conversion options and the sharp tax asymmetries between government bonds and CF bonds, as well as incomplete accounting information,

[2] Liquidity is defined as the ability to trade large amounts of assets in a short period, at low cost and without affecting their price (Pástor and Stambaugh, 2003), or also the ability to sell an asset quickly, as close as possible to its value in a market without friction (Ericcson and Renault, 2006). In this assumption, liquidity is related to the ease of transforming an asset into cash without changing its value. The lack of such, as well as uncertainty about the future liquidity levels of certain assets gives rise to sources of risk to investors, commonly referred to as liquidity risk, which implies that an asset cannot be bought or sold fast enough to avoid or minimize losses. Therefore, investors require some type of compensation to keep assets less liquid, the most logical being a higher expected return, i.e. less liquid assets are expected to have higher discount rates (lower prices) and therefore have larger spreads.

leverage (Flannery, Nikolova, and Öztekin, 2012), the tax burden (Elton et al., 2001) and market variables (Campbell and Taksler, 2003; Krishnan, Ritchken, and Thomson, 2005), such as the level of interest rates, the slope of the yield curve, and volatility also have a significant effect on CF bond credit spreads.

Moreover, the existence of additional options also determines the credit spread differences between different securities. The most common are call, put, and conversion options[3]. Option pricing can generally be done through non-arbitrage models. However, the most common practice in reduced spread calculation models is to control through a dummy variable, or to exclude these instruments from analysis.

Credit risk or default risk is another important determinant of credit spread. In fact, it refers to the risk that a debtor will not fulfill, at any stage of the process, the fully or partly payment of the debt that it has contracted and are required to make. In this sense, investors do not want to lend their money without receiving anything in return, so they require an additional risk-free rate premium to offset the uncertainty they assume when investing in companies most likely to default. This rate differential can be explained by at least two reasons. Firstly, because the expected market flow is particularly lower than promised, as it is estimated that there is a certain probability that the security will default and only a fraction of the nominal value could be recovered. And secondly, because there is a possibility that the expected flow could also be discounted at a higher rate due to market risk aversion and the systemic nature of the risk. Generally, securities issued by the

[3] The most common option bonds are Callable Bonds (prepaid or redeemable bonds), Puttable Bonds (securities that the bondholder has the right, but not the obligation to demand early repayment of these bonds to the issuer prior to maturity, for a certain price) and the Convertible Bonds (hybrid debt and equity instruments, debt which the holder may convert into ordinary shares of the issuing company or into cash of equal value at an agreed price).

central bank of each country are internally assumed to be a risk-free asset because, on the one hand, it is the institution that issues the legal currency, and then, because of the advantage that the purchase of instruments issued in the same currency entails. However, countries may also evidence credit risk, with the international benchmark for risk-free assets being, in most cases, bonds or bonds issued by the US Treasury.

In this sense, the risk assessment is carried out, among others, by means of certain particularities, including: (a) the Risk Classification, which consists of the assignment of a particular risk category to a homogeneous basis of debt securities present in the market. This is usually done by independent private agencies operating in global and international markets, the most important being Standard & Poor's Rating Agency, Moody's Investor Services and Fitch Rating, all based in New York. The most widely used scale in the world is Standard & Poor's, which assigns the AAA category to the lowest-risk relative instrument, followed by the investment grade AA, A and BBB, and from BB there are levels assigned which correspond to investments of a speculative nature. Additionally, in categories AA and below, the + and - signs are assigned to represent relative higher or lower risk levels within each category (Dick-Nielsen et al., 2012; Kamin and von Kleist, 1999); b) the Accounting Variables, which refer to the use of relevant information by the agencies to classify the risk, the best known and most used in the literature, are pretax interest coverage, operating income to sales, long-term debt to assets, and total debt to capitalization (Campbell and Taksler, 2003; Chen et al., 2007; Dick-Nielsen et al., 2012); c) the Credit Default Swaps, these are defined as credit derivatives against which one party acquires protection from the other in exchange for a premium or spread, paid periodically, until a default event occurs or the contract expires. On the other hand, if the company defaults, the selling protection party is required to repurchase the obligation at its even value. That is, a Credit Default Swaps is

identical to an insurance that compensates the buyer for losses he experiences in a possible payment default or default (Pinho and Valente, 2011); d) the structural-form models, correspond to a theoretical strategy to quantify the spread portion due to credit risk. For that, we use the relevant information about the process that follows the assets of the company and its capital structure (Merton, 1974), these models include Kim and Sundaresan (1993), Longstaff and Schwartz (1995), and others. ; e) the reduced-form models use market information to value credit risk instruments, that is, these models conclude that, for the associated economy to have no arbitrage, there should be a spread that accounts for the credit risk associated with the default probability of a issuance (Litterman and Iben, 1991; Jarrow and Turnbull, 1992; Jarrow and Turnbull, 1995; Madan and Unal, 1996; Lando, 1998; Duffie, 1998; Duffie and Singleton, 1999). Differently of structural-form models, reduced-form models do not condition default to value the firm and empirical evidence concerning reduced-form models is rather limited. Duffee (1999) argues that these models can not easily explain the observed term structure of credit spreads across firms of different qualities.

The large academic literature have studied the determinants of CF yields spreads, including Jones, Mason, and Rosenfeld (1984), Longstaff and Schwartz (1995), Duffie and Singleton (1999), Duffee (1998, 1999), Duffie and Lando (2001), Elton et al. (2001), Collin-Dufresne, Goldstein, and Martin (2001), Eom, Helwege, and Huang (2004), Huang and Huang (2003), Collin-Dufresne, Goldstein, and Helwege (2003), Liu, Longstaff, and Mandell (2004), Longstaff et al. (2005), Chen et al. (2007), Bao et al. (2011), Flannery et al., (2012), Pinto and Marques (2019), among others.

Elton et al. (2001) show that several characteristics of CF bonds beyond rating categories convey information about their pricing, including maturity, coupon, time from issuance, trading volumes and face value. Similarly, Gabbi and Sironi (2005)

empirically investigate the factors affecting Eurobond issuance spreads. The authors present an analysis based on cross-sectional regressions where the CF bond issuance spread is used as the dependent variable and maturity, coupon, and face value are all used as independent variables. They describe the spread as the difference between the yield to maturity at issue and the yield to maturity of similar Treasury security. Also, they explain the use of at-issuance credit spreads as primarily market spreads reflect true transaction prices instead of "brokers indicative" prices". Besides, the fresh ratings as the credit analysis is made close to the issuance date. Their results are consistent with Elton et al. (2001), therefore both findings argue the existence of several characteristics beyond rating, although rating is the most important factor in determining CF bond spreads. Gabbi and Sironi (2005) find CF bonds' expected tax treatment (represented by coupon) has a positive statistically significant coefficient, so the variable coupon is an important determinant of CF bond' spreads. CF bonds with higher coupons have relatively worse tax treatment, so investors will require a higher return. While the amount fee charged by the issue, number of managers in the bond issuance syndicate, issuance process (private placement x public issuance or fixed priced x open priced), bond´s clauses (represented by negative pledge, cross-default and force majeure) and expected liquidity (represented by issue amount) appear with poor explanatory effect. In addition, the authors present evidence indicating that subordinated bonds have higher spreads.

Duffie and Lando (2001) by using CF bonds credit spreads in secondary markets, suggest that credit spreads are characterized in terms of accounting information. They find a hump-shaped relationship between spread and maturity under perfect information and a downward-slopping term structure as imperfect information problems start gaining significance. The authors argue that after issuance, bond investors are not kept fully informed of the status of the firm.

Moreover, Longstaff et al. (2005) using the information in credit default swaps to obtain direct measures of the size of the default and non-default components in CF bond credit spreads, find that most of the spread is due to default risk. Their results contrast with the results presented by Jones et al. (1984), Elton et al. (2001), Huang and Huang (2003), and others who argue that default risk accounts for only a small percentage of the spread for investment-grade bonds. Nonetheless, Elton et al. (2001) find evidence that spreads include an important risk premium in addition to compensation for the expected default loss.

Empirically, Chen et al. (2007) present liquidity as a "key determinant in yield spreads" using a sample of over 4,000 CF bonds, the authors find liquidity as the main factor when it comes to yield spread differences, presenting an explanation power even higher than credit ratings. The authors find negative relationship between yield spreads and liquidity, meaning that more illiquid bonds have higher yield spreads. More recently, Pinto and Marques (2019) using a sample of cross-section of 24,525 European CF bonds issued by financial and nonfinancial firms between 2000 and 2016, find similar results that besides credit rating being the main factor affecting CF bond credit spreads at issuance, investors rely on other characteristics to price these assets. The authors find that most important pricing determinants are maturity, transaction size, number of banks involved, bank reputation, country risk, legal enforcement, and market volatility. Also, they document that CF bonds are differently priced.

Thus, when it comes to CF bonds, the most discussed variables affecting yield spreads by large literature are: (i) credit rating; (ii) liquidity; (iii) leverage ratios; iv) bond volatility; (v) interest rate; (vi) debt maturity; (vii) credit risk; (viii) information asymmetry; (ix) equity volatility; (x) coupon rate; (xi) subordinated; (xi) transaction

size; (xii) tranche to transaction; (xiii) maturity; (xiv) currency risk (xv) subordinated; (xvi); legal framework; (xvii) bank reputation; (xviii) number of banks; (xix) creditors rights; (xx) country risk; (xxi) volatility; (xxii) risk free rate and (xxiii) yield curve slop (Collin-Dufresne and Goldstein, 2001; Campbell and Taksler, 2003; Gabbi and Sironi, 2005; Chen et al., 2007; Daniels et al., 2010; Pinto et al., 2019).

2. Research Questions and Hypothesis

The extensive empirical literature on CF bond pricing find credit rating as the most significant factor affecting spreads at issuance. Authors also present maturity, transaction size, number of banks, bank reputation, country risk, tax premium, legal enforcement, and market volatility as determinants of credit spreads. As PF bonds have different characteristics than CF bonds, we intend to investigate if the determinants of CF bonds also affect PF bond credit spreads.

The PF bonds are issued as subordinated, varying seniority and maturity claims. These structures help to mitigate agency conflicts between the parts involved (Berkovitch and Kim, 1990; John and John, 1991; Flannery, 1986; Esty, 2003, 2004b; An and Cheung, 2010). Besides, additional features to improve credit rating of the securities can be used by the SPV (e.g., cash reserve accounts and guarantee by an insurance company) (Fabozzi et al., 2006). Contrary to the traditional secured bonds, where the credit spread depends mainly on the issuing firm's characteristics, the credit spread of PF bond depends, besides that, on the assets and cash flows promised as collateral, and on the credit improvement mechanisms used (Liu et al., 2018; Pinto and Marques, 2019). So, this leads us to the following questions and hypothesis:

1) Do PF bonds have higher credit spreads than CF bonds with identical credit ratings?

   Hypothesis 1 (H1): PF bonds are issued with higher credit spreads than similarly rated CF bonds.

2) Are PF and CF bonds priced differently by common pricing factors?

Hypothesis 2 (H2): PF and CF bond issues are priced differently by common pricing factors and, as for CF bonds, investors rely on other factors besides credit ratings when pricing PF bonds.

3) Are the credit spreads and pricing determinants of PF and CF bonds significantly affected during crises periods?

Hypothesis 3 (H3): The financial crisis and the subsequent European sovereign debt crisis affected significantly PF and CF bond credit spreads and pricing determinants.

3. Data, Methodology and Descriptive Statistics

3.1 Sample selection

The principal data source used in this study is the DCM Analytics. This database contains detailed information on bond securities issued on the debt capital markets. The sample consists of individual bond offers extracted from the DCM Analytics and covers from January 1993 to January 2020. We include only those with a deal-type code of "corporate bond investment-grade" and "corporate bond high-yield". We also require that the credit spread be available and are classified as either fixed rate bonds or variable rate bonds and bonds classified as "fixed rate convertible to floating rate note", "fixed rate adjustable", "fixed rate extendible", "floating rate note extendible", and "floating rate note convertible" are excluded from the database. As our main goal is to investigate PF bond spreads at issuance and pricing

processes, we delete from our full database those issues by financial institutions, with a deal general industry group "Finance" or "Insurance". DCM Analytics does not have a deal type "project finance bond", thus, in order to classify as PF bonds, we select those for which the use of proceeds is "project financing" and classify then as PF bonds. The remaining bonds were classified as CF bonds. To have a more comparable sample, we keep only CF bonds for which the deal general industry had at least one PF bond offer register. Finally, with the objective of taking possible outliers in consideration, we winsorize the data for transaction size, maturity, and spread at the 1% and the 99% levels.

After applying these screens, we can examine a total sample of 47,196 bonds (763 PF bonds and 46,433 similar CF bonds) worth $17,218.1 billion of which $282.7 billion were classified as PF bonds and $16,935.3 billion as CF bonds.

Panel A describes the industrial distribution of bonds, meanwhile Panel B details the bonds allocation to issuers in a country. Panel C provides information on the biggest players and their relative importance in PF and CF bonds markets. Data are for bonds with credit spread and bond total value in USD available, closed during the 1993-2020 period.

Panel A presents that PF bonds are mostly issued by SPCs belonging to Utilities, Oil and Gas, and Transportation industries, while CF bonds are mostly issued by firms belonging to Utilities, Services, and Machinery and Equipment industries. Panel B points out most of PF bond issuances are concentrated in North American and Latin American countries, while most of CF bond issuances area concentrated in North American and Western European countries. Panel C provides information in relation to identifying the biggest players and their relative importance in PF and CF bonds markets. The top ten PF bond issuers contributed to a weight of 16.3%,

whether CF bond issuers contributed to a weight of only 4.2% by volume, of all bonds in our sample. Although PF bond market is an increasingly growing market, it still small when comparing with CF bond market. Panel B presents the top ten banks participating in the issuances' syndicates. The top ten banks were involved in around 93%, by volume, of all PF bonds in our sample. Similar fraction when compared with 92% of CF bonds. Citi bank is the most active bank in both PF and CF bonds markets and six banks (Citi; Bank of America Merril Lynch; MUFG; JPMorgan; HSBC; Credit Agricole CIB) are in the top ten for both PF and CF bonds.

Table 2: Industrial, geographic distribution, top issuers and top banks

Panel A: Industry distribution

Industrial category of issuer	Project Bond			Corporate bonds		
	Number of bonds	Total value [$ Million]	Percent of total value	Number of bonds	Total value [$ Million]	Percent of total value
Commercial and Industrial						
Agriculture, Forestry and Fishing	2	525	0,19	885	244.570	1,44
Communications	33	11.239	3,97	3.836	2.053.958	12,13
Construction/Heavy Engineering	59	15.359	5,43	4.162	1.053.221	6,22
Manufacturing						
Chemicals, Plastic and Rubber	6	3.380	1,20	1.641	554.985	3,28
Food and Beverages	1	1.000	0,35	1.946	748.540	4,42
Machinery and Equipment	9	3.387	1,20	4.408	1.955.066	11,54
Steel, Aluminum and other Metals	1	175	0,06	1.314	403.651	2,38
Other	2	73	0,03	1.602	579.175	3,42
Mining and Natural Resources	17	3.238	1,15	847	391.875	2,31
Oil and Gas	118	68.447	24,21	3.386	1.618.532	9,56
Real Estate	39	12.845	4,54	4.124	1.066.607	6,30
Retail Trade	5	738	0,26	1.475	580.250	3,43
Services	28	5.877	2,08	4.591	1.851.508	10,93
Utilities	330	118.662	41,97	7.837	2.516.095	14,86
Transportation	94	33.504	11,85	3.629	1.078.324	6,37
Public Administration/Government	18	4.196	1,48	21	5.114	0,03
Other	1	100	0,04	729	233.859	1,38
Total	**763**	**282.746**	**100,00**	**46.433**	**16.935.330**	**100,00**

Panel B: Geographic distribution

Geographic location of originator/issuer	Project Bond			Corporate bonds		
	Number of bonds	Total value [$ Million]	Percent of total value	Number of bonds	Total value [$ Million]	Percent of total value
North America	391	152.450	53,92	22117	8.845.470	52,23

United States	244	108.729	38,45	19654	8.011.426	47,31
Canada	99	25.967	9,18	1877	630.372	3,72
Western Europe	76	42.052	14,87	5463	3.219.262	19,01
United Kingdom	51	14.330	5,07	2337	1.109.361	6,55
Eastern Europe	10	4.681	1,66	337	176.738	1,04
Nothern Europe	9	2.826	1,00	1733	348.118	2,06
Middle East	14	11.045	3,91	292	161.359	0,95
Qatar	7	5.630	1,99	21	15.223	0,09
South Africa	3	3.250	1,15	94	31.218	0,18
South East Asia	64	18.593	6,58	7602	1.676.339	9,90
China	31	6.527	2,31	6174	1.340.691	7,92
Malaysia	13	6.575	2,33	112	26.245	0,15
Australia	36	12.049	4,26	677	218.146	1,29
Latin America	99	17.552	6,21	1849	341.671	2,02
Brazil	61	6.998	2,47	1359	235.825	1,39
Chile	11	3.675	1,30	165	61.709	0,36
Other	10	3.917	1,39	3932	807.649	4,77
Total	**763**	**282.746**	**100**	**46.433**	**16.935.330**	**100**

Panel C: Top issuers

Project Bonds			**Corporate bonds**		
	By value of deals	**By number of deals**		**By value of deals**	**By number of deals**
Sabine Pass Liquefaction LLC	4,37%	1,18%	China Railway Corp	0,69%	0,16%
Pemex Project Funding Master Trust	2,23%	0,92%	BP Capital Markets plc	0,60%	0,25%
North West Redwater Partnership	1,76%	1,70%	BMW Finance NV	0,40%	0,15%
Pemex Finance Ltd	1,72%	2,10%	IBM	0,39%	0,16%
Calpine Corp	1,23%	1,05%	Telefonica Emisiones SAU	0,39%	0,12%
NGPL PipeCo LLC	1,06%	0,39%	John Deere Capital Corp	0,37%	0,29%
Iberdrola International BV	1,05%	0,39%	GE Capital European Fund	0,35%	0,09%
Electricite de France SA	0,99%	0,26%	AT&T Inc	0,35%	0,09%
Gatwick Funding Ltd	0,99%	0,79%	Electricite de France SA	0,34%	0,12%
Cheniere Corpus Christi Holdings	0,97%	0,26%	Petroleos Mexicanos	0,32%	0,17%

Panel D: Top banks involved in PF and CF bonds issues

Project Bonds			**Corporate bonds**		
	By value of deals	**By number of deals**		**By value of deals**	**By number of deals**
Citi	34,56%	34,86%	Citi	45,51%	38,72%
MUFG	17,83%	13,00%	Bank of America Merril Lynch	12,02%	12,15%
Bank of America Merril Lynch	10,40%	9,31%	MUFG	9,99%	9,58%
JPMorgan	9,51%	9,01%	JPMorgan	9,63%	9,75%
Credit Agricole CIB	6,23%	4,28%	HSBC	3,83%	3,27%
HSBC	4,56%	5,91%	Credit Agricole CIB	2,90%	1,92%
Barclays	2,89%	3,40%	BNP Paribas	2,73%	2,02%
Credit Suisse	2,86%	3,25%	Barclays	2,05%	2,19%

RBC Capital Markets	2,37%	4,28%	Munich Re Cap Markets	1,79%	4,56%
Deutsche Bank	1,93%	0,89%	Goldman Sachs	1,58%	2,08%

Panel A describes the industrial distribution of bonds, whereas Panel B details the bond allocation to issuers in a particular country. Panel C provides information on the biggest players and their relative importance in PF and CF bond markets. Panel D provides information on the leading bank participants and their relative importance in PF and CF bond markets. Data are for bonds with credit spread and tranche amount available, closed during the 1993-2020 period.

3.2 Methodology and Description of Variables

In order to determine which factors drive PF bonds credit spreads, we use the model described in equation (1). Firstly, we test for endogeneity problems - the possibility of spread and maturity being jointly – by using the Durbin-Wu-Hausman chi-squared test. We find that maturity is exogenous to credit spread (p-value of 0.0121, indicating that OLS is consistent). Thus, we employ an OLS regression technique with *credit spread* as dependent variable, expressed in basis points, and adjust for heteroskedasticity. Considering the time varying risk premia and cross-country differences, we estimate standard errors clustered by year and country.

$$Credit\ spread_{i,t} = \alpha_0 + \beta_1 Rated_{i,t} + \sum_{n=2}^{21} \beta_n\ Rating\ dummy_{n,i,t} + \beta_{22}\ rating\ discordance_{i,t} + \gamma\ Contractual\ characteristics_{i,t} + \varphi\ Macroeconomic\ factors_t + \varepsilon_{i,t} \quad (1)$$

For an easier interpretation of the independent variables, we present Appendix D with a detailed definition and source for all the variables used and the expected impact of explanatory variables on credit spread.

3.2.1 Credit Spread

The credit spread corresponds to the margin yielded, due to the difference of risks associated with the bond at issuance date, above a corresponding currency treasury

benchmark with similar maturity (OAS - option adjusted spread[4]). It is necessary to consider in credit spread computation, the fact that the fixed rate bond carries interest rate risk and the floater does not (Pinto and Marques, 2019). Additionally, there can be both fixed-rate and floating-rate bonds in the same deal. Hence, we include a *fixed rate* dummy variable to control for this effect.

3.2.2 Credit Rating

Most literature on CF bond finds credit rating the most important factor when explaining credit spread. In fact, Cuchra (2005) argues that credit rating is actually even more important to structured finance which includes PF. Hence, we expect this variable to be as far as important to PF bonds, but we also expect other factors beyond credit rating to be important. All bonds in our study have at least one credit rating assigned by S&P or Moody's, which is translated as follows: AAA=Aaa=1, AA+=Aa1=2, and so on until D=21 (Gabbi and Sironi, 2005; Cornaggia et al., 2017, Pinto et al., 2019). We expect a positive relationship between our variable credit rating and credit spread, so that an increase in credit rating, also increases credit spread. This would mean that investors will require higher credit spread for lower credit ratings. As some PF bonds are not rated, we include the dummy variable *rated*, equal to 1 if the bond has a credit rating from S&P and/or Moody's, and 0 otherwise. Moreover, in order to consider for discordances of the rating assigned by S&P and Moody's, we replicate Gabbi and Sironi's (2005) work and include a dummy variable *rating discordance*, equal to 1 if the two ratings have a different numeric value, and zero otherwise. We expect, in the presence of rating discordance, credit spread to be higher, as this would suggest uncertainty regarding the transaction's default risk.

[4] We use the Option Adjusted Spread as it is the most common measure used by financial intermediaries to correct the normal credit spread for embedded options (e.g., the prepayment option), usually included in structured finance bonds (Cuchra, 2005; Fabozzi and Vink, 2012).

3.2.3 Contractual Characteristics

Prior empirical studies find that there are contractual factors beyond rating categories that explain CF bonds spreads: maturity, deal size, number of banks in the issuing syndicate, and gross fees, among others (Elton et al., 2001; Campbell and Taksler, 2003; Gabbi and Sironi, 2005; Chen et al., 2007). Similarly, structured finance literature indicates factors, like subordination level, currency risk, collateral-type and the type of interest rate that have impact on credit spreads, when controlling for credit ratings (Vink and Thibeault, 2008; Fabozzi and Vink, 2012).

Extant literature agrees that bonds with longer maturities tend to be riskier than bonds with shorter maturities, so investors usually demand higher premiums for longer-term securities. While several authors (Jones et al., 1984; Sarig and Warga, 1989; Gabi and Sironi, 2005) argue that, on average, the term structure of spreads for investment grade bonds appears upward-sloping, some has been more controversial when discussing non-investment grade bonds term structure of spreads (Fons, 1987; Sarig and Warga, 1989; Helwege and Turner, 1999). Structured finance literature, which includes PF literature, shows the impact of maturity on spreads to be non-linear (Vink and Thibeault, 2008). Sorge and Gadanecz (2008) argue that PF loans have a 'hump-shaped' or non-linear term structure. According to Pinto (2017) this occurs because PF loans usually have short-term liquidity constraints, lenders offer loans with longer maturities in order to reduce probability of default of the projects. Besides, projects go through predictable risk phases that are gradually solved with spreads first increasing and, then, reducing through time. So, in contrast with Kleimeier and Megginson (2000), who argue spread and maturity have an insignificant relationship, Pinto and Alves (2016) find a significantly negative relationship for a PF loans sample closed in both the U.S. and W.E. Hence, to investigate the term structure of PB spreads, we include *maturity* as explanatory

variable. Additionally, to control for maturity, we include the logarithm of maturity – *Log maturity* in our baseline multiple regression, as a proxy for any non-linear relationships between credit spread and maturity. As PF deals are naturally long-term structured deals, we expect a negative relationship between maturity and credit spread of PF bond.

The issue amount of a bond is positively related with lower uncertainty and higher liquidity than smaller issuances (Gabbi and Sironi, 2005; Chen et al., 2007; Sorge and Gadanecz, 2008). Coherently, Pinto and Alves (2016) find the impact of *transaction size* on spread to be negative and significant for PF loans. For this reason, we expect larger issues to exhibit lower spreads for both, PF and CF bonds.

The syndicate deal is structured to benefit each position from the credit protection of all subordinate positions, varying seniority and maturity claims. In order to control for differences in existing risks among different bonds, we included a *subordinated* dummy variable, which is equal to 1 for bonds that are subordinated. We expect subordinated bonds to have higher spreads than senior bonds. Sufi's (2007) argue that smaller bank syndicates indicate higher borrower's opacity. In this sense, as in Pinto et al. (2019), we consider in our analysis the bank involvement, by including a variable *number of banks* which are part of the transaction, for this we expect a negative relationship for both PF and CF bond credit spreads. Additionally, to consider for additional differences in bank syndicates, we also control for *bank reputation*, which is computed according to the yearly Refinitiv Project Finance International (PFI) annual league tables. The participation of banks with a higher reputation tend to mitigate information asymmetries, hence, we expect a negative relationship between bank reputation and credit spreads (Kara et al., 2016).

In addition, we expect, for both PF and CF bonds, bonds subject to currency risk to have higher spreads than bonds issued in the currency of the borrower's home country, hence not subject to currency risk (Kleimeier and Megginson, 2000; Vink and Thibeault, 2008; Vink and Fabozzi, 2012). We also include a *currency risk* dummy variable to examine this factor.

Nevitt and Fabozzi (2001) describe PF as the process of financing "a particular economic unit in which a lender is satisfied to look initially to the cash flows and earnings of that economic unit as the source of funds from which a loan will be repaid and to the assets of the economic unit as collateral for the loan." Kleimeier and Megginson (2000) document that the use of collateral is positively related to PF loan spreads, which may result from the fact that PF loans are already concentrated upon funding "tangible-asset-rich projects" and for that, the projects that are chosen as "collateralizable" are usually relatively riskier than average. Thus, we expect a positive relationship between the *collateralized* dummy variable and PF bond credit spreads, which is equal 1 if the bond has a collateral and 0 otherwise.

3.2.4 Macroeconomic Factors

The banks' lending capacity will ever be affected by differences in the level of economic development. In this sense, La Porta et al. (1998) argue that laws and their enforcement is a continuous function of GDP per capita. Additionally, creditor rights are stronger in poorer countries and richer countries have a higher quality of law enforcement. In order to examine this, we collected the S&P's country rating to control for *country risk*. Besides, we computed the logarithm of annual values of *GDP per capita – Log GDP per capita,* for countries in our sample, data from the World Development Indicators database (obtained from the World Bank website) (Baye and Goyal 2009). Besides, Bae and Goyal (2009) present results showing that banks

respond to poor enforceability of contracts by reducing loan amounts, shortening loan maturities and increasing loan spreads.

Boubakri and Ghouma (2010) presented evidence that investors require higher spreads for CF bond issuances from countries with poor creditor rights protection. We measure *creditor rights* using La Porta, Lopez-de-Silanes, Shleifer and Vishny's (1998). La Porta et al. (1998) show that, by affecting external financing and governance, the level of investor protection influences the firm market value in international equity markets. We also included a variable for *enforcement* level, which is an index for enforcing contracts, also obtained from World Bank Indicators. The variable is the average of the scores of some component indicators: the time and cost for resolving a commercial dispute through a local first-instance court, the quality of judicial processes that promotes quality and efficiency in the court system. Higher values indicate better enforcement. These proxies' control for unobserved country characteristics. We thus expect an inverse relationship of the spread with creditor rights and enforcement variables. In this sense, an increase in these variables should have significantly negative impact on PF and CF bond credit spreads.

We also control for macroeconomic factors such the level of interest rates, *risk free rate*, which is the 3-month US Treasury bill rate and the term structure of interest rates, *UST5y- UST3M*, which is estimated as the difference between the 5-year US Treasury bond yield and the 3-month US Treasury bill rate. Additionally, we computed the market *volatility*, measured by the Chicago Board Options Exchange Volatility Index. We expect, for both PF and CF bonds, that increases in the slope of the yield curve should have a negative impact on credit spreads, while a contrary effect is expected for market volatility (Campbell and Taksler, 2003; Titman et al., 2004; Cuchra, 2005; Krishnan et al., 2005; Cremers et al., 2008; An et al., 2011; Pinto and Marques, 2019).

As we want to analyze the impact of the 2007/2008 financial crisis and the subsequent European sovereign debt crisis on spreads and pricing processes, we include dummy variables for *financial crisis* and *sovereign crisis*. Finally, as in Riachi and Schwienbacher (2015) and Pinto et al. (2019), we also use industry and year dummy variables to control for possible industry-specific and unobserved macroeconomic trends.

4. Univariate Analysis

In order to perform a statistical analysis, we start by comparing PF and CF bonds pricing characteristics (see Appendix B for a further analysis of variables' characteristics). In addition, we present in Table 3 Wilcoxon z-tests and Fisher's exact tests comparing the values of each variable in the PF and CF bonds samples. Almost all of the pair-wise comparisons indicate statistically significant differences between the common pricing variables associated with PF vis-à-vis CF bonds.

Concerning the pricing differences between PF and CF bonds, Table 3 shows that average credit spreads are economically and statistically higher for PF bonds (241 bps) than CF bonds (206.8), in fact 34.3 bps higher. When comparing the same spread evolution through pre-crisis period from January, 1993 through to September 14, 2008, and a crisis period from September 15, 2008 (the first trading day after Lehman Brothers' bankruptcy filing the day before) through to December 31, 2016 (the subsequent European sovereign debt crisis peaked between 2010 and 2012, nonetheless, in order to study longer effects we consider the period from April 24, 2010 until December 31, 2016). We find evidence that strongly supports the assumption that the average credit spread is significantly higher for PF bonds (281.4

bps versus 232.2 bps) and CF bonds (241.4 bps versus 162.4 bps) during the financial crisis and the subsequent European sovereign debt crisis. In fact, we can note the crisis impact on credit spread is even higher for CF bonds than PF bonds, as the average spread of CF bond is 49% higher during crisis, while PF bond has an increase of only 21% in average spreads. This could result from the fact that PF bonds already have higher spreads off-crisis, given other factors that its already being considered in the pricing process (see Appendix C)[5]. In addition, also from Appendix C, we can note that the average credit rating of PF bonds decreases 0.5 during crisis time, whether CF bonds average credit rating decreases 2.7, suggesting that CF bonds becomes more riskier during crisis time, comparing with PF bonds in the same period. Additionally, the average transaction size, which can be seen as a liquidity proxy, increases for CF bonds, also indicating that creditors will require higher liquidity to lend through CF bonds. Curiously, the number of banks for PF bonds increases during crisis time, which could be related to the need of sharing the risk through larger bank syndicates. In addition, as expected, both PF and CF bonds avoid currency risk during crisis time and they both slightly increase the number of collateralized bonds, which could suggest that in crisis period, issuers choose to use a collateral.

[5] Almost all the pair-wise comparisons presented in Table 3 indicate that equality of means for continuous and dummy variables can be rejected for PF and CF bonds - except tranche size and callable. In addition, Panel A of Appendix C indicate that equality of means for continuous variables can be rejected for Pre-crisis and Crisis bonds– except maturity, transaction size and country risk for PF bonds and the number of banks for CF bonds. Similar findings are presented in Panel B for dummy variables, except subordinated and callable for PF bonds.

Table 3: Univariate analysis

Variable of interest	Project Bonds	Corporate bonds	Wilcoxon z-test		Variable of interest	Project Bonds	Corporate bonds	Wilcoxon z-test	
Univariate analysis - continuous variables									
Credit spread (bps)					**Transaction size ($ Million)**				
Number	763	46.433			Number	763	46.433		
Mean	241,0	206,8	-8,53	***	Mean	611,0	593,0	-6,37	***
Median	195,0	145,7			Median	450,0	321,0		
Rating [1-22 weak]					**Tranche size ($ Million)**				
Number	592	45.603			Number	763	46.433		
Mean	8,5	6,7	-9,64	***	Mean	371,0	365,0	-1,36	
Median	9	7			Median	282,0	250,0		
Maturity (years)					**Number of banks**				
Number	763	46.433			Number	763	46.433		
Mean	13,7	9,6	-15,09	***	Mean	5,0	5,9	5,01	***
Median	10,0	7,1			Median	4	4		
Number of tranches					**Country risk [1-22 weak]**				
Number	763	46.433			Number	763	46.433		
Mean	2,0	1,6	-8,49	***	Mean	4,0	2,7	-6,04	***
Median	1	1			Median	1	1		
Creditor rigths [0-4 strong]					**Legal Enforcement [32 - 85 strong]**				
Number	763	46.433			Number	763	46.433		
Mean	1,5	1,6	4,06	***	Mean	66,6	70,2	12,55	***
Median	1	1			Median	69	72		

Variable of interest	Project Bonds	Corporate bonds	Fisher's exact test		Variable of interest	Project Bonds	Corporate bonds	Fisher's exact test	
Univariate analysis - dummy variables									
Fixed rate					**Currency risk**				
Nr. of tranches	763	46.433			Nr. of tranches	763	46.433		
Nr. of tranches with d=1	626	40.938	0,000	#	Nr. of tranches with d=1	244	9.806	0,000	
% of total	82,0%	88,2%			% of total	32,0%	21,1%		
Callable					**Civil vs common law**				
Nr. of tranches	763	46.433			Nr. of tranches	763	46.433		
Nr. of tranches with d=1	395	22.639	0,100		Nr. of tranches with d=1	300	20.472	0,009	
% of total	51,8%	48,8%			% of total	39,3%	44,1%		
Rated					**Subordinated**				
Nr. of tranches	763	46.433			Nr. of tranches	763	46.433		
Nr. of tranches with d=1	592	34.074	0,009	#	Nr. of tranches with d=1	8	1.633	0,000	
% of total	77,6%	73,4%			% of total	1,0%	3,5%		
Collateralized					**Rating Discordance**				
Nr. of tranches	763	46.433			Nr. of tranches	763	46.433		
Nr. of tranches with d=1	284	3.671	0,000	#	Nr. of tranches with d=1	166	13.435	0,016	
% of total	37,2%	7,9%			% of total	21,8%	28,9%		

This table reports summary statistics for a sample of PF and CF bonds issued during the 1993-2020 period. Information on the characteristics of bond issuances was obtained from DCM Analytics and Datastream. We test for similar distributions in contractual characteristics using the Wilcoxon rank-sum test for continuous variables and the Fisher's exact test for discrete ones. indicates significant difference at the 1% level between PF and CF bonds. (***) indicates significant difference at the 1% level between PF and CF bonds. (#) indicates significant difference at the 1% level between PF and CF bonds. Bond rating is based on the S&P and Moody's rating at the time of bond issuance. The rating is converted as follows: AAA=Aaa=1, AA+=Aa1=2, and so on until D=22. For a definition of the variables, see Appendix D.

PF generally have longer average maturity, so, as expected PF bonds have an average maturity of 13.7 years, which is a long period if we compare with the average of 9.6 years of CF bonds. Average credit ratings for PF bonds (8.5 | BBB+) issues are significantly inferior than for CF bonds (6.7 | A-). This may suggest that PF bonds are riskier than CF bonds. However, this also could reflect the country rating, since PF deals are more likely in development countries, hence, in riskier-than-average countries. In line with this, the average country risk for PF bonds (4.0) borrowers is significantly higher than the corresponding value for CF bonds (2.7).

Table 4 presents the distribution of PF and CF bonds by credit rating scale for investment-grade bonds. The investment- grade bonds account for 61% of PF bonds issued between 1993 and 2020, while account for 52% of CF bonds issued during the same period. The top rating of AAA is seen for 5.6% and 1.2% of the total bonds for both PF and CF bonds, respectively. We find interesting distributions when we divide the sample into bonds issued during pre-crisis period and crisis period. For the pre-crisis sub-sample, PF bonds awarded with investment-grade, represents 71%, while CF bonds investment-grade represents 64%. For the same sample, we can note that AAA rated PF bonds represent 14%, while AAA rated CF bonds represent 2.9%. It could suggest that in times of normality, PF bonds require better rating scores to succeed.

However, during crisis periods PF bonds awarded with AAA fall curiously to less than 3% and AAA rated PF bonds appear to have lower average credit spread than CF bonds. Nevertheless, PF bonds investment grade issues represent 82% of the total sample of bonds issued during crisis time, which is in line with what we expected, therefore, investors will require even higher assessment and monitoring during crisis periods, but due to country risk factors, ratings can be affected during this time. Considering the remaining rating classes, and in line with Wojtowicz (2014),

we find that PF bond average credit spread is consistently higher than that of CF bond for the three sub-samples, with the exception of AAA in the crisis sub-sample, as PF bond average credit spreads are lower than CF bond credit spread for identical credit rating.

Table 4 : PF and CF bonds mean and median credit spreads by credit rating

1993-2020 Period

Credit rating (S&P / Moody's)	Project Bond			Corporate Bond		
	Number	Credit spread		Number	Credit spread	
		Mean	Median		Mean	Median
AAA / Aaa	43	81,8	65,0	559	67,5	45,0
AA+ / Aa1	7	88,0	80,0	366	85,2	70,0
AA / Aa2	7	131,0	122,5	1.025	63,9	45,0
AA- / Aa3	14	188,3	160,0	1.628	66,0	55,0
A+ / A1	20	132,8	99,0	2.111	92,9	83,7
A / A2	29	121,7	112,0	3.570	106,1	95,0
A- / A3	91	152,8	144,7	3.715	119,7	110,0
BBB+ / Baa1	84	224,9	195,0	4.204	151,6	136,9
BBB / Baa2	85	201,2	200,0	4.287	172,1	160,0
BBB- / Baa3	82	249,4	263,8	2.596	206,4	195,0

Pre-crisis Period

Credit rating (S&P / Moody's)	Project Bond			Corporate Bond		
	Number	Credit spread		Number	Credit spread	
		Mean	Median		Mean	Median
AAA / Aaa	38	82,2	65,0	419	49,9	34,0
AA+ / Aa1	1	79,0	79,0	159	55,5	43,0
AA / Aa2	1	10,0	10,0	480	46,1	27,0
AA- / Aa3	3	202,5	187,5	739	44,0	23,0
A+ / A1	6	138,4	114,0	824	76,3	68,0
A / A2	5	161,8	103,0	1.398	86,0	80,0
A- / A3	25	124,3	102,0	1.293	97,3	91,0
BBB+ / Baa1	37	231,3	220,8	1.526	121,1	111,8
BBB / Baa2	26	205,9	201,3	1.464	133,0	120,0
BBB- / Baa3	48	251,7	284,5	970	147,1	135,5

Crisis Period

	Project Bond		Corporate Bond	
	Number	Credit spread	Number	Credit spread

Credit rating (S&P / Moody's)		Mean	Median		Mean	Median
AAA / Aaa	5	78,8	69,0	121	112,6	95,0
AA+ / Aa1	4	100,5	100,0	188	106,8	90,0
AA / Aa2	3	175,9	191,0	449	76,3	58,0
AA- / Aa3	5	290,0	312,5	671	87,2	77,0
A+ / A1	5	200,8	190,0	849	115,5	96,9
A / A2	11	115,2	112,0	1.531	128,8	108,8
A- / A3	44	182,1	185,5	1.667	142,8	121,1
BBB+ / Baa1	28	275,0	218,8	1.757	187,5	160,0
BBB / Baa2	36	217,8	217,5	1.917	210,9	190,0
BBB- / Baa3	17	289,5	295,6	1.034	266,8	245,0

Table 4 displays number, mean and median credit spread for PF and CF bond issues by initial S&P and / or Moody's credit rating. Only investment grade bonds were included.

According to Kleimeier and Megginson (2000), PF credits involve more participating banks. Surprisingly, our data suggest that PF bonds (5.0) have significantly fewer than the average participant banks than CF bonds (5.9). Thus, the observed level of the number of banks participating in the issuing syndicate does provide indirect evidence that CF lending may be considered relatively riskier than PF lending. It could suggest that underwriting banks may like an increase in the number of institutions participating in a CF bond issuance of a given transaction size, so banks can share the risks involved.

Regarding creditors rights and legal enforcement, as we expected, PF bonds are more commonly issued by originators located in countries with lower creditor rights and lower legal enforcement, when compared with CF bonds.

PF bonds exhibit slightly higher average tranche size of $371 million when compared $365.0 million average tranche size exhibited by CF bonds. Similarly, the average transaction size exhibited by PF bonds ($611 million) is higher than the average transaction size exhibited by CF bonds ($593 million). This short difference

can be explained by the fact that a tiny significantly larger number of tranches per transaction is issued in an PF bond issuance. Our findings indicated that average number of tranches per transaction of PF bond is 2 while for CF bond is 1.6.

A larger fraction of both PF and CF bond credit spreads is fixed rate, 82.0% for PF bonds and 88.2% for CF bonds. PF bonds are more frequently issued with a collateral than CF bonds. PF bonds are more likely to be issued in common law countries, which in line with table 2 – panel that shows U.S. as the country with more PF bonds, and the type of legal system in U.S. is the common law. Most of PF and CF bonds are rated. In addition, a significantly lower fraction of bonds is subordinated, for both PF and CF bonds. Similarly, both PF and CF bonds have few cases of rating discordance.

Appendix C shows that significantly high fraction of PF bonds is issued during crisis. Almost 40% of PF bonds were issued during the 2007-2008 financial crisis and the subsequent European sovereign debt crisis.

5. Regression Results

5.1 Do Project Finance bonds have higher credit spreads than Corporate Finance bonds with identical credit ratings?

Table 5 presents the results of estimated equation (1) using each of the two samples discussed in section 3 and 4, for PF and CF bonds. Models [1], [2] and [3] present pricing regression results for the full sample of 47,196 bonds (PF and CF bonds), 763 PF bonds and 46,433 CF bonds, respectively. We re-estimate these models for sub-samples of issues closed during pre-crisis and crisis periods – models

[1a], [1b], [2a], [2b], [3a] e [3b] models, respectively. Model [1] shows that PF bonds have higher credit spreads compared with CF bonds. In fact, they have, on average, 30.86 bps higher spreads than CF bonds. This difference is even higher during the crisis period (52.9 bps). However, credit spreads do not differ significantly between PF and CF bonds in the pre-crisis period. This may mean that both crises increased the difference in credit spreads between the two bond types with 99% confidence level. This might be explained by the significant increase in PF bonds credit risk in the crisis period vis-à-vis the pre-crisis period, as can be seen in Table 4. We thus validate H1 for the crisis period only.

5.2 Do Project Finance bonds and Corporate Finance bonds priced differently by common pricing factors?

In this section we perform a regression analysis to examine whether PF and CF bonds are influenced differently by common pricing characteristics. We examine the determinants of credit spreads for each bond type separately.

Regarding the impact of credit rating on credit spread, Table 5 shows exactly the results expected; rated bonds have lower credit spreads and the higher the credit risk, the higher the credit spread. Bonds awarded with AA- have an increase of 150.3 bps on credit spreads than AAA bonds for PF bonds, while for CF bonds, the same credit rating has a negative impact on credit spreads of 23.3 bps. The deterioration of CF bonds credit ratings starts to have significantly positive impact on credit spread since A- bonds, with an increase of 18.97 bps on credit spread than AAA bonds. For PF bonds, a poor quality credit rating can impact an increase on credit spread as bad as 562.12 bps (for CCC+ bonds) than AAA rated bonds, while for CF bonds, the highest positive impact of credit rating on credit spread is 558.22 bps (for

CC bonds) comparing to AAA rated bonds. The results suggest that credit rating has an earlier positive impact on credit spread of PF bonds than CF bonds

On a side note, we can examine that the relationship between credit spread and credit rating is not linear as the impact of one unit increase in credit rating increases as the credit rating deteriorates. Besides, we estimate models [1], [2], [3] considering only rated and credit rating dummies as independent variables and find that models yield adjusted R2 values of 0.38, 0.29, 0.39, respectively. This means that credit ratings as the most important determinant of credit spreads in both PF and CF bonds. Moreover, the adjusted R2 value increases, on average, 0.24 for PF bonds and 0.18 for CF bonds with the inclusion of additional contractual and macroeconomic variables, which shows that credit rating is not the only determinant of credit spread. Which confirm our suspicious that investors do not rely exclusively on ratings: they consider other factors when pricing both PF and CF bonds, hence, they do rely on more information beyond the awarded credit rating, which validates H2 first suspicious. We also find that rating discordance between S&P and Moody's has a substantial positive impact of 26.43 bps on the credit spread for CF bonds only and seems to be insignificant to PF bonds. This can be justified by the fact that PF deals are created to achieve a specific credit rating, thus, mitigating discordance.

Table 5: Regression analyses of the determinants of PF and CF bond credit spreads

Dependent variable: Credit spread (bps)	[1] PF and CF bonds	[1a] PF and CF bonds | pre-crisis	[1b] PF and CF bonds | crisis	[2] PF bond	[2a] PF bond pre-crisis	[2b] PF bond crisis	[3] CF bond	[3a] CF bond pre-crisis	[3b] CF bond crisis
Independent variables:									
Intercept	211,31 ***	-225,05	326,29 ***	641,43 ***	23,8	928,47 ***	115,21 *	-68,07	390,78 ***
	(65.62)	(170.61)	(112.17)	(170.98)	(329.65)	(216.45)	(69.41)	(67.43)	(104.43)
PF bond	30,86 **	165,51	52,90 ***						
	(14.47)	(106.72)	(20.50)						
Rated	-97,22 ***	-115,16 ***	-114,64 ***	-131,57 ***	-93,82 **	-69,16 *	-92,91 ***	-111,56 ***	-114,47 ***
	(9.68)	(9.44)	(17.23)	(28.15)	(42.70)	(40.41)	(9.94)	(9.49)	(17.59)
AA+	-29,85 ***	-7,18	-33,55 *	55,17	-79,32	33,86	-34,56 ***	-11,25	-36,29 **
	(9.56)	(8.13)	(17.78)	(47.36)	(57.10)	(72.07)	(9.42)	(8.27)	(17.89)
AA	-26,39 **	-9,58	-38,79 *	63,87 *	-147,63 **	113,12	-31,64 ***	-13,92	-40,93 *
	(11.61)	(10.98)	(21.30)	(32.66)	(60.26)	(74.92)	(11.55)	(10.71)	(21.60)
AA-	-18,41 **	-9,49	-12,48	150,32 ***	49,92	142,50 *	-23,33 ***	-13,71 **	-14,72
	(7.53)	(6.68)	(16.52)	(39.64)	(31.55)	(85.26)	(7.48)	(6.56)	(16.97)
A+	-3,14	14,86 *	8,36	42,92	125,67 ***	-97,89	-7,92	10,77	6,83
	(7.72)	(8.04)	(15.70)	(33.20)	(39.56)	(65.72)	(7.63)	(7.90)	(16.23)
A	9,96	26,11 ***	24,92	58,14 **	88,09	1,65	4,85	21,30 ***	23,21
	(7.76)	(8.43)	(15.48)	(26.17)	(56.24)	(39.02)	(7.59)	(8.00)	(15.91)
A-	24,00 **	37,07 ***	42,20 ***	103,26 ***	113,99 ***	75,75	18,97 **	32,46 ***	40,84 **
	(7.61)	(6.83)	(15.70)	(22.39)	(35.60)	(48.28)	(7.51)	(6.51)	(16.18)
BBB+	54,92 ***	51,66 ***	86,32 ***	133,54 ***	142,04 ***	107,13 **	49,33 ***	46,55 ***	83,73 ***
	(7.86)	(6.62)	(17.10)	(24.76)	(31.90)	(44.06)	(7.80)	(6.72)	(17.56)
BBB	72,76 ***	63,79 ***	113,08 ***	128,40 ***	129,43 ***	99,11 **	67,83 ***	59,50 ***	102,05 ***
	(8.40)	(7.86)	(17.01)	(21.17)	(33.59)	(39.73)	(8.47)	(7.91)	(17.58)
BBB-	113,45 ***	88,78 ***	169,26 ***	185,55 ***	189,06 ***	145,10 ***	107,75 ***	82,35 ***	167,81 ***
	(12.57)	(7.82)	(17.76)	(24.16)	(33.02)	(47.60)	(8.89)	(7.95)	(18.19)
BB+	187,94 ***	147,57 ***	269,14 ***	212,97 ***	222,70 ***	174,66 *	182,95 ***	142,21 ***	268,83 ***
	(12.57)	(13.81)	(19.75)	(43.09)	(48.12)	(104.73)	(12.70)	(13.98)	(20,55)
BB	204,05 ***	155,89 ***	285,43 ***	291,39 ***	197,97 ***	379,20 ***	198,01 ***	151,07 ***	282,29 ***
	(13.81)	(14.91)	(22.41)	(35.16)	(49.96)	(72.61)	(14.22)	(15.77)	(22.92)
BB-	264,85 ***	215,05 ***	339,75 ***	409,74 ***	434,66 ***	395,18 ***	258,80 ***	208,15 ***	337,83 ***
	(13.81)	(18.46)	(23.49)	(45.87)	(53.62	(72.17)	(13.98)	(19.03)	(23.99)
B+	317,06 ***	264,84 ***	403,32 ***	389,96 ***	418,44 ***	417,30 ***	311,71 ***	258,63 ***	401,76 ***
	(18.48)	(28.00)	(24.36)	(44.67)	(69.14)	(73.18)	(18.72)	(28.78)	(24.81)
B	365,50 ***	297,50 ***	475,92 ***	400,93 ***	348,04 ***	565,38 ***	359,99 ***	292,73 ***	474,18 ***
	(21.83)	(33.44)	(22.62)	(70.22)	(89.60)	(109.55)	(21.96)	(34.03)	(23.31)
B-	408,54 ***	346,80 ***	517,66 ***	505,20 ***	497,01 ***	479,30 ***	402,80 ***	341,21 ***	515,53 ***
	(4.22)	(42.67)	(22.48)	(97.47)	(101.64)	(122.94)	(26.86)	(42.77)	(22.31)
CCC+	498,56 ***	400,79 ***	594,86 ***	562,12 ***	560,14 ***		492,49 ***	393,31 ***	592,45 ***
	(25.01)	(46.53)	(23.31)	(98.60)	(96.93)		(25.05)	(47.41)	(23.13)
CCC	545,35 ***	407,00 ***	671,41 ***				539,82 ***	401,94 ***	669,47 ***
	(30.85)	(51.77)	(21.79)				(30.73)	(51.55)	(21.81)
CCC-	511,55 ***	468,09 ***	707,16 ***	-180,85 ***	-122,52 *		545,64 ***	512,79 ***	705,19 ***
	(56.92)	(70.13)	(59.76)	(53.91)	(70.90)		(43.33)	(53.70)	(60.32)
CC	478,94 ***	499,52 ***		510,76 ***	426,39 ***		558,22 ***	538,30 ***	
	(61.29)	(37.48)		(50.94)	(57.59)		(14.02)	(15.13)	
C	357,17 ***	438,18 ***	578,40 ***				354,09 ***	432,94 ***	583,26 ***
	(100.78)	(29.52)	(25.36)				(100.36)	(29.48)	(25.79)
Rating discordance	26,55 ***	26.28 ***	25,55 ***	17,58	21,95	-4,09	26,43 ***	26,08 ***	25,31 ***
	(3.02)	(3.85)	(3.85)	(13.80)	(19.90)	(27.46)	(3.03)	(3.90)	(3.79)

(Continued)

Maturity	1,04 ***	1,26 ***	0,79 ***	1,30 *	-0,93	1,30	1,02 ***	1,27 ***	0,78 ***
	(0.15)	(0.14)	(0.22)	(0.69)	(1.35)	(1.45)	(0.169	(0.14)	(0.23)
Log maturity	0,05	16,54	7,04 ***	20,57 **	44,17	5,49	10,35 ***		
	(2.71)	(15.78)	(4.74)	(10.02)	(29.95)	(10.40)	(1.82)		
Log transaction size	-9,20 **	0,63	-11,63 **	-36,81 ***	-9,89	-63,96 ***	-9,02 **	0,43	-11,27 **
	(3.65)	(2.92)	(5.29)	(9.03)	(17.98)	(10.14)	(3.71)	(2.91)	(5.44)
PF bond	30,86 **	165,51	52,90 ***						
	(14.47)	(106.72)	(20.50)						
Subordinated	-85,61 ***	-56,87 ***	30,25	38,65	19,25	19,77	-85,91 ***	-56,49 ***	29,64
	(18.57)	(11.68)	(21.07)	(46.91)	(57.36)	(109.08)	(18.68)	(11.79)	(21.10)
Currency risk	41,03 ***	47,34 ***	44,55 ***	17,56	-3,02	41,10 *	41,58 ***	48,87 ***	45,07 ***
	(5.21)	(10.30)	(7.29)	(15.63)	(25.29)	22.25)	(5.24)	(10.42)	(7.32)
Fixed rate	-23,37 **	29,28 **	-31,78 **	-62,10 **	64,60 **	-91,98 **	-22,10 **	28,51 **	-29,55 **
	(9.19)	(11.80)	(12.74)	(27.31)	(26.55)	(43.18)	(9.06)	(11.89)	(12.59)
Collateralized	63,22 ***	6,81	58,67 ***	35,61 **	27,88	60,64 *	64,81 ***	5,00 *	58,74 ***
	(7.06)	(7.60)	(8.05)	(16.75)	(30.55)	(33.95)	(7.36)	(7.61)	(8.16)
Callable	47,80 ***	25,83 ***	59,39 ***	6,31	-12,19	15,24	48,53 ***	26,40 ***	60,26 ***
	(7.02)	(8.35)	(8.04)	(11.64)	(18.10)	(21.64)	(7.16)	(8.49)	(8.16)
Number of banks	-1,36 ***	1,12 *	-2,49 ***	-2,60 *	-6,88 *	-3,72	-1,36 ***	1,05 *	-2,47 ***
	(0.40)	(0.59)	(0.49)	(1.50)	(3.49)	(3.30)	(0.40)	(0.59)	(0.49)
Bank reputation	0,00	1,29 ***	-0,86 **	0,35	-0,64	1,11	0,00	1,32 ***	-0,89 ***
	(0.28)	(0.36)	(0.34)	(1.05)	(1.86)	(1.59)	(0.28)	(0.36)	(0.34)
Number of tranches	1,45	4,45	4,73 *	2,87	-6,51	17,87 **	1,5	5,54 *	4,41
	(4.94)	(2.84)	(7.16)	(5.29)	(7.75)	(8.01)	(5.10)	(2.92)	(7.39)
Country risk	5,36 ***	5,62 ***	4,32 ***	8,60 ***	5,67 *	10,99 ***	5,13 ***	5,44 ***	3,93 ***
	(1.05)	(1.69)	(1.48)	(2.17)	(3.20)	(3.62)	(1.06)	(1.77)	(1.45)
Creditor rights	-7,16 ***	-14,36 ***	-3,45	-8,07	-4,58	-16,15 *	-7,16 ***	-14,94 ***	-3,20
	(2.22)	(4.41)	(2.89)	(5.75)	(10.90)	(8.19)	(2.23)	(4.49)	(2.89)
Legal Enforcement	0,69 *	1,63 ***	0,66	0,90	-0,80	2,29 **	0,66	1,64 ***	0,59
	(0.39)	(0.54)	(0.59)	(0.74)	(1.65)	(1.10)	(0.40)	(0.55)	(0.60)
Financial crisis	61,06			79,59			59,97		
	(45.35)			(130.44)			(45.19)		
Sovereign crisis	43,60			-23,63			41,93		
	(47.37)			(83.94)			(47.20)		
Volatility	2,65 ***	1,96 **	3,78 ***	-0,16	-1,82	2,42	2,69 ***	2,00 **	3,82 ***
	(0.63)	(0.84)	(0.96)	(1.56)	(2.44)	(2.41)	(0.63)	(0.85)	(0.96)
USA5y-USA3M	-0,07	-0,03	-0,12 *	-0,06	1,21 ***	0,11	-0,07	-0,04	-0,13 *
	(0.63)	(0.06)	(0.07)	(-0.77)	(0.37)	(0.23)	(0.05)	(0.06)	(0.07)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	47.196	15.578	21.490	763	283	294	46.433	15.295	21.196
Adjusted R^2	0,56	0,49	0,65	0,53	0,64	0,5688	0,56	0,49	0,65
Rated and rating dummies as independent variables only									
Adjusted R^2	0,38	0,30	0,54	0,29	0,40	0,28	0,39	0,30	0,55
Differences in adjusted R^2	0,18	0,19	0,11	0,24	0,24	0,29	0,18	0,19	0,10

Table 5 presents the results of an OLS regression analysis of the determinants of PF and CF bond credit spreads for: (i) a full sample of 47,196 bonds – model [1] ; (ii) a sample of 15,578 PF and CF bonds closed during the pre-crisis period– model [1a]; (iii) a sample of 21,490 PF and CF bonds closed during the crisis period – model [1b]; (iv) a sample of 763 PF bonds – model [2] –, of which 283 were closed during the pre-crisis period – model [2a] – and 284 during the crisis period – model [2b]; and v) a sample of 46,433 CF bonds – model [3] –, of which 15,295 were closed during the pre-crisis period – model [3a] – and 21,196 during the crisis period – model [3b]. For a definition of the variables, see Appendix D. ***, ** and * indicate that the reported coefficients are significantly different from zero at the 1%, 5% and 10% levels, respectively. The t-statistics reported in parentheses are based on heteroskedasticity-consistent standard errors. Due to time varying risk premia and cross-country differences, we estimate standard errors clustered by year and country.

Contrary to what we expected, we find a positive and robust hump-shaped relationship between credit spread and maturity for PF bonds. Sorge and Gadanecz (2008) point out that the term structure of credit spreads in PF is negative and hump-shaped because of the time spending between the construction phase and the beginning of cash flow´s generation in PF deals. Therefore, such finds deserve further research attention. Additionally, in agreement with Duffie and Lando´s (2001) work that finds a hump-shaped relationship between credit spread and maturity for CF bond under perfect information, our results suggest a hump-shaped relationship between credit spread and maturity for CF bond at issuance. We can thus argue that at issuance investors are fully informed of the status of the firm.

The impact of transaction size on credit spread is significantly negative for PF and CF bonds, suggesting that increasing transaction size of PF and CF bonds by $100 million the required credit spread will reduce 36.81 bps and 9.02 bps, respectively. This negative transaction size and credit spread relationship could be due to economies of scale or it could be due to better known and more creditworthy borrowers being able to arrange larger deals, or even both.

As expected, the relationship between credit spread and the number of banks is negative and significant for both PF and CF bonds and the reputation of the banks supporting the transaction seems to not have significant impact on credit spreads for both type of bonds. We also find number of tranches insignificant for both PF and CF bonds.

The callable dummy and the subordinated dummy have insignificant impact on PF bond credit spreads. Although, we find that, the introduction of a call option on a CF bond, as expected, increases the credit spread and, surprisingly, the subordinated structure reduces CF bonds credit spreads.

Contrary to what we expected, the impacts of currency risk on credit spread is insignificant for PF bonds but significant positive for CF bonds. In addition, issuers raise capital through PF and CF bonds at a lower credit spread through fixed rate issued than through floating rate issues.

As expected and similar with Kleimeier and Megginson (2000), PF bond is issued with higher credit spread if the bond is structured with a collateral. In addition, Dailami and Hauswald (2003) argue that in practice the effectiveness of collateral realization critically depends on the quality of the ambient legal institutions required to make the contract enforcement. Contrary to what we expected, we also find significantly positive impact on CF bond credit spreads. Although we do not have a definitive explanation, one could argue that such relationship is due to investors overall risk perception and the existence of collateralized bonds awarded with lower credit ratings, suggesting riskier bonds.

As expected, country risk is significantly positive related to credit spread for PF and CF bonds, reflecting that the risk perception of lenders regarding the borrowers' country is considered when pricing both type of bonds. In addition, the creditor rights index has insignificant, but negative, impact on PF bond credit spread, while for CF bonds appears to have negative and significant impact, indicating that borrowers located in countries with strong creditors rights benefit from lower spreads. The impact of legal enforcement is insignificant for both PF and CF bonds.

We use year fixed effects, so that financial crisis and sovereign crisis dummies capture the variation of bonds credit spread for bonds issued during these crises' periods. Both crisis dummies are insignificant for both PF and CF bonds, still they have positive relationship with credit spread. Controlling for micro and other macro variables, we do not find evidence to corroborate H3.

The relationship of credit spread and the slope of the USD swap curve, USA5y-USA3M, appears insignificant for both PF and CF bonds. Although the variable has a significantly positively impact on PF bond credit spread during pre-crisis period, suggesting that steeper the curve the higher the spread of PF bonds. We will examine this effect in section 5.4.

Pinto and Alves (2016) find credit spread and market volatility are significantly negatively related for PF loans. Although the negative coefficients for PF bonds, we find insignificant impact of this variable on credit spread. However, credit spread, and market volatility are significantly positive related for CF bonds. Hence, we can argue that in case of higher market volatility scenarios, there is a higher demand for PF bonds instead of CF bonds.

Overall, our results corroborate H2 that both PF and CF bonds are priced differently by common pricing factors and investors rely on factors other than credit ratings when pricing PF bonds.

5.3 Additional sensitivity tests

We re-estimate our models controlling for additional variables that either reduce our sample observations or have correlation with other included variables. Hence, we perform the follow models presented in Table 6 to examine the impact of these variables on credit spread: [4] and [5] for gross spread; [6] and [7] for management

fee; [8] and [9] for civil vs common law; [10] and [11] for log GDP per capita; [12] and [13] for risk free rate.

Table 6: Regression analyses of the determinants of credit spreads – remaining variables

Dependent variable: Credit spread (bps)	[4] PF bond incl. Gross Spread	[5] CF bond incl. Gross Spread	[6] PF bond incl. Management Fee	[7] CF bond incl. Management Fee	[8] PF bond incl. Civil vs common law	[9] CF bond incl. Civil vs common law	[10] PF bond incl. Log GDP per capita	[11] CF bond incl. Log GDP per capita	[12] PF bond incl. Risk Free rate	[13] CF bond incl. Risk free rate
Independent variables:										
Intercept	80,12	-322,03 ***	581,57 ***	141,13 *	817,3 ***	218,46 ***	984,43 ***	371,76 ***	1002,45 ***	250,91 ***
	(213.59)	(6.53)	(168.62)	(78.18)	(187.51)	(79.83)	(198.53)	(90.67)	(193.69)	(73.92)
Rated	125,26	-60,46 ***	-148,98 ***	-95,13 ***	-139,56 ***	-105,64 ***	-128,42 ***	-91,51 ***	-126,66 ***	-86,91 ***
	(95.88)	(9.73)	(28.93)	(9.90)	(28.22)	(9.88)	(27.51)	(10.52)	(26.22)	(10.01)
AA+	37,16	-29,60 ***	80,39	-32,13 ***	70,20	-34,45 ***	65,06	-33,88 ***	66,33	-37,71 ***
	(57.19)	(8.99)	(49.35)	(9.64)	(47.37)	(9.37)	(49.72)	(9.51)	(46.91)	(9.51)
AA	50,52	-30,88 ***	89,31 ***	-32,16 ***	46,87	-27,10 **	56,64	-27,37 **	63,65 *	-34,34 ***
	(52.38)	(9.10)	(33.70)	(11.98)	(37.17)	(10.93)	(34.45)	(11.31)	(34.13)	(11.55)
AA-	81,78 **	-7,45	170,62 ***	-21,74 ***	142,11 ***	-16,20 **	160,33 ***	-18,84 **	147,44 ***	-26,01 ***
	(36.28)	(6.30)	(42.43)	(8.23)	(36.60)	(7.63)	(43.27)	(7.47)	(37.05)	(7.46)
A+	44,13	6,25	65,10 *	-7,63	40,68	-3,08	43,42	-6,05	47,18	-10,40
	(30.40)	(5.97)	(37.44)	(7.86)	(32.80)	(7.68)	(33.68)	(7.64)	(32.93)	(7.57)
A	55,47	17,06 ***	77,70 ***	3,37	57,41 **	8,26	51,25 **	6,28	60,11 **	2,39
	(36.33)	(5.53)	(28.32)	(7.70)	(26.79)	(7.68)	(25.31)	(7.59)	(25.66)	(7.50)
A-	118,93 ***	33,69 ***	120,11 ***	19,03 **	99,51 ***	22,77 ***	98,87 ***	20,80 ***	99,86 ***	15,68 ***
	(35.17)	(5.34)	(24.19)	(7.67)	(22.73)	(7.67)	(21.74)	(7.54)	(22.00)	(7.45)
BBB+	146,89 ***	56,31 ***	144,30 ***	51,29 ***	141,62 ***	54,39 ***	137,96 ***	51,39 ***	131,88 ***	45,32 ***
	(43.88)	(5.82)	(28.39)	(7.91)	(25.77)	(7.97)	(24.39)	(7.82)	(24.61)	(7.77)
BBB	100,36 ***	74,61 ***	141,90 ***	68,14 ***	131,54 ***	73,48 ***	128,28 ***	70,31 ***	124,39 ***	63,40 ***
	(32.32)	(6.88)	(23.16)	(8.47)	(22.76)	(8.55)	(21.33)	(8.45)	(20.71)	(8.44)
BBB-	218,92 ***	108,54 ***	212,18 ***	108,53 ***	189,84 ***	116,02 ***	185,44 ***	110,98 ***	177,27 ***	102,55 ***
	(35.64)	(7.27)	(26.73)	(9.11)	(24.43)	(8.97)	(23.98)	(8.91)	(22.66)	(8.91)
BB+	208,78 ***	163,05 ***	206,61 ***	184,62 ***	221,55 ***	193,72 ***	210,50 ***	-187,01 ***	210,63 ***	176,04 ***
	(54.06)	(12.79)	(52.71)	(12.86)	(42.79)	(12.36)	(42.88)	(12.59)	(43.74)	(12.89)
BB	256,04 ***	158,24 ***	324,39 ***	290,86 ***	298,63 ***	207,62 ***	288,42 ***	201,47 ***	282,17 ***	190,14 ***
	(52.38)	(14.12)	(37.63)	(13.61)	(36.16)	(13.95)	(34.96)	(14.19)	(34.48)	(14.66)
BB-	488,65 ***	211,14 ***	425,44 ***	271,01 ***	411,58 ***	268,87 ***	402,92 ***	262,94 ***	396,95 ***	249,97 ***
	(85.81)	(13.95)	(48.04)	(13.49)	(45.32)	(13.83)	(44.28)	(13.97)	(43.37)	(14.58)
B+	426,88 ***	235,23 ***	403,20 ***	336,87 ***	411,90 ***	319,28 ***	403,05 ***	313,52 ***	373,32 ***	301,34 ***
	(90.08)	(21.57)	(51.75)	(13.60)	(44.06)	(18.64)	(43.54)	(18.76)	(46.47)	(19.79)
B	391,91 ***	267,51 ***	492,44 ***	394,45 ***	415,28 ***	368,79 ***	404,20 ***	363,27 ***	391,73 ***	349,79 ***
	(98.11)	(21.19)	(97.85)	(15.01)	(70.25)	(21.80)	(70.34)	(21.98)	(74.12)	(23.06)
B-	274,60 ***	268,33 ***	732,29 ***	452,56 ***	517,65 ***	408,46 ***	500,49 ***	404,66 ***	488,95 ***	392,56 ***
	(104.17)	(39.09)	(89.00)	(13.24)	(96.57)	(26.81)	(97.68)	(26.91)	(96.87)	(27.84)
CCC+	485,96 ***	291,00 ***	294,04 ***	524,10 ***	573,29 ***	497,42 ***	556,62 ***	494,47 ***	555,91 ***	482,74 ***
	(132.51)	(54.13)	(54.18)	(18.34)	(87.81)	(25.24)	(97.01)	(25.11)	(111.20)	(25.47)
CCC		449,83 ***		580,18 ***		547,04 ***		542,54 ***		530,33 ***
		(54.02)		(22.82)		(30.53)		(30.78)		(30.90)
CCC-		393,28 ***		494,89 ***	-219,01 ***	553,32 ***	-193,87 ***	546,72 ***	-164,66 ***	536,41 ***
		(54.06)		(77.30)	(55.47)	(43.88)	(54.22)	(43.47)	(55.32)	(42.06)
CC	505,70 ***	439,63 ***	438,10 ***		526,99 ***	567,61 ***	531,40 ***	560,69 ***	482,93 ***	549,49 ***
	(79.58)	(19.47)	(56.08)		(51.84)	(12.79)	(51.56)	(13.94)	(51.13)	(14.56)
C		305,56 ***		291,95		377,08 ***		358,47 ***		346,58 ***
		(35.18)		(184.60)		(98.08)		(100.18)		(100.54)
Rating discordance	19,32	18,99 ***	10,61	22,35 ***	20,17	26,05 ***	20,38	26,42 ***	18,04	26,82 ***
	(17.16)	(2.619	(15.34)	(2.56)	(13.69)	(2.86)	(13.50)	(2.99)	(13.48)	(3.05)

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Maturity	0,47	0,83 ***	1,36 *	0,82 ***	1,06	0,93 ***	1,03	1,02 ***		
	(0.63)	(0.18)	(0.72)	(0.14)	(0.66)	(0.16)	(0.66)	(0.15)		
Log maturity	48,33 **		12,59	11,00 ***	18,45 *	8,83 ***	22,14 **	9,14 ***		
	(20.30)		(8.94)	(2.04)	(10.12)	(2.89)	(9.99)	(2.28)		
Log transaction size	-21,98 *	10,84 ***	-42,42 ***	-9,60 **	-39,87 ***	-9,82 **	-38,07 ***	-9,46 **	-37,41 ***	-9,05 **
	(12.65)	(2.46)	(9.03)	(4.20)	(9.73)	(3.95)	(9.35)	(3.77)	(8.92)	(3.66)
Subordinated	124,59	-76,42 ***	51,58	-36,68 ***	34,56	-86,44 ***	30,14	-87,05 ***	51,18	-81,65 ***
	(98.20)	(20.48)	(46.07)	(10.47)	(43.99)	(18.45)	(48.85)	(18.55)	(53.62)	(18.97)
Currency risk	19,05	49,22 ***	27,46 *	43,01 ***	27,00 *	45,88 ***	17,87	40,68 ***	13,79	40,31 ***
	(27.10)	(6.19)	(15.74)	(4.96)	(15.80)	(5.84)	(16.08)	(4.83)	(16.22)	(5.22)
Fixed rate	114,69 ***	15,10 *	-72,48 **	-25,60 ***	-74,87 **	-25,07 ***	-74,40 **	-28,15 ***	-52,70 *	-18,80 **
	(33.97)	(8.36)	(29.74)	(8.93)	(30.31)	(9.64)	(29.26)	(9.44)	(27.82)	(9.04)
Collateralized	40,79 *	26,59 ***	41,90 **	60,52 ***	32,68 *	63,19 ***	33,94 **	64,84 ***	40,08 **	66,99 ***
	(18.09)	(6.37)	(18.82)	(6.03)	(16.81)	(7.33)	(17.20)	(7.38)	(16.22)	(7.47)
Callable	-13,37	34,63 ***	4,99	62,88 ***	-1,94	39,21 ***	4,99	47,85 ***	2,56	51,65 ***
	(21.64)	(6.63)	(13.29)	(5.71)	(12.15)	(6.96)	(12.00)	(7.33)	(11.95)	(6.97)
Number of banks	0,36	0,74 **	-1,53	-1,41 ***	-2,28	-1,42 ***	-2,81 *	-1,58 ***	-2,64 *	-1,44 ***
	(1.78)	(0.34)	(1.50)	(3.38)	(1.51)	(0.38)	(1.52)	(0.40)	(1.49)	(0.39)
Bank reputation	-0,70	0,87 ***	0,53	0,56 **	0,15	-0,90	0,44	0,11	0,09	0,03
	(2.60)	(0.27)	(1.04)	(0.22)	(1.06)	(0.27)	(1.07)	(0.27)	(1.04)	(0.28)
Number of tranches	-1,76	-10,46 ***	5,76	1,67	3,15	1,14	3,01	1,68	3,36	1,77
	(8.89)	(2.19)	(5.70)	(5.55)	(5.77)	(5.33)	(5.50)	(5.15)	(4.76)	(5.02)
Country risk	0,28	6,75 ***	7,94 ***	5,47 ***					7,67 ***	4,96 ***
	(3.93)	(1.63)	(2.28)	(1.04)					(2.05)	(1.06)
Creditor rights	-8,03	-12,36 ***	-5,62	-4,97 **	-6,80	-8,11 ***	-9,09	-7,65 ***	-6,98	-7,12 ***
	(10.43)	(3.28)	(5.39)	(1.94)	(5.98)	(2.28)	(5.81)	(2.18)	(5.69)	(2.24)
Legal Enforcement	-0,03	2,12 ***	1,00	0,63	-0,18	-0,12	0,40	0,00	0,39	0,55
	(1.48)	(0.53)	(0.70)	(0.40)	(0.71)	(0.40)	(0.75)	(0.4)	(0.72)	(0.4)
Financial crisis	543,61 ***	68,33	128,47	56,26			140,37	56,96	100,46	29,30 **
	(127.13)	(64.49)	(109.28)	(47.04)			(135.11)	(46.09)	(109.47)	(13.27)
Sovereign crisis	-224,98 *	41,59	72,22	40,29			26,56	39,63	-	-
	(130.42)	(67.67)	(82.03)	(49.16)			(84.48)	(48.05)		
Volatility	-0,32	2,58 ***	0,09	2,89 ***	-0,36	3,1 ***	-0,16	2,72 ***	-1,15	2,72 ***
	(1.72)	(0.85)	(1.72)	(0.71)	(1.58)	(0.60)	(1.52)	(0.63)	(1.58)	(0.56)
USA5y-USA3M	0,26	-0,08 *	0,49 **	-0,06	0,46 **	-0,04	0,42 **	-0,08	0,06	-0,11
	(0.18)	(0.04)	(0.22)	(0.06)	(0.22)	(0.05)	(0.21)	(0.05)	(0.24)	(0.06)
Gross Spread	-0,05	0,35 ***								
	(0.12)	(0.09)								
Management Fee bps			0,36	-0,64 **						
			(0.35)	(0.31)						
Civil vs Common Law					31,43 **	-5,34				
					(13.91)	(6.98)				
Log GDP per capita							-29,55 ***	-18,11 ***		
							(9.44)	(4.40)		
Risk Free rate									-0,56 **	-0,07
									(0.22)	(0.09)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	237	19.289	668	41.135	763	46.433	763	46.433	763	46.433
Adjusted R^2	0,79	0,54	0,55	0,61	0,51	0,56	0,52	0,56	0,52	0,56
Rated and rating dummies as independent variables only										
Adjusted R^2	0,29	0,39	0,29	0,39	0,29	0,39	0,29	0,39	0,29	0,39
Differences in adjusted R^2	0,50	0,15	0,26	0,23	0,22	0,17	0,23	0,17	0,23	0,17

Table 6 presents the results of an OLS regression analysis of the determinants of PF and CF bond credit spreads for: (i) a sample of 237 PF bonds – model [4] and (ii) a sample of 19,289 CF bonds – model [5]; (iii) a sample of 668 PF bonds - model [6] and (iv) a sample of 41,135 CF bonds – model [7] ; v) a sample of 763 PF bonds– model [8] and vi) a sample of 46,433 CF bonds– model [9]; vii) a sample of 763 PF bonds – model [10] and viii) a sample of 46,433 CF bonds – model [11]; ix) a sample of 763 PF bonds – model [12] and x) a sample of 46,433 CF bonds – model [13]. For a definition of the variables, see Appendix D. ***, ** and * indicate that the reported coefficients are significantly different from zero at the 1%, 5% and 10% levels, respectively. The t-statistics reported in

parentheses are based on heteroskedasticity-consistent standard errors. Due to time varying risk premia and cross-country differences, we estimate standard errors clustered by year and country.

We test the sensitivity of our results to the inclusion of fees and we find insignificant relationships between credit spreads and gross spread and credit spread and management fee, for PF bonds. Nevertheless, in line with Pinto et al. (2019) findings, we find gross spread as significantly and positively correlated with CF bond credit spreads. Not in line with their finds, our results show that management fee is instead negatively related with CF bond credit spreads.

Also, from model [4] we can argue that the financial crisis dummy is associated with a highly significant increase in credit spreads for PF bond, while the start of the European sovereign debt crisis has imposed a significant decrease in credit spreads for PF bond. However, the impact of such variables on CF bond credit spreads is insignificant.

We test the sensitivity for the civil law vs common law dummy, and as expected, we find significantly and positively impact with PF bond credit spreads and insignificant impact for CF bond credit spreads. According to La Porta et al. (1998), civil law countries have weaker investors legal protections. Besides, PF deals are more commonly extended to countries with lower GDP per capita and creditor rights. Thus, it suggests that lenders will require higher spreads due to this legal framework.

Regarding log GDP per capita, as expected we find significant negative impact of this variable on credit spread for both PF and CF bond. This can be justified by the fact that banks' lending capacity will ever be affected by differences in the level of economic development and lenders take into account the quality of the institutional environment. Additionally, we find the risk-free rate has an insignificant

relationship with CF bond credit spreads, but a significantly negative relationship with PF bond credit spreads, i.e., the higher the general level of interest rates the lower the credit spread.

5.4 Are the credit spread and pricing determinants of Project Finance bonds and Corporate Finance bonds significantly affected during crisis periods?

The results of statistical analysis, presented in Appendix C, strongly supports the assumption that the average credit spread is significantly higher for PF bonds (281.4 bps versus 232.2 bps) and CF bonds (241.4 bps versus 162.4 bps) during the financial crisis and the subsequent European sovereign debt crisis. Nevertheless, the regression analysis results suggest that both crisis dummies are insignificant for both PF and CF bonds, still they have positive relationship with credit spread. Hence, controlling for micro and other macro variables, we do not find evidence to corroborate H3.

As in Pinto et al. (2019), we also compare the evolution of credit spreads for PF and CF bonds, by considering a pre-crisis period from January 1, 1993 through to September 14, 2008, and a crisis period from September 15, 2008 (the first trading day after Lehman Brothers' bankruptcy filing the day before) through to December 31, 2016 (the subsequent European sovereign debt crisis peaked between 2010 and 2012, nonetheless, in order to study longer effects we consider the period from April 24, 2010 until December 31, 2016) (see Appendix C).

In order to examine the crisis effect on remaining variables, we estimate model [2b] and [3b], exhibited in Table 5, which is the sample of PF and CF bonds issued during the crisis period, respectively. We can note that the coefficient values for

transaction size have even higher negative impact on credit spread during the crisis period, than in regular times. In fact, decreases 63.96 during the crisis compared to 36.81, for PF bonds, and 11.27 during the crisis period compared to 9.02, for CF bonds. This negative transaction size/credit spread relationship is consistent with the results of statistical analysis presented in section 4, which could be a sign that creditors value liquidity even more during the crisis period.

Regarding the impact of the crisis period on the credit spread-maturity relationship, we find now insignificant for PF bonds and significantly positively lower for CF bonds. The reason for this result is still to explain.

As expected, currency risk and callable dummies have significantly higher positive impact on credit spread during the crisis period for both PF and CF bonds. While the collateralized dummy has significantly higher positive impact on PF bond credit spreads and significantly slightly lower positive impact on CF bond credit spreads. The higher impact on PF bond credit spreads could be due to an increase in the country risk, making investors more skeptical about the effectiveness of collateral realization in the event of default and for that penalizing the bonds with such features.

The fixed rate dummy has higher negative impact on PF bond credit spread during the crisis period. Moreover, we can note that creditors right have now significantly negative impact on PF bond credit spreads issued during the crisis period, while for CF bonds issued during the same period is insignificant. In addition, legal enforcement seems to have significantly positive impact for PF bonds and insignificant impact for CF bonds. The negative impact of creditors rights for PF bonds is consistent to what we expected, as investors consider the country host specificities such as governing law, and the legal and institutional frameworks to do

the risk assessment. As higher is the creditor rights index, strong is the creditor rights, therefore implying in lower PF bond credit spreads.

During the crisis period, we find a negative relationship between bank reputation and credit spreads. It suggests that the participation of banks with a higher reputation can reduce information asymmetries (Kara et al., 2016). In addition, as expected, credit spread and the slope of the yield curve become significantly negative related for CF bond credit spreads. As expected, credit spread and market volatility have higher significantly positive relationship. We still find insignificant relationship of bank reputation, yield curve slope and market volatility for PF bond credit spreads.

The volume and number of PF bonds have increased significantly from 2009, same period of the 2007-2008 financial crisis (see Appendix A). According to Kara et al. (2019), during good states of a credit cycle it might be more difficult for investors to assess the true value of information-intensive securities. Thus, it can suggest that in order to avoid information asymmetries and debt overhang problems, firms may choose PF bonds instead of CF bonds.

6. Conclusions

This dissertation compares credit spreads and pricing processes for a sample of PF and CF bonds issued in the 1993-2020 period. Additionally, we examine whether PF and CF bond credit spreads are affected by the 2007/08 financial crisis and the subsequent sovereign debt crisis.

Our findings indicate that credit ratings may be limited in pricing both PF and CF bonds, since the credit spreads seem to incorporate additional information beyond credit ratings in both normal and crises periods. We conclude that PF bonds have, on average, 34.3 bps higher credit spread than CF bonds. This difference increases during the crisis period. We can thus argue that this difference is certainly due to the larger maturities, the fixed rate price, collateral presence, and host country risk, quality of financial, legal, and political institutions and economic indicators. In analyzing the determinants of issuance credit spreads for PF bonds, we show the most important pricing determinants are *credit rating*, *maturity*, *transaction size*, *number of banks*, *fixed rate price*, *collateralized* (backed with a collateral), *civil vs common law* (rule of law), *GDP per capita*, *country risk* and *risk free rate.* During the crisis period, the variables *creditors rights* and *legal enforcement* are also important determinants of PF bond credit spreads. While we show for CF bonds, that the most important pricing determinants are: *credit rating*, *rating discordance, maturity*, *transaction size*, *number of banks*, *subordinated* (seniority), *fixed rate price*, *currency risk, collateralized* (backed with a collateral), *callable* (have a call option), *gross spread, management fee, GDP per capita, country risk, creditors rights and volatility.* During the crisis period, the variables *bank reputation* and *yield curve slope* are also important determinants of CF bond credit spreads.

This thesis presents evidence worth of discussion on the pricing of PF and CF bonds, identifying the most important determinants of credit spreads at issuance. It provides an empirical perspective on PF and CF bonds pricing characteristics and on the dissimilarities between both bond types. In addition, it conveys information regarding the biggest fifteen PF bonds issuances. A further research on the term structure of PF bond credit spreads would be interesting to better understand the relationship between credit spread and maturity for investment-grade bonds and non-investment-grade bonds; i.e., if the impact of maturity on credit spread is

different for investment-grade bonds vis-à-vis non-investment grade bonds, and for different periods. Furthermore, there is also room to study the impact of issuers' characteristics on the pricing of PF bonds.

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Appendix

Appendix A: PF and CF bonds by year

Year	Project Bonds						Corporate Bonds					
	Number of tranches	Number of tranches W/ Spread info.	Total value [$ Million]	Total value [$ Million] W/ Spread info.	Percent of total value	Percent of total value W/ Spread info.	Number of tranches	Number of tranches W/ Spread info.	Total value [$ Million]	Total value [$ Million] W/ Spread info.	Percent of total value	Percent of total value W/ Spread info.
1993	1	1	500	500	0,18	0,18	726	725	130.547	130.087	0,46	46,01
1994	1	1	600	600	0,21	0,21	439	434	75.045	74.648	0,26	26,40
1995	10	7	2.377	2.005	0,84	0,71	615	614	112.218	112.168	0,39	39,67
1996	23	21	5.636	5.276	1,99	1,87	964	905	177.191	176.842	0,62	62,54
1997	38	37	8.594	8.414	3,04	2,98	1437	1.253	230.396	221.498	0,80	78,34
1998	22	20	5.909	5.404	2,09	1,91	1499	1.336	307.236	300.507	1,07	106,28
1999	37	35	11.229	10.729	3,97	3,79	955	900	290.755	272.654	1,01	96,43
2000	35	31	10.768	10.038	3,81	3,55	665	611	241.323	213.783	0,84	75,61
2001	23	23	9.546	9.546	3,38	3,38	1111	1.067	465.130	390.613	1,62	138,15
2002	6	5	1.770	1.570	0,63	0,56	946	936	296.383	285.416	1,03	100,94
2003	24	16	5.335	4.265	1,89	1,51	1435	1.243	393.485	356.887	1,37	126,22
2004	24	19	11.219	7.567	3,97	2,68	2783	1.262	553.505	363.432	1,93	128,54
2005	58	13	11.358	5.813	4,02	2,06	2612	1.027	563.273	330.870	1,97	117,02
2006	37	20	11.621	7.036	4,11	2,49	2777	1.028	797.558	413.130	2,78	146,11
2007	58	28	18.827	10.805	6,66	3,82	2865	1.144	884.710	536.211	3,09	189,64
2008	49	6	6.580	2.990	2,33	1,06	2668	1.052	892.684	508.903	3,11	179,99
2009	232	18	63.539	7.891	22,47	2,79	3949	1.816	1.524.258	950.162	5,32	336,05
2010	192	19	45.336	5.383	16,03	1,90	4163	2.052	1.292.020	865.741	4,51	306,19
2011	207	18	45.278	6.251	16,01	2,21	4501	2.011	1.365.567	825.187	4,76	291,85
2012	53	13	11.003	6.071	3,89	2,15	6606	2.570	2.053.586	1.209.723	7,16	427,85
2013	81	49	36.842	26.817	13,03	9,48	6658	2.524	2.056.347	1.119.044	7,17	395,78
2014	110	43	24.124	14.159	8,53	5,01	7220	3.613	2.167.508	1.284.641	7,56	454,35
2015	175	54	27.238	15.934	9,63	5,64	6628	3.258	2.125.094	1.136.250	7,41	401,86
2016	167	80	46.014	30.397	16,27	10,75	8023	3.110	2.479.552	1.130.272	8,65	399,75
2017	239	95	73.908	38.047	26,14	13,46	8183	3.591	2.428.696	1.300.885	8,47	460,09
2018	134	55	33.526	20.255	11,86	7,16	7470	3.085	2.117.253	1.085.817	7,39	384,03
2019	165	33	31.391	17.084	11,10	6,04	8095	3.092	2.482.539	1.239.545	8,66	438,40
2020	5	3	2.599	1.899	0,92	0,67	336	174	157.614	100.411	0,55	35,51
Total	**2.206**	**763**	**562.666**	**282.746**	**100,00**	**100,00**	**96.329**	**46.433**	**28.661.472**	**16.935.330**	**100,00**	**100,00**

This table presents the number of bonds and total transaction size by year for the complete database of PF and CF bonds, while also present the number of bonds and total transaction size for the full sample with credit spread information, the same sample used on the regressions.

Appendix B: PF and CF bonds summary statistics

Panel A: Continuous variables

Variable of interest	Project Bonds						Corporate bonds					
	Number	Mean	Median	Std. Dev.	Min	Max	Number	Mean	Median	Std. Dev.	Min	Max
Contractual characteristics												
Credit spread (bps)	763	241,0	195,0	180,3	1,2	1.025,0	46.433	206,8	145,7	193,3	-4,8	1.092,0
Rating [1-22 weak]	763	8,5	9,0	3,5	1,0	20,0	46.433	6,7	7,0	5,1	0,0	21,0
Maturity (years)	763	13,7	10,0	9,7	1,5	100,0	46.433	9,6	7,1	8,4	1,0	100,4
Transaction size ($ Million)	763	611,0	450,0	522,0	12,0	3.000,0	46.433	593,0	321,0	704,0	3,2	3.990,0
Tranche size ($ Million)	763	371,0	282,0	332,0	3,8	2.000,0	46.433	365,0	250,0	345,0	0,0	3.800,0
Number of tranches	763	2,0	1,0	1,7	1,0	12,0	46.433	1,6	1,0	1,2	1,0	21,0
Number of banks	763	5,0	4,0	4,3	1	24,0	46.433	5,9	4,0	5,1	0,0	46,0
Bank reputation [1-25 best]	763	18,7	23,0	8,0	1	25,0	46.433	17,8	23,0	9,2	1,0	25,0
Management fee	668	4,2	0,0	16,6	0,0	225,0	46.433	3,2	0,0	12,5	0,0	316,0
Gross spread (bps)	237	86,2	65,0	70,2	0,0	600,0	46.433	73,9	60,0	60,8	0,0	750,0
Macroeconomic factors												
Country risk [1-22 weak]	763	4,0	1,0	4,2	1,0	17,0	46.433	2,7	1	2,9	1,0	21
Risk Free	763	200,0	108,3	204,9	-0,3	634,5	46.433	160,7	94,8	184,2	-1,3	639,0
Log GDP per capita	763	10,1	10,5	1,0	6,0	11,7	46.433	10,3	10,6	0,8	5,9	11,7
Volatility	763	17,6	15,9	6,4	9,4	45,8	46.433	17,8	16,0	7,0	9,1	80,9
USA5y-USA3M (bps)	763	96,5	91,8	65,2	-85,4	284,2	46.433	108,5	105,0	71,8	-86,7	307,5
Creditor rights	763	1,5	1,0	1,1	0,0	4,0	46.433	1,6	1,0	0,9	0,0	4,0
Enforcement	763	66,6	68,7	3,7	34,2	49,3	46.433	70,2	72,0	6,6	32,4	84,1

Panel B: Dummy variables

Variable of interest	Project Bonds			Corporate bonds		
	Number	% of total	Std. Dev.	Number	% of total	Std. Dev.
Rated	763	77,6%	0,42	46.433	73,4%	0,44
Subordinated	763	1,0%	0,10	46.433	3,5%	0,18
Collateralized	763	37,2%	0,48	46.433	7,9%	0,27
Currency risk	763	32,0%	0,47	46.433	21,1%	0,41
Fixed rate	763	82,0%	0,38	46.433	88,2%	0,32
Rating discordance	763	24,4%	0,43	46.433	28,9%	0,45
Callable	763	51,8%	0,50	46.433	48,8%	0,50
Civil vs common law	763	39,3%	0,49	46.433	44,1%	0,50

This table presents the descriptive statistics of PF and CF bonds globally issued during the 1993-2020. Information on the characteristics of bond issuances was obtained from DCM Analytics and Datastream. For a definition of the variables, see Appendix D.

Appendix C: PF and CF bonds summary statistics during pre-crisis and crisis period

Panel A: The impact of the financial crisis on pricing characteristics - continuous variables

Variable of interest	Project Bond				Corporate Bonds			
	Number	Mean	Median	Wilcoxon z-test	Number	Mean	Median	Wilcoxon z-test
Credit spread (bps)								
pre-crisis	283	232,2	195,0	-3,33 ***	15.295	162,4	98,0	-51,70 ***
crisis	294	281,4	225,0		21.196	241,4	175,0	
Rating [1-22 weak]								
pre-crisis	266	8,8	9,0	2,39 **	14.465	8,7	10,0	48,57 ***
crisis	193	8,3	8,0		21.196	5,9	6,0	
Maturity (years)								
pre-crisis	283	13,3	10,0	-1,17	15.295	10,9	250,0	30,72 **
crisis	294	14,7	10,0		21.196	9,1	7,0	
Transaction size ($ million)								
pre-crisis	283	645,0	469,0	0,75	15.295	299,0	200,0	-28,48 ***
crisis	294	568,0	400,0		21.196	664,0	400,0	
Number of tranches								
pre-crisis	283	2,2	2	2,16 **	15.295	1,4	1,0	-17,16 ***
crisis	294	1,9	1,0		21.196	1,6	1,0	
Number of banks								
pre-crisis	283	3,4	3,0	-5,65 ***	15.295	4,4	3,0	-43,54
crisis	294	5,7	4,0		21.196	6,6	5,0	
Country risk [1-22 weak]								
pre-crisis	283	4,5	1,0	1,31	15.295	2,2	1,0	-35,63 ***
crisis	294	3,6	1,0		21.196	2,8	1,0	

Panel B: The impact of the financial crisis on pricing characteristics - dummy variables

Variable of interest	Project Bond				Corporate Bonds			
	Number	Number (d=1)	% of total	Fisher's exact test	Number	Number (d=1)	% of total	Fisher's exact test
Fixed rate								
pre-crisis	283	245	86,6%	0,009 #	15.295	13.956	91,2%	0,000 #
crisis	294	230	78,2%		21.196	18.417	86,9%	
Currency risk								
pre-crisis	283	162	57,2%	0,000 #	15.295	3.604	23,6%	0,000 #
crisis	294	51	17,3%		21.196	4.226	19,9%	
Collateralized								
pre-crisis	283	77	27,2%	0,000 #	15.295	846	5,5%	0,000 #
crisis	294	129	43,9%		21.196	1.753	8,3%	
Subordinated								
pre-crisis	283	5	1,8%	0,278	15.295	1.403	9,2%	0,000 #
crisis	294	1	0,3%		21.196	179	0,8%	
Callable								
pre-crisis	283	133	47,0%	0,244	15.295	7.753	50,7%	0,000 #
crisis	294	153	52,0%		21.196	9.972	47,0%	

This table reports statistics for PF and CF bonds separated into two sub-samples: pre-crisis period (from January 1, 1993 through to September 14, 2008) and crisis period (from September 15, 2008 through to December 31, 2016). We present similar distributions tests using the Wilcoxon rank-sum

test for continuous variables (Panel A) and the Fisher's exact test for discrete ones (Panel B). In Panel A, ***, **, and * indicate significant difference at the 1%, 5%, and 10% levels, respectively. In Panel B, # indicates that there is a statistically significant relationship between the dummy variable and the 2007-2008 financial crisis and subsequent European sovereign debt crisis.

Appendix D: Variable Definitions

Variable name	Variable definition	Source	Expected impact PF bond	Expected impact CF Bond
Dependent variable:				
Credit spread	Margin yielded by the security at issue above a corresponding currency treasury benchmark with a comparable maturity (OAS).	DCM Analytics		
Independent variables:				
Contractual characteristics				
Rated	Dummy equal to 1 if the bond has a credit rating from S&P or Moody's, and 0 otherwise.	DCM Analytics	-	-
Rating	Bond rating based on the S&P and Moody's rating at the time of bond issuance. The rating is converted as follows: AAA=Aaa=1, AA+=Aa1=2, and so on until D=22.	DCM Analytics	+	+
Rating discordance	Dummy equal to 1 if S&P and Moody's assign a different credit rating for the same tranche, and 0 otherwise.	DCM Analytics	+	+
Maturity	Maturity of bonds, in years.	DCM Analytics	NL / -	+
Transaction size	Bond transaction size. Transaction size is converted into Euro millions when necessary.	DCM Analytics	-	-
Subordinated	Dummy equal to 1 for tranches that are subordinated, and 0 otherwise.	DCM Analytics	+	+
Number of tranches	The number of tranches per transaction.	DCM Analytics	-	+
Currency risk	Dummy equal to 1 for bonds that are denominated in a currency different from the currency in the deal's nationality, and 0 otherwise.	DCM Analytics	+	+
Fixed rate	Dummy equal to 1 if a bond is fixed price, and 0 otherwise.	DCM Analytics	+	+
Number of banks	The number of financial institutions participating in bond issuance, as bookrunners, underwriters or servicers.	DCM Analytics	-	-
Bank reputation	Bookrunners rank according to Thomson Reuters League Tables. Ranks range from 1 (worst) to 25 (best).	Thomson Reuters DMI	NL / -	-
Collaterallized	Dummy equal to 1 if a bond is collateralized, and 0 otherwise.	DCM Analytics	+	NA
Management fee	Fees (in bps) that are periodically paid to the bank syndicates.	DCM Analytics	+	+
Gross spread	Gross spread (in bps) per tranche as given by bookrunner	DCM Analytics	+	+
Callable	Dummy equal to 1 if the bond has a call option, and 0 otherwise.	DCM Analytics	+	+
Macroeconomic factors				
Risk free	The yield on a 3-month U.S. Treasury bill at the deal closing date - a proxy for the general level of interest rates	Datastream	-	-
Volatility	The Chicago Board Options Exchange Volatility Index (VIX). VIX reflects a market estimate of future volatility.	Datastream	+	+
EUSA5y-Libor3M	The slope of the U.S. Treasury swap curve. Obtained as the difference between the five-year U.S. Treasury Bond Yield and the 3-month U.S. Treasury bill.	Datastream	-	-
Country risk	Moody's country credit rating at close. The rating is converted as follows: Aaa=1, Aa1=2, and so on until C=22.	Moody's Global Rating	+	+
Financial crisis	Dummy equal to 1 if the issue date belongs to the 2007-2008 financial crisis period (from September 15, 2008 - Lehman Brothers' bankruptcy filing date - through to April 23, 2010), and 0 otherwise.	(Pinto et al., 2019)	+	+
Sovereign crisis	Dummy equal to 1 if the issue date belongs to the European sovereign debt crisis (from April 24, 2010 through to December 31, 2016), and 0 otherwise.	(Pinto et al., 2019)	+	+
Creditor rights	The index ranges from 0 (weak creditor rights) to 4 (strong creditor rights).	LLSV (1998) and Spamann (2010)	-	-
Legal enforcement	The annual score for enforcing contracts, calculated as the simple average of the scores for each of the component indicators: the time and cost for resolving a commercial dispute through a local first-instance court, as well as the quality of judicial processes that promotes quality and efficiency in the court system.	World Bank	-	-
Civil vs common law	Civil law dummy takes the value 1 for civil law countries and the value 0 for common-law countries	LLSV (1998)	+	+
Log GDP per capita	Logarithm of gross national income per capita expressed in USD from World Development Indicators.	World Bank	-	-

The following characters mean: – = negative impact on the credit spread | + = positive impact on the credit spread | NL = Not linear | NA = information about this variable is not available.