



UNIVERSIDADE CATÓLICA PORTUGUESA

Pricing and Choice of Project Finance Bonds

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Católica Porto Business School
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By,

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Abstract

This dissertation examines the pricing of project finance (PF) *vis-à-vis* corporate finance (CF) bonds and studies the factors that influence the sponsors'/issuers' choice between off-balance sheet PF bonds and on-balance sheet CF bonds.

Using a cross-section sample of 763 PF and 46,433 similar CF bonds globally issued between January 1993 and January 2020, we compare credit spreads and pricing factors of the both bond types and analyse their pricing determinants. Findings suggest that, although credit ratings are the most important pricing determinants for both PF and CF bonds at issuance, investors also rely on borrowers' characteristics as well as on contractual and macroeconomic factors beyond these ratings. The results show that credit spreads for PF and CF bonds are influenced differently by common pricing characteristics. Additionally, we find that PF bonds have, on average, 30.85 bps higher credit spreads than CF bonds. This difference decreases to 19.15 bps when we include sponsors'/issuers' characteristics in the pricing analysis.

Publicly traded firms that prefer PF to CF are smaller, less profitable, less creditworthy and have lower asset tangibility. Finally, our results also document that issuers use PF to raise relatively larger amounts of debt and seek long-term funding.

Keywords: project finance bonds, credit spreads, corporate bonds, debt financing choice.

Resumo

Este trabalho compara o *pricing* de obrigações emitidas em operações de *project finance* (PF) face a operações de *corporate finance* (CF), assim como analisa os fatores que influenciam a escolha do promotor/emitente entre estas duas tipologias de financiamento por dívida.

Usando uma amostra de 763 obrigações de PF e 46.433 obrigações comparáveis de CF, emitidas globalmente entre Janeiro de 1993 e Janeiro de 2020, comparam-se os spreads de crédito, e os seus determinantes, entre obrigações emitidas em PF (*off-balance sheet*) e obrigações emitidas diretamente (*on-balance sheet*) pelas empresas (CF). Concluiu-se que, embora os ratings sejam o determinante mais importante dos spreads, estes também dependem das características dos promotores/emitentes e, ainda, de características contratuais e macroeconómicas. Os resultados demonstram que as variáveis determinantes dos preços das obrigações influenciam de forma diferente o spread das obrigações de PF *versus* CF. Conclui-se ainda que as obrigações de PF são emitidas com um spread significativamente superior às obrigações de CF, em média 30,85 bps. Esta diferença diminui para 19,15 bps quando são adicionadas as características dos promotores/emitentes às regressões. Com isto, pode-se afirmar que o financiamento através da emissão de obrigações em PF é mais dispendioso do que o financiamento semelhante diretamente pelos promotores destas operações.

As empresas que optam por PF em detrimento de CF são de menor dimensão, menos rentáveis e apresentam maior risco de crédito e menor tangibilidade dos seus ativos. Os resultados demonstram ainda que as empresas utilizam o regime de PF para captarem elevados montantes de dívida e com maturidades mais longas.

Palavras-chave: project finance bonds, spreads de crédito, corporate bonds, escolha de financiamento por dívida

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1. Introduction

Long-term investment is a fundamental driver for a sustainable growth, employment and financial stability of any nation. Project finance (hereafter PF) has emerged as a leading way to finance long-term and large-scale infrastructure projects around the world over the last 40 years (Garcia-bernabeu and Mayor-vitoria, 2015).

The 2008 financial crisis has resulted in stricter regulation standards on banks and their lending requirements. Traditionally, PF agreements are financed by syndicated loans (Esty and Megginson, 2003). However, Basel III required more rigorous monitoring and disclosures, leading to higher funding costs. To mitigate the effect of these additional costs in projects internal rates of return, sponsors started to look for the bond market as an alternative way of funding their projects.

The mix of debt and equity funding sources has changed during the last years as the capital market for project bonds has grown (Scannella, 2012). Through the PF bond market, institutional investors have the opportunity to participate in infrastructure projects through securities offering higher returns (Dailami and Hauswald, 2007). Esty and Sesia (2007) report that a record \$328 billion in PF funding was globally arranged in 2006, a 51.2% increase from the \$217 billion reported for 2001. More recently, 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.

PF is an economically significant growing financial market segment, but still largely understudied, especially regarding PF bonds. Although the extant empirical literature presents several studies about PF transactions and the

pricing of PF loans (Dailami and Leipziger, 1998; Pollio, 1998; Kleimeier and Megginson, 2000; Esty, 2003; Dailami and Hauswald, 2003; Corielli *et al.*, 2010; Gatti *et al.*, 2013; Pinto and Alves, 2016), the literature focusing on PF bonds is scant. To the best of our knowledge, there are only two empirical studies on project bonds pricing: Dailami and Hauswald (2003) study a sample of emerging market bonds and show that, on average, PF are issued at 300 bps above U.S. Treasury securities and that maturity and credit rating are the most significant determinants of PF bond spreads; Navi (2020) examines the credit spreads and pricing processes of PF and CF and find that, on average, PF bonds have 34.3 bps higher spreads than CF bonds and that, although credit ratings are the most important pricing factors, investors rely on other contractual and macroeconomic characteristics beyond these ratings. We extend this literature by presenting a detailed analysis of the PF bond market in terms of its size, industrial, country distribution and contractual and borrowers' characteristics. We also contribute to the extant literature by investigating the impact of sponsors' (for PF bonds) and issuers' (for CF bonds) characteristics on bond pricing.

Additionally, there are just a few works that empirically investigate the determinants of structured finance¹ transactions usage by nonfinancial firms (Kleimeier and Megginson, 2000; Mills *et al.*, 2005; Hainz and Kleimeier, 2012; Subramanian and Tung, 2016; Pinto and Santos, 2019; Pinto and Alves, 2020). As far as we know, only Pinto and Alves (2020) examine sponsoring firms' characteristics that determine the choice of PF *vis-à-vis* CF for a sample of syndicated loans. We extend Pinto and Alves (2020) work by presenting a

¹ Structured finance (SF) is an off-balance-sheet contractual arrangement designed to fund a sole project or a specific group of assets, within a special purpose vehicle (SPV) incorporated to serve as a separate contracting entity for the transaction parties. SF includes project finance, asset securitization, structured leases, and leveraged corporate acquisition activities. See Caselli and Gatti (2005), Esty (2004b), Leland (2007), Corielli *et al.* (2010), Fabozzi *et al.* (2016).

detailed analysis of the factors that determine the choice between on-balance sheet financing, via CF bonds, and off-balance sheet financing, via PF bonds.

This paper aims to analyse the pricing of PF bonds and compare with that of CF bonds, examining whether the pricing of both types of bonds is determined by the same factors. Therefore, we analyse a sample of 763 PF bonds and 46,433 similar CF bonds, issued between January 1993 and January 2020. Additionally, to study the impact of firms' characteristics on bond pricing and debt choice, we extract information from Datastream about 2,133 publicly traded firms located in OECD countries that closed bond deals in the same period. As bond data extracted from DCM Analytics do not provide firms' identification codes, we hand-matched contractual data extracted from DCM Analytics and firms' characteristics drawn from Datastream.

We began our analysis examining the contractual characteristics of both PF and CF bonds and we find that PF bonds are issued, on average, with 30.85 bps higher credit spreads than CF bonds. When we add the sponsors'/issuers' characteristics to the pricing analysis, the difference in credit spreads decreases to 19.15 bps. Our findings suggest that although credit ratings are the most important pricing determinant for both PF and CF bonds at issuance, investors also rely on sponsors'/issuers' accounting and financial characteristics, as well as on contractual and macroeconomic factors beyond these ratings. Regarding the sponsors' characteristics, we find strong evidence that for PF bonds, investors only rely on borrowers' default risk, measured by the sponsoring firm's z-score, and that the spread depends mainly on the assets and cash flows promised as collateral and not in other characteristics of the issuer.

To examine the firms' choice between PF and CF bonds, we implemented a deal-level analysis. Using a sample of 516 PF deals and 36,035 CF deals, we find strong evidence that PF mitigates the deadweight costs of asymmetric information frictions. Borrowers that choose project financing over CF are

relatively smaller, have lower asset tangibility and seek long-term financing. We also find that less profitable firms are more likely to use PF and that this funding method is mostly use for larger debt issuances because of the potential economies of scale in relation to issuance costs. Results show that PF bond sponsors have higher credit risk.

This work is organized as follows. Chapter 2 reviews extant literature on the determinants of PF loan and CF bond spreads and discusses theoretical and empirical backgrounds regarding the choice of PF. Chapter 3 presents the research questions. Chapter 4 describes the methodology, sample selection and variables used. Empirical results about the pricing of both bond types are presented in Chapter 5. Chapter 6 examines the determinants of sponsoring firms' debt choices. Finally, Chapter 7 concludes the study.

2. Literature review

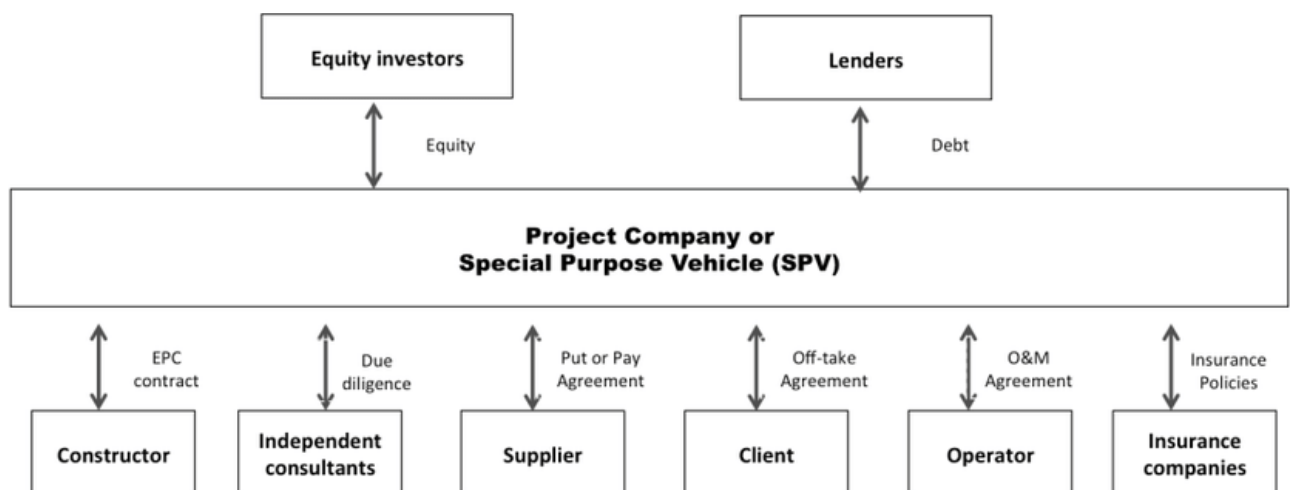
2.1 What is Project Finance?

Project Finance (PF) is a financing mechanism that involves the creation of a legally independent project company from one or more sponsoring firms (Esty, 2004b). The sponsor provides equity and management for that special purpose company (SPC or SPV) that raises non-recourse debt for the purpose of investing in a capital asset. The project's cash flows are the source of funds from which the debt will be repaid and only project's assets serve as collateral for the loans provided. The assets and the cash flows of the project are segregated for financial purposes from its sponsors in order to obtain better credit appraisal. The project lenders must rely exclusively on the ability of the project for repayment of project-related obligations and have limited or no recourse to the sponsor's cash flows and assets. Thus, PF allows the separation of project credit risk from those of its sponsor, so that creditors, investors and other parties evaluate the project strictly on their own economic merits (Shah and Thakor, 1987; John and John, 1991; Esty, 2004b; Brealey *et al.*, 1996).

The SPV is a standalone company created for the unique purpose of investing in an individual project with a limited life. Project companies are characterised by a concentrated equity and debt ownership. Typically, they are composed of one to three sponsors who provide equity capital, though the majority of financing is provided through debt (Esty, 2004b). According to Esty (2003), the primarily type of debt is in form of syndicated bank loans. Project debt is non-resource for the sponsors so that project's assets serve as collateral in case of bankruptcy (James, 2008). In fact, Esty (2004b) points out that SPVs have highly leveraged capital structures: the average project company has a debt-to-capital ratio of 70%, compared to 35% for public companies.

Figure 1 illustrates the basic structure of a PF transaction. PF requires an extensive set of contractual agreements between the SPV and its creditors, suppliers, operators and off-takers. A typical project can evolve 15 or more parties through 40 or more contracts. For that reason project finance is also referred as “contract finance” (Esty, 2004b; Corielli *et al.*, 2010). This contractual structure is designed to determine the operation's management and assign the main risks of the projects to the party that is best able to access and manage that risk (Yescombe, 2007). In this way, Pinto and Alves (2020) argue that, the risks between borrowers and creditors that may arise from the combination of large idiosyncratic investments are reduced, as well as information asymmetries and agency problems among all parties involved.

Figure 1: Basic Structure for Project Finance: Participants and Agreements



Source: Garcia-Bernabeu *et al.* (2015).

The creation of an independent company for a specific project allows sponsors to finance large projects off-balance sheet. In this way, the risk is transferred to the SPV and project's impact on cost of the shareholders' existing debt and its debt capacity is considerably less. SPV creates value by minimizing the deadweight costs in case of a bankruptcy (Gorton and Souleles, 2005). Ayotte and Gaon (2011) also demonstrate that separation of SPV creditors from

the sponsoring firm can limit expropriation in bankruptcy. However, in case of losses, sponsors will carry them ahead of debt holders as distributions to equity holders are always subordinated to debt repayments.

From the creditor's perspective, a key difference between conventional financing and project financing is that the creditor's evaluation of the project is linked only to the project's cash flow generation capacity (Shah and Thakor, 1987). Project cash flows are the only basis for repaying debt (Gatti, 2008), so lenders must base their assessment on the financial impact that each specific risk can have on the project's ability to generate positive cash flows. In addition to carrying out a detailed due diligence and risk valuation, it is common for creditors to require some pre-requisites for accessing debt, as a significant capital investment or the establishment of covenants related to minimum coverage ratios (Yescombe, 2007). The main type of debt is provided through syndicated bank loans. Debt ownership is thus concentrated in lending banks, creating incentives for the constant evaluation and monitoring of the project. Brealey *et al.* (1996) argue that when the construction phase is completed and the project is in operation, there is less incentive for creditors to monitor it and the bond market can be used to replace existing debt.

To ensure debt repayment, a contractual payment schedule and a debt payment reserve account are used to accumulate funds to pay the principal instalment and interest of each period, are established. Thus, the credit risk is reduced, allowing loans to be obtained with low credit spreads (Yescombe, 2007).

Pinto and Alves (2016) show that PF deals are concentrated in five key industries. Utilities, Construction, Manufacturing, Mining and Transportation account for 77.3% of all PF lending (value) and 71.0% of all PF deals. Kleimeier and Megginson (2000) and Corielli *et al.* (2010) also present similar results. Kleimeier and Megginson (2000) found that 90.9% of a sample of 4.956 PF loans from January 1, 1980 to March 23, 1999, is made to borrowers in the

Commercial and Industrial, Utilities and Transportation industries. Corielli *et al.* (2010) based on a sample of PF loans closed between January 1998 and May 2003, show that 52% of the total loans value was awarded to electricity/power and other energy utilities, followed by telecommunications with a weight of 28% and transportation with 14% of the total value. These findings corroborate the common understanding that PF is used primarily to fund tangible-asset-rich and capital-intensive projects.

2.2 Why firms choose Project Finance?

Extant literature suggests several reasons for firms choosing PF instead of a conventional on-balance sheet financing.

Esty (2003, 2004a,b) presents four primary reasons for using PF. Firstly, PF can be used to mitigate agency conflicts inside project companies and capital providers - agency cost motivation. Problems between ownership and control and owners and related parties can be reduced through this type of transactions (John and John, 1991; An and Cheung, 2010; Berkovitch and Kim, 1990). Secondly, PF can improve risk management- risk management motivation. The large number of contracts that involve PF are structured in such a way that the project risks are allocated to the parties that are most capable of evaluating and managing them (Brealey *et al.*, 1996; Corielli *et al.*, 2010). PF also mitigates underinvestment problems that may exist due to distress costs and managerial risk aversion (Stulz, 1984). Thirdly, PF can be used to mitigate underinvestment due to information asymmetries - asymmetric information motivation. Shah and Thakor (1987) argue that the reduction of information search cost is the main benefit of PF, Fourthly, PF transactions allow companies with little debt capacity to avoid the opportunity cost of under investment in positive NPV projects - debt overhang motivation (Myers, 1977). Off-balance sheet financing has limited impact on sponsor's creditworthiness and does not impact their

ability to incur in additional debt in the future (John and John, 1991; Nevitt and Fabozzi, 2001; Fabozzi, Davis, and Choudhry, 2016). Additionally, Leland (2007) argues that the nonrecourse debt provides to the sponsor a valuable option of walking away in case the project does not generate expected cash flows.

Shah and Thakor (1987), John and John (1991), Chemmanur and John (1996), Nevitt and Fabozzi (2001), Kensinger and Martin (1988), Byoun, Kim, and Yoo (2013), among others, study the advantages and disadvantages that PF have in firm's capital structure. Shah and Thakor (1987) present cost reduction as the main benefit of PF and argue that it allows higher optimal leverage than conventional financing, increasing the value of some of the sponsoring firm's projects. John and John (1991) point out that the value of interest tax shields can be increased through PF, when compared with corporate debt financing. In this sense, Chemmanur and John (1996) show that the SPV's leverage depends on the level of control benefits of the project compared with the sponsor. According to Nevitt and Fabozzi (2001), the segregation of the financing operations allows the maintenance of sponsoring firms' financial flexibility, as well as limiting the risk of contamination. Lastly, Kensinger and Martin (1988) show that riskier projects should be project-financed to reduce signalling costs.

Despite the advantages described above, there is evidence in the literature showing that PF techniques can convey some disadvantages. PF deal is expensive to structure and it is highly restrictive once in place (Esty, 2004a). It evolves complex transactions in terms of designing the transaction, writing the required documentations and implementing adequate due diligence. Additionally, the negotiation of financing and operating agreements is very time-consuming. According to Gatti (2008), compared to corporate financing, PF is more costly.

Furthermore, Pinto and Alves (2020) point it out that a PF transaction can increase the risk of existing on-balance sheet creditors. The structuring of a PF

transaction involves the segregation of a subset of assets from the sponsoring firm and the transfer to a remote bankruptcy company, the SPV, preventing the sponsor's creditors from having access to the project's cash flows. In this way, the risk perception of existing creditors may increase if the sponsor chooses to fund the projects with the highest NPV through PF. However, Esty (2004b) and Bonetti *et al.* (2010) argue that in practice, these additional costs are more than compensated by the advantages that arise from the reduction in the net financing costs, off-balance sheet financing, and appropriate risk allocation when PF is compared to CF.

In addition to the advantages and disadvantages above mentioned, literature also presents other factors that influence the choice of off-balance sheet financing. Hainz and Kleimeier (2012), through a sample of non-U.S. borrowers, found evidence that political risk and credit rights are positively correlated with the use of PF. They argue that there is a negative relationship between the industry's leverage ratio and the use of PF. Subramanian and Tung (2016) conducted a similar study showing that PF is more likely in countries with weaker laws and weaker creditor rights.

Recently, Pinto and Alves (2020) analysed the factors that influence public firms' choice between PF and CF. Using a sample of syndicated deals in OECD countries, this study shows that borrowers' characteristics, contractual characteristics and macroeconomic factors affect the choice between PF and CF. They found evidence supporting the hypothesis that PF is used as a mechanism that facilitates the reduction of the deadweight costs from asymmetric information problem. Additionally, they argue that companies that use PF are less profitable than comparable companies and that transaction cost considerations lead companies, that employ project finance and corporate finance (called switchers), to choose PF for new debt. Despite their findings show that PF deals do not reduce the cost of borrowing compared to CF, it is possible to conclude that public firms choose PF for relatively large amounts of

debt to economize on scale, and switchers in the utilities industry with high agency costs of debt are more likely to choose PF rather than CF (Pinto and Alves, 2020).

2.3 Project Finance credit spreads

The existing theoretical literature presents the reduction in net financing costs as a motivation for the use of PF. According to Esty (2003, 2004b), PF syndicated debt structures reduce funding costs by mitigating deadweight costs of market imperfections and frictions, namely agency and asymmetric information problems. PF contractual structure provides a framework for the asset collateralization and the stipulation of covenants reducing the expected default costs (Smith and Warner, 1979; John and John, 1991). Corielli *et al.* (2010) also argue that PF can reduce the sponsor's cost of debt due to the segregation of some assets from their balance sheet. Kleimeier and Megginson (2000) showed empirically that PF loans have lower spreads than syndicated non-PF loans. Their findings support the argumentation that PF transactions reduce the default risk and agency problems and, therefore, the cost of funding.

However, Lewellen (1971) and Pollio (1998) argue that PF deals are more costly than conventional forms of debt. According to Lewellen (1971), PF credit spreads can be 50 to 400bp (basis points) higher, since in PF operations creditors cannot rely on the cross-collateralized cash flows and assets as in corporate financing. Pollio (1998), based on a sample of 330 projects in which 123 were financed through PF transactions and 207 by CF, shows that the average loan spread in PF is 101bps, which is 32bps higher than the average for conventional loans. Pinto and Alves (2020) point it out four main aspects that can explain the higher costs for PF transaction compared to CF, (i) legal, financial, insurance, accounting and fiscal, engineering and environmental advisory fees (Yescombe, 2002; Caselli and Gatti, 2005; Esty and Kane, 2010); (ii) time consumption and

structuring costs involved in a very extensive, detailed and complex contract framework (Fabozzi *et al.*, 2016; Gatti, *et al.*, 2013); (iii) higher credit risk due to greater SPV leverage (Esty, 2004a; Esty and Kane, 2010); and (iv) operational complexity (An and Cheung, 2010).

Several studies were also carried out on the factors that influence PF loan pricing. Dailami and Leipziger (1998) argue that the spread depends on the lender's perspective of the overall risk of the project and that the existence of guarantees and the country risk level are also important factors. Through a sample of foreign currency loans for large projects, they conclude that lenders require higher credit spreads in countries with higher inflation. Pollio (1998) finds evidence that spread is positively related with country risk and negatively related with the existence of guarantees and currency risk. In this sense, Kleimeier and Megginson (2000) show that average PF loans come from countries with higher political and economic risks, and that PF is significantly related with country risk, the existence of covenants and the level of project's leverage.

Pinto and Alves (2016) examine the factors that influence PF and CF loan spreads. Based on a sample of 210,273 syndicated loans closed between 2000 and 2014, they find that PF and Non-PF loans are influenced differently by common pricing characteristics and that PF loans in the U.S. and Western Europe (W.E.) are priced in segmented markets. Testing the effect of eleven contractual characteristics and five macroeconomic factors they show that the deal size is significant and negative related with spreads for PF loans in both regions. Contrary to Dailami and Leipziger (1998) and Kleimeier and Megginson (2000), that argue that loan maturity does not impact PF loan spreads, Pinto and Alves (2016) found evidence of a negative impact of maturity on PF loan spreads.

The number of banks involved has a significant and negative impact on the spread of PF loans extended to U.S. borrowers, but it is insignificant when loans

are arranged for W.E. borrowers. A larger number of banks involved may lower the spread because this can be associated with an increase in the certification of the transaction and thus mean that a higher number of banks will share default risk (Pinto and Alves, 2016). The banks' reputation also influences the credit spread. Corielli *et al.* (2010) and Gatti *et al.* (2013) show that the certification of a prestigious lead arranging bank lowers the spread of PF loans comparing with loans granted by less prestigious banks.

Regarding the loan size, Pinto and Alves (2016) show that an increase in the weight of the tranche size to the transaction size will increase the required spread for PF loans extended to W.E. borrowers. The authors also found evidence that spread and fixed rate are significantly positively related for PF loans in the U.S..

Regarding macroeconomic variables, although Blanc-Brude and Strange (2007) found an insignificant relationship between the risk-free rate and the pricing of PF tranches for a sample of U.S and U.K. Public-Private Partnerships, Pinto and Alves (2016) show that the risk free rate is significantly and negatively related to PF loan spreads closed by W.E borrowers. Sorge and Gadanez (2008) and Hu and Cantor (2006) show a significant and positive relation between PF loan spreads and the yield curve slope. Finally, Pinto and Alves (2016) demonstrated that in higher market volatility scenarios there is a higher demand for syndicated loans *vis-à-vis* other debt alternatives, finding a significant negative relationship between market volatility and the spread for PF loans.

2.4 Project Finance Bonds

PF bonds are securities issued by private (or public-private) project companies to finance a specific project. Issuing project bonds would expand the investor base, from bank loans to a border capital market. Project bonds may be

public issues (placed with bond investors through the stock exchange) or private placement (placed with a limited number of bond investors). Bond-based financing model aims mainly at the non-banking market and takes the form of a tradable financial instrument (Scannella, 2012).

As discussed before, the project company raises debt without recourse (or with limited recourse) to the sponsors. The cash flows generated by the project will be used to pay off coupons and principal amortization. Thus, bondholders must rely exclusively on the ability of the project for repayment of project-related obligations.

PF bonds are mostly used to finance major projects and infrastructures from their early stages. These types of projects are known as Green Field projects and the bond issuance process is subject to several procedures, including: (i) the setting-up of an SPV; (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).

A typical PF is mainly financed by debt. Banks provide 2/3 of the debt and the rest is financed through bonds or multilateral development agencies (Scannella, 2012). In PF, among the advantages of PF bonds over bank loans is the fact that bonds generally offer longer maturities and are issued with fixed coupon payment, allowing a wide range of participants to invest in the project. Additionally, according to Scannella (2012), in some markets it is possible to issue bonds with the interest rate linked to the inflation rate, if the project's revenues are linked to inflation. However, PF bonds present higher transaction costs, higher disclosure requirements and, if the project gets into difficulties, negotiations with banks could be kept confidential, while negotiations with bondholders may be publicized and less flexible (Scannella, 2012). Furthermore, bond-based financing methods require at least one or two credit ratings,

depending on the type of project and the volume of funds required. Moreover, bonds are typically issued without a call option, which makes impossible to amortize the principal before the bond maturity date (Rossi *et al.*, 2015).

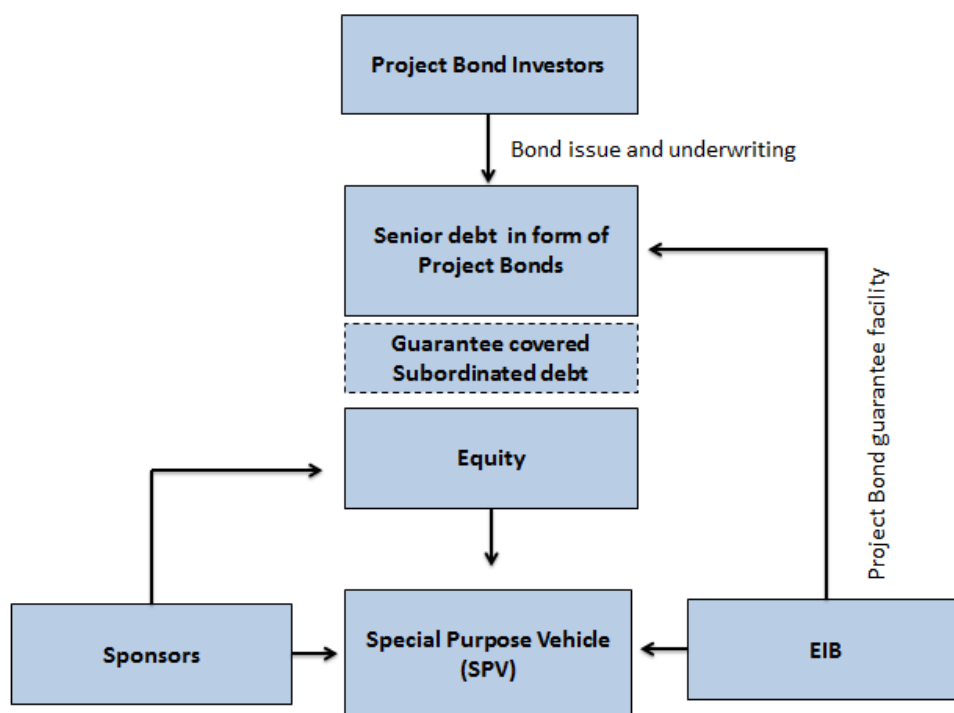
The main difference between PF and CF bonds is related to the guarantees provided to bond holders in case of default. In a PF, the bond is issued for the purpose of financing a single capital investment project, whose cash flows are the only source for meeting financial obligations. In the case of CF, the security is typically issued against the firm's general creditworthiness and the underlying assets consist of multiple sources of cash flows (Dailami and Hauswald, 2003). In PF bond market, as the project's cash flows are the unique source to meet debt obligations, if the project fails and the single source of cash flow ceases, the SPV experiences a liquidity crisis that might force it to default on its bonds. PF bond's investors are, therefore, very cash-flow oriented and demand much more careful analysis of factors that determine the underlying economics of the project and the issuer's economic and legal structures (Dailami and Hauswald, 2003).

The project bond market is highly concentrated in the U.S., accounting for more than half of the global issuance of project bonds (Scannella, 2012). To enhance this alternative financing mechanism in Europe, the European Union (EU) and the European Investment Bank (EIB) promoted the Europe 2020 Project Bond Initiative (PBI). This program aims to use European funds for credit enhancement to increase the appetite of institutional investors – such as pension funds and insurance companies – to boost large-scale infrastructure financing (Vassallo *et al.*, 2018). This program consists of injecting funds into the projects, protecting it from credit risk and increasing its creditworthiness. Thus, the purpose was to improve access to financing for SPVs by providing them with PF bond issuance capacity (Rossi *et al.*, 2015).

The 2020 PBI was launched based on the fact that the EU, through the EIB, may provide either a layer of subordinated debt or a stand-by liquidity facility

to projects to reduce the exposure to the project risk by senior lenders (Vassallo *et al.*, 2018). The subordinated debt layer will reduce the portion of senior debt, but if the cash flows generated by the project are still not sufficient to repay the senior debt, the stand-by liquidity mechanism will provide funds for that purpose. The European Commission guarantees these two funding mechanisms up to a certain level. As presented in figure 2, the SPV would divide its debt into two layers: a senior debt, to be placed with institutional investors; and a subordinated debt obligation, which would be underwritten by the EIB (Vassallo *et al.*, 2018). During this process, the EIB evaluates and selects projects according to its own metrics, structures the financing instruments and monitors the projects.

Figure 2: EU Project Bonds structure



Source: adapted from Vassallo *et al.* (2018).

There are only two studies related to ours. Dailami and Hauswald (2003), based on a sample of 105 bonds, issued between January 1993 and March 2002

with the purpose of finance infrastructure projects in development countries, analysed the pricing determinants of PF bonds. They show that, on average, PF are issued at 300 bps above U.S. Treasury securities and that maturity and credit rating are the most significant determinants of PF bond spreads. They also show that legal and regulatory obstacles have relevant and positive impact on spread and that investors take into consideration not only the contractual features of the project, but also the quality of the institutional environment and.

More recently, Navi (2020) through a sample of 763 PF and 46,433 comparable CF bonds issued between 1993 and 2020, compares credit spreads and pricing processes of PF and CF to analyse the main differences in terms of pricing determinants. The author shows that, on average, PF bonds have 34.3 bps higher spreads than CF bonds and that, although credit ratings are the most important pricing factors, investors rely on other contractual and macroeconomic characteristics beyond these ratings. PF bonds and CF bonds are priced differently by common pricing factors and, for PF bonds, the most important pricing determinants are credit rating, maturity, transaction size, number of banks, interest rate type, if the bond is collateralized, rule of law, GDP per capita, country risk and the level of interest rates.

2.5 Corporate Finance Bonds

CF bonds are debt instruments issued by corporations, governments or public institutions to finance investment in fixed assets, restructure debt or to fund working capital (Laroza, 2015) . The issuer (also called the debtor or borrower) must have to repay the amount borrowed (the principal) plus interests over a specified period. A typical (“plain vanilla”) bond specifies a fixed date when the principal is due and the contractual coupon rate and the amount of interest, which can be paid quarterly, semi-annually or annually (Fabozzi, 2007).

In this sense, companies issue bonds to raise capital to finance their activities. CF bonds offer great financial flexibility as they can be design according to the characteristics that fit with issuer's funding requirements and are not necessarily backed by specific guarantees (Duffie, 1998).

According to Pinto and Santos (2019), the credit spread of CF bonds can be defined as "the margin yielded by the security at issue above a corresponding currency treasury benchmark with a comparable maturity (option adjusted spread)". The treasury yield curve is used as a reference due to the riskiness and liquidity of this type of securities.

Virtually all of the empirical studies on straight bond spreads found credit ratings to be one of its most important determinants (Collin-Dufresne and Goldstein, 2001; Elton *et al.*, 2001; Hull *et al.*, 2004; Gabbi and Sironi, 2005; Longstaff *et al.*, 2005). Researchers also found other factors to be important, like maturity (Fons, 1987; Sarig and Warga, 1989; Helwege and Turner, 1999), liquidity (Longstaff *et al.*, 2005; Chen *et al.*, 2007), systematic risk (Elton *et al.*, 2001; Collin-Dufresne *et al.*, 2001; Longstaff *et al.*, 2005), incomplete accounting information (Flannery *et al.*, 2012), leverage (Flannery *et al.*, 2012), and taxes (Elton *et al.*, 2001). According to Campbell and Taksler (2003) and Krishnan *et al.* (2005), market variables like the level of interest rates, the slope of the yield curve and market volatility, also have a significant impact on straight bond spreads. Focusing on bank bonds, Zaghini (2014) show that credit rating, government guarantees, sovereign credit risk, and the systemic relevance of issuing institutions affect significantly their spreads.

Extant literature also points out additional spread determinants. Elton *et al.* (2001) argue that, although rating is the most important determinant, characteristics such as coupon rate, time for issuance, trading volume and face value also convey information about CF bond spreads. Gabbi and Sironi (2005) found that CF bonds' expected tax treatment, represented by coupon, has a positive impact on spreads. Duffie and Lando (2001) argue that after issuance,

bondholders are not kept fully informed about the firm. Incomplete information has significant implications for the level and shape of the term structure of secondary-market yield spreads, that is related to the excess over risk-free rates at which CF bonds prices are quoted in public market (Duffie and Lando, 2001).

Pinto and Marques (2020), using a sample of 24,525 European CF bonds issued by financial and non-financial firms over 2000 to 2016, also show evidence that, besides credit rating being the main determinant of CF bond spread, investors rely on other aspects such as maturity, transaction size, bank reputation, number of banks involved, country risk, legal enforcement and market volatility. The level of interest rates and the yield curve slope are also important determinants (Campbell and Taksler, 2003). In addition, the inclusion of call, put and conversion options also affect CF bond spreads (Navi, 2020).

Sargent (1979) studies the rational expectation theory and argues that the decisions made by firms are not irrational decisions because of the availability of perfect information, and thus, firm specific factors could influence changes in corporate credit spreads. Thus, factors such firms' credit and financial risk, size, level of debt and profitability are also important determinants of CF bonds credit spreads (see also Fisher, 1959; Fama and French, 1993; Esho, Lam, and Sharpe, 2001; Denis and Mihov, 2003; Flannery, Nikolova, and Ôztekin, 2012; Bai and Wu, 2016).

3. Research question and hypotheses

Extant empirical literature on CF bond pricing presents credit rating as the most significant determinant of credit spreads at issuance (Collin-Dufresne and Goldstein, 2001; Elton *et al.*, 2001; Hull *et al.*, 2004; Gabbi and Sironi, 2005; Longstaff *et al.*, 2005). However, other pricing factors like transaction size,

number of banks involved, bank reputation, country risk, tax premium, legal enforcement, and market volatility also affect credit spreads (Elton *et al.*, 2001; Duffie and Lando, 2001; Campbell and Taksler, 2003; Gabbi and Sironi, 2005; Krishnan *et al.*, 2005; Pinto and Marques, 2020). Additionally, firms' characteristics such as size, credit risk, profitability and leverage are also important determinants of CF bond spreads (Elton *et al.*, 2001; Collin-Dufresne *et al.*, 2001; Longstaff *et al.*, 2005; Flannery *et al.*, 2012) . As PF bonds have different characteristics than CF bonds, we expect that the common determinants of CF bond affect differently PF bond credit spreads. Contrary to the straight bonds, where the spread depends essentially on the issuing firm's characteristics, the spread of PF bonds depend, instead, on the project cash flows and on the credit enhancement mechanisms used (Liu *et al.*, 2006; Pinto and Marques, 2020).

We intend to extend Dailami and Hauswald's (2003) and Navi's (2020) works by including in our analysis sponsors' (for PF bonds) and issuers' (for CF bonds) accounting and financial characteristics. Liu *et al.* (2006) and Pinto and Marques (2020) argue that structured finance security credit spreads depend mainly on the assets and cash flows promised as collateral, and on the credit improvement mechanisms used. Due to the non-recourse characteristic of PF debt, PF bond spreads depend essentially on the project creditworthiness and not on the sponsors' accounting and financial characteristics (Fabozzi and Vink, 2012). This leads us to hypothesize:

Hypothesis 1 [H1]: 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.

Regarding the credit spreads, Kleimeier and Megginson (2000) showed empirically that PF loans have lower spreads than syndicated non-PF loans. PF

transactions can reduce the sponsor's cost of debt, due to the segregation of some assets from their balance sheet (Corielli *et al.*, 2010) and also the default risk associated (Kleimeier and Megginson, 2000). Under this framework, we propose:

Hypothesis 2 [H2]: PF bonds are issued with lower credit spreads than similarly rated CF bonds. Therefore, PF transactions allow the reduction of sponsors' cost of borrowing when compared with CF transactions.

However, some researches such as Lewellen (1971), Pollio (1998) and Pinto and Alves (2020) found evidence that PF is more costly than CF. These arguments lead us to propose the opposite of what H2 predicts:

Hypothesis 3 [H3]: PF bonds are issued with higher credit spreads than similarly rated CF bonds. Therefore, PF transactions do not allow the reduction of sponsors' cost of borrowing when compared with CF transactions.

Based on extant literature, the choice between off-balance-sheet financing and on-balance-sheet financing is mostly affected by: i) asymmetric information problems (Leland and Pyle, 1977; Stiglitz and Weiss, 1981) – according to Myers and Majluf (1984) firms with high deadweight costs of asymmetric information are more prone to underinvestment; ii) agency costs - higher leverage creates incentives to risk shifting, claim dilution and sub-optimal investment, thereby increasing conflicts of interest between shareholders and creditors (Jensen and Meckling, 1976); iii) issuance costs - according to Blackwell and Kidwell (1988), larger debt issues can result in economies of scale in relation to issuance costs; iv) cost of funding - firms will always look for the least expensive funding alternative to finance their activities, and; v) firm's profitability – profitable

firms are more likely to use public debt to signal managerial prospects of future earnings (Denis and Mihov, 2003).

PF structure can help to reduce asymmetric information because the separation of projects from the sponsoring firms facilitates initial credit decisions (Corielli *et al.*, 2010). In addition, the extensive and detailed networks of contracts between the parties involved increase the amount of information disclosed to creditors (John and John, 1991; Gatti *et al.*, 2013). This leads us to hypothesize that:

Hypothesis 4 [H4]: Firms with higher information asymmetry prefer PF to CF.

Regarding agency problems, PF reduces leverage-induced underinvestment through separate incorporation and nonrecourse debt (Myers, 1977; John and John, 1991). According to Brealey *et al.* (1996) PF can reduce the debt-overhang problem by assigning project returns to new investors rather than existing capital providers. In addition, the PF contractual structure acts as a disciplinary device to reduce the potential inefficient effects of agency problems on corporate loans (Pinto and Alves, 2020). Similarly, the off-balance sheet treatment of the funding allows firms with higher growth opportunities to avoid the opportunity costs of underinvestment (Esty, 2003). Under these frameworks, we propose:

Hypothesis 5 [H5]: Firms with high agency costs of debt and with more growth opportunities are more likely to choose PF rather than CF.

PF involves various transaction costs and is very time-consuming (Esty, 2004a; Gatti, 2008). Thus, we expect that firms choose PF for larger debt

issuances because of the potential economies of scale, which leads us to hypothesize:

Hypothesis 6 [H6]: Borrowers choose PF over CF when issuing large amounts of debt.

The off-balance-sheet treatment of the funding raised avoids contamination risk and allows the preservation of financial ratios, with a limited impact on sponsors' creditworthiness (Pinto and Alves, 2020). We thus expect firms with lower profitability to use PF rather than CF. This leads to our last hypothesis:

Hypothesis 7 [H7]: Firms with lower profitability are more likely to choose PF over CF.

4. Data, methodology and descriptive statistics

4.1 Sample selection

The sample consists of individual bond offers extracted from the DCM Analytics and covers from January 1993 to January 2020. DCM Analytics database provides detailed information on bond securities issued on the debt capital markets. Information is available on the micro characteristics of the bonds (e.g., rating, transaction size, maturity, currency, type of interest rate) and of the issuers (e.g., name, nationality, industry sector). We included only bonds with a deal type code of "corporate bond investment-grade" and "corporate bond high-yield", classified as with either fixed rate bonds or variable rate bonds, and with information available about the credit spread. As our main focus are PF transactions, bonds issued by financial institutions, with

a deal general industry group "Finance" or "Insurance", were deleted. DCM Analytics does not have a deal type code of "project finance bond", so we classified as PF bonds those for which the use of proceeds is "project finance". The remaining bonds were classified as CF bonds. To have a more comparable sample and to avoid selection bias problems, we selected only CF bonds for which the deal industry has at least one record of PF bond issuance.

After applying these screens, we can examine a total sample of 47,196 bonds worth \$17,218.1 billion, of which 763 bonds worth \$282.7 billion were classified as PF bonds and 46,433 bonds worth \$16,935.3 billion as CF bonds. We call to this sample our Full Sample (FS).

As we intend to analyse the impact of issuer's characteristics in the bond's credit spreads and also the firm's choice between PF and CF, we collected firm specific accounting and market data from Datastream. DCM Analytics does not provide an identification code, so data from DataStream was merged with deal information from DCM Analytics by hand-matching issuer's name for CF. For the PF deals, as these bonds are issued by vehicle companies, we hand-matched the sponsor with the highest equity ownership in the PF firm with Datastream by using the sponsor's name. This approach allows the bonds to be matched with the ultimate party responsible for the financing choice decision. Following the same rationing of Pinto and Alves (2020) and Carey and Nini (2007), to reduce the problems of unmeasured credit quality correlated with nationality, we only collected information about companies with deals closed in OECD countries.

After merging firms involved in the transactions with Datastream and applying the screens mentioned, we are able to analyse a sample of 22,863 bonds issued by 2,133 publicly traded firms located in OECD countries between January 1993 and January 2020. This sample is called the High Information Sample (HIS).

Panel A of Table 1 presents the industrial distribution of our full sample of bonds (FS), meanwhile Panel B describes the bonds allocation to issuers in a particular region. The presenting data are for bonds with credit spread and bond total value in USD available, closed during the Jan 1993-Jan 2020 period.

The industry distribution reveals significant differences between PF and CF bond issuances. Panel A shows that PF bonds issuances are concentrated in three key industries; i.e., Utilities (41.97%), Oil and Gas (24.21%) and Transportation (11.85%) account for 78.03% of all PF bonds by volume. CF bonds reveal a far less concentrated pattern: this type of bonds are mostly issued by firms belonging to Utilities (14.86%), Communications (12.13%), Machinery and Equipment (11.54%), Services (10.93%) and Oil and Gas (9.56%) industries. Panel B shows that 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. The United States is the region with the highest concentration of bond issues in terms of the amount traded, representing 38.45% of PF securities and 47.31% of CF securities by volume.

Table 1: Industrial and geographic distribution

Panel A: Industry distribution						
Industrial category of issuer	Project Bonds			Corporate Bonds		
	Number of Bonds	Total Value (\$ Million)	Percent of total value	Number of Bonds	Total Value (\$ Million)	Percent of total value
<i>Commercial and Industrial</i>						
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
<i>Manufacturing</i>						
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
Real 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
<i>Transportation</i>	94	33,504	11.85	3,629	1,078,324	6.37
<i>Public Administration/Government</i>	18	4,196	1.48	21	5,114	0.03
<i>Other</i>	1	100	0.04	729	233,859	1.38
Total	763	282,746	100	46,433	16,935,330	100

Panel B: Geographic distribution

Geographic location of issuer	Project Bonds			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	22,117	8,845,470	52.23
United States	244	108,729	38.45	19,654	8,011,426	47.31
Canada	99	25,967	9.18	1,877	630,372	3.72
United Kingdom	76	42,052	14.87	5,463	3,219,262	19.01
Western Europe	51	14,330	5.07	2,337	1,109,361	6.55
Eastern Europe	10	4,681	1.66	337	176,738	1.04
Northern Europe	9	2,826	1.00	1,733	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	7,602	1,676,339	9.90
China	31	6,527	2.31	6,174	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	1,849	341,671	2.02
Brazil	61	6,998	2.47	1,359	235,825	1.39
Chile	11	3,675	1.30	165	61,709	0.36
Other	10	3,917	1.39	3,932	807,649	4.77
Total	763	282,746	100	46,433	16,935,330	100

Panel A describes the industrial distribution of bonds, whereas Panel B details the bond allocation to issuers in a particular country. Data are for bonds with credit spread and tranche amount available, closed during the Jan 1993- Jan 2020 period.

4.2 Methodology and variable definition

The main objective of our analysis is to determine which factors drive PF bonds credit spreads, namely to investigate how bonds' contractual features, firms' characteristics, and macroeconomic variables affect credit spreads. For this analysis, we use the model in equation (1):

$$\begin{aligned} \text{Credit spread}_{i,t} = & \alpha_0 + \beta_1 \text{Rated}_{i,t} + \sum_{n=2}^{21} \beta_n \text{Rating dummy}_{n,i,t} + \beta_{22} \text{Rating discordance}_{i,t} + \\ & \gamma \text{Contractual characteristics}_{i,t} + \theta \text{Corporate characteristics}_{i,t-1} + \varphi \text{Macroeconomic factors}_t \\ & + \varepsilon_{i,t} \end{aligned} \quad (1)$$

where the subscripts refer to bond i at time t .

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 premium and cross-country differences, we estimated standard errors clustered by year and country

Our dependent variable, credit spread, corresponds to the option adjusted spread (OAS)², defined as the margin yielded by the security at issue above a corresponding currency treasury benchmark with a comparable maturity. Following the rationing of Pinto and Marques (2020), it is necessary to account, in credit spread computation, for the fact that the fixed rate bond carries interest rate risk, whereas a floater does not. Hence, to control this issue, we included a *fixed rate* dummy variable.

For a detailed definition and source for all the variables used and the expected impact of explanatory variables on credit spread, see Appendix A.

²We use the Option Adjusted Spread as it is the most common measure used by financial intermediaries to correct the normal yield spread for embedded options (e.g., the prepayment option), usually included in structured finance bonds (Cuchra, 2005; Fabozzi and Vink, 2012)

4.2.1 Credit Rating

Credit rating is the most significant determinant of CF bond credit spreads. Cuchra (2005) argues that the importance of credit ratings in structured finance transactions, which includes PF, seems to be far greater than in the case of CF. In our sample all bonds have at least one credit rating assigned by Standard and Poor's (SandP) or Moody's, which is converted as follows: AAA=Aaa=1, AA+=Aa1=2, and so on until D=21 (Gabbi and Sironi, 2005; Cornaggia, Cornaggia, and Hund, 2017; Pinto and Marques, 2020). The lower the credit rating, the greater is the risk that the borrower fail to satisfy the terms of the obligation with respect to the timely payment of interest and repayment of the principal (Fabozzi, 2007) and therefore, the higher is the spread required by investors. Rating scales are inverse scales, so we expect a positive relationship between our variable *credit rating* and credit spread, so that an increase in credit rating also increases credit spread. As some bonds, namely PF bonds, are not rated, we included the dummy variable *rated*, equal to 1 if the bond has a credit rating from SandP and/or Moody's, and 0 otherwise. Additionally, as Gabbi and Sironi (2005), we included a dummy variable *rating discordance*, equal to 1 if the two ratings assigned by the two rating agencies have a different numeric value, and zero otherwise. If there is discordance about the rating, we expect a higher credit spread, as this would suggest uncertainty regarding the transaction's default risk.

4.2.2 Contractual Characteristics

Despite the credit rating being the factor that most influences the credit spread of CF bonds, numerous empirical studies show that maturity, deal size, number of banks in the issuing syndicate, gross fees, among others contractual factors, convey information about the pricing of these bonds (Elton *et al.*, 2001; Campbell and Taksler, 2003; Gabbi and Sironi, 2005; Chen *et al.*, 2007). In the

structured finance literature, factors such as subordination level, collateral-type, currency risk, and the type of interest rate are also presented as determinants of credit spreads, when controlling for credit ratings (Vink and Thibeault, 2008; Fabozzi and Vink, 2012; Pinto and Marques, 2020).

It is widely known that bonds with longer maturities tend to be riskier than bonds with shorter maturities. Therefore, investors usually demand higher premiums for longer-term securities. Several authors (Jones *et al.*, 1984; Sarig and Warga, 1989; Gabbi and Sironi, 2005) argue that, on average, the term structure of spreads for investment grade bonds appears upward-sloping. Therefore, we expect a positive impact of maturity in the credit spread for CF bonds. For structure finance transactions, which includes PF, results suggest a non-linear (Sorge and Gadanecz, 2008) or negative (Vink and Thibeault, 2008) impact of maturity on spreads. Additionally, Pinto and Alves (2016) found a significantly negative relationship for a PF loans sample closed in both the U.S. and W.E. To control for maturity, we included the *maturity* variable. We also included the *logarithm of maturity* in our analysis, as a proxy for any non-linear relationships between credit spread and maturity. As for PF loans (Sorge and Gadanecz, 2008), we expect a hump shaped relationship between PF bonds credit spread and maturity.

The higher the issue amount, the lower is the level of uncertainty and the higher is the liquidity level (Gabbi and Sironi, 2005; Chen *et al.*, 2007). Additionally, Pinto and Alves (2016) presented a significant and negative impact of *transaction size* on the PF loans' spread. 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 (Navi, 2020). We used *subordinated* dummy variable to control for differences in risk existing among different tranches of a deal. This dummy is equal to 1 for bonds that are subordinated and we expect subordinated bonds to have higher

credit spreads than senior bonds. As Pinto and Marques (2020) and Navi (2020), taking into account the bank involvement and the differences in bank syndicates, we included variables *number of banks* and *bank reputation*. We expect a negative relationship between these two variables and credit spreads of both PF and CF bonds.

According to Kleimeier and Megginson (2000) and Vink and Thibeault (2008), bonds issued in the currency of the borrower's home country have lower spread than bonds subject to currency risk. In order to examine this factor, we used a *currency risk* dummy. We expect a positive relationship between currency risk and the spreads of both types of bonds.

Nevitt and Fabozzi (2001) argue that, in PF transactions, the assets of the economic unit are seen as collateral for the loan. Kleimeier and Megginson (2000) show that the use of collateral is positively related to PF loan spreads. Thus, we expect a positive relationship between the *collateralized* dummy variable, which is equal 1 if the bond has a collateral, and PF bond credit spreads.

We also expect a positive relationship between the credit spread and the *callable* dummy variable, which is equal to 1 if the bond has a call option embedded.

4.2.3 Firms' accounting and financial variables

The argument that investors should employ their own credit analysis instead of relying solely on ratings assigned by rating agencies is generally accepted, but may not be straightforward for some types of investment vehicles (Fabozzi and Vink, 2012). In the case of CF bonds, there are well-known metrics computed based on sponsors'/issuers' financial statements that can be used to assess their creditworthiness. However, in structured finance, the key element is to legally separate the credit risk of the sponsor from that of the legal entity raising debt. Following Fabozzi and Vink (2012), in structured finance,

investors can look only to the performance of the collateral for fulfilment of the terms of the debt obligation rather than the performance of the corporation that used the securitization for funding.

However, we want to examine if the financial metrics of the sponsoring firms actually have some influence on the pricing of PF bonds. Hence, we collected information about the main sponsor of the SPV for PF bonds, and about issuers for CF bonds. The most discussed variables beyond the credit rating, affecting CF bonds' yield spreads are firm size, debt level, credit risk and profitability.

The variable *total assets* refers to firms' size (Mayberger, 2014). Fama and French (1993) argue that small companies can suffer long depressions in earnings that do not affect large companies. Additionally, Paschall and Hawkins (1999) state that investors demand higher risk premium to smaller firms because they are generally accepted as riskier. Thus, we expect that larger sized firms will have lower spreads.

Flannery *et al.* (2012) show that when investors expect the debt of a firm to increase, the corporate credit spread should increase as well. As in Mayberger (2014), we used the *debt to total assets* ratio to capture information about a firm's debt and we expect a positive relationship between this variable and the credit spread of PF and CF bonds; i.e., firms with lower leverage will have lower spreads.

Duffie and Lando (2001) found a hump-shaped relationship between spread and maturity under perfect information and a downward-sloping term structure as imperfect information problems start gaining significance. Thus, we can conclude that asymmetric information affects bond's credit spread. As Pinto and Alves (2020) we computed the *EPS surprise* variable as the difference between the actual earnings per share for year t and the earliest consensus (median) forecast for year t , deflated by the beginning of year t share price. We expect that bonds issued by firms with higher asymmetric information problems have higher credit spreads. Thus, we expect a positive relation

between higher earnings surprise and the credit spread for both PF and CF bonds.

Following the same approach as Esho *et al.* (2001), Denis and Mihov (2003) and Pinto and Alves (2020), we used the Altman's (1993) Z-score as a proxy for a firm's credit risk. The higher the Z-score, the lower the firm's bankruptcy risk and, consequently, lower the spread. Thus, we expect a negative relation between *Log Z-score* and the credit spread for both PF and CF bonds.

As in Mayberger (2014) we used the *return on assets* to capture information about firm's profitability. Bai and Wu (2016) argue that higher profitability reduce the corporate credit spread. Firms with higher operating profit margins, or other measures of profitability, are seen by investors as less risky (Grabowski and King, 2000). Thus, we expect that firms that are more profitable will have lower spreads. Additionally, we also computed the *Fixed assets to total assets*, *Free Cash Flow to total assets* and *Market to book* ratios to capture information about a firm's asset tangibility, efficiency/value creation and growth opportunities, respectively. These factors are determinants of the choice of debt so we want to examine their effect on the credit spreads. We expect a negative relationship between these three variables and the credit spread of both PF and CF bonds.

4.2.4 Macroeconomic Factors

We also control for macroeconomic factors such as the level of interest rates, given by the 3-month US Treasury bill rate, and the term structure of interest rates (*UST5y- UST3M*), estimated through the difference between the 5-year US Treasury bond yield and the 3-month US Treasury bill rate.

La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1998) argue that the level of investor protection influences the firm market value in international equity markets. Additionally, Hainz and Kleimeier (2012) and Subramanian and Tung (2016) show that creditor rights and legal regimes affect the choice of PF as a

funding alternative. We thus included the variable *creditor rights*, measured through La Porta *et al.* (1998) indices. We also included a variable for *enforcement level*, which is an index for enforcing contracts, also obtained from World Bank Indicators. These variables control for unobserved country characteristics over time.

Finally, we added two dummy variables, *financial crisis* and *sovereign debt crisis* to examine the impact of the 2008 financial crisis and the subsequent European sovereign debt crisis on bonds spreads. As Riachi and Schwienbacher (2015), Pinto and Marques (2020) and Navi (2020), we also used year and industry dummy variables to control for unobserved macroeconomic and industry-specific trends.

5. The pricing Project Finance bonds

5.1 Univariate Analysis

To perform a statistical analysis, we started by comparing PF and CF bonds characteristics (see Appendix B for a further analysis of variable characteristics).

Table 2 presents Wilcoxon z-test and Fisher's exact test comparing the values of each contractual variable in PF and CF bonds samples. When assessing credit spreads differences across deal categories, we find that the average credit spread for PF bonds (241.0 bps) and CF bonds (206.8 bps) differ significantly. In fact, on averaged, PF bond spreads are 34.2 bps higher than that of CF bond spreads.

As expected, PF bonds have longer maturity. On average, PF bonds have a maturity of 13.7 years, which is a long period if we compare with the average of 9.6 years of CF bonds. There is also a significant difference between the credit rating of PF and CF bonds. The average credit ratings for CF bonds (6.7|A-)

issues are significantly better than for PF bonds (8.5|BBB+), which may suggest that PF bonds are riskier than CF bonds. This also could reflect the country rating, since PF deals are more likely to be implemented in development countries; i.e., in riskier-than-average countries. The average country risk for PF bonds (4.0) borrowers is significantly higher than the corresponding value for CF bonds (2.7). Similarly, PF deals are more commonly extended to countries with lower creditor rights and lower legal enforcement.

The mean (median) PF transaction size of \$611.00 million (\$450.00 million), which can be seen as a proxy for liquidity, is significantly higher than the CF mean (median) transaction size of \$593.0 million (\$321.0 million), indicating that creditors will require higher liquidity to lend through PF bonds. Although the number of tranches is, on average, higher in PF deals (2.0) than in CF deals (1.6), the average of banks involved in PF transactions (5.0) is significantly lower than the number of banks involved in CF deals (5.9). The difference between tranche size is not significant.

Table 2: Univariate analysis- Bond's contractual characteristics

Variable of interest	Project Bonds	Corporate Bonds	Wilcoxon z-test		Variable of interest	Project Bonds	Corporate Bonds	Wilcoxon z-test
<i>Univariate analysis- continuous variables</i>								
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	9.0	7.0			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	4.0	4.0	

Number of tranches				Country risk [1-22 weak]					
Number	763	46,433			Number	763	46,433		
Mean	2.0	1.6	-8.5	***	Mean	4.0	2.7	-6.05	***
Median	1.0	1.0			Median	1.0	1.0		
Creditor rights [0-4 strong]				Enforcement [32-85 strong]					
Number	763	46,433			Number	763	46,433		
Mean	1.5	1.6	4.06	***	Mean	66.6	70.2	12.56	***
Median	1.0	1.0			Median	68.7	72.0		

Variable of interest	Project Bonds	Corporate Bonds	Fisher's exact test	Variable of interest	Project Bonds	Corporate Bonds	Fisher's exact test		
<i>Univariate analysis- dummy variables</i>									
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				Subordinated					
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	8	1,633	0.000	***	
% of total	51.8%	48.8%		% of total	1.0%	3.5%			
Rated				Rating discordance					
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	186	13,435	0.005	***
% of total	77.6%	73.4%		% of total	24.4%	28.9%			
Collateralized									
Nr. of tranches	763	46,433							
Nr. of tranches with d=1	284	3,671	0.000						
% of total	37.2%	7.9%							

This table reports summary statistics for a sample of PF and CF bonds issued during the Jan 1993- Jan 2020 period- Full Sample (FS). 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. ***, **, and * indicates significant difference at the 1%, 5%, 10% levels, respectively, between PF and CF bonds. Bond rating is based on the SandP 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 A.

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 collateral, and have significantly lower cases of rating discordance than CF bonds. Most of PF and CF bonds are rated (77.6% and 73.4% respectively) and

there is a significantly lower fraction of subordinated bonds for PF compared with CF.

In addition, we also compare the characteristics of PF sponsoring firms *versus* CF issuers. Table 3 presents a Wilcoxon z-test comparing accounting and market characteristics of firms per issuance typology.

Table 3: Univariate Analysis- Firms' characteristics

Variable of interest	Project Bonds	Corporate Bonds	Wilcoxon z-test		Variable of interest	Project Bonds	Corporate Bonds	Wilcoxon z-test		
<i>Univariate analysis- continuous variables</i>										
Total assets (\$ million)					Market to book					
Number	364	22,499			Number	364	22,499			
Mean	97,800	45,100	-5.078	***	Mean	384.50%	244.72%	-3.198	***	
Median	26,200	17,800			Median	213.02%	181.70%			
Fixed assets to total assets					EPS surprise					
Number	364	22,499			Number	303	19,534			
Mean	46.31%	44.70%	-0.725		Mean	-0.187%	-0.398%	2.905	***	
Median	57.41%	43.88%			Median	0.001%	0.043%			
Debt to total assets					Z-score					
Number	364	22,499			Number	281	20,068			
Mean	33.98%	36.43%	2.628	***	Mean	1.46	1.96	7.092	***	
Median	34.27%	35.44%			Median	0.78	1.09			
Return on assets					FCF to total assets					
Number	364	22,499			Number	352	22,116			
Mean	3.35	5.47	8.962	***	Mean	9.63%	12.67%	9.239	***	
Median	3.54	4.97			Median	5.49%	7.46%			

This table reports summary statistics for a sample of PF and CF bonds issued by 2,133 publicly traded firms located in OECD, between Jan 1993- Jan 2020 - High Information Sample (HIS). We test for similar distributions in public firms' characteristics across samples via the Wilcoxon rank-sum test. ***, **, and * indicates significant difference at the 1%, 5%, 10% levels, respectively, between PF and CF bonds. For a definition of the variables, see Appendix A.

On average, firms that issue PF bonds are typically larger - with an average (median) size of \$97.80 billion (\$26.20 billion). As we expected, PF issuers have significantly higher default risk (lower Z-score), lower profitability (lower return on assets) and higher growth opportunities (higher market to book ratio), than those issuing CF bonds. Similarly, there is a significant difference in

EPS surprise, confirming that PF sponsors suffer from higher asymmetric information problems than CF bond issuers. The average debt to total assets ratio is 36.43% for CF bonds issuers and 33.98% for PF bonds issuers. Similarly, CF issuers have a significantly higher FCF to total assets ratio than PF issuers.

5.2 Regression Results

In this section, we perform a regression analysis to, first, examine whether PF bonds actually have credit spreads higher than CF bonds and, second, to examine whether the two bond types are influenced differently by common price characteristics.

Table 4 presents the results of estimating equation (1) using each of the two samples discussed in section 3, the full sample of PF and CF bonds (FS) and the sample of bonds with sponsors'/issuers' accounting and market information available (HIS). Models [1], [2] and [3] present pricing results for the full sample of 47,196 bonds, 763 PF and 46,433 CF bonds, respectively. Models [4], [5] and [6] present pricing results for the HIS, taking into account the core firms' characteristics (Log total assets, Fixed assets to total assets, Debt to total assets, Return on assets and Market to book). Model [4] estimates the results for a sample including both PF and CF securities, while models [5] and [6] estimate the results for the sample of PF and CF bonds, respectively.

5.2.1 Do Project Finance bonds have higher spreads than Corporate Finance bonds?

Model [1] shows that PF bonds have higher credit spreads compared with CF bonds. In fact, they have, on average, 30.85 bps higher spreads than CF bonds. However, taking into account the core firms' characteristics, this difference is lower. Model [4] shows that, on average, PF bonds credit spreads are 19.15 bps higher than CF bonds spreads.

Based on these results, we validate H3 that PF bonds are issued with higher credit spreads than similarly rated CF bonds. Therefore, H2 is rejected.

5.2.2 Are Project Finance bonds and Corporate Finance bonds priced differently by common pricing factors?

To answer this question, we examine the determinants of credit spreads for each bond type separately. We began by analysing the sign and significance of the coefficients for contractual and macroeconomic variables for FS models (models [2] and [3]). Secondly, based on models [5] and [6], we examine the impact of firms' characteristics on credit spread for PF and CF bonds, respectively.

Starting with the credit rating, there is a nonlinear relationship between credit spread and credit rating as the impact of one unit increase in credit rating increases as the credit rating deteriorates. Results confirm that credit rating is, in fact, the most important determinant of credit spreads in both PF and CF bonds, but investors do not rely exclusively on rating when pricing those bonds. We estimated models [1], [2] and [3] considering only rated and credit rating dummies as independent variables and find that models yield adjusted R^2 values of 0.38, 0.29, 0.39, respectively. The inclusion of additional contractual characteristics and macroeconomic variables in these models increases their adjusted R^2 values. In fact, on average, the adjusted R^2 increases 0.24 for PF bonds and 0.18 for CF bonds. Models [4], [5] and [6] yield similar results, showing that the inclusion of additional variables of contractual, macroeconomic and firm characteristics, in addition to the credit rating, increases the explanation power of the model. Therefore, the credit rating is not the only determinant of the credit spread, investors rely on additional information beyond the ratings when assess PF and CF bonds.

Table 4: Regression analysis of the determinants of PF and CF bond credit spreads

Dependent variable:	[1]	[2]	[3]	[4]	[5]	[6]
Credit spread (bps)	PF and CF bonds [FS]	PF bonds [FS]	CF bonds [FS]	PF and CF bonds [HIS]	PF bonds [HIS]	CF bonds [HIS]
Independent variables:						
Intercept	211.5 *** (66.51)	650.4 *** (175.9)	115.2 (70.48)	62.95 (95.61)	371.4 (234.8)	-231.1 *** (65.99)
PF Bond	30.85 ** (14.47)			19.15 ** (7.970)		
Rated	-97.23 *** (9.684)	-131.6 *** (28.15)	-92.92 *** (9.935)	-73.02 *** (11.71)	-86.22 ** (32.99)	-68.83 *** (11.87)
AA+	-29.85 *** (9.561)	55.17 (47.36)	-34.56 *** (9.420)	-49.64 *** (13.21)	-89.59 (57.25)	-52.29 *** (13.54)
AA	-26.39 ** (11.61)	63.87 * (32.66)	-31.65 *** (11.55)	-31.52 ** (13.27)	37.49 (43.53)	-34.73 *** (13.15)
AA-	-18.41 ** (7.529)	150.3 *** (39.64)	-23.34 *** (7.484)	-6.490 (8.225)	8.027 (53.72)	-9.760 (8.435)
A+	-3.143 (7.724)	42.92 (33.21)	-7.925 (7.634)	-2.867 (6.698)	-16.25 (35.17)	-6.351 (6.929)
A	9.939 (7.756)	58.14 ** (26.17)	4.845 (7.592)	8.991 (7.105)	16.05 (35.64)	5.396 (7.249)
A-	24.00 *** (7.611)	103.3 *** (22.39)	18.97 ** (7.513)	22.04 *** (7.338)	23.47 (26.33)	18.25 ** (7.611)
BBB+	54.91 *** (7.857)	133.5 *** (24.76)	49.33 *** (7.800)	47.92 *** (7.774)	10.87 (32.00)	43.83 *** (8.017)
BBB	72.75 *** (8.395)	128.4 *** (21.17)	67.82 *** (8.469)	67.18 *** (8.615)	93.18 *** (29.08)	62.75 *** (8.875)
BBB-	113.4 *** (9.053)	185.5 *** (24.16)	107.7 *** (8.888)	106.7 *** (9.694)	141.4 *** (27.93)	102.0 *** (9.597)
BB+	187.9 *** (12.57)	213.0 *** (43.09)	182.9 *** (12.70)	182.2 *** (15.29)	232.3 *** (59.24)	177.0 *** (15.14)
BB	204.0 *** (13.81)	291.4 *** (35.16)	198.0 *** (14.22)	204.4 *** (16.06)	201.6 *** (42.31)	200.5 *** (16.38)
BB-	264.8 *** (13.81)	409.7 *** (45.87)	258.8 *** (13.98)	251.6 *** (14.73)	334.6 *** (45.67)	246.9 *** (14.85)
B+	317.1 *** (18.48)	390.0 *** (44.67)	311.0 *** (18.72)	304.3 *** (19.65)	178.4 *** (41.33)	300.3 *** (19.80)
B	365.5 *** (21.83)	400.9 *** (70.22)	360.0 *** (21.96)	345.8 *** (19.91)	502.9 *** (106.0)	340.5 *** (19.91)
B-	408.5 *** (27.07)	505.2 *** (97.47)	402.8 *** (26.85)	389.3 *** (22.02)	172.5 (112.1)	385.5 *** (21.68)
CCC+	498.6 *** (25.01)	562.1 *** (98.60)	492.5 *** (25.05)	487.5 *** (27.19)	544.7 *** (50.68)	481.8 *** (27.17)
CCC	545.3 *** (30.85)		539.8 *** (30.72)	578.2 *** (34.62)		573.4 *** (34.77)
CCC-	511.5 *** (56.92)	-180.9 *** (53.91)	545.6 *** (43.33)	504.8 *** (67.16)		500.9 *** (66.67)
CC	478.9 *** (61.29)	510.8 *** (50.94)	558.2 *** (14.02)			
C	357.2 *** (100.8)		354.1 *** (100.4)	431.3 *** (51.80)		426.8 *** (52.22)
Rating discordance	26.55 *** (3.020)	17.58 (13.80)	26.43 *** (3.029)	18.39 *** (2.646)	-5.477 (15.38)	18.27 *** (2.666)
Maturity	1.039*** (0.152)	1.304 * (0.686)	1.022 *** (0.157)	1.345 *** (0.150)	0.350 (1.040)	1.340 *** (0.152)
Log maturity	0.0482 (2.709)	20.57 ** (10.02)	10.35 *** (1.824)	-0.775 (2.397)	14.66 (12.39)	9.501 *** (1.845)

(Continued)

Log transaction size	-9.200** (3.654)	-36.81 *** (9.032)	-9.025 ** (3.714)	6.289 ** (2.772)	-13.02 (9.716)	6.614 ** (2.854)
Subordinated	-85.61*** (18.57)	38.65 (46.91)	-85.92 *** (18.68)	-72.72 *** (17.09)	87.97 (80.82)	-72.69 *** (17.28)
Currency risk	41.03*** (5.205)	17.56 (15.63)	41.57 *** (5.242)	30.23 *** (5.125)	29.04 ** (13.68)	29.89 *** (5.162)
Fixed rate	-23.38** (9.189)	-62.10 ** (27.31)	-22.11 ** (9.061)	-17.77 * (10.09)	0.142 (33.85)	-18.74 * (10.18)
Collateralized	63.22*** (7.058)	35.61 ** (16.75)	64.81 *** (7.358)	34.62 *** (6.085)	19.29 (23.57)	35.22 *** (6.411)
Callable	47.79*** (7.021)	6.310 (11.64)	48.62 *** (7.163)	34.02 *** (6.417)	5.835 (14.62)	34.25 *** (6.482)
Number of banks	-1.365*** (0.397)	-2.599 * (1.505)	-1.362 *** (0.397)	-0.591 ** (0.279)	-0.861 (1.832)	-0.587 ** (0.279)
Bank reputation	-0.00632 (0.278)	-0.345 (1.055)	0.00066 (0.280)	0.357 (0.326)	-0.176 (1.393)	0.337 (0.328)
Number of tranches	1.453 (4.937)	2.874 (5.292)	1.497 (5.100)	-7.475 *** (2.329)	-13.03 ** (6.339)	-7.067 *** (2.425)
Country risk	5.359*** (1.054)	8.604 *** (2.167)	5.127 *** (1.060)	-1.507 (1.636)	-0.919 (2.948)	-1.518 (1.682)
Creditors rights	-7.156*** (2.218)	-8.066 (5.745)	-7.157 *** (2.230)	-2.379 (1.956)	2.927 (8.385)	-2.408 (1.991)
Legal enforcement	0.687* (0.391)	0.897 (0.745)	0.661 * (0.401)	0.709 (0.454)	-1.696 (1.199)	0.711 (0.467)
Volatility	2.650*** (0.634)	-0.156 (1.557)	2.687 *** (0.633)	3.067 *** (0.796)	-1.514 (1.620)	3.126 *** (0.792)
USA5y-USA3M	-0.0671 (0.0524)	0.362 * (0.210)	-0.0733 (0.0520)	-0.0735 (0.0517)	0.392 * (0.201)	-0.0791 (0.0515)
Financial crisis	61.06 (45.35)	79.59 (130.4)	59.97 (45.19)	71.62 (52.19)	137.4 ** (52.43)	69.40 (51.67)
Sovereign crisis	43.60 (47.37)	-23.63 (83.94)	41.92 (47.20)	50.87 (54.17)	17.35 (88.39)	47.18 (53.63)
Log total assets				-9.600 *** (1.251)	3.678 (4.133)	-10.19 *** (1.303)
Fixed assets to total assets				-24.13 *** (6.702)	32.82 (37.11)	-24.95 *** (6.818)
Debt to total assets				3.897 (7.733)	36.23 (47.09)	2.831 (8.107)
Return on assets				-0.707 ** (0.289)	0.0936 (0.721)	-0.772 *** (0.293)
Market to book				0.00801 (0.0144)	-1.059 (0.722)	0.00793 (0.0145)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	47,196	763	46,433	22,863	364	22,499
Adjusted R^2	0.56	0.53	0.56	0.63	0.63	0.63
Rated and rating dummies as independent variables only						
Adjusted R^2	0.38	0.29	0.39	0.44	0.43	0.44
Differences in adjusted R^2	0.18	0.24	0.17	0.19	0.20	0.19

This table 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 [FS] – model [1], of which 763 are PF bonds – model [2]- and 46,433 are CF bonds – model [3]; (ii) a sample of 22,863 PF and CF bonds issued by 2,133 publicly traded firms located in OECD [HIS] – model [4], of which 364 are PF bonds- model [5]- and 22,499 are CF bonds- model [6]. For a definition of the variables, see Appendix A. ***, ** 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 premium and cross-country differences, we estimate standard errors clustered by year and country.

As we expected, rated bonds have lower credit spreads and the lower is the rating (higher credit risk), the higher is the credit spread. PF bonds with a credit rating of AA- have a 150.3 bps higher credit spread than AAA bonds. On the other hand, for CF bonds, the AA- dummy has a negative impact on credit spreads of 23.34 bps. Only bonds with A- rating have a significant positive impact on spreads: bonds with an A- rating have an 18.97 bps higher spreads than AAA bonds. This can be explained by the fact that there are a small number of CF bonds with A+ or better credit ratings. Results show that credit rating has a higher impact on credit spread for PF bonds than for CF bonds in higher credit rating scales. Rating discordance between SandP and Moody's has a significant positive impact of 26.43 bps on credit spread for CF bonds. The fact that PF transactions are generally created to achieve a specific credit rating justifies the insignificant impact of this variable on credit spreads.

Contrary to what we expected, the results show a significant and positive relationship between credit spread and maturity for PF bonds. Several studies about structured finance, namely about PF, argue that there is a non-linear relationship between maturity and credit spreads due to the special features of this type of arrangements. Therefore, such finds deserve further research attention.

Results show that the transaction size has a significantly negative impact on credit spread for both PF and CF bonds. In fact, an increase in the transaction size by \$100 million will reduce the credit spread by 36.81 bps for PF bonds and 9.03 bps for CF bonds. These results indicate a positive price liquidity effect and, can also be explained by the creation of economies of scale related with larger amounts issued. Additionally, the number of tranches has an insignificant impact on credit spread for the both types of bonds.

Callable and subordinated dummies have insignificant impacts on credit spread for PF bonds. For CF bonds, as we expected, bonds with a call options

have higher spreads. Surprisingly, the subordinated dummy has a significantly negative impact on CF bonds credit spreads.

Currency risk has no significant influence on credit spreads for PF bonds, while there is a significantly positive relationship between this variable and CF bond credit spreads. Due to interest rate risk, we expected a negative relationship between fixed rate dummy and credit spreads. However, results show that, for both PF and CF bonds, the credit spread for fixed rate issues is lower than the credit spread for floating rate issues.

Regarding the number of banks, we find, as expected, that a higher number of financial institutions involved in a bond issuance reduces credit spread for both PF and CF bonds, while banks' reputation does not influence credit spreads.

In line with Kleimeier and Megginson (2000), we find that collateralized PF bonds are issued with higher credit spreads. For CF bonds, we also find a significantly positive impact on credit spreads. Although this result is surprising for CF bonds, it can be explained by the existence of collateralized bonds with lower credit rating classifications, suggesting riskier bonds.

Regarding the macroeconomic factors, as expected, we find a significantly positive impact of country risk on credit spreads for both PF and CF bonds. In addition, results show that there is a negative relationship between creditor rights index and credit spread for both bond types of bonds, however, it is insignificant for PF bonds. The relationship between credit spread and the slope of the USD swap curve, $USA5y-USA3M$, is significantly negative for PF bonds, but insignificant for CF bonds. The impact of legal enforcement is insignificant for both bond types. We also find that market volatility has an insignificantly impact for PF bonds credit spread and a significantly positive impact on CF bonds credit spread.

Sovereign crisis dummy is insignificant for both PF and CF bonds, while in model [5], we find a positive impact of the financial crisis dummy on PF bonds

credit spread, meaning that during this period there was a positive significant variance in PF bonds credit spreads.

Regarding firms' characteristics, we find that, for PF bonds, sponsors' characteristics do not impact credit spreads. These results are in line with Fabozzi and Vink (2012) argument, showing that investors do not rely on sponsors' characteristics when accessing PF bond credit spreads. The non-recourse characteristic underlying PF debt leads lenders to focus on the project creditworthiness instead of those of the sponsors. In this sense, as Liu *et al.* (2006) and Pinto and Marques (2020), we can also argue that PF bonds credit spread depends mainly on the assets and cash flows promised as collateral. For CF bonds, as we expected, Log total assets, fixed to total assets and return on assets have a significantly negative impact on credit spreads, while debt to total assets seems to have a positive but insignificant impact.

Overall, our results corroborate H1 that 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.

5.2.3 Additional sensitivity tests

We re-estimated our models controlling for additional firms' variables that either reduce our sample observations or have correlation with previously included variables. Hence, we re-estimate models [5] and [6] of Table 5 to examine the impact of these variables on credit spread: EPS surprise in models [7] and [8]; Log Z-score in models [9] and [10]; and FCF to total assets ratio in models [11] and [12].

We test the sensitivity of our results to the inclusion of the EPS surprise variable and, surprisingly, we find a significant and negative relationship between this variable and credit spread for CF bonds. For PF bonds, although there is a negative impact of EPS surprise and the credit spread, this impact is insignificant.

Regarding the Z-score, we find a significantly positive impact on credit spread for PF bonds, suggesting that investors required higher credit spreads for firms with lower bankruptcy probability. Although we didn't expect such result, it can be explained by the perception of the investors about PF transactions. The company itself may be unlikely to default, however, when carrying out a PF transaction, the risk for the investor increases since it will be dependent only on the cash flows that the project generates and its performance for fulfilment of the terms of the debt obligation and not on the sponsor's ability to repay the debt. It is also important to mention that, when the Z-score is taken into account, the firm's return on assets ratio becomes significant and sponsors that are more profitable are expected to issue PF bonds with lower spreads. For CF bonds, as we expected, Log z-score is significantly negative related to credit spread.

Finally, there is an insignificant impact of the FCF to total assets ratio on credit spreads for PF bonds. However, this ratio has a significant positive impact on CF credit spread. Finally, model [11] also shows that the financial crisis dummy is associated with a significant increase in credit spreads for PF bond.

Table 5: Regression analysis of the determinants of credit spreads – remaining variables

Dependent variable:	[7]	[8]	[9]	[10]	[11]	[12]
Credit spread (bps)	PF bonds [HIS] incl. EPS surprise	CF bonds [HIS] incl. EPS surprise	PF bonds [HIS] incl. Log Z-score	CF bonds [HIS] incl. Log Z-score	PF bonds [HIS] incl. FCF to total assets	CF bonds [HIS] incl. FCF to total assets
Independent variables:						
Intercept	711.2 *** (258.9)	-297.8 *** (74.10)	729.3 *** (258.3)	-261.8 *** (68.19)	357.5 (242.5)	-222.3 *** (64.45)
Rated	-83.43 ** (33.11)	-66.62 *** (12.66)	-99.27 * (51.41)	-62.85 *** (11.85)	-98.73 ** (39.71)	-65.60 *** (12.20)
AA+	-87.22 (56.52)	-42.34 *** (14.40)	-83.08 * (47.39)	-48.57 *** (12.95)	-76.49 (48.72)	-53.25 *** (13.59)
AA	54.90 (58.99)	-34.97 ** (13.95)	48.31 (66.07)	-32.47 ** (12.82)	50.31 (48.42)	-35.55 *** (13.26)
AA-	-0.206 (63.60)	-7.245 (9.090)	-9.626 (60.61)	-7.384 (7.942)	12.91 (59.04)	-11.06 (8.613)
A+	-22.19 (39.96)	-2.411 (7.375)	-60.67 (47.56)	-2.861 (6.615)	-10.51 (38.97)	-6.082 (6.948)
A	-11.87 (31.74)	10.01 (7.685)	12.76 (45.46)	7.425 (6.670)	26.01 (37.24)	5.874 (7.323)
A-	15.56 (27.56)	23.71 *** (8.259)	7.756 (35.28)	19.68 *** (7.238)	30.79 (28.38)	18.14 ** (7.739)
BBB+	5.533 (35.35)	49.26 *** (8.581)	-7.332 (35.85)	46.10 *** (7.617)	17.46 (32.18)	42.79 *** (8.157)
BBB	82.63 ** (32.58)	69.42 *** (9.605)	81.77 ** (37.14)	62.12 *** (8.496)	98.89 *** (30.80)	61.86 *** (9.059)
BBB-	123.9 *** (30.75)	107.4 *** (10.48)	118.9 *** (37.74)	99.41 *** (9.385)	150.1 *** (29.15)	100.1 *** (9.811)
BB+	219.5 *** (32.63)	181.1 *** (16.89)	238.1 *** (59.34)	176.2 *** (14.76)	240.1 *** (61.72)	175.3 *** (15.49)
BB	190.8 *** (41.50)	205.0 *** (18.08)	195.1 *** (51.94)	206.9 *** (16.05)	205.3 *** (44.10)	197.3 *** (16.55)
BB-	332.1 *** (56.31)	246.4 *** (16.37)	367.0 *** (53.58)	246.6 *** (15.47)	368.8 *** (50.18)	245.6 *** (15.31)
B+	117.5 (73.33)	303.8 *** (21.54)	173.9 *** (58.49)	292.7 *** (20.76)	196.3 *** (48.18)	300.1 *** (19.89)
B	510.7 *** (99.30)	350.1 *** (21.29)	486.0 *** (135.9)	331.2 *** (21.88)	513.6 *** (116.2)	336.8 *** (20.65)
B-	199.4 * (112.4)	391.6 *** (23.66)	195.5 * (115.5)	377.2 *** (22.94)	181.3 (112.6)	383.9 *** (22.11)
CCC+	517.0 *** (50.31)	481.1 *** (30.81)	554.7 *** (56.43)	474.9 *** (27.90)	569.1 *** (56.02)	479.3 *** (27.47)
CCC		558.8 *** (38.75)		577.4 *** (37.65)		571.5 *** (34.82)
CCC-		580.7 *** (26.80)		499.0 *** (64.00)		498.2 *** (67.09)
CC						
C		425.6 *** (56.03)		429.2 *** (48.65)		423.5 *** (47.28)
Rating discordance	-17.80 (19.62)	19.13 *** (2.908)	-0.384 (15.76)	19.49 *** (2.876)	-0.200 (16.47)	19.25 *** (2.652)
Maturity	-0.349 (1.378)	1.439 *** (0.153)	-0.615 (1.372)	1.421 *** (0.138)	0.302 (1.075)	1.356 *** (0.149)
Log maturity	22.58 (13.94)	9.508 *** (1.461)	8.989 (14.76)	7.910 *** (2.084)	14.34 (12.66)	9.476 *** (1.849)
Log transaction size	-26.37 ** (12.30)	7.949 *** (2.945)	-18.62 (11.32)	7.020 ** (3.004)	-12.15 (10.56)	6.533 ** (2.867)
Subordinated	173.1 (107.1)	-70.48 *** (18.36)	190.4 (123.1)	-71.25 *** (17.24)	102.5 (84.51)	-70.11 *** (17.66)

(Continued)

Currency risk	36.62 ** (18.36)	31.08 *** (5.088)	53.04 *** (16.33)	30.98 *** (5.298)	30.85 ** (14.59)	29.10 *** (5.061)
Fixed rate	-4.830 (33.58)	-21.42 ** (10.45)	-27.47 (45.66)	-13.26 (9.872)	1.092 (34.28)	-19.24 * (10.17)
Collateralized	32.93 (29.65)	33.69 *** (6.453)	28.03 (33.83)	29.58 *** (5.777)	16.24 (25.47)	34.53 *** (6.359)
Callable	19.28 (17.66)	33.63 *** (6.590)	2.845 (17.77)	28.48 *** (5.842)	4.839 (15.11)	35.27 *** (6.563)
Number of banks	-0.132 (1.792)	-0.757 *** (0.285)	0.628 (2.038)	-0.520* (0.292)	-0.708 (1.803)	-0.722 *** (0.268)
Bank reputation	-0.989 (1.696)	0.386 (0.347)	-0.813 (1.706)	0.360 (0.328)	-0.0797 (1.473)	0.338 (0.333)
Number of tranches	-11.45 (7.025)	-7.132 *** (2.607)	-6.745 (8.250)	-7.271 *** (2.603)	-11.19 * (6.185)	-6.812 *** (2.408)
Country risk	0.391 (3.740)	-0.0952 (1.704)	-5.929 (3.636)	-0.670 (1.715)	-1.271 (3.097)	-1.322 (1.690)
Creditors rights	-2.113 (10.86)	-1.495 (2.054)	-4.926 (11.36)	-3.223 (2.069)	1.167 (8.799)	-2.431 (2.023)
Legal enforcement	-1.801 (1.605)	1.402 ** (0.613)	-2.029 (1.318)	1.226 ** (0.485)	-1.706 (1.203)	0.718 (0.468)
Volatility	-1.883 (2.364)	3.157 *** (0.756)	-2.192 (2.482)	3.140 *** (0.779)	-1.709 (1.810)	3.153 *** (0.793)
USA5y-USA3M	0.303 (0.199)	-0.0536 (0.0528)	0.273 (0.243)	-0.0738 (0.0518)	0.382 * (0.212)	-0.0775 (0.0516)
Financial crisis	73.10 (69.14)	69.62 (50.50)	81.96 (74.49)	67.76 (52.30)	141.2 ** (60.00)	68.50 (51.58)
Sovereign crisis	-23.44 (107.9)	47.47 (52.06)	56.26 (108.7)	49.58 (54.24)	18.94 (89.82)	46.14 (53.54)
Log total Assets	1.235 (5.877)	-10.57 *** (1.389)	2.089 (5.693)	-11.31 *** (1.433)	4.139 (4.174)	-11.14 *** (1.363)
Fixed assets to total assets	-6.407 (48.98)	-26.78 *** (7.516)	20.82 (45.80)	-30.72 *** (7.699)	32.63 (40.66)	-27.81 *** (6.930)
Debt to total assets	54.07 (59.18)	2.343 (8.298)	97.75 (59.39)	-6.098 (9.262)	32.83 (49.76)	1.282 (8.150)
Return on assets	-1.414 (2.204)	-0.831 ** (0.328)	-3.817 ** (1.749)	-0.469 (0.334)	0.267 (0.743)	-0.749 ** (0.296)
Market to book	-2.028 (1.550)	0.0135 (0.0151)	-0.585 (0.782)	0.00958 (0.0151)	-1.202 (0.785)	0.00828 (0.0144)
EPS surprise	28.69 (205.7)	-17.00 *** (5.173)				
Log Z-score			57.71 *** (18.49)	-12.24 *** (4.139)		
FCF to total assets					1.671 (3.179)	0.306 *** (0.115)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	303	19,534	281	20,068	352	22,116
Adjusted R ²	0.65	0.63	0.61	0.63	0.63	0.63
Rated and rating dummies as independent variables only						
Adjusted R ²	0.46	0.44	0.40	0.44	0.44	0.44
Differences in adjusted R ²	0.19	0.19	0.21	0.19	0.19	0.19

This table presents the results of an OLS regression analysis of the determinants of PF and CF bond credit spreads for: (i) a sample of 303 PF bonds – model [7] and (ii) a sample of 19,534 CF bonds – model [8]; (iii) a sample of 281 PF bonds - model [9] and (iv) a sample of 20,068 CF bonds – model [10]; v) a sample of 352 PF bonds– model [11] and vi) a sample of 22,116 CF bonds– model [12]. For a definition of the variables, see Appendix A. ***, ** 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 premium and cross-country differences, we estimate standard errors clustered by year and country.

6. The choice between Project Finance and Corporate Finance

In this section, we intend to study the reasons that lead firms to choose between off-balance-sheet financing, via PF, and on-balance-sheet financing, via CF.

6.1 Sample

In the analysis of the choice of debt, the unit of observation is the deal. As we are using the database presented in section 3, multiple tranches (bonds) from the same deal appear as separate observations; e.g., PF deals typically consist on several tranches funding the same purpose. Therefore, to perform a deal-level analysis, we used data at the deal-level and, when necessary, we aggregated tranche-level data (e.g., spread, transaction size and maturity). In this aggregation process, we dropped some observations (bonds), since we require that information on all the tranches of each deal be available. Hence, we are able to analyse a full sample of 516 PF deals worth \$266.7 billion and 36,035 CF deals worth \$15,881.3 billion, closed in the Jan 1993- Jan 2020 period. We call to this first sample the Deals Full Sample (DFS).

As in section 4, to test our hypotheses it is crucial taking into account the characteristics of the issuers. Therefore, our Deals High Information Sample (DHIS) consists of 16,788 deals closed by 2,093 publicly traded firms located in OECD countries between January 1993 and January 2020.

Firms that closed the two types of deals in the sampling period, the switchers, are a very important field of study in this analysis. Table 6 presents information for a subsample of deals implemented such firms. Results show that PF and CF deals implemented by switchers are concentrated in four

industries: Utilities, Communications, Oil and Gas, and Transportation, which account for 82.3% of the total debt issued via bonds, between 1993 and 2020.

Table 6: Industrial distribution of deals closed by switchers

<i>Industrial category of issuer</i>	<i>Number of deals</i>	<i>Number of switchers</i>	<i>Total Value (\$ Million)</i>	<i>Percent of total value</i>
<i>Commercial and Industrial</i>				
Agriculture, Forestry and Fishing	7	1	3,250	0.14
Communications	492	9	433,047	18.18
Construction/Heavy Engineering	70	4	32,994	1.39
<i>Manufacturing</i>				
Chemicals, Plastic and Rubber	51	2	33,063	1.39
Food and Beverages	72	2	62,110	2.61
Machinery and Equipment	41	1	31,356	1.32
Other	30	1	5,409	0.23
Mining and Natural Resources	28	3	19,056	0.80
Oil and Gas	485	27	348,342	14.63
Real Estate	177	11	92,400	3.88
Real Trade	46	1	29,202	1.23
Services	126	6	90,440	3.80
Utilities	2,341	60	1,048,324	44.02
<i>Transportation</i>	190	12	130,318	5.47
<i>Public Administration/Government</i>	5	1	895	0.04
<i>Other</i>	14	1	21,209	0.89
<i>Total</i>	4,175	142	2,381,413	100

This table describes the industrial distribution of deals closed in OECD countries by switchers with accounting and market data available. We classify as switchers firms that close both PF and CF deals during the Jan 1993- Jan 2020 period. We include only bonds with a deal type code of "corporate bond investment-grade" and "corporate bond high-yield. We classify as PF deals those for which the use of proceeds is "project finance". The remaining deals were classified as CF.

6.2 Methodology and variables

In this section, our main objective is to examine firms' choice between PF and CF, namely to investigate how deals' contractual features, firms' characteristics, and macroeconomic variables affect the choice between off-balance-sheet

financing, via PF, and on-balance-sheet financing, via CF. For this analysis, we utilized the logistic regression model presented in equation (2):

$$\begin{aligned} \text{Choice of debt}_{i,t} = & \alpha_0 + \gamma \text{ Contractual characteristics}_{i,t} + \theta \text{ Corporate characteristics}_{i,t-1} \\ & + \varphi \text{ Macroeconomic factors}_t + \varepsilon_{i,t} \end{aligned} \quad (2)$$

where the subscripts refer to deal i at time t .

Our dependent variable, choice of debt, is a binary variable equal to 1 if the firm closes a PF deal and 0 if it, instead, closes a CF deal. Although the dependent variables are the same as those used in the previous chapter regarding the analysis of bond pricing, an explanation of the approach used in this section follows. Again, Appendix A presents a detailed definition and source for all the variables used in this paper.

6.2.1 Description of variables

As in Denis and Mihov (2003), Altunbaş, Kara, and Marques-Ibanez (2010), Pinto and Alves (2020), we used firm's size and asset tangibility- proxied by *Log total assets* and *fixed assets to total assets* ratio, respectively- to capture information asymmetries problems. We expect smaller firms and those with a lower degree of asset tangibility to prefer PF to CF. Additionally, we also used the *EPS surprise* as a measure of asymmetric information. It is expect a positive relationship between this variable and the choice of PF. As in Pinto and Alves (2020), we used the deal's weighted average maturity (WAM), computed as the weighted average between the bond maturity, in years, and its weight in the deal size, to capture informational costs associated with liquidity risk induced by debt refinancing. We expect a positive relationship between WAM and the probability of a firm choosing a PF deal.

Debt to total assets was used as a proxy for agency costs of debt. The *market to book* ratio was used as a proxy of firm's growth opportunities (Denis and

Mihov, 2003). We expect that firms that face higher agency costs of debt, higher leverage and higher growth opportunities will prefer PF *vis-à-vis* CF.

Following the same approach as Esho *et al.* (2001) and Pinto and Alves (2020), we used the deal size as a proxy for economies of scale in relation to issuance costs. Taking into account the cost of structuring a PF deal compared to CF alternatives, we expect a positive impact of the *Log transaction size* in the choice of PF *versus* CF. Firm size can also test the issuance costs argument (Denis and Mihov, 2003), and, in this case, we expect that relatively larger firms prefer PF over CF.

As a proxy of deal's cost of borrowing we used the deal's weighted average spread (*WAS*), computed as the sum of the product between bond spread and its bond size to deal size ratio. In *WAS* computation, we required that information about the spread for all bond tranches is available. Additionally, as in Esho *et al.* (2001), Denis and Mihov (2003) and Pinto and Alves (2020), we used the Altman's (1993) *Z-score* as a proxy for a firms' credit risk. We also computed the deal's weighted average rating (*WAR*), computed as the sum of the product between bond rating and its bond size to deal size ratio.

To examine the impact of firm's profitability on the debt choice, we used the *return on assets* ratio and we expect a negative relationship between this variable and the probability of observing a PF deal. We also included the *FCF to total assets* ratio to capture firm's efficiency and agency costs of free cash flow. We expect a negative relationship between this variable and the likelihood of choosing PF.

We also control for macro-economic factor. Besides the variables used in Chapter 5, we add more three variables: *civil vs common law* dummy variable, *risk free rate* and *GDP per capita*. To control for the supply side conditions of bonds market we include the number of banks involved in each deal and the bank reputation. A final dummy variable - *switcher* - identifies firms that employ multiple debt types (PF deals and CF deals) within our sample period.

6.3 The characteristics of Project Finance and Corporate Finance deals

Table 7 provides descriptive statistics for our samples of PF and CF deals between 1993 and 2020. When assessing WAS differences across deal categories, we find that the average WAS for PF (251.2 bps) and CF deals (216.0 bps) differs significantly. In line to what we showed in Chapter 4, in the bond market, PF deals have, on average, higher credit spread than CF deals. Our results show that PF deals are extended, on average, to projects in riskier countries than CF bond deals. PF deals average country risk (3.9) is significantly higher than that of CF (2.8) deals. Similarly, although the average WAR for PF (7.1|A-) deals is similar to the WAR for CF (6.7|A-) deals, results show that there is a significant difference between the two deal categories.

The mean PF deal size of \$517.0 million is significantly higher than the CF mean deal size of \$441.0 million, which corroborate, so far, the hypothesis [H6] that sponsoring firms choose PF over CF to obtain economies of scale in relation to issuance costs. Similarly, PF deals have, on average, a significantly higher number of tranches. The average number of banks involved is higher for CF deals (5.6) compared with PF deals (5.0) and prestigious arranging banks participate more in CF deals rather than PF deals. Regarding the maturity, PF deals have a WAM of 13.7 years, which is significantly higher than that of CF deals (9.3 years).

Table 7: Descriptive statistics for PF and CF deals' samples

Variable of interest	PF Deals	CF Deals	Wilcoxon z-test		Variable of interest	PF Deals	CF Deals	Wilcoxon z-test		
<i>Univariate analysis- continuous variables</i>										
WAS (bps)					Number of banks					
Number	516	36,035			Number	516	36,035			
Mean	251.2	216.0	-7.07	***	Mean	5.0	5.6	2.24	*	
Median	206.6	153.0			Median	4.0	4.0			
WAR [1-22 weak]					Bank reputation					
Number	516	36,035			Number	516	36,035			
Mean	7.1	6.7	-2.43	*	Mean	7.2	8.9	1.91	*	
Median	8.0	7.0			Median	3.0	4.0			
WAM (years)					Creditor rights [0-4 strong]					
Number	516	36,035			Number	516	36,035			
Mean	13.7	9.3	-14.03	***	Mean	1.5	1.6	3.76	***	
Median	10.0	7.2			Median	1.0	1.0			
Deal size (\$ Million)					Enforcement [32-85 strong]					
Number	516	36,035			Number	516	36,035			
Mean	517.0	441.0	-6.7	***	Mean	66.8	70.6	10.52	***	
Median	380.0	270.0			Median	69.1	72.0			
Number of tranches					Country risk [1-22 weak]					
Number	516	36,035			Number	516	36,035			
Mean	1.3	1.2	-5.06	***	Mean	3.9	2.8	-4.42	***	
Median	1.0	1.0			Median	1.0	1.0			
Variable of interest	PF Deals	CF Deals	Fisher's exact test		Variable of interest	PF Deals	CF Deals	Fisher's exact test		
<i>Univariate analysis- dummy variables</i>										
Currency risk					Sovereign crisis					
Nr. of deals	516	36,035			Nr. of deals	516	36,035			
Nr. of tranches with d=1	164	7,197	0.000	***	Nr. of tranches with d=1	188	14,189	0.188		
% of total	31.8%	20.0%			% of total	36.4%	39.4%			
Financial crisis					Civil vs Common law					
Nr. of deals	516	36,035			Nr. of deals	516	36,035			
Nr. of tranches with d=1	14	1,937	0.005	***	Nr. of tranches with d=1	202	16,726	0.001	***	
% of total	2.7%	5.4%			% of total	39.1%	46.4%			

This table presents the descriptive statistics of PF and CF samples of bond's deals closed during the Jan 1993- Jan 2020 period- Deals Full Sample (DFS). 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. ***, **, and * indicates significant difference at the 1%, 5%, 10% levels, respectively, between PF and CF bonds. For a definition of the variables, see Appendix A.

A significantly larger fraction of CF deals is closed in the financial crisis period (5.4%) compared to the sample of PF deals (2.7%). PF deals are less frequently extended to projects in common-law compared to civil-law countries. The average country risk for PF deals (3.9) is higher than the risk for CF deals (2.8) and PF deals are more commonly extended to countries with lower creditor rights and lower legal enforcement. CF deals (20.0%) are less likely to bear currency risk than PF deals (31.8%).

6.4 The sponsor/issuer debt choice

This section presents univariate and multivariate analyses examining how contractual variables and public firms' characteristics influence the choice between PF and CF deals, while controlling for macroeconomic factors. Our sample comprises deals that are often divided into smaller tranches (bonds).

6.4.1 Univariate analysis

Table 8 reports characteristics of OECD public firms that were sponsors in a PF bond deal or borrowers in a CF deal. We subdivide these firms into three categories according to their borrowing record within our sample period. The PF and CF deals' subsample is categorized as firms that close: [I] only PF deals; [II] only CF deals; and [III] both PF and CF deals.

Although the difference is not statistically significant, firms that use only PF deals (firms in category [I]) are typically larger with an average size of \$129.00 billion. Surprisingly, results show that, on average, firms that use only CF have higher level of financial constraint. Firms with higher asset tangibility also prefer CF over PF deals. As we expected, firms in category [II] have higher profitability and efficiency levels, while firms in category [I] have more growth opportunities.

Firms utilizing both markets (switchers) are smaller than those reliant on PF only, but higher than those using CF lending exclusively. Similarly, switchers have smaller Z-scores than firms that use only PF deals but lower Z-score than those that only use CF.

Table 8: Descriptive statistics for public firms' characteristics

Firms categorized according to choice of deals				
Variable of interest		[I] PF deals only	[II] CF deals only	[III] PF and CF deals (switchers)
Total assets (\$ million)	Number	53	13,136	3,599
	Mean	129,000	33,000	68,800 ^{b c}
	Median	10,600	11,600	32,800
Fixed assets to total assets	Number	53	13,136	3,599
	Mean	29.15%	43.62% ^a	56.43% ^{b c}
	Median	12.81%	40.33%	62.16%
Debt to total assets	Number	53	13,136	3,599
	Mean	28.11%	37.77% ^a	36.39% ^{b c}
	Median	26.85%	36.58%	35.79%
Return on assets	Number	53	13,136	3,599
	Mean	2.02	5.41 ^a	4.74 ^b
	Median	1.78	5.05	4.50
Market to book	Number	53	13,136	3,599
	Mean	489.79%	252.34% ^a	183.28% ^c
	Median	251.90%	176.84%	210.23%
EPS surprise	Number	38	11,324	3,129
	Mean	-1.36%	-0.61%	-0.07%
	Median	-0.12%	0.04%	0.04%
Z-score	Number	38	11,498	3,295
	Mean	1.57	2.21	1.42 ^{b c}
	Median	1.14	1.18	0.76
FCF to total assets	Number	52	12,914	3,479
	Mean	3.30%	13.34% ^a	10.47% ^{b c}
	Median	3.08%	7.52%	6.81%

Our Deals High Information Sample (DHIS) includes 16,788 deals closed by 2,093 publicity traded firms, located in OECD countries between January 1993 and January 2020. We test for similar distributions in public firms' characteristics across samples via the Wilcoxon rank-sum test. ^a denotes statistical difference at the 10% level between 'PF deals only' and 'CF deals only' subsamples; ^b denotes statistical difference at the 10% level between 'PF deals only' and 'PF and CF deals' subsamples; ^c denotes statistical difference at the 10% level between 'CF deals only' and 'PF and CF deals' subsamples. For a definition of the variables, see Appendix A.

Firms that used PF and CF simultaneously have higher leverage, profitability and efficiency ratios than firms in category [I]. On the other side, on average, switchers have lower debt to total assets, market to book and FCF to total assets ratios than firms that use only CF bonds deals. Regarding asset tangibility, firms in category [III] have a higher fixed assets to total assets ratio than firms belonging to the other categories. Differences in analysts' forecast accuracy are not significant for our sample.

Thus, so far, we find evidence supporting hypothesis that firms with higher growth opportunities and lower profitability prefer PF instead of corporate financing. Contrary to what we expected, results suggest that highly levered firms use CF to raise funds. Although PF is generally used by larger firms operate in capital-intensive industries, we only find evidence supporting the argument that larger firms and those with higher level of asset tangibility prefer PF for switchers.

6.4.2 Multivariate analysis

Table 9 reports the results of the logistic regression (2) to predict firms' choice of debt between PF and CF deals. Estimations were developed following a stepwise approach, focusing firstly, on our DFS, examining the influence of contract characteristics on the debt choice- model [13]. Subsequently, the same estimation method was extended to include firms' characteristics. This sample includes all deals closed in OECD for which we had accounting and market information about the borrowers (DHIS) - model [14]. Considering that Log Z-score, FCF to total assets and EPS surprise imposes a significant reduction in the number of observations, we first exclude these variables from our baseline models and, subsequently, we re-estimated our models by adding each individual variable - models [15], [16] and [17], respectively.

Table 9: Regression analysis of the determinants of public firms' debt choice

Dependent variable	PF deal =1, CF deal = 0				
	[13]	[14]	[15]	[16]	[17]
Choice of debt	PF vs CF deals [DFS]	PF vs CF deals [DHIS]	PF vs CF deals [DHIS] incl. Log Z-score	PF vs CF deals [DHIS] incl. FCF to total assets	PF vs CF deals [DHIS] incl. EPS surprise
Independent variables:					
Intercept	-5.827 *** (1.898)	-2.844 (5.590)	0.480 (5.496)	-0.658 (5.515)	-2.104 (6.398)
Log deal size	0.287 *** (0.062)	0.284 ** (0.111)	0.380 *** (0.128)	0.326 *** (0.115)	0.263 ** (0.124)
Number of tranches	0.148 ** (0.074)	-0.022 (0.119)	-0.071 (0.152)	-0.036 (0.123)	-0.052 (0.143)
Currency risk	0.049 (0.148)	-0.212 (0.227)	-0.307 (0.263)	-0.228 (0.241)	-0.151 (0.240)
Number of banks	-0.055 *** (0.017)	-0.021 (0.018)	-0.025 (0.022)	-0.015 (0.018)	-0.016 (0.017)
Bank reputation	-0.008 (0.001)	-0.016 (0.016)	-0.021 (0.017)	-0.012 (0.015)	-0.022 (0.016)
WA Spread	0.002 *** (0.000)	0.003 *** (0.001)	0.003 *** (0.001)	0.003 *** (0.001)	0.003 *** (0.001)
WA Maturity	0.027 *** (0.004)	0.018 *** (0.006)	0.018 *** (0.006)	0.018 *** (0.006)	0.014 ** (0.007)
WA Rating	-0.063 *** (0.018)	-0.114 *** (0.029)	-0.119 *** (0.034)	-0.120 *** (0.030)	-0.112 *** (0.033)
Financial crisis	-0.907 ** (0.434)	-1.644 *** (0.602)	-1.770 *** (0.637)	-1.514 ** (0.597)	-1.610 *** (0.586)
Sovereign crisis	-0.078 (0.243)	-0.488 * (0.267)	-0.383 (0.318)	-0.433 (0.267)	-0.505 * (0.283)
Log GDP per capita	-0.224 * (0.134)	-0.053 (0.424)	-0.354 (0.406)	-0.297 (0.445)	-0.167 (0.465)
Country risk	0.095 *** (0.030)	0.093 * (0.049)	0.052 (0.053)	0.079 (0.049)	0.091 * (0.053)
Civil vs common law	-0.497 *** (0.178)	-0.716 ** (0.279)	-0.498 (0.339)	-0.809 *** (0.299)	-0.759 ** (0.295)
Creditors rights	0.0980 (0.080)	0.350 *** (0.090)	0.376 *** (0.120)	0.368 *** (0.097)	0.388 *** (0.097)
Legal enforcement	-0.036 *** (0.011)	-0.043 *** (0.016)	-0.048 *** (0.018)	-0.048 *** (0.016)	-0.032 * (0.017)
Risk free rate	0.000 (0.000)	-0.001 (0.001)	-0.002 * (0.001)	-0.002 * (0.001)	-0.001 (0.001)
Volatility	-0.013 (0.011)	-0.033 ** (0.016)	-0.031* (0.016)	-0.037 ** (0.015)	-0.057 *** (0.019)
USA5y-USA3M	-0.001 (0.000)	-0.003 ** (0.001)	-0.004 *** (0.001)	-0.003 ** (0.001)	-0.002 * (0.001)
Switcher	2.322 *** (0.135)	3.159 *** (0.212)	3.406 *** (0.240)	3.125 *** (0.212)	3.335 *** (0.237)

(Continued)

Log total assets	-0.197 ***	-0.326 ***	-0.185 **	-0.183 **
	(0.075)	(0.063)	(0.079)	(0.084)
Debt to total asset	0.023	-0.212	0.007	0.192
	(0.634)	(0.558)	(0.634)	(0.611)
Fixed assets to total assets	-0.730 **	-0.215	-0.546 *	-0.662
	(0.372)	(0.412)	(0.319)	(0.434)
Market to book	0.001	-0.001	0.000	0.001 **
	(0.000)	(0.001)	(0.000)	(0.000)
Return on assets	-0.030 *	0.001	-0.016	-0.032 ***
	(0.016)	(0.010)	(0.021)	(0.011)
Log Z-score		-0.578 ***		
		(0.217)		
FCF to total assets			-4.237	
			(2.938)	
EPS surprise				-0.159
				(0.242)
Number of observations	36,551	16,788	14,831	16,445
Corrected predictions (%)	98.58%	98.49%	98.59%	98.52%
Pseudo- R^2	0.165	0.218	0.242	0.226
				0.234

This table presents the results of logistic regressions which predict public firms' choice between PF and CF. The dependent variable equals 1 when a firm selects PF lending and 0 when it chooses a CF deal. Model [13] was estimated for the full sample of 36,551 deals, closed between January 1993 and January 2020 (DFS). Model [14] was estimated for a sample of 16,788 deals, closed by 2,093 publicly traded firms located in OECD countries between January 1993 and January 2020 (DHIS), for which we have information on firms' characteristics. Models [15], [16] and [17] include additional firms' characteristics. For a definition of the variables, see Appendix A. ***, ** 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 premium and cross-country differences, we estimate standard errors clustered by year and country.

As we expected, results document that borrowers located in risky countries, with lower GDP per capita and lower legal enforcement prefer PF rather than CF. Additionally, we find that the civil law vs common law dummy variable and the number of banks involved in the transaction have a negative impact on the probability of observing a PF deal. The level of interest rates, market volatility, and the creditor rights' level do not affect significantly the probability of observing a PF deal. Finally, we find that the financial crisis dummy variable affects significantly and negatively the sponsors' choice of PF over CF deals.

Information asymmetries

As we expected, relatively smaller firms and those with a lower degree of asset tangibility prefer PF *vis-à-vis* CF (model [14]). Regarding the EPS surprise, results show that this variable do not have a significant impact on the choice of debt (model [17]). These findings corroborate H4. Firms with more severe information problems tend to use PF transactions because they disclose private information to a limited number of informationally sophisticated investors, are helpful in mitigating informational asymmetries (Pinto and Santos, 2019).

In line with the argument that by reducing the level of asymmetric information between lenders and borrowers, structure finance enables borrowers to raise funding with longer maturities (Flannery, 1986; Diamond, 1991), we find that WAM has a positive influence on the choice of a PF deals, meaning that the sponsors choose PF when they seek long-term funding for a specific large-scale project.

Agency costs of debt and growth opportunities

Although results show that the level of financial constraint and the potential firm's growth opportunities affect positively the choice of PF over CF, we only find a significant impact on the choice of debt for the market to book ratio (model [17]). However, this significant impact happens only for a small sample when we taking into account the EPS surprise. Therefore we did not find significant evidence to corroborate H5.

Issuance costs

Our findings regarding issuance costs are twofold. First, results reported in model [1] shows that deal size and the number of tranches positively affects the probability of observing a PF deal. Second, as previous mentioned, firm size is significantly negatively related to the probability of observing a PF deal. These results are in line with descriptive statistics in Table 7. Although the average

size of PF issuers is higher than the average size of CF issuers, there is not a significantly difference. Therefore, we believe that, in this case, firm size seems to be well suited to measure information asymmetries than capturing effects of economies of scale.

These results corroborate the hypothesis that borrowers choose PF over CF when issuing large amounts of debt to benefit from potential economies of scale [H6].

Cost of funding

The borrowing cost is given by the deal' associated credit spread. We find that there is a significantly positive relationship between WAS and the probability of observing a PF deal. Meaning that PF deals are more likely to have higher funding costs than CF deals. Additionally, we found a significantly negative influence of both WAR and Z-score on the choice of PF *vis-à-vis* CF (models [1] and [15]). These results are in line with our findings in Chapter 4. PF bonds have, on average, significantly higher credit spreads and credit ratings than CF bonds. Results also show that sponsoring firms with higher credit risk prefer PF over CF and choose PF when such transactions allow the issuance of bonds with better WAR.

Therefore these findings corroborate our hypothesis that PF transactions do not allow the reduction of sponsors' cost of borrowing when compared with CF transactions [H3], thus we reject H2.

Profitability

We find that profitability reduces the likelihood of accessing PF markets, which corroborates structured finance literature: firms choose off-balance-sheet financing to improve or maintain sponsors' key financial ratios (Caselli and Gatti, 2005; Fabozzi, Davis, and Choudhry, 2016). Therefore we accept H7.

6.4.3 Focusing on the switchers

Switchers are in fact the firms that use extensively both on-and off-balance-sheet debt. Therefore, a switcher-focused analysis may provide interesting insights into the choice determinants. Additionally, it will address endogeneity concerns that may arise in the choice between PF and CF in the previous section, since we do not know whether the PF was chosen because the company has high credit risk and did not get access to CF or because the company simply opted for project financing over CF.

Table 10 reports the results of using the logistic regression (2) to predict switcher's choice of debt between PF and CF deals.

Results show that switchers resorting to PF are relatively smaller and less profitable. In line with the idea that for larger debt issuances PF transactions allow sponsors to benefit from potential economies of scale, we find a positive relationship between the deal size and the likelihood of a switcher choose a PF transaction. Regarding the cost of borrowing, as in the previous analysis, the probability of observing a PF deal is positively related with higher WAS and lower WAR, suggesting that PF transactions evolves higher borrowing costs compared with CF deals. The number of banks and its reputation is negatively related with the likelihood of switchers choose a PF deal.

PF deals issued by switchers are more likely to be closed in riskier countries with higher creditor's rights and lower levels of legal enforcement. Additionally, the level of interest rates is negatively related with the probability of observing a PF deal. During the period of the financial crisis, switchers were more likely to close a CF deal.

Table 10: Regression analysis of the determinants of switchers' debt choice

Dependent variable	PF deal =1, CF deal = 0			
	[18] PF vs CF deals [DHIS] Switchers	[19] PF vs CF deals [DHIS] incl. Log Z-score Switchers	[20] PF vs CF deals [DHIS] incl. FCF to total assets Switchers	[21] PF vs CF deals [DHIS] incl. EPS surprise Switchers
Independent variables:				
Intercept	-8.887 (6.211)	-7.118 (5.918)	-6.836 (6.260)	-7.524 (6.945)
Log deal size	0.429 *** (0.108)	0.487 *** (0.135)	0.454 *** (0.108)	0.451 *** (0.128)
Number of tranches	0.000 (0.134)	-0.028 (0.178)	-0.011 (0.140)	0.035 (0.149)
Currency risk	0.0120 (0.253)	-0.130 (0.267)	-0.048 (0.275)	0.117 (0.253)
Number of banks	-0.032 * (0.019)	-0.036 * (0.022)	-0.027 (0.018)	-0.035 * (0.019)
Bank reputation	-0.042 ** (0.021)	-0.048 ** (0.023)	-0.033 (0.021)	-0.035 * (0.020)
WA Spread	0.004 *** (0.001)	0.004 *** (0.001)	0.004 *** (0.001)	0.003 *** (0.001)
WA Maturity	0.006 (0.006)	0.007 (0.007)	0.006 (0.006)	0.006 (0.001)
WA Rating	-0.143 *** (0.034)	-0.122 *** (0.040)	-0.149 *** (0.037)	-0.120 *** (0.037)
Financial crisis	-3.019 *** (0.745)	-2.767 *** (0.808)	-2.915 *** (0.736)	-2.515 *** (0.709)
Sovereign crisis	-0.432 (0.293)	-0.347 (0.322)	-0.413 (0.287)	-0.366 (0.314)
Log GDP per capita	0.589 (0.499)	0.325 (0.478)	0.369 (0.526)	0.403 (0.536)
Country risk	0.142 ** (0.070)	0.104 (0.069)	0.124* (0.071)	0.117 * (0.071)
Civil vs common law	-0.405 (0.393)	-0.086 (0.430)	-0.493 (0.412)	-0.431 (0.401)
Creditors rights	0.290 ** (0.122)	0.384 *** (0.144)	0.331 ** (0.133)	0.298 ** (0.118)
Legal enforcement	-0.030 * (0.018)	-0.037 ** (0.018)	-0.035 * (0.019)	-0.019 (0.019)
Risk free rate	-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)
Volatility	-0.030 * (0.018)	-0.033 * (0.018)	-0.036 ** (0.018)	-0.049 ** (0.0205)
USA5y-USA3M	-0.003 ** (0.001)	-0.003 ** (0.001)	-0.003 ** (0.001)	-0.003* (0.001)

(Continued)

Log total assets	-0.311 *** (0.087)	-0.331 *** (0.090)	-0.296 *** (0.098)	-0.337 *** (0.098)
Debt to total asset	0.685 (0.758)	0.504 (0.729)	0.770 (0.742)	1.009 (0.740)
Fixed assets to total assets	-0.126 (0.453)	0.471 (0.511)	-0.062 (0.431)	-0.276 (0.505)
Market to book	0.001 (0.002)	0.000 (0.002)	0.001 (0.002)	0.003 (0.003)
Return on assets	-0.044 ** (0.022)	-0.011 (0.027)	-0.039 (0.026)	-0.039 * (0.023)
Log Z-score		-0.498 (0.314)		
FCF to total assets			-0.980 (2.518)	
EPS surprise				0.297 (1.292)
Number of observations	3,599	3,295	3,479	3,129
Corrected predictions (%)	94,5%	94.7%	94.5%	94.4%
Pseudo- R^2	0.108	0.126	0.114	0.107

This table presents the results of logistic regressions which predict public firms' choice between PF and CF. The dependent variable equals 1 when a switcher selects PF and 0 when it chooses a CF. For a definition of the variables, see Appendix A. ***, ** 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 premium and cross-country differences, we estimate standard errors clustered by year and country.

7. Conclusions

This dissertation compares credit spreads and pricing processes for a sample of project finance (PF) and corporate financing (CF) bonds issued in the Jan 1993- Jan 2020 period. Additionally, we examine firms' borrowing decisions, namely the factors that influence sponsors'/issuers' choice between off-balance sheet financing, via PF, and on-balance sheet financing, via CF.

Our findings indicate that, although the credit ratings are the most important determinants of both PF and CF bond credit spreads, they seem to incorporate additional information beyond these ratings. We conclude that PF bonds have, on average, 30.85 bps higher credit spreads than CF bonds. This difference decreases to 19.15 bps, taking into account the characteristics of the sponsors/issuers when pricing the two bond types. In analysing the determinants of credit spreads for PF bonds, we show that the most important pricing determinants are credit ratings, bond maturity, transaction size, interest rate type (fixed versus floating), number of banks involved, if the bond is collateralized, country risk, the yield curve slope and sponsors' credit risk. As in extant empirical literature, we show that contractual (*credit rating, rating discordance, maturity, transaction size, subordinated, currency risk, fixed rate, collateralized, callable, number of banks*) and macroeconomic variables (*country risk, creditors rights, legal enforcement, volatility*) explain CF bond credit spreads. We also show that issuers' characteristics, like size, asset tangibility, profitability (*return on assets*), default risk and the capability of creating market value also affect credit spreads.

By comparing firms' debt choices, our results show that PF is in fact a mechanism that facilitates the reduction of the deadweight costs from asymmetric information problems. Results are consistent with the argument

that borrowers choose PF when issuing large amounts of debt to benefit from potential economies of scale. However, in line with our results regarding bonds' pricing, we can argue that PF is more costly than CF. Finally, we find that that firms resorting to PF are less profitable and have higher credit risk than comparable firms that use CF.

This work presents a detailed analysis about the pricing of PF and CF bonds, identifying the most important determinants of credit spreads at issuance. It provides an empirical perspective of the dissimilarities in the pricing determinates of PF and CF bonds in relation to contractual characteristics, issuers' accounting and market characteristics and macroeconomic factors. In addition, it provides an empirical analysis of the choice between PF and CF having as background the international bond market. We consider that a further research on the impact of PF on sponsoring firms' cost of borrowing, considering other factors that affect contract design would be very interesting. Furthermore, there is also room to a deeper research on the term structure of PF bond credit spreads to better understand the relationship between credit spread and maturity. Finally, we consider that a study focusing on the choice between loans and bonds inside to fund a PF deal will be extremely useful, extending extant literature on the debt choice between bank loans and bonds (e.g., Denis and Mihov, 2003; Altunbaş *et al.*, 2010).

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Appendix

Appendix A: Variable definition

Variable Name	Variable definition	Source	Expect impact on spread	
			PF bond	CF bond
Dependent Variables				
Credit spread	Margin yielded by the security at issue above a corresponding currency treasury benchmark with a comparable maturity (OAS).	DCM Analytics		
Choice of debt	Dummy equal to 1 if the firm closes a PF deal and 0 if it, instead, closes a CF deal.	Pinto and Alves (2020)		
Independent variables				
<i>Contractual characteristics</i>				
Rated	Dummy equal to 1 if the bond has a credit rating from SandP or Moody's, and 0 otherwise.	DCM Analytics	-	-
Rating	Bond rating based on the SandP 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 SandP 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/ -	-
Collateralized	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	+	+

(Continued)

Firm characteristics

Log total assets	Natural logarithm of firm total assets measured in \$ million.	Datastream	-	-
Debt to total assets	The ratio of total debt to total assets.	Datastream	+	+
Fixed assets to total assets	The ratio of fixed assets to total assets. Fixed assets include property, plant and equipment.	Datastream	-	-
Market to Book	The sum of book value of liabilities and market value of equity divided by the book value of assets.	Datastream	-	-
Return on Assets	The net income before preferred dividends minus preferred dividend requirement, divided by total assets.	Datastream	-	-
EPS surprise	Difference between the actual earnings per share for year t and the earliest consensus (median) forecast for year t, deflated by beginning of year t share price.	Datastream	+	+
Log Z-score	Logarithm of Altman's (1993) Z-score. Altman's Z-score is calculated as $Z = 1.2 (\text{Working Capital}/\text{Total Assets}) + 1.4 (\text{Retained Earnings}/\text{Total Assets}) + 3.3 (\text{Earnings Before Interest and Taxes}/\text{Total Assets}) + 0.6 (\text{Market Value of Equity}/\text{Book Value of Liabilities}) + 0.999 (\text{Net Sales}/\text{Total Assets})$.	Datastream	-	-
FCF to total assets	The ratio of Free Cash Flow to total assets.	Datastream	-	-

Macroeconomic factors

Risk free rate	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 closing date falls within the 2007-2008 financial crisis period (September 15, 2008 – December 31, 2014) and 0, otherwise.	Pinto and Alves (2020)	+	+
Sovereign crisis	Dummy equal to 1 if the closing date falls within the sovereign debt crisis period (April 24, 2010 – December 31, 2016) and 0, otherwise.	Pinto and Alves (2020)	+	+
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.

Appendix B: Descriptive statistics for PF and CF bond samples

Panel A: Continuous variables

Variable of interest	Project Finance Bonds						Corporate Finance Bonds					
	Number	Mean	Median	Std.Dev.	Min	Max	Number	Mean	Median	Std.Dev.	Min	Max
<i>Contractual characteristics</i>												
Credit spread (bps)	763	241.0	195.0	180.3	1.2	1,025	46,433	206.8	145.7	193.3	-4.8	1,092
Rating [1-22 weak]	592	8.5	9.0	3.5	1.0	20.0	45,603	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	1.0	24.0	46,433	5.9	4.0	5.1	0.0	46.0
Bank reputation [1-25 best]	763	7.3	3.0	8.0	1.0	25.0	46,433	8.2	3.0	9.2	1.0	25.0
<i>Macroeconomic factors</i>												
Country risk [1-22 weak]	763	4.0	1.0	4.2	1.0	17.0	46,433	2.7	1.0	2.9	1.0	21.0
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 [32-85 strong]	763	66.6	68.7	8.6	32.4	84.1	46,433	70.2	72.0	6.6	32.4	84.1

Panel B: Dummy variables

Variable of interest	Project Finance Bonds			Corporate Finance 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
Financial crisis	763	2.6%	0.16	46,433	5.6%	0.23
Sovereign crisis	763	35.9%	0.48	46,433	40.0%	0.49