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Thierie, Wouter; De Moor, Lieven

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Loan tenor in project finance

Wouter Thierie[1], Lieven De Moor[1,2]

[1] Vrije Universiteit Brussel, Faculty of Economic and Social Sciences and Solvay Business School, Pleinlaan 2 B-1050 Brussels, Belgium

[2] Corresponding author, lieven.de.moor@vub.be, +32 498 61 64 63

Abstract

Purpose – The purpose of this paper is to develop a better understanding of the debt structuring of PF loans and the main drivers affecting the maturity of bank loans in infrastructure deals. When banks grant loans to a project, they have two decision variables: the interest margin or the spread and the maturity of the loan. Although several studies analyze the drivers of the spread, few studies in the literature look at the maturity of bank loans. As infrastructure projects are typically highly leveraged, the structuring of bank lending is an important parameter in the financial viability of the project.

Data/methods – The paper develops a regression analysis of the loan's maturity on four categories: characteristics of the project, political risk of the country where the project is executed, the macro-economic setting and the regulatory framework. By using a new dataset of InfraDeals containing data on bank spreads of more than 1800 infrastructure projects worldwide from 1997 to 2016, this paper reveals new insights on the debt structuring of banks for PF loans.

Findings – Our results indicate that the maturity of bank loans granted to infrastructure deals is predominantly driven by political risk and regulation, rather than the structuring of the project. This implicates that the region where the deal is closed weighs more heavily than the specificities of the project itself.

Practical implications – The results have important policy implications. The paper allows to develop a better understanding on how political risk and new regulation, like Basel III, might affect the project finance market. The paper is the first one finding empirical evidence of the impact of Basel III regulation on PF lending. By delving deeper into the political risk variable, we formulate several recommendations to mitigate political risk.

Authors

Wouter Thierie

Wouter Thierie is PhD researcher at the Vrije Universiteit Brussel, financially supported by the VUB Chair in Public-Private Partnership. He obtained a master degree in Advanced Studies in Economics at KU Leuven. His major research interest is in infrastructure finance.

Lieven De Moor

Lieven De Moor is associate professor of finance and study program committee chairman at the Vrije Universiteit Brussel and chairholder of the VUB Chair in Public-Private Partnership. He obtained a PhD in Applied Economics at KU Leuven.

Introduction

Across the world, there is an intense need to invest more in infrastructure. Private investors need to play a larger role in filling the gap in the financing of large and long-term infrastructure projects. Project finance (PF) is one of the most common finance techniques for the financing of single-purpose, capital-intensive projects, such as infrastructure. Gardner and Wright (2012) define project financing as follows: *"The raising of finance on a limited recourse basis, for the purposes of developing a large capital-intensive infrastructure project, where the borrower is a special purpose vehicle (SPV) and repayment of the financing by the borrower will be dependent on the internally generated cashflows of the project"*. The responsibilities of all parties involved and the distribution of risks and returns are written down in contractual arrangements (Ehlers, 2014). While PF reduces potential agency conflicts and aligns incentives of the various parties involved (Morellec, 2004), it involves high legal and transaction costs and can be relatively time-consuming compared to other forms of financing (Sorge and Gadenecz, 2008). Since the economies of scale for large projects outweigh the ones of smaller deals, the legal and transactions costs for large projects are relatively lower. Hence, PF has been especially used to fund large-scale capital-intensive projects generating hard currency cash flows. PF lending is non-recourse lending which means that lenders have little or no claim on the balance sheets of its sponsors in the event of default by the SPV. The loans granted to the project are fully paid from the cash flows of the project. PF loans are fully self-contained, one-time financing events. Sorge (2004), however, argues that one drawback of non-recourse debt is that it exposes lenders to project-specific risks that are difficult to diversify. A project financing is typically a highly leveraged transaction, up to 70%–80% of financing would be procured in the form of debt while the share of equity would not normally exceed 20%–30%[1]. Since project financing has peculiar characteristics compared to corporate finance, we must analyze their characteristics separately.

There is a variety of ways how the debt component of infrastructure projects may be financed (for example, bond financing, commercial lending, public institutional capital investor markets), but bank lending is still the major source of funding in PF deals which is the focus of this paper. When banks grant loans to a project, they have two decision variables: the interest margin or the spread and the maturity of the loan. Although several studies analyzed the drivers of the spread, few studies in the literature look at the maturity of bank loans. As infrastructure projects are typically highly leveraged, debt structuring is an important parameter in determining the financial viability of the project. PF deals could significantly decrease funding costs by achieving high leverage as debt financing is much cheaper than equity financing. However, the higher the debt-to-equity ratio, the more likely that the project company will run the risk of a loan default during hard times, possibly terminating the project. The shorter the loan tenors of the debt granted to the project, the more quickly the project should raise new debt financing on the market. A shorter loan term exposes the project more to refinancing risk, increasing the probability of a project default.

In the remainder of this paper, the purpose is to develop a better understanding of the debt structuring of PF loans and the main drivers affecting the maturity of bank loans in infrastructure deals. After a brief review of some studies which analyzed loan maturities in infrastructure deals, the second section presents some descriptive statistics on our sample of loan tranches. The core of this report is the third and fourth section where we propose our own empirical analysis answering the questions: What are

[1] http://www.eib.org/epec/g2g/annex/1-project-finance/

the main drivers of loan maturities for infrastructure? How do banks structure debt? What is the impact of new regulation, like Basel III, on bank debt? The conclusion summarizes the main findings and draws some policy implications. Our goal is to define the drivers of loan maturities and to show how tenors vary in relation with these variables.

A deeper understanding of debt structuring and the risks involved in PF is important for both practitioners and policymakers. This study is intended primarily for government officials who influence the political environment of infrastructure projects. It will help government officials to assess how political risk and new regulation, like Basel III, might affect the PF debt market and will support their efforts to improve PF lending. By delving deeper into the political risk variable, we formulate several policy recommendations to mitigate political risk. This report should also be helpful to private infrastructure investors, developers and operators, as it provides them with a deeper understanding of PF lending and how lenders determine the maturities of PF loans. It will help them to improve the structuring of their projects and mitigate risk factors that might shorten the maturity lenders are willing to grant.

Literature review and hypotheses

Although projects could be funded from different sources (for example, export credit agencies and multilateral agencies, bond financing, bank loan market, public institutional investor capital markets), commercial bank lending still represents the principal source of financing for a project. Bank loans have some key advantages over bonds or other structured financing solutions. Firstly, they have the expertise to perform a crucial monitoring role in the project (Ehlers ,2014). Secondly, bank loans are sufficiently flexible to deal with a gradual disbursement of funds or the restructuring of existing debt in the case of unforeseen events. Further, Niehuss (2015) argues that capital markets and institutional investors never became the dominant funding source because they are reluctant to accept construction phase risk. However, the maturity of assets banks can safely hold is limited by the short-term liabilities they have. Sponsors, on the other hand, will invariably be drawn to the longest maturities, ceteris paribus, as it brings inherent benefits to a project's economics (Gardner and Wright, 2012). The SPV should evaluate the combination of tenors and interest rate structures of each type of financing and opt for the one(s) that best suit the project's revenues and debt profile (AFME, 2015).

Several studies (Kleimeier and Megginson, 2000; Blanc-Brude and Strange, 2007) argue that PF loans strongly differ from corporate debt. By comparing 90,000 syndicated loans including 5,000 PF loans, Kleimeier and Megginson (2000) find that PF debt facilities are typically structured with much longer repayment tenors compared to other forms of financing. Craciun (2011) argues that tenors in project finance are, historically, usually two or even three times longer than corporate loan financing. These longer maturities are granted to better match the economic life of the underlying asset (Sorge and Gadenecz, (2008). Infrastructure projects require significant initial capital investments and only start to generate cash flows after the construction period which could take a long time (Sorge and Gadenecz, 2008; Gardner and Wright, 2012; Ehlers, 2014). Although PF deals typically face a liquidity shortage during development and construction, these projects could be financially viable on the long-term. Therefore, several authors (Bouzguenda, 2014; Ehlers, 2014; Blanc-Brude and Strange, 2007) argue that PF loans require much longer maturities than corporate debt loans. As projects usually require substantial investments up front and loan repayment relies primarily on these cash flows, longer maturities play a crucial role in ensuring a project's financial viability.

By providing longer-term infrastructure loans, banks could moderate liquidity constraints of the project company, thereby reducing the risk of default (Bouzguenda, 2014). Longer-term PF loans are therefore less risky than short-term loans. Shortening loan maturities force the project company to make large payments in the early stages of the project. Sorge and Gadenecz (2008) argue that this might, ceteris paribus, exacerbate the project company's liquidity constraints, thus increasing the risk of default. Longer maturities allow the SPV to amortize all capitalized costs over a longer period alleviating default risk (Gardner and Wright, 2012). Hence, longer-term infrastructure loans might not necessarily be perceived by lenders as riskier, compared to shorter-term ones (Sorge, 2004). The question of what determines loan maturities is crucial to understanding the peculiar nature of credit risk in PF but has remained so far largely unexplored. Since PF has several peculiar characteristics, we might expect tenors in PF to behave differently from that of other loans or bonds.

Although PF loans typically have longer maturities, the tenor is still shorter than the full lifecycle of the project. In Bouzguenda (2014), the average maturity of loans is approximately eight years. For many projects, banks provide loans, also known as 'mini-perms', with much shorter maturities of three to seven years. This leaves the project company and sponsors with material refinancing risk. PF deals are generally more vulnerable to refinancing risk compared to corporates as the life of PF assets is limited. Since refinancing might not be available or very expensive, this creates substantial project default risk, especially in markets vulnerable to a credit crunch or in which long-term maturities are not available. As the length of the loan tenor is crucial for the long-term viability of PF deals, we should shed more light on the factors that influence these maturities.

H1: Higher political risk has a negative impact on loan maturities

As ***political risk*** is hard to manage for private companies and can often not be allocated to the public sector, this is expected to affect PF loan characteristics. Political risks refer to the risks related to the effects of government actions on an infrastructure project or asset. Della Croce and Sharma (2014) argue that political risk is among the greatest concerns of private investors, representing a major disincentive for investments. In emerging economies, political risk is the greatest constraint on investment decisions, except for macroeconomic stability (WEF, 2015). Political risk and regulatory risk can take many forms: delayed construction permits, community opposition, changes to various regulations or taxation laws, outright expropriation, corruption, currency convertibility, failure of state-owned suppliers or customers to fulfil their contractual obligations or the unilateral renegotiation of existing contracts by new governments. (WEF, 2015; Ehlers, 2014; Sorge and Gadenecz, 2008). WEF (2015) notes that political risk applies particularly strongly to infrastructure investments as the asset lifecycle is much longer than political cycles. Investor returns could be eroded not only by the current government, but also future governments could severely affect the performance of infrastructure investments. Governments have the power to renegotiate contracts, and sometimes are tempted to do so (Ehlers, 2014). Precedents of contract renegotiations and one-sided political interference greatly increase the perception of risks for private investors. The economic performance of an infrastructure asset depends directly on (changes in) the regulatory framework and/or on money from the public purse (WEF, 2015). The regulations in question might be sector-specific, as in the case of power grids (which involve a natural monopoly) or public transportation (when assets rely on subsidies). Creating a pipeline of suitable projects requires a coherent and trusted legal framework for infrastructure projects (Ehlers, 2014). In some countries, those frameworks do not

exist. Even when a solid legal framework exists, the expertise and institutions for the development of large infrastructure projects are lacking.

Some papers find evidence of the impact of political risk on lending conditions in the PF loan market. Sorge and Gadenecz (2008) find that political risk significantly affects credit spreads in emerging markets. By proxying political risk by the corruption index provided by Transparency International, Sorge (2004) finds that more corruption in the host country raises the risk premium for borrowers in in emerging markets. However, in advanced economies, results suggest that corruption is not a significant problem for PF. Although most attention in the literature is drawn to the impact on the spread, Sorge and Gadenecz (2008) also analyze the impact on loan maturities. The authors find evidence that commercial lenders are more likely to commit for longer maturities under the umbrella of multilateral development banks or export credit agencies in their sample of emerging countries.

H2: The involvement of a development bank exercises an upward pressure on the length of the loan tenor

Secondly, the presence of ***Export Credit Agencies (ECAs) and multilateral institutions*** might significantly affect debt structuring. Development banks and ECAs play a crucial role in financing and facilitating infrastructure deals in both developing and developed countries. The difference between ECAs and multilateral agencies is that the latter are established by intergovernmental agreements and are independent of the interests of any single country member or recipient government (Gardner and Wright, 2012). Both provide political risk covers, which reassures other lenders such as local banks (Ehlers, 2014; Gardner and Wright, 2012). Their loan commitments are in some cases a pre-condition for private lenders to make their funding available. They can also provide direct lending or even equity participation. However, Gardner and Wright (2012) note that development banks usually are not main financier of infrastructure projects as their financial resources are naturally limited. Development banks and ECAs also play an important role as facilitator of PF deals as they bring vast expertise and monitoring capabilities in the project (Ehlers, 2014).

The political risk guarantees provided by multilateral development banks or ECAs can either be explicit (formal insurance contract against specific political risk events) or implicit (no formal contract) (Sorge and Gadenecz, 2008). Even if no formal credit guarantee is provided to lenders, the de facto preferred creditor status of multilateral development banks is perceived to mitigate political risks. The special relationship between multilateral development banks and host governments, which are also their shareholders, facilitates the resolution of any problems that might arise in the regulatory or policy environment leading to project default. Additionally, before being approved for co-financing, projects are subject to detailed appraisals and thorough evaluation by the multilateral development banks. It is difficult to distinguish between implicit and explicit guarantees. In the absence of any formal contractual arrangement spelling out the terms of the credit protection, it is hard to verify the nature and extent of risk mitigation for implicit guarantees.

Sorge and Gadenecz (2008) and Sorge (2004) find that the availability of such explicit or implicit forms of risk mitigation appear on average to significantly reduce the spread attached to PF deals. Sorge (2004) argues that loans with political risk guarantees from these agencies are priced on average about 50 bp cheaper, ceteris paribus. These results, however, need to be viewed with some caution, as they are based on ex-ante measures of credit risk, given the limited available evidence on actual default rates for PF loans or secondary prices for PF loans. Sorge and Gadenecz (2008) find evidence that

commercial lenders are more likely to commit for longer maturities under the umbrella of multilateral development banks or ECAs in their sample of emerging countries. The median maturity for loans with an agency guarantee increases to 12 years from a median of only 7.5 years for the whole sample of loans with and without agency guarantees. Further, Sorge (2004) also finds empirical evidence that suggests that the availability of agency guarantees effectively lengthens maturities of PF loans in emerging markets.

H3: PPPs are granted longer loan maturities relative to traditional projects

There are several reasons why we hypothesize ***Public-Private Partnerships*** (PPPs) projects having longer maturities. The structuring and delivery of modern infrastructure projects is extremely complex as it involves many different stakeholders over the project's lifecycle with different roles, and often conflicting interests (Beckers et al., 2013). Large infrastructure projects often suffer from a lack of forward-looking, life-cycle-oriented risk assessment in the early stages of the project. The seeds of many project failures are sown in the early stages of development as poor risk assessment in the project-origination and design phase generates risks which can materialize in later stages. This leads to delays, cost overruns, and ultimately diminished returns. Proper front-end project planning can alleviate many of these issues. Crawford (2014) argues that a detailed risk assessment is required prior to procurement contracts being awarded to minimize the chance of a risk being realized at a given stage in the project.

In PPPs, risks are typically better anticipated and managed from the outset (Beckers et al., 2013). Since the risk allocation is already set out contractually before the construction phase, the different parties involved put a lot of effort to identify and quantify all the potential risks at the beginning of the project. In PPP contracts, each risk is ideally allocated to the party, either public, private or shared between the two, that is best able to manage the risk (WEF, 2013). As the public sector is better able to manage some risks, the involvement of the government in PPPs might reduce the overall risk exposure, creating trust among lenders allowing them to grant longer maturities. Further, the involvement of the government might also reduce specific risks by granting credit support or guarantees. In PPP projects, the government, which is the procurer, may also retain an ownership stake in the project and be a sponsor. Gardner and Wright (2012) note that the government may contractually provide several undertakings to the project company, sponsors, or lenders which may include credit support in respect of the procurer's payment obligations under a concession agreement. Craciun (2011) argues that the direct involvement of the public authorities, through guarantees or direct contracting and through local or national budget funding, results in a reduced specific risk.

H4: The size of the banking syndicate has a negative impact on maturities

Fourthly, the ***size of the banking syndicate*** is expected to have a negative impact on loan maturities in PF transactions. Bank loans in PF are usually provided by a syndicate of banks rather than a single bank. Since large projects might be too big for a single bank to finance on its own (Sorge, 2004), they are more likely for very large loans. Kleimeier and Megginson (2000) noted how PF loans are generally characterized by larger syndicates compared to other syndicated credits. A syndicate of a limited number of banks has also an attractive feature. Sorge (2004) and BIS note that a syndicate would help to diversify risks of a single project across a group of banks. Sorge and Gadenecz (2008) found empirical evidence that sharing the risks across multiple investors has an important risk-mitigating effect. Sorge and Gadenecz (2008) even note that PF is making increasing use of larger syndicates to cope with

political risks. Although a syndicate of banks helps to diversify risks, Sorge (2004), however, notes that too many banks in the syndicate might make it harder to monitor the project or to enforce project specific governance rules to avoid conflicts of interest.

H5: Basel III negatively affects loan maturities

Further, the impact of the ***country's regulatory framework*** on debt structuring is discussed. The focus in this study is on the new Basel III regulation. Since Basel III limits the possibilities of banks to grant long-term loans, we expect this to be reflected in the data. Typically, a PF structure involves one or more sponsors who act as investors and a syndicate of banks that provide loans that fund 70-80% of the project (Ma, 2016). As a result, regulation of banking activities, such as capital requirements or liquidity coverage ratios, significantly affects the optimal financing structure for infrastructure. This regulatory risk is defined by Craciun (2011) as the risks following from changes in the regulation of certain aspects of business. Recently, banks face increasing restrictions in their capacity to fund infrastructure projects. Basel III, which was proposed in the aftermath of the financial crisis of 2007-08, introduced two liquidity standards, the liquidity coverage and net stable funding ratio, that are likely to have a far-reaching impact on the global PF industry (Ma, 2016). The Liquidity Coverage Ratio (LCR) requires banks to hold sufficient assets, such as cash, central bank reserves, and government bonds (Morrison, 2012) that can be converted easily into cash in private markets with limited losses (Wandhöfer, 2014) which should allow the bank to survive a stress scenario (Gelencser and Campbell, 2014). Morrison (2012) notes that an undrawn revolving loan requires 100% liquidity cover if made to a SPV, used in most project financings. The second liquidity standard introduced by Basel III is the Net Stable Funding Ratio (NSFR) which requires banks to fund their activities with secure longer term, higher cost sources of funding for long-term, illiquid assets (such as PF loans). Gardner and Wright (2012) argue that the continuing pressure on bank liquidity forced some banks to withdraw from the markets resulting in a smaller universe of banks with the appetite and balance sheet capacity to fund large infrastructure projects. For those banks that remain in the market, Shearman & Sterling LLP (2014) and Ma (2016) argue that Basel III has certainly begun to change the structuring of PF deals.

Although Basel III will not be fully integrated until 2018, banks are already adjusting funding profiles under the gradual phase-in period and the market pressure of peers (McNamara and Metrick, 2014). Various sources indicate an upsurge in funding costs for banks from 60 bp to 110 bp, as compared to Basel II (Härle et al., 2011). For global systemically important banks (G-SIB), which carry out a major portion of global PF transactions, the actual impact on bank funding cost will be even higher as these banks must hold extra common equity (Watson et al., 2012). The question is how much of this rise in funding costs for banks will result in an increase of the cost of debt for infrastructure projects. Apart from the spread, Basel III is also expected to affect loan tenors as banks face increasing restrictions on the tenor of the loans they can offer (AFME, 2015). Prior to the crisis, commercial banks were willing to make PF loans with long-maturity, covering both the construction and operational phase of the project. Largely because of the NSFR, banks are increasingly unwilling to finance PF structures with long-maturity loans. Morrison (2012) argues that the number of lenders able to lend project loans with tenors longer than seven to ten years has become smaller, especially for larger loans above £100 million. Gelencser and Campbell (2014) note that the appetite for loan tenors of more than 15 years is minimal. Finally, Shearman & Sterling LLP (2014) argue that transactions are structured differently with lending done at reduced tenors.

H6: The economic setting has an impact on the length of a loan tenor

The role of the ***economic outlook*** at the time of granting the loan on loan maturities is discussed in this section. During the Great Recession (2008-10), risk premiums rose sharply and banks withdraw from the PF market in large numbers. The significant increase in funding costs combined with the general deterioration of global macroeconomic parameters, deteriorated the expected returns on infrastructure investments (Craciun, 2011). Consequently, many projects were postponed or abandoned. However, Ehlers (2014) notes that, although volumes over 2011-13 has shrunken compared to 2008-10, issuance volumes over 2011-13 were already significantly higher than in the credit-boom period 2005–07. Deleveraging and adjustment to new global financial regulations by banks may have contributed to the decline, as well as government budget restrictions the deleveraging and shrinking of balance sheets in the banking sector. The impact of macroeconomic parameters on loan maturities is unknown as empirical evidence is lacking. However, there are some indications that debt structuring is a function of the economic outlook. Craciun (2011) notes that, according to Euromoney estimates, the average duration of loans to finance investment projects dropped from 10 to 7 years during the Great Recession. By including several macroeconomic factors pertaining to the country of the borrower in their regressions (real GDP growth, inflation, investment to GDP, credit to GDP), Sorge and Gadenecz (2008) find the pricing of PF loans to be very sensitive to several sources of macroeconomic risk as well as the cyclical stance of the world economy.

H7: Availability-based projects are characterized by longer maturities

H8: Greenfield projects are granted loans with shorter tenors

Finally, some remaining factors are discussed that we expect to have an impact on loan tenors, such as whether the ***revenue scheme of the project*** is revenue-based or availability-based or whether the project is a ***greenfield or brownfield project***. Availability-based projects are expected to have longer loan maturities. In contrast to revenue-based projects when the demand risk resides with the concessionaire which is expected to recoup its initial investment from user fees, in availability-based projects, the government retains the demand risk for the project. We expect that longer loan maturities are granted to projects with availability-based payment mechanisms. These projects face lower default risk as the private party bears no demand risk. While greenfield projects are associated with assets yet to be constructed, brownfield projects involve established assets in need of improvement. Greenfield projects are expected to have shorter tenors as they expose lenders to higher default risk making lenders more reluctant to lend on the long term.

Data

The main source of data used in our study is the Transactions database of Inframation Group, a primary market information provider on infrastructure projects, listing loan, project and borrower characteristics. Our sample is complemented with macroeconomic data from the IMF and the World Bank. These variables include GDP growth (World Bank), Central Government Debt (World Bank) and Inflation (World Bank). We linked these macroeconomic variables to the transactions database on the country and the date. Also, a Political Risk Rating, measuring the political stability of a country, is added to our sample[2]. This rating includes 12 components covering both political and social attributes which are grouped together in 6 major categories of political risk: Voice and Accountability, Political Stability

[2] https://www.prsgroup.com/wp-content/uploads/2012/11/icrgmethodology.pdf

and Absence of Violence, Government Effectiveness, Regulatory Quality, Rule of Law, and Control of Corruption. Each political risk component is awarded a score between a minimum of zero and a maximum number of points that depends on the importance (or weighting) of that component to the overall risk of a country. The higher the score, the lower the potential risk for that component, with zero corresponding to the highest potential risk. After a risk assessment score has been awarded to each of the 12 risk components, the components are added together to provide an overall risk rating. As the scores of the different political risk categories are given separately, we could track the effect of a single category on loan maturities.

As an exploratory analysis, in this section, we present some descriptive statistics on our sample of loan tranches. The focus in this paper is on the general loan terms. There exist many different types of loans, each with different objectives and characteristics. As Table A1 shows, loan maturities considerably vary across these loan types. Therefore, these other loan types fall outside the scope of this paper. Our sample contains information on loan maturities for 1801 transactions over 1997-2016, representing a substantial fraction of the entire PF population. The average maturity is 15.11 years, varying from less than a year to up to 60 years. In 355 infrastructure projects, there is at least one governmental or multilateral agency involved which might provide political risk guarantees. In 76 projects, multiple governmental or multilateral agencies provided debt financing. Our sample also shows a substantial difference in loan maturities between PPP and non-PPP projects. While the 817 PPP projects in our sample have an average loan maturity of 19 years, the other 994 non-PPPs show a much shorter average maturity of 12 years.

Tables A2 and A3 show the geographic breakdown of the PF loans with table A3 showing only a selected number of countries. Although Europe (1060 loans, 58,9%) accounts for most of the loans, our sample has a worldwide coverage with also a substantial number of observations in North America (223 projects, 12.4%), Latin America (199, 11.0%), Australia (144, 8.0%), Asia (125, 6.9%), the Middle East (36, 2.0%) and Africa (14, 0.8%). Most observations are UK-based projects (421, 23.0%), followed by Thailand (8.2%), Spain (8.2%), Italy (5.2%), France (5.2%) and Germany (2.9%). The share of the other countries did not exceed 2% of the sample. Tables A2 and A3 also show the average loan maturity for each country. Since loan maturities substantially vary across countries, it seems that country or political risk plays an important role in defining the maturity of the loan. The average loan maturity in Peru (11.7 years) is substantially lower than the average one of the UK (19.6 years). Table A4 shows the industrial breakdown of project loans. Most of the loans in our sample are granted to renewables (618, 34.3%), transportation (479, 26.6%) and social infrastructure projects (402, 22.3%), but also includes a substantial fraction in Power (184, 20.2%), Environment (92, 5.1%) and Telecoms (19, 1.1%). In Table A4, these sectors have been further unraveled in several subsectors. Average loan maturities seem to vary substantially across sectors. While Health, Education and Social Housing projects are typically granted loan maturities above 20 years, for Airports and Ports this falls below 10 years.

Methodology

We develop a regression analysis of PF loan maturities on the different variables presented above, using ordinary least-squared (OLS) estimation. The dependent variable is the term of the loan tranche, expressed in number of years. As in Corielli et al. (2010), we use multiple tranches as separate observations. Unfortunately, our samples were too small to attempt panel data analysis. Using an OLS regression, we examine how loan maturities granted by lenders change with variables expected to

have an impact on tenors. They are regressed on characteristics of the projects (deal type, revenue scheme, PPP, size of the banking syndicate) along with a dummy to indicate the presence of multilateral institutions or export credit agencies and several control variables including the macroeconomic condition (economic growth, inflation, return on equity and debt-to-GDP ratio) and political risk prevailing in the country of the borrower at the time of signing the loan. Although loans to individual projects might exhibit very different characteristics, our OLS model shows the average effect at the portfolio level of these variables on the tenor. By including sector dummies, we control for the impact of sector characteristics on loan maturities.

$$\text{Loan maturity} = \alpha + \beta_1 \text{ Political risk} + \beta_2 \text{ Agency} + \beta_3 \text{ PPP} + \beta_4 \text{ Syndicate size} + \beta_5 \text{ Basel III} + \beta_6 \text{ Economic growth} + \beta_7 \text{ Inflation} + \beta_8 \text{ ROE} + \beta_9 \text{ Debt-to-GDP ratio} + \beta_{10} \text{ Availability-based project} + \beta_{11} \text{ Greenfield project} + \beta_{12} \text{ Sector dummies} + u$$

where
Loan maturity = the term of the loan tranche, in number of years
Political risk = Indicator measuring the political stability of a country
Agency = dummy equals one if at least one governmental or multilateral agency is involved in the project i.e. development banks or European Investment Bank (EIB), for European projects
PPP = dummy equals one if the project is a Public-Private Partnership, zero otherwise
Syndicate size = the number of different financers awarding the loan
Basel III = variable reflecting the gradual phase-in of Basel III regulation, between zero and one
Economic growth = real GDP growth in project's country, for the year concerned
Inflation = The rate at which the general level of prices for goods and services is rising, for the year concerned
ROE = Return on Equity of the banking sector in the project's country, for the year concerned
Debt-to-GDP ratio = the ratio of a country's public debt to its gross domestic product (GDP), for the year concerned
Availability-based project = dummy equals one if the project is entirely financed by availability payments and is not exposed to demand risk, zero otherwise
Greenfield = dummy equals one if the project is a greenfield project, zero otherwise

Results

In this section, we discuss the impact of the different variables on loan maturities. Table 1 reports our baseline regression results for the sample of PF loans. The table shows how loan maturities of term loans granted to infrastructure project change with several variables which are expected to have an impact on the length of the loan tenor. As loan maturities considerably vary across sectors, we control for sector-specific risks by adding sector dummies to the model. Table 1 shows five different specifications of the model presented above. The first three specifications include all loan tranches in our sample. In the last two specifications, the sample is limited to Europe. In the second specification, we control for sector-specific risks by adding sector dummies to the model. In the third, macro-economic variables are added to the model. In the last two columns, we test whether the presence of the European Investment Bank has an impact on the length of the loan tenor. In the final specification, we test the impact of Basel III on PF loans characteristics.

Table 1: Regression output: total sample vs. Europe

Sample	Total	Total	Total	Europe	Europe
Control variables	**/**	**Sector**	**Sector & Economy**	**Sector**	**Sector & Basel III**
Political risk	9.17**	9.49**	9.69**	7.97**	8.14**
Development bank	1.18	1.52*	2.00*		
EIB				1.97	1.96
PPP	5.07**	6.24**	6.53**	6.27**	6.27**
Syndicate size	-0.22**	-0.10	-0.14	-0.19*	-0.19*
Basel III					-2.34*
Economic growth			-0.01		
Inflation			0.20		
ROE			0.10**		
Debt-to-GDP ratio			0.01		
Avail. payments	2.67**	1.49*	1.30	1.42*	1.39*
Greenfield	4.30**	2.92**	2.27**	2.29**	1.91**
Sector dummies	No	Yes	Yes	Yes	Yes
Constant	4.04**	2.48	7.17	-0.01	0.90
R^2	0.39	0.47	0.53	0.51	0.52
N	1,205	1,205	892	979	979

* p<0.05; ** p<0.01

As put forward in ***hypothesis one***, political risk has a negative impact on loan conditions. The political risk index is constructed in a way that the higher the index is, the lower the potential risk is, with a score of zero corresponding to the highest potential risk. Results show that countries with little political risk (a high score on the political risk index) are granted loans which last, on average, eight to ten years longer for similar projects. In our whole sample, there is difference up to 9.7 years. When the sample is limited to European projects, the impact is slightly smaller but still very large (eight years) and highly significant. Since political risk increases project default, lenders put their money at risk for a shorter term. The ***second hypothesis*** states that the involvement of a governmental or multilateral agency in the debt financing of the project is expected to result in longer loan maturities. The list of all multilateral agencies and credit agencies considered for defining our dummy variable are provided Table A5 in the Appendix. Results in Table 1 show that the presence of such agencies, providing political risk guarantees, extends the average length of the loan by 1.5 to 2 years (columns two and three). Development banks often provide guarantees lowering the credit risk of the project. This results, on average, in longer loan maturities. In the last two columns, we limit our sample to European projects and test whether the presence of the European Investment Bank (EIB) has an impact on the length of the loan tenor. The presence of the EIB in the syndicate size seems to extend loan maturities with almost two years. However, the impact is not significant.

Hypothesis three is also accepted as results in Table 1 show that loan conditions are less favorable for non-PPPs. PPP projects have, on average, loan maturities which are 6.2 to 6.5 years longer relative to traditional projects. Under the PPP scheme, lifecycle costs and returns have already been charted before the start of the project. A risk matrix is constructed which lists all risks and their potential impact and assigns each risk to the party that is best able to bear them. An SPV is set up and all parties have already closed contractual agreements listing their rights and responsibilities before the construction phase. Therefore, lenders are willing to grant more favorable loan terms as they consider the likelihood

of default of these projects as lower. The ***fourth hypothesis*** states that the size of the banking syndicate negatively affects loan maturities in PF transactions. To assess the extent to which risk is being shared among many institutions as opposed to the case where the syndicate is small, the number of banks providing funds in the syndicate is included as explanatory variable. A larger syndicate size results in significantly lower loan maturities. However, the effect is small. The more banks involved, the higher the transactions costs and so project risk leads to shorter loan maturities.

Further, we tested in the last specification whether Basel III has an impact on loan conditions in our sample of European PF transactions (***hypothesis five***). The Basel III regulatory framework came into force in January 2013 with a gradual phase-in period of seven years. Therefore, the Basel III dummy included in our model increased every year with $1/7^{th}$ to take into account this gradual phase-in period. Although the new regulation will be fully effective from the start of 2019, a negative impact on loan conditions is already observed in our sample of PF transactions. Between 2013 and 2016, the Basel III regulatory framework reduced the average length of the loan tenor with 2.3 years. This paper is the first one finding empirical evidence of the impact of Basel III regulation on PF lending. In ***hypothesis six***, the economic outlook at the time of granting the loan is discussed. Therefore, four different macroeconomic indicators are added to the model: Economic growth, Inflation, the Return on Equity of the banking sector and the Debt-to-GDP ratio. During the Great Recession of 2007-09, loan conditions for infrastructure projects deteriorated dramatically with an upsurge in spreads and many banks withdrawing from the PF lending market. Therefore, we expected to find loan maturities also to evolve with the business cycle. However, results show that the impact of the economic outlook on loan maturities is negligible.

The ***seventh hypothesis*** stated that projects with availability-based payment mechanisms are expected to have longer loan maturities. This is confirmed by the results in Table 1. Loan maturities of availability-based projects are, on average, 1.3 to 1.5 years longer compared to projects where (part of) the demand risk resides with the SPV. In the first specification, the coefficient of 2.7 is slightly higher. As social infrastructure projects typically have availability-based payment schemes and are characterized by lower sector-specific risks, this coefficient seems to pick up this last effect. Since the government retains the demand risk for projects with availability-based revenue schemes, these projects face lower default risk encouraging lenders to grant loans with longer maturities. Based on the output in Table 1, the ***eighth hypothesis***, specifying that greenfield projects are granted loans with shorter tenors, can also be accepted. The coefficient is estimated at 2.9. When we control for the macro-economic setting at the time of granting the loan, the impact is slightly smaller but still very significant. For our European sample, estimates vary between 1.9 and 2.3. As greenfield projects are associated with assets yet to be constructed, they expose lenders to higher default risk making lenders more reluctant to grant long-term maturities.

Table 2: Regression output: advanced vs. developing countries and political risk categories

Sample	**Total**	**Advanced**	**Developing**	**Advanced**	**Developing**
Control variables	**Sector & Polit. risk categories**	**Sector**	**Sector**	**Sector & Polit. risk categories**	**Sector & Polit. risk Categories**
Political risk		5.26	9.27**		

Accountability	0.73			-1.20	-5.36*
Political stability	-0.60			-4.72	7.40
Government effectiv.	0.98			2.81	1.56
Regulatory quality	4.85**			5.42**	2.62
Rule of law	7.09**			5.27	5.40*
Control of corruption	-4.37*			-6.97**	0.54
Development bank	1.46*	1.56	0.59	1.45	0.72
PPP	5.97**	7.72**	3.66**	7.65**	3.24**
Syndicate size	-0.12*	-0.15	-0.07	-0.17*	-0.07
Avail. payments	1.61*	1.23	1.84	1.46*	2.26
Greenfield	2.79**	2.51**	3.02**	2.25**	2.87**
Sector dummies	Yes	Yes	Yes	Yes	Yes
Constant	2.68	12.24	5.43	14.69	1.74
R^2	0.48	0.50	0.35	0.51	0.39
N	1,205	964	241	964	241

* p<0.05; ** p<0.01

In the remainder of this section, we distinguish between advanced and developing countries. The first specification in Table 2 shows the regression output for the total sample. In specification two (four) and three (five) the analysis is executed for respectively advanced and developing countries. In the first (i.e. total sample) and last two specifications the political risk index is further unraveled in its different categories: Voice and Accountability, Political Stability and Absence of Violence, Government Effectiveness, Regulatory Quality, Rule of Law, and Control of Corruption. Table 2 shows that political risk affects advanced and developing countries differently. Political risk weighs more heavily for developing countries. For the sample of advanced countries (specification two), the political risk index is no longer significant. However, in the sample of developing countries, the index has a strong and significant effect on loan maturities. Instead of estimating the impact of the political risk index on loan conditions, the impact of its different categories on loan maturities are estimated separately in the final two specifications. This again reveals differences between advanced and developing countries. In the sample of advanced countries (specification four), regulatory quality shows a significant impact on loan maturities while in the sample of developing countries, the impact of the political risk index is mainly driven by the categories: Voice and Accountability and Rule of Law. As expected, the higher the country score on Rule of Law, the longer loan maturities, ceteris paribus. Remarkably, the coefficient of Voice and Accountability is negative which indicates that a higher score on this category is related to shorter loan maturities, which is left as an open question in this paper. This has important policy implications. Across the world, there is an intense need to invest more in infrastructure. Governments could reduce the infrastructure gap in their country by mitigating political risk, which deters private financers to invest in infrastructure in their country. The results in this paper show that political risk largely deteriorates loan conditions for infrastructure projects as loan maturities granted to infrastructure projects are significantly shorter in countries with high political risk. Results show that the focal point, however, differs between advanced and developing countries. Governments in advanced countries should mainly focus on their regulatory quality to improve loan conditions, while public authorities in developing countries should mainly pay attention to improve the Rule of Law.

Conclusion and policy recommendations

Given the special nature of PF deals, loan maturities in PF behave differently from corporate debt loans. Longer maturities are granted to better match the economic life of the underlying asset and to

moderate the project company's liquidity constraints during development and construction. Therefore, loan tenors play a crucial role in ensuring a project's financial viability. Analyzing how lenders determine PF loan tenors is crucial to uncover the special nature of credit risk in PF. However, this has remained so far largely unexplored. This paper provides practitioners and policymakers with a deeper understanding of the debt structuring of PF loans and the main determinants that affect the maturity of PF bank loans. The main results show that maturities are mainly driven by political and regulatory risk, the revenue scheme, deal type (greenfield vs. brownfield), execution approach (PPP or non-PPP) and the presence of multilateral institutions and export credit agencies.

These results shed more light on the time profile of credit risk for this asset class and the peculiar nature of the term structure in PF lending. Several papers in the literature find either a downward effect (Bouzguenda, 2014; Altunbaş and Gadanecz, 2004; Sorge, 2004; Sorge and Gadanecz, 2008) or no effect (Kleimeier and Megginson, 2000; Dailama and Leipziger; 1998) between the credit spread and maturity. Ceteris paribus, longer-maturity PF loans appear to be associated with lower or constant credit spreads. By controlling for interaction between loan maturities and explicit or implicit political risk covers provided by development banks or export agencies, Sorge and Gadenecz (2008) concluded that this behavior must be due to more fundamental characteristics of PF structures as the relationship holds even in the absence of agency guarantees. However, other factors in our analysis might drive the behavior of the hump-shaped behavior of the term structure in PF lending. Our results show that political risk shortens loan maturities granted to projects, while evidence indicates that it drives up the spread[3]. Further, the development and construction risk in greenfield projects might result in higher spreads[4] and leads to shorter loan tenors as indicated by the results above. Contrary, projects with availability-based revenue schemes are charged higher spreads[5] while at the same time are granted longer loan maturities; longer compared to projects where (part of) the demand risk resides with the SPV. Availability-based payment schemes might alleviate the perceived risk of longer-maturity PF loans. In this way, our results indicate why longer-maturity PF loans are related with lower credit spreads which is pointed as surprising and left largely as an open question by Sorge and Gadenecz (2008). Further evidence is left for future research.

The results have important policy implications. The paper provides a cross-country assessment of the determinants of PF loan maturities. A deeper understanding of debt structuring and the risks involved in PF would be helpful to private infrastructure investors, developers and operators to improve the structuring of their projects and mitigate risk factors that might shorten loan maturities that lenders are willing to grant. For instance, the longer maturities that are granted to PPPs underline that a proper risk distribution and project preparation is crucial to get attractive loan conditions. Further, this paper gives government officials an insight in how political risk and new regulation, like Basel III, might affect the PF debt market and will support their efforts to improve PF lending. Hence, governments must take decisive measures to deter or insure against such risks. These recommendations deserve the attention of policy makers as they help to reduce the infrastructure gap and encourage investors to invest in their country. By delving deeper into the political risk variable, we formulate several policy recommendations to mitigate political risk. The focal point, however, differs between advanced and

[3] Pollio (1998); Dailama and Leipziger (1998); Kleimeier and Megginson (2000); Esty and Megginson (2000); Sorge and Gadanecz (2008); Sorge (2004); Corielli et al. (2010); Bouzguenda (2014); Altunbaş and Gadanecz (2004); Blanc-Brude and Strange (2007)

[4] Buscaino et al. (2012)

[5] Buscaino et al. (2012); Blanc-Brude and Strange (2007); Flyvbjerg et al. (2003); Bain and Plantagie (2004)

developing countries. While advanced economies should mainly focus on the quality of the regulatory framework to improve lending for their infrastructure projects, developing countries should mainly pay attention to the rule of law. The legal and regulatory environment of the country has a significant bearing on the willingness of investors to invest in a country's infrastructure. Legislation alone is not enough, however, government officials must also comply with the laws. This should be a priority for developing countries. As political risk weighs more heavily for developing countries, they could realize substantial gains by improving the rule of law in their countries. Finally, this paper is, to our knowledge, the first one finding empirical evidence of the impact of Basel III regulation on PF loan maturities. Although the Basel III regulation will be fully effective from the start of 2019, a negative impact on loan conditions is already observed in our sample of PF transactions as it reduced the average length of the loan tenor between 2013 and 2016. This regulation induces banks to shorten PF loan maturities which might worsen the projects' viability. It encourages banks to reallocate their portfolio away from long-term commitments into more short-term exposures which might not be necessarily safer. This new regulation might, unintendedly, make long-term PF lending riskier instead of safer. Future research is needed to analyze whether regulatory capital relief should be granted to PF deals, given the peculiar nature of the PF term structure.

Appendix: Descriptive statistics' tables

Table A1: Descriptive statistics on tenors: observations across loan types

LOAN TYPE	OBS	MEAN	STDDEV	MIN	MAX
LOAN	1801	15.11	8.58	0.5	60
MULTILATERAL	82	19.60	7.13	1.67	37
EQUITY BRIDGE LOAN	27	1.94	0.92	1	4
OTHER	2239	0.47	2.67	0	35
VAT FACILITY	3	4.88	4.57	2	10.15
CAPEX FACILITY	111	8.27	7.57	0.5	28
CREDIT FACILITY	39	4.46	2.97	2	20
GOVERNMENT LOAN	4	31.25	14.36	10	40

Table A2: Descriptive statistics on tenors: observations across continents

CONTINENT	OBS	MEAN	STDDEV	MIN	MAX
EUROPE	1060	17.63	8.49	0.75	60
NORTH AMERICA	223	11.23	8.42	1	40
LATIN AMERICA	199	13.02	6.64	0.5	52.2
AFRICA	14	15.43	3.80	8	25
ASIA	125	14.64	4.76	5	30
AUSTRALASIA	144	5.21	3.66	1	25
MIDDLE EAST	36	17.23	6.40	4	27

Table A3: Descriptive statistics on tenors (selected countries): observations across countries

COUNTRY	OBS	MEAN	STDDEV	MIN	MAX
AUSTRIA	12	16.71	5.65	10	27
BELGIUM	26	18.26	9.34	2	30

FINLAND	14	9.36	5.15	5	19
FRANCE	94	16.92	8.93	1.25	44
GERMANY	53	14.88	8.08	2	31
INDIA	22	14.28	2.49	5	17
INDONESIA	16	13.58	3.30	10	20
IRELAND	30	17.52	6.75	7	32.2
ITALY	93	15.96	4.38	3	30
JAPAN	24	18.49	4.30	5	30
NETHERLANDS	30	19.85	9.85	1	34.42
PERU	15	11.71	5.80	4	25
PHILIPPINES	11	13.91	3.56	7	20
POLAND	12	15.08	7.53	5	30
PORTUGAL	26	19.24	6.53	10	27
SPAIN	147	17.76	7.44	2	40
SWEDEN	10	14.60	6.59	5	28.5
THAILAND	147	17.76	7.44	2	40
TURKEY	10	14.60	6.59	5	28.5
UNITED ARAB EMIRATES	15	16.70	6.77	4	27
UNITED KINGDOM	421	19.63	9.33	0.75	60
USA	27	6.56	2.77	2	15.3

Table A4: Descriptive statistics on tenors (reduced sample): observations across sectors

VARIABLE	OBS	MEAN	STDDEV	MIN	MAX
SOCIAL INFRASTRUCTURE	402	21.59	9.05	2	60
DEFENCE	9	13.88	5.48	5	24.5
EDUCATION	143	23.55	7.49	2	36.5
HEALTH	118	21.30	9.62	2.5	52.2
LEISURE	12	20.67	9.70	3	32.5
OTHER	4	15.50	9.88	5	27
PRISONS	22	15.95	9.64	2.33	27.5
SOCIAL HOUSING	15	22.33	5.86	5	30
STREET LIGHTING	17	23.82	3.05	18	28
ENVIRONMENT	92	14.01	8.39	1	28
WASTE	45	16.19	8.82	1	28
WATER	47	11.93	7.47	1.5	25
POWER	184	9.84	6.25	1	35
ENERGY GENERATION	83	11.53	5.62	3	25.5
ENERGY STORAGE	12	8.33	5.82	3	22
ENERGY TRANSMISSION	84	7.97	5.84	1	22
OTHER	5	16.80	11.78	4	35
TRANSPORT	479	14.01	9.11	0.5	44
AIRPORTS	53	8.66	7.20	2	40
BRIDGES	23	16.89	11.40	3	44
CAR PARKS	10	12.25	9.40	3	28
LIGHT RAIL	28	20.84	7.61	5	31
ROADS	245	16.29	8.64	0.5	37
PORTS	70	8.59	5.33	1	30

RAIL	22	10.93	11.11	2.5	40
ROLLING STOCK	22	10.93	11.11	2.5	40
OTHER	45	12.66	8.93	1.33	35
RENEWABLES	618	13.76	5.77	0.75	40
BIO	12	9.89	4.02	2	15
HYDRO	37	15.73	9.87	1.5	40
OFFWIND	16	14.28	3.07	7	18
ONWIND	323	12.96	4.91	1	21.99
OTHER	4	15.75	4.92	11	20
PORTFOLIO	8	11.63	7.07	2	19
SOLAR CSP	18	19.89	5.92	6	33
SOLAR PV	197	14.34	5.78	0.75	27
TELECOMMUNICATIONS	19	7.26	4.57	3	23.5
FIXED LINE	4	7.75	4.03	3	12
OTHER	5	8.60	8.54	3	23.5
WIRELESS TRANSMISSION	10	6.40	1.41	5	9
OTHER	7	10.29	6.51	4.5	21.5

Table A5: List of governmental or multilateral agencies providing political risk guarantees

LIST OF GOVERNMENTAL OR MULTILATERAL AGENCIES PROVIDING POLITICAL RISK GUARANTEES[6]	NUMBER OF PROJECTS INVOLVED
EIB	125
EXIMBANK	9
AFRICAN DEVELOPMENT BANK	10
CAF ANDEAN DEVELOPMENT CORPORATION	6
ASIAN DEVELOPMENT BANK	24
CHINA DEVELOPMENT BANK	5
EKSPORT KREDIT FONDEN	11
INTER-AMERICAN DEVELOPMENT BANK (IDB)	25
INTERNATIONAL FINANCE COPORATION (IFC)	64
EUROPEAN BANK FOR RECONSTRUCTION AND DEVELOPMENT	39
OTHER[7]	10
KEXIM	12
FMO	26
INDUSTRIAL DEVELOPMENT CORPORATION OF SOUTH AFRICA	6
JAPAN BANK FOR INTERNATIONAL CORPORATION (JBIC)	23
NORDIC INVESTMENT BANK	12
OVERSEAS PRIVATE INVESTMENT CORPORATION (OPIC)	24
TOTAL	432[8]

[6] Based on the list provided in Sorge and Gadanecz (2008), p.56-57

[7] Other includes Coface (1 project), Export Finance and Insurance Corporation (1 project), Hungarian Development Bank (1 project), Export-Import Bank of China/China Exim Bank (4 projects), SACE (1 project) and the Export-Import Bank of India (1 project)

[8] In 76 projects, there is more than one governmental or multilateral agency involved. This brings the number of infrastructure projects with at least one governmental or multilateral agency involved at 355.

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