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## Working Paper

# An empirical analysis of factors responsible for the use of capital market instruments in infrastructure project finance

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**ADB Working Paper Series**

**AN EMPIRICAL ANALYSIS  
OF FACTORS RESPONSIBLE  
FOR THE USE OF CAPITAL  
MARKET INSTRUMENTS IN  
INFRASTRUCTURE PROJECT  
FINANCE**

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**Abstract**

The paper provides an empirical analysis of factors affecting the use of capital market instruments for financing infrastructure public–private partnership (PPP) projects. The findings of the paper contain useful policy guidance as the data provides some evidence to suggest that banks play a role in crowding-out bond finance. This is due to the traditionally close relationships banks enjoy with projects which allow them an advantage over bonds. Banks typically finance projects at financial close and bonds refinance banks after projects are operational. The findings are in accordance with the Asian Development Bank's (ADB's) experience in promoting the use of capital market instruments to finance PPP infrastructure projects. Accordingly, the findings suggest that, more than underwriting greenfield risk, MDBs have a role to play in supporting bond holders through risk mitigation, project appraisal and project structuring, as bond holders are less capable of mitigating and absorbing project risk than banks.

**Keywords:** Basel III, infrastructure project finance, capital markets

**JEL Classification:** G15, G18, G21, H54

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## 1. INTRODUCTION

Generating adequate finance for infrastructure is a critical development challenge. This paper examines factors impacting the use of different forms of debt for infrastructure projects, and implications of new bank capital regulations (i.e., Basel III) on loan and bond finance. The objective is also to suggest the policy actions required to meet the global infrastructure investment requirement of about 3.8% of gross domestic product (GDP), or an average of \$3.3 trillion a year up to 2030, to support expected rates of growth. Estimates for developing Asia indicate that a \$1.7 trillion investment is needed per year in infrastructure over 2016–2030 to achieve the growth momentum required to tackle poverty, and respond to climate change.<sup>1</sup> Table 1 provides the current level of syndicated bank lending for infrastructure in select Asian economies.

**Table 1: Syndicated Infrastructure Loans–Select Asian Economies, 1993–2015**

<b>Economy</b>	<b>Aggregate (\$ billion)</b>
People's Republic of China	200
India	157
Taipei, China	45
Hong Kong, China	44
Republic of Korea	41
Indonesia	28
Thailand	27
Philippines	24.5
Malaysia	21
Viet Nam	16
Sri Lanka	0.4

Source: Hansakul and Levinger (2016).

If the underinvestment continues, the world will fall short of the required investments by around 11% or \$350 billion a year. The size of the gap triples if we consider the additional investment required to meet the new UN Sustainable Development Goals (\$2.5 trillion per year) (McKinsey Global Institute 2016).<sup>2</sup> While global financial assets are potentially sufficient to meet infrastructure needs, the challenge is how to channel investments, improve the risk-return profile of new and potentially vulnerable investments, and generate sustained economic impact. In response, a few governments and supra-national institutions have introduced measures to address infrastructure debt requirements, especially after the financial crisis. The majority were conceived for public–private partnership (PPP) schemes such as Build Operate and Transfer and Design, Build, Finance, Maintain/ Operate DBFM/O, summarized below (Hellowell, Vecchi, and Caselli 2015; Vecchi, Casalini, and Gatti 2015):

- Grants, to reduce the capital requirements of the project or to integrate revenues;

<sup>1</sup> The estimates are based on the ADB (2017), study covering 32 of ADB's 45 developing member countries (DMCs) and four sectors: transport, power, telecommunications, and water supply and sanitation.

<sup>2</sup> These values are even bigger on a longer-term horizon. See Oxford Economics (2018) for detailed estimates of infrastructure needs to 2040.

- Availability-based payments to mitigate demand risk;
- Credit-enhancements, such as the minimum revenue guarantee and guarantees on bonds, to mitigate credit risk to banks and/ or bondholders;
- Viability gap funds (VGF), direct provision of senior debt to offset the liquidity gap, direct provision of subordinated/mezzanine debt and equity to increase project rating;
- Other measures, i.e., *inter alia*, favorable taxation.

The required investments need both public and private sector resources and the use of all potential financing instruments. While public finance reforms could boost revenues for investment, the private sector is expected to increase investments from around \$63 billion in 2016 to around \$250 billion a year over 2016–2030, primarily through PPPs. Given the scale of financing, while banks will remain important vehicles, the inherently short-term nature of deposits constrains banks from offering longer maturity loans. In addition, Basel III regulations introduced in the wake of the global financial crisis have increased the capital buffers that banks must hold and has required banks to better manage asset-liability mismatch and liquidity risk. This, along with other prudential regulations, has reduced the ability of banks to provide long-term project finance.

The Financial Stability Board 2018 has suggested that the implementation of Basel III rules are *yet* to have a significant impact on infrastructure financing by banks,<sup>3</sup> however, it has clarified that the full effects of Basel III will develop in the longer term, and suggested the need for capital market instruments such as project bonds, to complement banks. The securitization of bank infrastructure loans could also support lending, broaden the investor base and diversify risk, while also developing capital market instruments (Gatti 2014). The descriptive analysis in Section 3 also confirms that capital markets became an increased source of funds after 2007–2009, accompanied with a reduction of equity contributions.

Capital market instruments can effectively complement bank financing. Given their long-term project finance expertise, banks are the obvious lenders during the construction phase of an infrastructure project. Institutional investors are less familiar with the intricacies of the technological, construction, and legal risks arising during this phase of the project. Instead, they are more interested in investing in assets with a proven track record of operational activity. Accordingly, best practices suggest that projects refinance existing bank loans after the construction phase, with a project bond. As we show in Section 4, this is indeed the case.

Bank loans have several advantages over bonds or other structured instruments in the construction phase, such as: (i) banks provide an essential monitoring role; (ii) bank lending has the required flexibility to structure disbursements;<sup>4</sup> and (iii) infrastructure projects are relatively more likely to require debt restructuring in unforeseen events, and banks can quickly negotiate such restructuring with each other (Esty and Megginson 2003). Banks take on higher project risk during construction, which is significantly mitigated in the operation phase, at which time bond financing and other structured instruments are more attractive for long-term investors in this asset class (Gatti 2014).

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<sup>3</sup> Implementation and Effects of the G20 Financial Regulatory Reforms 28 November 2018 (4th Annual Report).

<sup>4</sup> It is important to notice that the gradual disbursement of funds is something difficult to be managed with a bond issue. Typically, a bond issuer receives the full amount of money upfront and is then forced to invest the unused amount in short term liquid Securities with a suboptimal yield (i.e., *negative carry* effect).

Given a differential capital charge and lower spread, based on reduced risk in the operational stage of a project (Gatti 2018, Chapter 3), banks may support a project during the construction phase and then encourage re-financing with capital market instruments once projects are operational. The recycled capital may then finance new greenfield projects and earn higher returns. Accordingly, there may be greater demand for capital market instruments to replace banks in ADB developing member countries (DMCs) as is the case in developed economies. If projects are sufficiently de-risked and banks have new projects to finance, there is scope for those projects to access institutional finance through capital market instruments to re-finance banks. Further, the replacement of banks with capital markets instruments could promote cooperation between banks and institutional investors, with banks retaining a pivotal role in assessing project viability and sustainability during the riskiest phase of the project, and institutional investors supporting brownfield projects (Gatti 2014).

The aim of this paper is to determine the factors responsible for the use of alternative financing modalities and instruments for infrastructure PPP projects. The paper also examines the implications of the Basel III regulations as a contributing factor in encouraging the refinancing of bank debt with capital market instruments. The Basel III regulations appear to penalize long-term bank lending, particularly in the December 2017 version (Basel 3.5) of the accord. An emerging option is for nonbank financial institutions, such as pension, insurance or investment funds, to provide long-term loans, or invest in securitized and capital markets instruments linked to infrastructure finance (Inderst 2016; Gatti and Chiarella 2018).

The paper is organized as follows. In Section 2, we present the analysis of factors impacting the use of capital market instruments for infrastructure project finance, including the BASEL III regulations. An analysis of the current state of regulation in banking has important implications for: (i) the availability of finance; and (ii) the choice of financing instruments. While capital market instruments for infrastructure projects provide an alternative to banks in developed economies, the use of such instruments is still in its infancy in many ADB DMCs. Thus, the paper will also focus on emerging market developing economies and ADB DMCs and provide policy guidance to facilitate project finance through capital market instruments.

In Section 4, we analyze the determinants that drive bond financing vis-à-vis loans in project finance deals. The empirical analysis is based on a sample of 8,765 international infrastructure projects funded via project finance between 1994–2019. Section 5 presents a discussion on policy measures introduced in Europe and some emerging countries to facilitate access to capital markets by infrastructure projects. Section 6 concludes with a policy analysis supporting the use of bond financing in Asia, especially in the aftermath of Basel III.

The findings add to the empirical literature on the use of financing instruments for PPP infrastructure projects. Interestingly the paper finds evidence that bank lending crucially impacts the use of bonds. Banks have advantages over bond investors in selecting good projects due to their closer relationships with projects, and by providing initial greenfield debt. Although it is counterintuitive, bond investors are thus more likely to finance projects in weaker institutional and credit settings, as they are less skilled investors than banks. The paper also finds that MDB support increases the probability of bank rather than bond finance. This suggests that there is an opportunity for MDBs to design risk mitigation instruments to support bond investors and complement their weaker project appraisal capacity.

The paper also examines the implications of BASEL III for bonds. In line with the findings of the Financial Stability Board (November 2018), the paper did not find significant



evidence that BASEL III norms have yet kicked in, however, the paper finds evidence that country level ratings have negatively impact bank finance (positively impact bonds), post-Basel III. This also supports the findings that bonds are more likely to be present in weaker institutional and credit related settings.

Finally, the paper undertakes a cross-regional analysis and benchmarks the use of bonds in Asia vis-à-vis Latin America. This comparison is useful as Latin America has a more established PPP framework over a longer period. The paper finds that in Asian markets bonds financiers make investment decisions based on macro-economic considerations rather than project finance considerations.

## **2. IMPACT OF MARKET, INSTITUTIONAL, AND REGULATORY FACTORS ON THE USE OF CAPITAL MARKET INSTRUMENTS IN INFRASTRUCTURE PROJECT FINANCE**

Several elements contribute to the evolution of the project bond market, including: (i) issuers looking for more competitive pricing; (ii) institutional investors seeking to diversify their portfolios into a recognizable infrastructure asset class; (iii) regulatory framework that limits bank lending, so that banks are unable to meet infrastructure finance needs; and (iv) instruments such as the (Rao 2012) initiative and the Europe 2020 Project Bond Initiative, which provide credit enhancements to project bonds to a level acceptable to investors.

The monetary policy actions taken in many countries to boost growth and target inflation have pushed down returns on almost all the categories of asset classes. The effect has been severe financial repression, particularly for long-term investors. As a result, the search for yield has forced institutional investors to consider alternative assets, including infrastructure equity and debt, to improve portfolio returns and gain the illiquidity premium that private assets can offer vis-à-vis listed instruments. Taken as a whole, the supply of project bonds depends on benefits to the project company vis-à-vis alternative debt instruments. On the other hand, demand for project bonds depends on risk preferences and liquidity. Finally, institutional factors, including the sophistication of the capital market, play a role. A representative list of factors is provided in Table 2.

### **2.1 Supply of Project Bonds**

The descriptive analysis in Section 3 shows that about 9% of the analyzed projects used project bonds over 1994–2018, however, the use of bonds was more common after the financial crisis of 2007–2008. From less than \$5 billion in 2008, the volume of project bonds reached \$25 billion in 2017. The bond leverage ratio also increased from less than 5% in 2008 to about 15% in 2017–2018.<sup>5</sup> Given costs, complexity and investor appetite, bonds are suited to larger transactions (over \$100 million). While public offerings are more common for large transactions, private placements are more suited to small transactions involving lower costs and less on-going administration (EPEC 2012). This view is echoed by (Weber and Alfen 2010), who suggest that project bonds are more

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<sup>5</sup> Weight of project bond value over the sum of syndicated loans and project bonds.

viable when project volume is large and where long-term finance is needed.<sup>6</sup> Our sample confirms that average loan maturity is about four years less than project bonds.

**Table 2: Factors Impacting the Use of Project Bonds**

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<b>Supply Side</b>
<ul style="list-style-type: none"> <li>• Political risk</li> <li>• Policy changes</li> <li>• Regulatory uncertainty</li> <li>• Lack of a project pipeline</li> <li>• Complex procurement processes</li> <li>• Project size</li> </ul>
<b>Demand Side</b>
<ul style="list-style-type: none"> <li>• Investor scale</li> <li>• Internal resources and experience (governance, management, operational) concentration</li> <li>• Portfolio</li> <li>• Concerns over construction risks</li> <li>• Legal and reputation risks</li> </ul>
<b>Market structure and intermediation</b>
<ul style="list-style-type: none"> <li>• Lack of appropriate investment vehicles</li> <li>• Capital markets, e.g., for project bonds</li> <li>• Thin secondary markets</li> <li>• Fee levels of funds</li> <li>• Alignment/conflicts of interests</li> <li>• Cyclical overvaluation of assets</li> </ul>

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Source: Inderst (2016).

**Table 3: Project Finance Loans and Bond Maturities (1994–2019)**

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	Mean	5th Percentile	Median	95th Percentile	# Obs. (Fraction Total)
Bonds	15.22	4	13	32	985 (69.86%)
Loans	11.81	1.5	11.3	25	10,835 (88.54%)

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Maturities expressed in years. Last column includes number of tranches with non-missing maturity and, in brackets, the percentage of observations with non-missing maturity relative to the total number of tranches for each type.

Source: Dealogic Project Ware.

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<sup>6</sup> The analysis of our sample (not reported in the text but available upon request) based on the quintiles of the distribution of project amounts – where the first quintile includes smaller projects and the fifth larger deals – indicates that the percentage of bonds on the total capital structure monotonically increases from 3.98% to 12.61%. An opposite decreasing pattern (from 88.09% to 67.05%) is shown for project finance loans.

In terms of factors affecting bond issuance, (Dailami and Hauswald 2003) provide empirical evidence which suggests that institutional variables, and legal and regulatory obstacles have the largest and statistically most significant effect on bond issuance. Their estimates show that an increase of 1 in the obstacle score for the judicial system increases at-issue spreads by 144bps. A similar increase in the regulatory and tax obstacle score increases at-issue spread by 159 bps, and a 10-point increase in the composite risk index (e.g., from low to moderate country risk) increases project bond credit spreads by 150 bps.

Securing a credit rating at or above investment grade from a credible rating agency is a pre-requisite for accessing the capital markets.<sup>7</sup> The disappearance of monoline insurers has complicated channeling institutional finances, as investors do not have the expertise to appraise projects. An additional drawback preventing bond instruments is the absence of a pipeline of well-structured projects, reflecting an inadequate legal and regulatory framework (Ehlers, Packers, and Remolona 2014). Building up the necessary expertise is costly, and investors will only be willing to incur these fixed costs if there is a sufficient and predictable pipeline of infrastructure investment opportunities, otherwise, the costs can easily outweigh the potential benefits of investing in infrastructure over other asset classes such as corporate bonds.

## 2.2 Demand for Project Bonds

More recently, institutional investors have experienced low returns, high volatility and rising liabilities connected to low-interest rates and improved tenor. Concurrently, investors are seeking to diversify portfolios in the search for yields. Infrastructure investments are potentially useful to long-term investors such as pension and insurance funds, as they have long-term, predictable income streams, low correlations to other asset classes, and relatively favorable default and recovery rates for project finance (Inderst 2016). Institutional investors, however, appear less optimistic about infrastructure exposures compared to a year ago. Investors are considering scaling back the amounts they commit to infrastructure funds in the next 12 months, in light of an impending market correction, or because most are fully allocated. Data provided by Preqin indicates that in Quarter 2 (Q2) 2018, 25% of new investors planned to commit \$500 million or more to infrastructure funds, compared with only 5% in Q2 2019.<sup>8</sup> The amounts are 44% and 67%, respectively, for \$100 million or less.

Primary infrastructure funds remain the strategy of choice for investors, with 91% planning to commit to such vehicles in the year ahead. North America and Asia and the Pacific appear to have fallen out of favor with infrastructure investors: 31% and 18% are planning commitments to funds focused on each region in the next 12 months respectively, compared with 41% and 23% in Q2 2018 (Figure 9). In contrast, the appetite for Rest of the World-focused funds and emerging markets has increased, reflecting the opportunities in large infrastructure projects in developing nations.

An uncertain legal and regulatory framework prevents capital from participating in infrastructure projects. This issue is more prevalent in emerging markets, where there can be a lack of robust regulation (PwC 2018). A related issue highlighted by Nishizawa (2018), suggests that risk allocation and the price of assuming risks are critical considerations for investors. Potential investors become cautious where risks are not equitably allocated. These investors are unwilling to take on certain risks, or projects

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<sup>7</sup> *Demand for Long-Term Financing of Infrastructure Issues* Note (No. 7) for Consideration by G20 Coordinated by the World Bank Infrastructure Policy Unit, Sustainable Development Network.

<sup>8</sup> Preqin Quarterly Update: Infrastructure Q2 2019.

where compensation is inadequate, and will support other projects with a more equitable risk allocation structure. Accordingly, if tolls are regulated by the state, service providers without a price-setting capacity might risk being in a commercially unviable business. It is therefore reasonable that the demand risk associated with public services provision via regulated prices should be borne by the public authority responsible for price setting.

Given the different risk profiles of fund managers with varying mandates, strategies and preferences, investors also face a challenge in finding fund managers whose risk profile, and strategic and geographic focus align with their own investment mandates, risk appetite and horizons. Fund managers have varying mandates, strategies and preferences. They cited valuations as their top challenge in 2018, with 59% of fund managers agreeing that it was a crucial challenge (PwC 2018). Record levels of fundraising, coupled with investors investing directly in corporates or project companies, have created an abundant supply of capital that is competing for these limited investment opportunities.

The availability of exit options is important to investors looking to divest after a target timeframe. These investors are usually infrastructure funds and private equity players. Exit strategies may involve a refinancing or sale of interest to an investor with a different risk-return profile that better matches the risk profile of the project at the time of divestment. The availability of a secondary market for infrastructure investments is essential, to facilitate the recycling of capital, the matching of buyers to sellers, and the matching of investment and exit preferences.

An additional reason for the relative illiquidity in infrastructure project bonds is the lack of clarity among project sponsors regarding the feasibility of bond finance vis-à-vis bank debt. No dominant project bond model has yet emerged, and local conditions vary. A deep infrastructure project debt market would use bank debt for construction and refinance just as in the long-term institutional markets. The key risk is the refinancing risk due to project operations, regulation, interest, and exchange rate, and who will ultimately underwrite the risk (ADBI 2015).<sup>9</sup> Bouzguenda (2014), also found evidence that the impact of country risk on loan spread is negative and significant. The importance of country risk is especially significant in large international projects financed with international capital. Even if the project is economically and financially viable, its ability to service foreign investors depends on policies related to capital mobility and currency convertibility, which are beyond the control of the project company.

## 2.3 Institutional and Regulatory Factors

Investors need appropriate benchmarks for infrastructure, given that it is a distinct asset class. While project bonds should ideally not be benchmarked to corporate bond indexes, this is currently the case due to a lack of alternatives. It may thus be useful to provide project bonds the same waivers to withholding tax as to government bonds, considering that corporate/project bonds are frequently disadvantaged compared to risk-free government bonds for domestic and foreign investors. Accordingly, the development of infrastructure bonds linked to the development of government and corporate bond markets, including a deep liquid yield curve, repo markets, and futures contracts, becomes necessary and useful.

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<sup>9</sup> A natural mitigation of such project-specific risks can be found in the securitized debt market, where banks can package a bundle of project finance loans and sell them as securitized debt in the institutional markets, thus obviating the need for institutions to invest/lend directly to the projects themselves.

In order to promote transparency and reduce information asymmetry, securities laws in the jurisdiction in which the project is located should not prevent the transmission of financial information to potential investors (e.g., the provision of financial models to potential investors). However, project bonds are not typical corporate bonds with a standard offering circular with normal subscription period, and investors will need due diligence. In many nascent project bonds markets, sponsors face actual or perceived execution risk when raising project finance through capital markets. Firm underwriting by the arrangers, backstop loan facilities, and so on can mitigate this.<sup>10</sup>

**Bank funding costs:** Changes in bank regulation and supervision are likely to have a substantial impact on the outlook for project finance. Various sources estimate that the implementation of Basel III could add between around 60–110 bps to a bank's funding costs, as compared with Basel II (Ma 2016). This estimation excludes the proposed minimum ratio for common equity for G-SIBs. Since G-SIBs carry out a major portion of global project finance transactions, it is expected that the actual impact on bank funding cost will be even higher than the above estimate.

**Loan tenor:** By providing longer-tenor, banks moderate the liquidity constraints of a project, thereby reducing default risk (Bouzguenda 2014). Longer-tenor loans are therefore less risky than short-term loans, as shorter maturities force the project to make large payments in the early stage. In one of the few empirical papers on the impact of Basel III, (Thierie and De Moor 2018) reveal that Basel III resulted in a reduction of 2.3 years in the average length of the loan tenors between 2013–2016. Mainly due to net stable funding ratio (NSFR), banks are increasingly unwilling to provide long-term project finance. The authors report that the market for tenors of over 7–10 years is currently declining, especially for loans above £100 million. Banks may move towards shorter-term facilities with bullet or balloon final repayments, so that the risk is essentially limited to the construction phase, however, the use of hard or soft mini perms (Gatti 2018) exposes infrastructure projects to a higher refinancing risk and forces banks to find other investors willing to replace them in the capital structure of the SPV. This is another factor in the increased role of debt capital market instruments in infrastructure.

**Impact on bank balance sheets:** The most cost-effective strategies to meet the NSFR are to increase holdings of higher-rated securities and to extend the maturity of wholesale funding. In a study to determine bank responses to the introduction of NSFR, (King 2013) found evidence from across 15 countries that the principal strategy for reducing required stable funding is to substitute assets requiring 100% funding with high-quality, liquid investments. This change in a bank's investment portfolio reduces its risk weighted assets, leading to a modest increase in a bank's regulatory capital ratio. These changes reduce net interest margins by 70–90 basis points on average, or around 40% of year-end 2009 values. The analysis suggests possible responses to this liquidity regulation, in that banks may: (i) choose to shrink their balance sheets; (ii) change the composition or reduce maturity of their loans; or (iii) change the composition of investments.

**Alternative funding:** As bank balance sheets are constrained by Basel III, they are no longer able to provide substantial amounts of long-term project finance. The PPP modality has led to growing interest in the use of project bonds, with successful experiences in several countries. Highly rated bonds are more liquid than project finance loans and by nature are a long-term commitment which matches the long-term liabilities of institutional investors, and also PPP contract maturities. Cheaper funding through

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<sup>10</sup> Asia Securities Industry & Financial Markets Association Limited. 2016.

brownfield bond issuances reduces overall lifecycle project costs and strengthens the value for money argument in favor of PPP projects.

**Implications for capital structure:** In determining the use of capital market instruments, (Faulkner and Petersen 2003), explain patterns of leverage seen in firms that can access the capital market. They found that small firms are credit constrained. Very little public information is available about such small firms, as the relative cost of information can be high. With larger publicly traded firms, the regulatory requirements of issuing public equity means there is much more information, however, even here the authors find evidence that the firm's capital structure (ability to issue debt) is constrained by the development of the capital market.

The costs of monitoring and imperfect financial contracting in smaller firms (project SPVs) will raise debt costs and thus lower desired leverage. If monitoring and contracting solutions are insufficient, these firms may face quantity constraints and more expensive capital. The findings imply that capital market shocks may impact firms differentially. Slovin, Sushka, and Poloncheck (1993) report that firms whose banks suffer capital shocks, which are independent of the firm's demand for finance, affect the firm's financing. For firms that cannot easily move from one market to other, shocks to banks may thus have a larger impact than on bonds. Since firms that do not have access to bonds are less transparent, the impact on their finances will be more significant.

### 3. DATASET CONSTRUCTION AND DESCRIPTION

We source data for from Dealogic Project Ware. First, we select projects with close financial dates between January 1994 and May 2019 that have no missing information for project country, amount, sector, and number of tranches. In order to identify infrastructure projects, we filter out projects in un-related sectors.<sup>11</sup> This yields an initial sample of 15,276 projects. We then retrieve financing information at the facility-level (instrument type, amount, currency, and other variables described below) for the tranches associated with these projects. We eliminate projects for which the absolute deviation from the total amount of the facilities and the project amount accounts for more than 0.1% of the project amount. This leaves us with a final sample of 11,054 projects/23,991 facilities, which covers 152 countries and 31 sectors. The total project cost of these projects, in January 1994 prices, is \$2,810.03 billion.

#### 3.1 Market Trends and League Tables

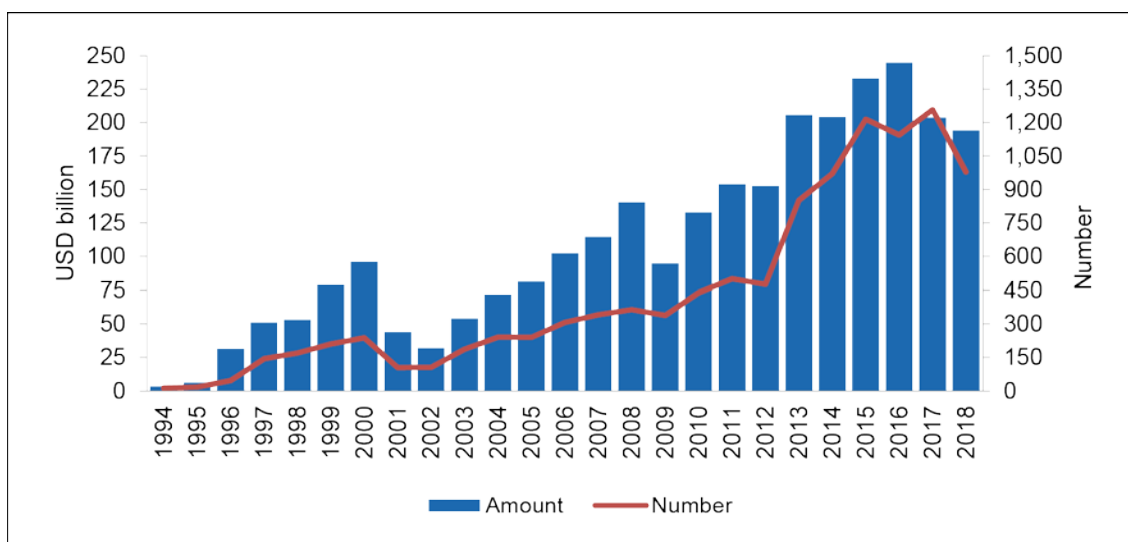
Figure 1 shows the financing trend (in January 1994 constant USD prices, left axis, and number of projects, right axis) for 1994–2018.<sup>12</sup> The chart shows the dependence of project finance on the business cycle, with a marked decrease during the 2001–2002 and 2008–2009 recessions.

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<sup>11</sup> We exclude the following sectors (20 in total): agricultural, aircraft, commercial property, hard commodities, hotel/resort/casino, industrial/commercial zone, machinery, manufacturing, mining, other capital goods, processing plant, project equipment, pulp and paper, recreational facilities, residential property, shipping, soft commodities, soft and hard commodities, steel mill, trade finance (oil and gas-related). Making use of project and sector remarks, we also exclude 46 projects that Project Ware labels "Other infrastructure projects".

<sup>12</sup> In the first five months of 2019, we observed 156 projects for \$30.10 billion (January 1994 constant prices).

**Figure 1: Infrastructure Projects Trend, 1994–2018**



Infrastructure project in January 1994 constant USD billion (left axis); number of infrastructure projects (right axis).  
 Source: Dealogic Project Ware.

Table 4 reports the top 10 countries in terms of infrastructure projects (January 1994 prices). The United States is at the top. Australia, Brazil, India, and the United Kingdom follow, although they differ in their orders: Australia and the United Kingdom rank higher for USD amount, while emerging markets rank higher for the number of funded projects.

**Table 4: Top 10 Countries in Terms of Infrastructure Projects**

	Amount		Number		
United States	544.40	19.37%	United States	1,857	16.80%
Australia	217.80	7.75%	India	1,320	11.94%
United Kingdom	177.73	6.32%	Brazil	1,016	9.19%
India	167.07	5.95%	United Kingdom	821	7.43%
Brazil	115.07	4.10%	Australia	639	5.78%
Saudi Arabia	110.90	3.95%	Spain	601	5.44%
PRC	107.61	3.83%	France	375	3.39%
Spain	83.50	2.97%	Italy	299	2.70%
Qatar	65.19	2.32%	Canada	283	2.56%
Italy	63.87	2.27%	Japan	275	2.49%
Others	1,156.87	41.17%	Others	3,568	32.28%

Amount expressed in January 1994 constant USD billion; percentages relative to the sample of 11,054 infrastructure projects between January 1994 and May 2019.

Source: Dealogic Project Ware.

Table 5 reports the sector composition of projects.<sup>13</sup> Oil and gas accounts for about one third of project amount, followed by power, while renewables is the highest in terms of numbers.

**Table 5: Sector Breakdown of Infrastructure Projects**

	Amount		Number	
Health and Education	59.30	2.11%	546	4.94%
Oil and Gas	865.84	30.81%	1,695	15.33%
Power	652.24	23.21%	1,974	17.86%
Public infrastructure	23.49	0.84%	206	1.86%
Renewable energy	406.72	14.47%	4,166	37.69%
Road	228.49	8.13%	868	7.85%
Telecom	228.11	8.12%	476	4.31%
Transport (excl. road)	306.31	10.90%	842	7.62%
Waste, water and sewerage	39.53	1.41%	281	2.54%

Amount expressed in January 1994 constant USD billion: percentages relative to the sample of 11,054 infrastructure projects between January 1994 and May 2019.

Source: Dealogic Project Ware.

**The financial structure of deals.** We group facilities into equity, loans, bonds, and other debt.<sup>14</sup> As discussed, more than 75% of projects use loans (8,529 projects). The second most common source is other debt (4,972 projects, about 45% of the sample), followed by equity (2,865 projects, about 25% of the sample) and lastly bonds (951 projects, about 9% of the projects). As a percentage of aggregate project amount in January 1994 prices, loans amount to 59.5%, other debt 19.4%, equity 12.4%, and bonds 8.7%. Figure 2 shows that banks are the most important source of finance, with equity and other debt becoming less relevant in recent years.<sup>15</sup>

Figure 3 shows the reliance on loans (resp. bonds) in USD amount (January 1994 constant USD billion) as well as the number of projects that include at least one USD of loans (resp. bonds).

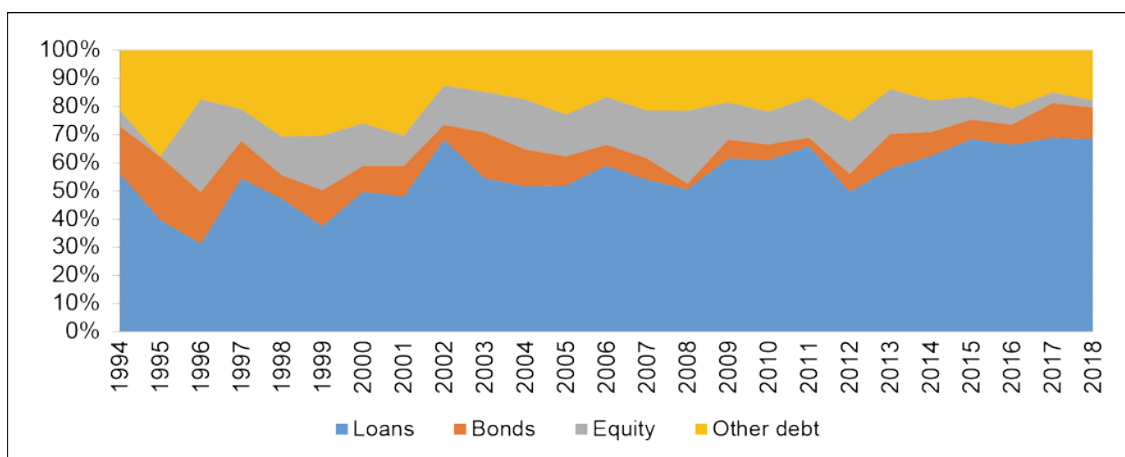
<sup>13</sup> We aggregate the Project Ware 31 sectors for our sample projects into nine macro-sectors as follows: health and education (education, hospital); oil and gas (gas distribution, gas pipeline, gas field exploration and development, oil refinery/LNG and LPG plants, oil pipeline, oilfield exploration and development, other downstream, other upstream); power (power); public infrastructure (defense, government buildings, police stations, prison); renewable energy (renewable fuel, wind farm); road (road); telecom (telecom, telecommunication equipment); transport excl. road (airport, bridge, port, rail – equipment, rail – infrastructure, tunnel, urban railway/LRT/MRT); waste, water and sewerage (waste, water and sewerage). Projects belonging to the Project Ware sector “Other infrastructure projects” are manually classified into these macro-sectors.

<sup>14</sup> Equity includes equity (2,876 facilities) and public shares (2); loans includes term loans (11,565), A loans (156), B loans (166), C loans (23), concessionary (1), construction (326) and tax-spared loan (1); bonds includes 1,410 bond facilities: other debt includes credit facility (2,334), L/C facility (1,255), revolving credit (1,533) and bridge facility (1,085) plus other less common facilities.

<sup>15</sup> The 156 projects signed during the first five months in 2019 corroborate this trend whereby equity and other debt together account for about 12% of project financing.



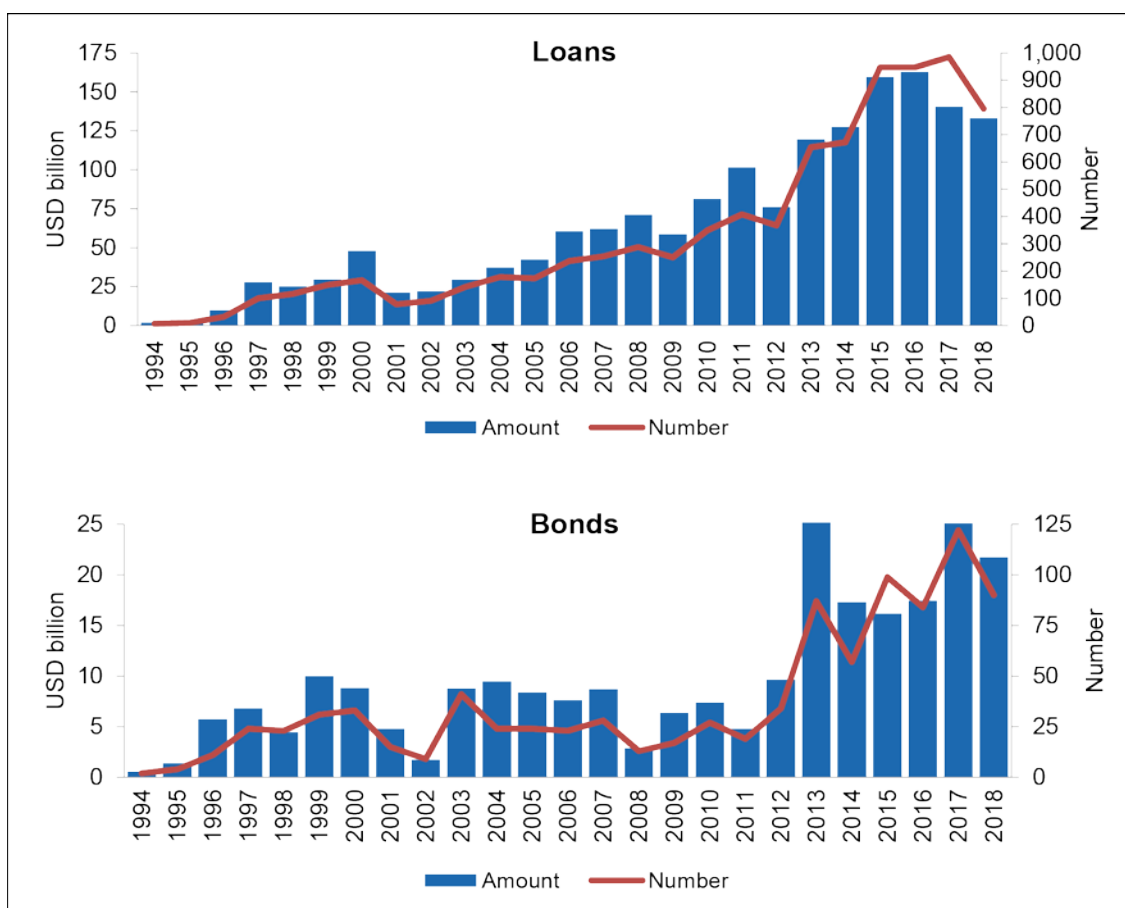
**Figure 2: Financing Structure of Infrastructure Projects, 1994–2018**



Amount of each financing source (loans, bonds, equity and other debt) relative to project amount (January 1994 constant USD billion).

Source: Dealogic Project Ware.

**Figure 3: Trend of Loans and Bonds Used for Infrastructure Financing, 1994–2018**

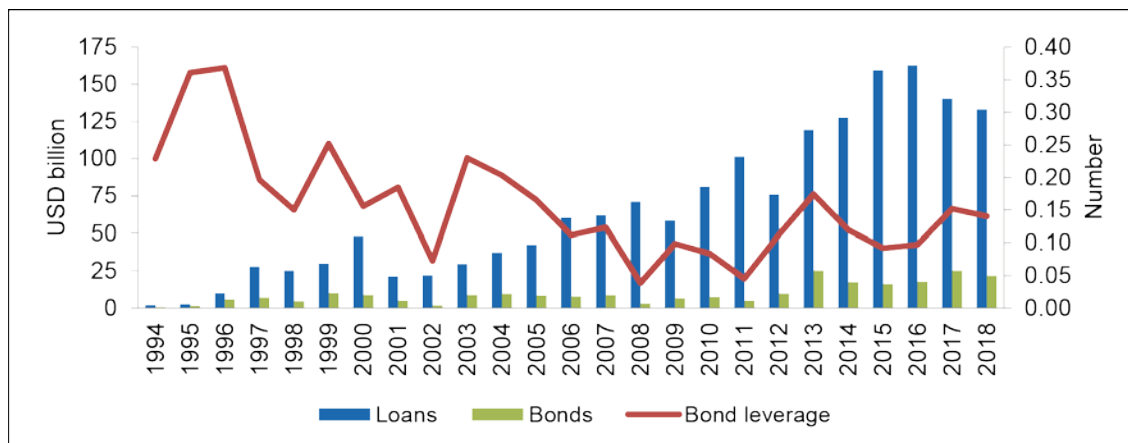


Infrastructure financing (loans and bonds) amount expressed in January 1994 constant USD billion (left axis); number of infrastructure projects financed with a positive amount of loans and bonds (right axis).

Source: Dealogic Project Ware.

Figure 3 demonstrates the dominance of bank facilities for debt, however Figure 4, indicates a disintermediation from banks toward the debt capital markets after 2008.

**Figure 4: Relative Contribution of Loans and Bonds, 1994–2018**



Loan and bond amounts expressed in January 1994 constant USD billion (left axis); bond leverage equals bond amount scaled by the sum of loan plus bond amounts (right axis).

Source: Dealogic Project Ware.

## 4. EMPIRICAL ANALYSIS

To empirically investigate the determinants of project financing (bonds vs. loans), we first exclude those projects that are exclusively financed with equity or other debt (or both) yielding a sample of 9,289 projects. For these projects, we follow Adrian, Colla, and Shin (2013) and set the indicator variable *Bond financing* as equal to one if the amount of bond financing exceeds that of loan financing, and zero otherwise. We also require a sufficient number of variables described below (definitions provided in Appendix 1), which brings us to a final sample of 9,074 projects. For about 9% of these projects (835 projects), *bond financing* equals one. The overall amount of these projects, expressed in January 1994 prices, equals \$2,407.73 billion, which corresponds to roughly 86% of the projects in Section 3. The country breakdown of the final sample (Table 6) is in line with that in Table 4, where the top ten countries for number of projects account for about 70% of the sample. The sector breakdown of the final sample (Table 6) also resembles Table 5.

**Macro-level variables.** We consider the *Term spread* (the difference in yields between 10Y and 2Y constant maturity US treasuries) as a proxy for risk premia on long-term debt securities,<sup>16</sup> the *Credit spread* (the difference in yields between Moody’s seasoned Baa corporate bonds and 10Y constant maturity US treasury) as a proxy for risk premia on corporate bond investing, and *VIX* as a proxy for risk aversion (Bekaert and Hoerova 2014; Bloom 2009). These variables are measured at the quarter-end prior to financial close.

<sup>16</sup> "The spread tracks a term or maturity risk premium in expected returns that is similar for all long-term assets. A reasonable and old hypothesis is that the premium compensates for exposure to discount-rate shocks that affect all long-term securities (stocks and bonds) in roughly the same way" (Fama and French 1989).

**Table 6: Breakdown of Infrastructure Projects Across Countries and Sectors**  
(final sample)

Country	Number		Sector	Number	
United States	1,547	17.05%	Health and education	465	5.12%
India	1,230	13.56%	Oil and gas	1,261	13.90%
United Kingdom	689	7.59%	Power	1,625	17.91%
Brazil	642	7.08%	Public infrastructure	191	2.10%
Australia	560	6.17%	Renewable energy	3,478	38.33%
Spain	507	5.59%	Road	773	8.52%
France	309	3.41%	Telecom	339	3.74%
Italy	273	3.01%	Transport (excl. road)	706	7.78%
Japan	267	2.94%	Wastewater and sewerage	236	2.60%
Canada	250	2.76%			
Others	2,800	30.86%			

Source: Bloomberg, Datastream, Dealogic Project Ware, FRED, World Bank.

**Country-level variables.** We consider *GDP* (real GDP annual growth rate), *Inflation* (annual change in CPI), *Government debt* (general government gross debt as % of GDP), and *Rating* (Standard and Poor's long-term credit ratings).<sup>17</sup> We source six worldwide governance indicators from the World Bank: control of corruption (CC), government effectiveness (GE), political stability (PS) and absence of violence/terrorism, regulatory quality (RQ), rule of law (RL), and voice and accountability (VA). The inclusion of worldwide governance indicators is in line with Byoun, Kim, and Yoo (2013) and Hammami, Ruhashyankiko, and Yehoue (2006), as governance variables should influence debt investors, even more so if they are bondholders. In fact, stable countries with a robust institutional setting and a higher regulatory quality are perceived as less risky by international investors. *Rating* is measured at financial close, while all the other variables are measured in the year prior to financial close.<sup>18</sup>

**Project-level variables.** We consider project *Size* (log of January 1994 USD million), *Leverage* (ratio of Bonds+Loans+Other debt over Bonds+Loans+Other debt+Equity). These variables are shown in the empirical corporate finance literature to affect a firm's marginal choice between bank and bond financing (Adrian, Colla, and Shin 2013; Denis and Mihov 2003). We also create several indicator variables: (i) *MDB* equals one when at least one facility witnesses the involvement of a MDB;<sup>19</sup> (ii) *guarantee* equals one when at least one facility (export credit, or guarantee facility, or L/C facility) reports at least one guarantor; (iii) *offtaking* equals one when the project has at least one off-taker or PPA; (iv) *foreign currency* equals one when at least one facility is denominated in a currency that differs from the national currency of the project country; (v) *refinancing* equals one for refinancing projects.

<sup>17</sup> We source the majority of ratings from Standards and Poor's; when a country is not rated by Standards and Poor's, we source the long-term credit rating, if available, from Moody's or Fitch, and convert the rating into the Standards & Poor's rating scale. We map credit ratings on a numerical scale ranging from 1 (Standard & Poor's AAA) to 22 (Standard & Poor's SD).

<sup>18</sup> The governance indicators are available between 1996 and 2017, and between 1996 and 2002 they are available every other year. We therefore use the 1996 values for projects with financial close between the beginning of the sample and 1998, the 1998 values for projects with financial close 1999 and 2000, the 2000 values for projects with financial close 2001 and 2002, and the one-year lagged values from 2003 onward.

<sup>19</sup> MDB involvement can participate as arranger/bookrunner, provider, or guarantor.

The involvement of MDBs can reduce the risk profile of a project by offering longer tenors, and (i) as anchor investors based on a credible evaluation of the project risk; (ii) exert a disciplining effect on opportunistic behavior by the borrowers (Hainz and Kleimeier 2012) and; (iii) resolve legal issues (Esty and Megginson 2003).<sup>20</sup> However, the involvement of MDBs may also indicate high *ex-ante* risk. Guarantees offered by MDBs, governments or other public institutions, provide credit enhancement to reduce the exposure of debt providers, mainly to demand risk or other macroeconomic events.<sup>21</sup> *Offtaking* contracts ensure the stability of the cash flows, and therefore act as an implicit “project guarantee” to increase the project rating (Byoun, Kim, and Yoo 2013; Corielli, Gatti, and Steffanoni 2010; Dailami and Hauswald 2007). *Foreign currency* captures the exposure of the borrower to currency risk.

Since international institutional investors do not always invest in local currencies, we posit that the presence of currency risk should be tolerated more by banks than bondholders. *Refinancing* indicates that a debt is provided to a project that has completed construction, which is perceived by investors as the riskiest phase of the project life cycle.<sup>22</sup> The level of demand risk also varies between greenfield and brownfield projects, as brownfield projects are already operational with a more predictable stream of revenues. Unfortunately, despite the importance of this variable for studies related to debt finance, we only have this information for 353 projects. In Appendix Table 2 we provide descriptive statistics for this subsample.

The corporate finance literature has theoretically and empirically dealt with financing decisions regarding the choice between bank and arm's length financing. The key difference lies in the fact that banks are better at screening borrowers and handling renegotiations. Houston and James (1996) and Johnson (1997) provide early empirical studies of the determinants of the choice between bank debt and bonds. Both papers document that reliance on bank borrowing is decreasing in firm size and overall leverage, suggesting that banks specialize in lending to smaller and more risky firms.

More recently, Denis and Mihov (2003) found that the primary determinant of a firm's choice of debt instruments is their credit quality. Larger and more profitable firms, and those with more tangible assets, rely more on corporate bonds. These firms have higher credit ratings. The aforementioned literature suggests that bond financing is positively associated with a borrower's size (assets), credit quality (credit rating), project quality (profitability), and leverage. All these cumulative findings have been confirmed more recently in Adrian, Colla, and Shin (2013).

When turning to infrastructure financing, we clearly face the problem that our *Size* and *Leverage* variables are at the project level (rather than the borrower level). Moreover, we lack variables that capture, for example, profitability and tangibility. Last, we do not consider a project's credit rating and instead use the credit rating of the country where the project is developed.

**Methodology.** With *Bond finance* as the dependent variable, we use OLS regression to investigate the determinants of marginal financing choices, regressing *Bond financing* on the macro, country and project-level covariates. To assuage concerns about omitted variables bias, we include year fixed effects as well as country fixed effects, interacted by sector fixed effects. By means of these latter fixed effects, identification comes from

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<sup>20</sup> Paragraph 5.1 we illustrate the features of the European Investment Bank Project Bond Initiative

<sup>21</sup> For an example see Paragraph 5.1 in which we illustrate the feature of the UK Guarantee Scheme, or Paragraph 5.2 that illustrates the credit enhancement facility offered by Peru's government.

<sup>22</sup> For an example see Paragraph 4.2 that illustrates the Construction Period Guarantee (CPG) used in Malaysia.

variation in financing choices (bond versus loan) at the level of a sector in a country, and thus the final sample drops to 8,765 projects.

Fixed effects favors a linear model in lieu of non-linear models, as fixed effects makes inferences problematic due to the well-known incidental parameters problem (Lancaster 2000).<sup>23</sup> In all specifications, we cluster standard errors at the country level to account for within countries heteroscedasticity and correlation across projects. These clusters provide more conservative (i.e., wider) standard errors than clustering at the level of our finer country times sector fixed effects. We opt for clustering at the country-level (instead of sector-level) because of the numerousness of cross-sectional country units (89 clusters based on countries viz 31 clusters based on sectors). To sum up, our baseline specification is written as:

$$\text{Bond financing}_{i(j,c,t)} = \beta X_t + \gamma X_{c,t} + \delta X_i + \zeta_t + \eta_{j,c} + \varepsilon_{i(j,c,t)}$$

where  $X_t$  is a vector of macro variables (Term spread, Credit spread and VIX),  $X_{c,t}$  is a vector of country-level variables (GDP, Inflation, Government debt, Rating or Governance Indicators),<sup>24</sup>  $X_i$  is a vector of project-level variables (Size, Leverage, MDB, Guarantee, Offtaking, Foreign currency, and Refinancing),  $\zeta_t$  are year fixed effects, and  $\eta_{j,c}$  are (country x sector) fixed effects.

We report regression results from our baseline specification. Each column includes a different measure of country risk (credit quality, and the six governance indicators). According to Table 7 the only macro-variable that is significantly associated with Bond financing is VIX (10% significance level), implying that a 1% increase in the VIX translates into a 0.15%–0.17% decrease in the probability of issuing project bonds.<sup>25</sup> Interestingly, increased volatility in the equity market can spill over to bonds, reducing investor interest in financing infrastructure using capital market instruments. This is consistent with the idea that the VIX proxies for global risk aversion.

As far as country-level variables are concerned, Table 7 suggests that GDP positively affects bond finance (significant in four specifications out of seven). A 1% increase in GDP growth increases the probability of bond financing by 0.27%–0.33%. This is probably because better economic fundamentals (e.g., GDP growth) translate into higher demand for infrastructure projects. This is in line with the existing literature that explains and predicts levels of infrastructure based on macroeconomic variables (Canning 1998; Basile et al 2001; Calderón and Servén 2004; Égert et al. 2009; Fay 2000; Calderón et al. 2011; Broyer and Gareis 2013; European Commission (2014).

Country risk (credit risk, or more broadly institutional risk) positively affects reliance on bond financing.<sup>26</sup> Specifically, bond investors deploy money in lower-rated countries, and in those with worse government effectiveness and regulatory quality (to a lesser extent, worse rule of law and political stability also positively affect the probability of bond

<sup>23</sup> Given our choice to use fixed effects (year, and country x sector) we are using a linear model (OLS) rather than a non-linear one such as probit/logit. This is due to the incidental parameter problem, which states that fixed effects in non-linear models lead to inconsistent estimates.

<sup>24</sup> Due to the high correlation across *Rating* and Governance Indicators, we employ one indicator at a time, therefore considering seven different variants of our baseline specification. The correlation between *Rating* and governance indicators ranges from -0.637 (*Voice and accountability*) to -0.906 (*Government effectiveness*). Correlations among the governance indicators range between 0.625 (*Political stability and Voice and accountability*) and 0.971 (*Rule of law and Control of corruption*).

<sup>25</sup> The VIX index is sourced from the FRED-St. Louis database (available at <https://fred.stlouisfed.org>). It is a calculation provided by the Chicago Board Options Exchange (CBOE) designed to produce a measure of expected volatility of the US stock market implied by S&P 500 index options.

<sup>26</sup> Recall that *Rating* goes from good to bad, while the governance indicators go from bad to good.

financing). This evidence complements Bae and Goyal (2009) who show that good contract enforceability increases the loan financing provided by banks to firms.<sup>27</sup> This is a key finding, since emerging economies with weaker institutional settings seem likely to attract more bond financing, which is less stable than bank finance and more affected by capital markets conditions.

While intuition suggests that less skilled investors such as bondholders are more comfortable in more robust settings (and with the support of MDB), Bae and Goyal (2009) find the opposite. Banks are more likely to be present in such contexts. Our interpretation is more subtle, with important policy implications. We find that bonds are more likely to be used in the opposite situation, which could imply that exactly because bondholders are less skilled than banks, the use of bonds is more likely in countries with weaker settings and without MDB support. Put differently, bond investors are less able to evaluate investment risk. If our interpretation holds, then banks crowd out bondholders in better situations, leaving bondholders holding the risk in weaker institutional settings. Given that bond markets are more volatile and bank-borrowers relationships are relatively stable, policy makers should note the potential impact of financial market stability on investment decisions.

Turning to project-level variables, we uncover the strong and positive dependence of bond reliance on project size (significant at the 1% level), as well as on project leverage (significant at the 5% level). With the caveat that we are using project-level variables instead of borrower-level variables, these findings are in line with the empirical literature on corporate finance choice (Adrian, Colla, and Shin 2013). Larger firms (more total assets) tend to rely more on bond financing. This is consistent with the information asymmetry argument, as banks and other private lenders are better monitors than arm's length, bond investors. Large firms with low information asymmetry thus prefer bonds, while small firms with high information asymmetry prefer loans.<sup>28</sup> Table 7 further shows that the reliance on bonds increases for refinanced projects (4.7%–4.9% probability increase in bond financing), while the presence of a MDB acts as a catalyst for loan providers (9.9%–10.2% probability increase in loan financing). The latter finding is consistent with Bae and Goyal (2009) who show that loans are larger when lenders are part of syndicates. An alternative explanation is that banks are better equipped to analyze project risks, and that they require multilateral support only for riskier projects. If this explanation holds, emerging economies and MDBs should support less informed bond investors if they finance infrastructure projects.

#### 4.1 Implications of Basel III

We assess whether Basel III changes the sensitivity of the probability of bond financing to one (or more) covariates. We create the indicator variable Basel III (resp. Pre-Basel III) as taking the value of one for the years 2013–2019 (resp. 1994–2012). We then

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<sup>27</sup> Bae and Goyal (2009) measure property rights protection as an average of three indicators (corruption, repudiation of contracts, risk of expropriation) sourced from the International Country Risk Guide. Their measure, which takes higher values for less risky countries – i.e., better property rights protection – is shown to positively correlate with loan size and maturity, and negatively with loan spread. The evidence in Bae and Goyal (2009) for the dependence of bank funding behavior on a country's credit risk is mixed: loan size is larger in countries with worse credit quality when issuer-level variables (size, profitability, leverage, growth opportunities, and tangibility) are not included, while the opposite holds true after the inclusion of these variables. Our specification, which includes project-level variables, provides evidence consistent with the latter – rather than the former – finding.

<sup>28</sup> With the caveat that we are using project-level variables instead of borrower-level variables, these findings are in line with those from the empirical literature on corporate financing choices for e.g., Adrian, Colla, and Shin (2013).

modify our baseline specification by including the interactions between our (macro-, country- and project-level) covariates and Basel III, as well as Pre-Basel III as follows:

$$\text{Bond financing}_{i(j,c,t)} = (\beta_1 X_t + \gamma_1 X_{c,t} + \delta_1 X_i) \times \text{Basel III} + (\beta_2 X_t + \gamma_2 X_{c,t} + \delta_2 X_i) \times \text{Pre-Basel III} + \zeta_t + \eta_{j,c} + \varepsilon_{i(j,c,t)}$$

The coefficients  $\beta_1$  and  $\beta_2$  indicate the sensitivities of bond finance with respect to macro-level variables, respectively, before and after the introduction of Basel III (the interpretation of  $\gamma$ s and  $\delta$ s is similar). The indicator variables Pre-Basel III and Basel III are not included since they are subsumed by the year fixed effects. In essence we maintain the (country x sector) fixed effects as the only common restriction between the two sample periods, while allowing all other coefficients to differ across the two states. The advantage of augmenting our baseline specification in this way (as opposed to running the baseline separately for each subsample) is that we can directly assess the difference in the sensitivities before and after Basel III by means of standard statistical testing methodologies.

Table 8 reports the results, where for each measure of country risk, we report the estimated coefficients before and after Basel III introduction. We also report the p-value for the test of equal coefficients across the two subsamples (to ease interpretation, we report these values only when the differences in coefficients are significant at least at the 10% level). With respect to those variables that are found to be important drivers of infrastructure financing in Table 7, the VIX, project size, MDB involvement, and refinancing status are stable across the two subsamples.

The results on *Ratings*, are in line with the behavior of banks that given higher capital requirements banks have cut lending and even more so for weaker borrowers. Since project finance is penalized compared to corporate exposures (Gatti 2018) for decreasing levels of rating (although not in a monotonic way), our results indicate that banks refrained from lending to riskier countries more after Basel III than before, paving the way to bond financing. Interestingly, the VIX variable is insignificant after Basel III, implying that risk aversion doesn't seem to play a role in bond financing.<sup>29</sup>

Among the proxies of country risk, only *Rating* appears to exert a significantly different impact on bond financing, stronger after the introduction of Basel III. In two instances (when using *Rating* and *Government effectiveness* are used as proxies for country risk) the positive dependence of bond financing on GDP accrues exclusively to the pre-Basel III sample.<sup>30</sup> *Leverage* is strongly positively associated with the probability of bond financing only before Basel III. Table 8 further highlights that before the Basel III introduction the credit spread is positively associated with bond finance, consistent with the presence of risk premia in corporate bond investing. The economic impact of this effect is questionable, as a 1% increase in the credit spread translates into an increase in the probability of bond financing of less than 0.02%. As far as project-level variables are concerned, we also found that the guarantee offered by offtake contracts attracted bond financing prior to Basel III but was insignificant after Basel III.

<sup>29</sup> This raises the question of whether bond investors are less sensible to general market volatility after Basel III because they have lot of money to invest, or are desperately looking for yields for the few deals available on the market?)

<sup>30</sup> The majority of ratings are sourced from Standards and Poor's. When a country was not rated by Standards and Poor's, the long-term credit rating was sourced from Moody's or Fitch, where available, and converted into the Standards and Poor's rating scale. We mapped credit ratings on a numerical scale ranging from 1 (Standard and Poor's AAA) to 22 (Standard and Poor's SD). We have reported the range of ratings in Appendix Table 1.

As per the corporate finance literature on corporate choice between bank and bonds (above), firm leverage is a proxy for borrower reputation in credit markets. Assuming that project-level leverage is correlated with borrower-level leverage, we should thus expect a positive relationship between leverage and bond financing. Both credit spreads and leverage are insignificant after Basel III. Conversely, higher leverage and higher credit spreads were positively associated with the probability of bond financing before Basel III. We interpret the pre-Baseel III coefficient of leverage in line with the corporate finance literature which indicates that firm leverage is a proxy for borrower reputation. In addition, we interpret the non-significance of credit spread in influencing bond financing after Basel III as the consequence of the fall of yields that has pushed investors to finance borrowers paying less attention to the remuneration (relaxed risk premia).

## 4.2 Cross Regional Analysis

Finally, we provide a cross-region analysis for Asia (World Bank regions: East Asia and Pacific, South Asia, and Central Asia) and Latin America (World Bank region: Latin America). All other countries (labelled 'Other', including the World Bank regions: North America, Europe, Middle East, North Africa and sub-Saharan Africa). We follow the same approach as for the Basel III analysis, and interact our covariates with indicators for each of these three regions. The regression results are reported in Table 9. For each country risk variable, we report the estimated coefficients, and test the null hypothesis that these coefficients are equal for Asia and Latin America.

Latin America can be considered a relevant benchmark since it is where PPP transactions have been extensively used. Further, in some Latin American countries (Brazil, Peru and Mexico, Chile and Colombia), the infrastructure project bond market is relatively active. In both Asia and Latin America, the probability of bond financing is positively affected by GDP, project size, and refinancing status, and negatively associated with MDB involvement. According to Table 9, while sensitivity to GDP does not differ across the two regions, the economic magnitude of the other three project-level variables is more prominent in Latin America than in Asia: the impact of *Size* is about six times, that of *Refinancing* is about three times (Asia: 3.8%–3.9%; Latin America: 12%–12.5%), and that of *MDB* is about ten times larger (Asia: –1.8%/–2.1%; Latin America: –22.6%/–22.9%).

Finally, the two regions differ in their sensitivities to other variables. Term spread is negative and significant (5% to 1% significance) in Latin America, but insignificant in Asia. Projects in more indebted Asian countries attract significantly less bond financing, suggesting that bondholders may be substituting public investment; government debt is overall not significant (or weakly positively significant) in Latin America. Offtake contracts positively affect the probability of bond financing by about 7% in Latin American countries, while bond investors in Asian countries are unaffected by these agreements. Finally, bond investors are more (respectively less) likely to finance projects in Asia (respectively Latin America) when these projects entail currency risk.

Our interpretation of the results is that bond financing in Asia is driven more by macroeconomic variables rather than by project variables, which appear to affect bond financing in Latin America. This is consistent with Rao (2018). The role MDBs is often not captured in databases. For example, databases don't capture the role played in Mexico and in Malaysia by MDBs on project bonds. In Malaysia the role of MDBs is to provide a construction guarantee that is not captured in databases. In other countries, MDBs acted indirectly, by supporting governments to introduce structural reform to facilitate bond financing (such as in Latin America). An explanation could be that



lending to projects via syndicated loans is a more standard approach compared to more sophisticated approaches aimed at crowding in capital through project bonds. Alternatively, lending to big banks is less risky for MDBs. The European Project Bond initiative supported a few projects to crowd in capital for large projects in the wake of the financial crisis.

**Table 7: Empirical Results, Baseline Specification**

<b>Country Risk=</b>	<b>(1) Rating</b>	<b>(2) CC</b>	<b>(3) GE</b>	<b>(4) PS</b>	<b>(5) RL</b>	<b>(6) RQ</b>	<b>(7) VA</b>
Term spread	0.002 (0.010)	0.002 (0.010)	0.001 (0.010)	0.002 (0.010)	-0.000 (0.010)	0.000 (0.010)	0.002 (0.010)
Credit spread	0.006 (0.008)	0.006 (0.008)	0.006 (0.008)	0.006 (0.008)	0.007 (0.008)	0.006 (0.008)	0.005 (0.008)
VIX	-0.163* (0.091)	-0.163* (0.093)	-0.159* (0.091)	-0.160* (0.091)	-0.171* (0.093)	-0.158* (0.090)	-0.153* (0.091)
GDP	0.277* (0.165)	0.270* (0.155)	0.330* (0.168)	0.269 (0.169)	0.211 (0.175)	0.304** (0.146)	0.207 (0.191)
Inflation	0.156 (0.186)	0.169 (0.192)	0.143 (0.197)	0.155 (0.202)	0.155 (0.178)	0.148 (0.157)	0.215 (0.180)
Govt debt	-0.108 (0.082)	-0.035 (0.058)	-0.032 (0.062)	-0.009 (0.060)	-0.028 (0.059)	-0.081 (0.070)	0.001 (0.055)
Country risk	0.015*** (0.005)	-0.046 (0.053)	- (0.035)	-0.035* (0.021)	-0.156** (0.063)	- (0.047)	0.101 (0.071)
Size	0.025*** (0.009)	0.025*** (0.009)	0.025*** (0.009)	0.025*** (0.009)	0.025*** (0.009)	0.026*** (0.009)	0.025*** (0.009)
Leverage	0.117** (0.049)	0.114** (0.047)	0.114** (0.047)	0.114** (0.048)	0.111** (0.048)	0.111** (0.047)	0.115** (0.048)
MDB	- 0.101*** (0.034)	- 0.100*** (0.034)	- 0.101*** (0.034)	- 0.101*** (0.034)	- 0.102*** (0.034)	- 0.101*** (0.034)	- 0.099*** (0.034)
Guarantee	0.055 (0.069)	0.045 (0.072)	0.045 (0.072)	0.048 (0.071)	0.043 (0.073)	0.046 (0.069)	0.049 (0.071)
Offtaking	0.020 (0.013)	0.019 (0.013)	0.019 (0.013)	0.019 (0.013)	0.019 (0.013)	0.019 (0.013)	0.018 (0.013)
Foreign currency	0.045 (0.032)	0.045 (0.032)	0.043 (0.032)	0.045 (0.032)	0.046 (0.032)	0.047 (0.031)	0.047 (0.031)
Refinancing	0.047*** (0.007)	0.049*** (0.008)	0.049*** (0.008)	0.049*** (0.008)	0.048*** (0.007)	0.049*** (0.008)	0.049*** (0.008)
Observations	8,765	8,765	8,765	8,765	8,765	8,765	8,765
Adj R2	0.212	0.210	0.211	0.210	0.212	0.213	0.211

OLS regression results to examine the relationship between bond financing and macro-, country-, and project-level characteristics. The dependent variable equals one if the amount of bond financing exceeds that of loan financing, and zero otherwise. Definitions of the independent variables are provided in Appendix Table 1. Country risk is proxied by credit ratings in Column (1), and by the governance indicators in Columns (2)–(7). All specifications include year fixed effects and (country × sector) fixed effects. Robust standard errors are clustered at the country level and reported in parentheses. \*\*\*, \*\*, and \* denote statistical significance at the 1%, 5%, and 10% level, respectively.

Source: Bloomberg, Datastream, Dealogic Project Ware, FRED, World Bank.

**Table 8: Empirical Results, the Phase-in of Basel III**

Country Risk=	(1) Rating			(2) CC		
	Pre-BaseI III	BaseI III	Difference (p-value)	Pre-BaseI III	BaseI III	Difference (p-value)
Term spread	-0.002 (0.014)	0.023 (0.014)		-0.002 (0.014)	0.022 (0.013)	7
Credit spread	0.016* (0.009)	-0.035 (0.023)	0.048	0.017* (0.009)	-0.033 (0.023)	0.057
VIX	-0.166* (0.085)	-0.212 (0.240)		-0.167** (0.083)	-0.209 (0.239)	
GDP	0.633*** (0.202)	0.024 (0.273)	0.066	0.617** (0.240)	0.001 (0.291)	
Inflation	0.212 (0.139)	0.097 (0.433)		0.176 (0.143)	0.213 (0.453)	
Govt debt	-0.050 (0.067)	-0.072 (0.070)		-0.008 (0.055)	-0.019 (0.054)	
Country risk	0.007* (0.004)	0.015*** (0.005)	0.072	-0.015 (0.053)	-0.037 (0.055)	
Size	0.030** (0.014)	0.023*** (0.008)		0.031** (0.014)	0.022*** (0.008)	
Leverage	0.206*** (0.052)	0.045 (0.034)	<0.001	0.205*** (0.050)	0.041 (0.032)	<0.001
MDB	-0.103*** (0.020)	-0.099** (0.040)		-0.106*** (0.021)	-0.097** (0.040)	
Guarantee	0.112 (0.115)	-0.088* (0.047)	0.035	0.103 (0.117)	-0.086* (0.049)	0.051
Offtaking	0.038*** (0.012)	0.005 (0.015)	0.006	0.042*** (0.012)	0.003 (0.015)	0.001
Foreign currency	0.076*** (0.024)	0.039 (0.036)	0.090	0.068*** (0.024)	0.041 (0.036)	
Refinancing	0.040* (0.021)	0.050*** (0.010)		0.042* (0.021)	0.052*** (0.009)	
Observations		8,765			8,765	
Adj R2		0.215			0.213	

Country Risk=	(3) GE			(4) PS		
	Pre-BaseI III	BaseI III	Difference (p-value)	Pre-BaseI III	BaseI III	Difference (p-value)
Term spread	-0.003 (0.014)	0.022 (0.013)		-0.003 (0.014)	0.021 (0.013)	
Credit spread	0.016* (0.009)	-0.030 (0.023)	0.069	0.017* (0.009)	-0.032 (0.023)	0.060
VIX	-0.165* (0.085)	-0.213 (0.238)		-0.160* (0.086)	-0.213 (0.240)	
GDP	0.712*** (0.221)	0.067 (0.276)	0.074	0.482** (0.195)	0.128 (0.281)	
Inflation	0.171 (0.154)	0.022 (0.519)		0.083 (0.148)	0.363 (0.467)	
Govt debt	-0.012 (0.050)	-0.017 (0.061)		0.002 (0.053)	-0.008 (0.062)	
Country risk	-0.090** (0.035)	-0.129** (0.050)		-0.035* (0.020)	-0.027 (0.030)	
Size	0.031** (0.014)	0.023*** (0.008)		0.031** (0.014)	0.022*** (0.008)	
Leverage	0.204*** (0.049)	0.039 (0.032)	<0.001	0.210*** (0.049)	0.037 (0.031)	<0.001
MDB	-0.106*** (0.021)	-0.098** (0.040)		-0.109*** (0.023)	-0.096** (0.039)	
Guarantee	0.102 (0.119)	-0.088* (0.045)	0.054	0.108 (0.117)	-0.094* (0.048)	0.036
Offtaking	0.042*** (0.012)	0.002 (0.014)	<0.001	0.042*** (0.012)	0.003 (0.015)	<0.001
Foreign currency	0.064*** (0.023)	0.043 (0.035)		0.053* (0.027)	0.045 (0.036)	
Refinancing	0.042* (0.022)	0.052*** (0.010)		0.041* (0.021)	0.052*** (0.010)	
Observations		8,765			0.212	
Adj R2		0.214			0.212	

*continued on next page*

Table 8 continued

Country Risk=	(5) RL			(6) RQ		
	Pre-Basel III	Basel III	Difference (p-value)	Pre-Basel III	Basel III	Difference (p-value)
Term spread	-0.004 (0.014)	0.021 (0.013)		-0.005 (0.014)	0.021 (0.013)	
Credit spread	0.018** (0.009)	-0.033 (0.022)	0.047	0.018** (0.009)	-0.035 (0.022)	0.039
VIX	-0.176** (0.085)	-0.214 (0.238)		-0.168* (0.086)	-0.193 (0.234)	
GDP	0.521*** (0.187)	-0.003 (0.320)		0.556*** (0.210)	0.084 (0.276)	
Inflation	0.138 (0.135)	0.222 (0.402)		0.157 (0.127)	0.070 (0.420)	
Govt debt	-0.011 (0.054)	-0.022 (0.061)		-0.055 (0.053)	-0.082 (0.068)	
Country risk	-0.133** (0.055)	-0.146** (0.060)		-0.128*** (0.040)	-0.136*** (0.046)	
Size	0.031** (0.014)	0.023*** (0.008)		0.032** (0.014)	0.022*** (0.008)	
Leverage	0.200*** (0.050)	0.040 (0.033)	<0.001	0.201*** (0.050)	0.040 (0.032)	<0.001
MDB	-0.111*** (0.023)	-0.097** (0.040)		-0.107*** (0.021)	-0.097** (0.040)	
Guarantee	0.101 (0.119)	-0.087* (0.046)	0.056	0.102 (0.116)	-0.088** (0.041)	0.052
Offtaking	0.041*** (0.012)	0.004 (0.015)	0.002	0.041*** (0.013)	0.003 (0.014)	0.003
Foreign currency	0.063** (0.024)	0.042 (0.036)		0.062** (0.026)	0.046 (0.034)	
Refinancing	0.042* (0.021)	0.051*** (0.009)		0.042* (0.022)	0.052*** (0.010)	
Observations		8,765			8,765	
Adj R2		0.214			0.214	

Country Risk=	(7) VA		
	Pre-Basel III	Basel III	Difference (p-value)
Term spread	-0.001 (0.014)	0.020 (0.013)	
Credit spread	0.017* (0.009)	-0.033 (0.023)	0.054
VIX	-0.155* (0.088)	-0.200 (0.237)	
GDP	0.425** (0.205)	0.063 (0.275)	
Inflation	0.134 (0.139)	0.398 (0.350)	
Govt debt	0.007 (0.052)	-0.006 (0.059)	
Country risk	0.082 (0.073)	0.102 (0.070)	
Size	0.030** (0.014)	0.022*** (0.008)	
Leverage	0.211*** (0.049)	0.036 (0.032)	<0.001
MDB	-0.109*** (0.023)	-0.095** (0.039)	
Guarantee	0.110 (0.117)	-0.095** (0.046)	0.033
Offtaking	0.041*** (0.012)	0.002 (0.015)	0.001
Foreign currency	0.048* (0.027)	0.052 (0.035)	
Refinancing	0.043** (0.021)	0.051*** (0.010)	
Observations		8,765	
Adj R2		0.213	

Source: Bloomberg, Datastream, Dealogic Project Ware, FRED, World Bank.

**Table 9: Empirical Results, Geographic Areas**

Country Risk=	(1) Rating				(2) CC			
	Asia	Latam	Other	Difference (p-value)	Asia	Latam	Other	Difference (p-value)
Term spread	-0.005 (0.011)	-0.040** (0.019)	0.012 (0.011)	0.077	-0.006 (0.009)	-0.038** (0.016)	0.012 (0.010)	0.035
Credit spread	-0.001 (0.014)	0.027 (0.022)	0.006 (0.006)		-0.001 (0.014)	0.020 (0.019)	0.007 (0.007)	
VIX	0.074 (0.145)	-0.540 (0.341)	-0.151** (0.070)	0.097	0.080 (0.150)	-0.441* (0.264)	-0.165** (0.077)	0.079
GDP	0.957*** (0.305)	1.182*** (0.395)	0.368*** (0.120)		0.984*** (0.318)	1.338*** (0.492)	0.324*** (0.109)	
Inflation	0.262** (0.113)	0.502* (0.270)	0.110 (0.167)		0.256* (0.136)	0.612** (0.296)	0.120 (0.153)	
Govt debt	- (0.121)	0.100 (0.214)	-0.099 (0.087)	0.067	-0.319** (0.132)	0.230* (0.132)	-0.009 (0.055)	0.003
Country risk	0.012 (0.009)	0.024* (0.014)	0.013* (0.007)		-0.029 (0.047)	-0.148 (0.144)	-0.007 (0.042)	
Size	0.007*** (0.002)	0.043*** (0.015)	0.032*** (0.011)	0.017	0.006*** (0.002)	0.043*** (0.015)	0.031*** (0.011)	0.018
Leverage	0.016 (0.014)	0.176* (0.101)	0.124 (0.075)		0.016 (0.011)	0.169* (0.099)	0.121* (0.071)	
MDB	- (0.004)	- (0.027)	- (0.029)	<0.001	- (0.004)	- (0.027)	- (0.028)	<0.001
Guarantee			0.040 (0.075)				0.033 (0.077)	
Offtaking	-0.010 (0.008)	0.070** (0.027)	0.012 (0.010)	0.006	-0.011 (0.008)	0.070*** (0.025)	0.011 (0.010)	0.003
Foreign currency	0.027* (0.014)	- (0.025)	0.093** (0.044)	<0.001	0.026* (0.014)	- (0.039)	0.090** (0.044)	0.002
Refinancing	0.039*** (0.006)	0.120*** (0.036)	0.044*** (0.008)	0.029	0.039*** (0.006)	0.123*** (0.036)	0.047*** (0.009)	0.023
Observations			8,765				8,765	
Adj R2			0.228				0.226	
Country Risk=	(3) GE				(4) PS			
	Asia	Latam	Other	Difference (p-value)	Asia	Latam	Other	Difference (p-value)
Term spread	-0.007 (0.010)	-0.043** (0.017)	0.013 (0.010)	0.034	-0.008 (0.010)	-0.046** (0.018)	0.013 (0.010)	0.039
Credit spread	0.004 (0.012)	0.022 (0.019)	0.007 (0.007)		-0.004 (0.015)	0.019 (0.019)	0.008 (0.007)	
VIX	0.047 (0.132)	-0.440 (0.299)	-0.153** (0.074)		0.081 (0.148)	-0.450 (0.293)	-0.155** (0.075)	
GDP	1.029*** (0.284)	1.153*** (0.384)	0.399*** (0.120)		0.992*** (0.339)	1.134*** (0.421)	0.361*** (0.115)	
Inflation	0.143 (0.129)	0.614** (0.300)	0.099 (0.161)		0.187 (0.163)	0.612* (0.325)	0.081 (0.146)	
Govt debt	-0.294** (0.121)	0.249 (0.159)	-0.025 (0.067)	0.006	-0.387** (0.164)	0.320* (0.189)	0.001 (0.066)	0.006
Country risk	-0.102 (0.063)	-0.132** (0.066)	-0.073** (0.031)		-0.046 (0.029)	-0.005 (0.045)	-0.052** (0.024)	
Size	0.007*** (0.002)	0.043*** (0.015)	0.031*** (0.011)	0.020	0.006*** (0.002)	0.044*** (0.016)	0.031*** (0.011)	0.020
Leverage	0.017 (0.014)	0.171* (0.095)	0.119* (0.071)		0.016 (0.012)	0.176* (0.100)	0.120 (0.072)	
MDB	- (0.005)	- (0.026)	- (0.028)	<0.001	- (0.004)	- (0.027)	- (0.028)	<0.001
Guarantee			0.031 (0.078)				0.034 (0.076)	
Offtaking	-0.010 (0.009)	0.071*** (0.026)	0.011 (0.010)	0.003	-0.010 (0.008)	0.072*** (0.026)	0.011 (0.010)	0.002
Foreign currency	0.025* (0.014)	- (0.027)	0.090** (0.044)	<0.001	0.026* (0.014)	- (0.024)	0.092** (0.044)	<0.001
Refinancing	0.038*** (0.006)	0.122*** (0.036)	0.047*** (0.008)	0.024	0.039*** (0.006)	0.121*** (0.036)	0.047*** (0.009)	0.031

	(0.006)	(0.036)	(0.009)	(0.006)	(0.036)	(0.009)
Observations		8,765			8,765	
Adj R2		0.227			0.227	

*continued on next page***Table 9** *continued*

Country Risk=	(5) RL				(6) RQ			
	Asia	Latam	Other	Difference (p-value)	Asia	Latam	Other	Difference (p-value)
Term spread	-0.010 (0.010)	-0.045** (0.018)	0.012 (0.011)	0.057	-0.005 (0.010)	-0.042** (0.016)	0.012 (0.010)	0.032
Credit spread	-0.008 (0.014)	0.021 (0.021)	0.009 (0.007)		0.001 (0.014)	0.011 (0.016)	0.008 (0.008)	
VIX	0.101 (0.147)	-0.446 (0.297)	-0.175** (0.078)	0.091	0.081 (0.155)	-0.306 (0.268)	-0.177** (0.082)	
GDP	0.876*** (0.285)	1.106*** (0.381)	0.302*** (0.098)		0.999*** (0.339)	1.243*** (0.380)	0.323*** (0.113)	
Inflation	0.266** (0.126)	0.576** (0.265)	0.111 (0.155)		0.293** (0.123)	0.402** (0.171)	0.113 (0.150)	
Govt debt	-0.252* (0.128)	0.263* (0.156)	-0.026 (0.066)	0.010	-0.300** (0.117)	0.117 (0.141)	-0.044 (0.067)	0.020
Country risk	-0.148** (0.061)	-0.086 (0.081)	-0.154* (0.083)		-0.048 (0.062)	-0.245*** (0.083)	-0.064** (0.031)	0.072
Size	0.007*** (0.002)	0.043*** (0.015)	0.032*** (0.011)	0.017	0.006*** (0.002)	0.042*** (0.014)	0.032*** (0.011)	0.018
Leverage	0.012 (0.012)	0.170* (0.096)	0.119 (0.073)	0.098	0.014 (0.012)	0.163* (0.087)	0.120* (0.072)	0.087
MDB	-0.021*** (0.005)	-0.228*** (0.027)	-0.078*** (0.029)	<0.001	-0.019*** (0.005)	-0.229*** (0.026)	-0.077*** (0.028)	<0.001
Guarantee	-	-	0.028 (0.079)		-	-	0.032 (0.076)	
Offtaking	-0.008 (0.008)	0.071*** (0.026)	0.011 (0.010)	0.004	-0.010 (0.008)	0.071*** (0.026)	0.011 (0.010)	0.003
Foreign currency	0.030** (0.015)	-0.139*** (0.021)	0.090** (0.044)	<0.001	0.028* (0.014)	-0.095*** (0.025)	0.088** (0.044)	<0.001
Refinancing	0.039*** (0.006)	0.122*** (0.036)	0.046*** (0.008)	0.023	0.039*** (0.006)	0.125*** (0.035)	0.047*** (0.009)	0.017
Observations		8,765				8,765		
Adj R2		0.228				0.228		

Country Risk=	(7) VA			
	Asia	Latam	Other	Difference (p-value)
Term spread	-0.004 (0.010)	-0.047*** (0.018)	0.013 (0.010)	0.023
Credit spread	-0.003 (0.015)	0.015 (0.019)	0.007 (0.007)	
VIX	0.095 (0.157)	-0.395 (0.280)	-0.160** (0.080)	
GDP	1.136*** (0.341)	1.109*** (0.402)	0.330** (0.130)	
Inflation	0.347** (0.157)	0.611* (0.309)	0.175 (0.160)	
Govt debt	-0.334*** (0.122)	0.285* (0.162)	0.009 (0.055)	0.002
Country risk	-0.086** (0.035)	0.005 (0.096)	0.179 (0.114)	
Size	0.006*** (0.002)	0.043*** (0.015)	0.031*** (0.011)	0.019

Leverage	0.008 (0.009)	0.172* (0.097)	0.123* (0.071)	0.090
MDB	-0.020*** (0.005)	-0.226*** (0.027)	-0.076*** (0.028)	<0.001

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*continued on next page*

Table 9 *continued*

Country Risk=	(7) VA			Difference (p-value)
	Asia	Latam	Other	
Guarantee			0.037	
Offtaking	-0.008 (0.007)	0.071*** (0.026)	0.011 (0.010)	0.004
Foreign currency	0.031** (0.015)	-0.129*** (0.022)	0.093** (0.043)	<0.001
Refinancing	0.039*** (0.006)	0.122*** (0.036)	0.047*** (0.008)	0.028
Observations			8,765	
Adj R2			0.227	

OLS regression results to examine the relationship between bond financing and macro-, country-, and project-level characteristics. The dependent variable equals one if the amount of bond financing exceeds that of loan financing, and zero otherwise. All independent variables are interacted with the regional indicators Asia, Latin America, and Other countries. Definitions of the independent variables are provided in Appendix Table 1. Country risk is proxied by credit ratings in Column (1), and by the governance indicators in Columns (2)-(7). All specifications include year fixed effects and (country x sector) fixed effects. For each specification, the column "Difference (p-value)" reports, whenever it is less than 10%, the p-value for the null that coefficients are identical between Asia and Latin America. Robust standard errors are clustered at the country level and reported in parentheses. \*\*\*, \*\*, and \* denote statistical significance at the 1%, 5%, and 10% level, respectively.

Source: Bloomberg, Datastream, Dealogic Project Ware, FRED, World Bank.

## 5. PUBLIC SCHEMES TO SUPPORT BOND FINANCING

### 5.1 Europe

In this section, we analyze two key European initiatives to support infrastructure project bonds:

- The UK Guarantee Scheme
- The European Investment Bank "Project Bond Initiative".

Both schemes provide credit enhancements with different features. The first is a traditional guarantee, and the second is a mezzanine facility which no longer operates. In both cases the limited coverage of the credit enhancement was provided for 20 projects.

**UK Guarantee Scheme:** The UK Guarantee Scheme (UKGS) supports private investment by offering a government guarantee to help infrastructure projects raise debt. The UKGS can issue up to GBP 40 billion in guarantees and is open until at least 2026, as of Autumn 2016. UKGS is only available to 'nationally significant' infrastructure projects, and so is confined to projects with a potential to impact the UK economy.

Infrastructure is defined as any of the following:

- water, electricity, gas, telecommunications, sewerage or other services
- railway facilities (including rolling stock), roads or other transport facilities
- health or educational facilities
- court or prison facilities
- housing

The UKGS has to date issued ten guarantees totaling GBP 1.8 billion of Treasury-backed infrastructure bonds and loans, supporting over GBP 4 billion worth of investment (Table 10).

**Table 10: Projects that have Benefitted from the UKGS**  
(data as at 2017)

Project	Guarantee	Status	Sector
Drax Power – conversion from coal to biomass	£75mm (bond)	Released	Energy
Sustainable Development Capital Limited	£9mm (loan)	Released	Energy
Northern Line Extension	£750 mm (standby liquid facility)	Issued	Transport
Mersey Gateway Bridge PPP	£257mm (bond)	Issued	Transport
Ineos Grangemouth – Shale gas import and storage facilities	£285mm (bond)	Issued	Energy
Speyside CHP plant	£48mm (bond)	Issued	Energy
University of Northampton – relocation of campus	£292mm (bond)	Issued	University
Countesswells – 3,000 unit housing development	£86mm (loan)	Issued	Housing
University of Gloucestershire – Pittville Student Village	£39mm (bond)	Issued	University
Hinkley Point C	£2bn (bond)	Approved	Energy

Source: UK Government (2017).

The scheme guarantees the principal and interest on debt issued. All guarantees are commercially priced and based on the underlying risk and managed by the Infrastructure and Projects Authority (IPA). In March 2019, HM Treasury issued a consultation paper to attract private investors into infrastructure. At the time of writing, the feedback received was under analysis (HM Treasury 2019).

**European Project Bond Initiative:** Under the Project Bond Initiative (PBI), the European Investment Bank (EIB) provides eligible infrastructure projects with project bond credit enhancement (PBCE) via a subordinated instrument to support senior bonds issued by a project company. PBCE covers only a limited amount, and the maximum size of PBCE available for a transaction is less than EUR200 million or 20% of the nominal amount of bonds issued.

The PBCE facility provides credit enhancement in two different ways:

- Funded PBCE: Loan, subordinate to senior bonds, provided at the beginning;
- Unfunded PBCE: Letter of credit provided upon financial close for an amount that can be drawn if the cash flows generated by the projects are not sufficient to service the senior bond or to cover construction costs. If the project runs into difficulty and the credit line is drawn, EIB will create a mezzanine instrument subordinated to senior bonds.

Figure 5 highlights the differences between the funded and unfunded mechanism.

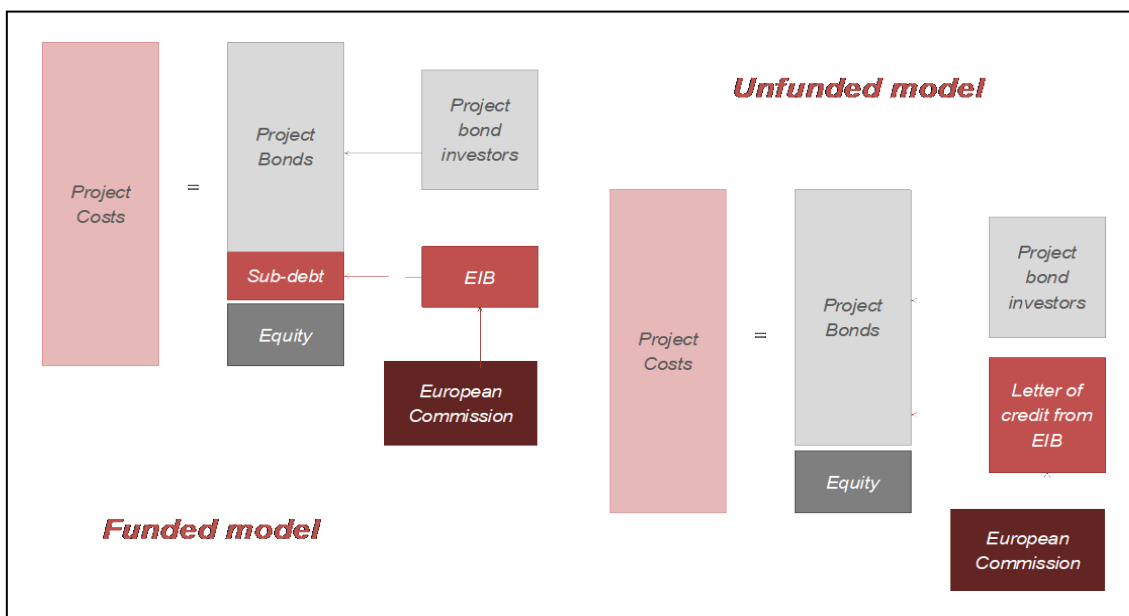
The EIB committed EUR230 million to the pilot phase (2021–2016), in three main sectors:

- Transport (TEN-T), with a budget of EUR200 million;
- Energy (TEN-E), with EUR10 million;
- Broadband and communication technology (ICT), with EUR20 million.

Ten projects have been approved to benefit from the PBCE facility, as shown in Table 11.



**Figure 5: Funded and Unfunded Model of the PBCE**



Source: Vecchi, Casalini, and Gatti (2015); Caselli, Corbetta, and Vecchi (2015).

**Table 11: List of Projects that Benefited from the PBCE from EIB**

Date	Project Name	Sector	Project Location	Currency
July 2013	Castor	Offshore Gas Storage	Spain	Euro
November 2013	Greater Gabbard	Offshore Transmission	UK	GBP
March 2014	A11 Motorway	Transportation	Belgium	Euro
July 2014	Axione	ICT/Telecom (Broadband Networks)	France	Euro
Aug 2014	A7 Motorway	Transportation	Germany	Euro
Feb 2015	Gwint Y Mor	Offshore Transmission	UK	GBP
July 2015	Port of Calais	Transportation	France	Euro
Aug 2015	WoDS West of Dunnon Sands	Offshore Transmission	UK	GBP
Jan 2016	New Ross N25 Bypass	Transportation	Ireland	Euro
April 2016	CAV Concessioni Autostradali Venete Spa	Transportation	Italy	Euro

Date	Project Bond Size	Type of Intervention	Amount of PBCE	Stage of Project Development
July 2013	1,400	Unfunded PBCE	Construction 14.3% Operations	Brownfield
November 2013	305	Unfunded PBCE	Operations 15%	Brownfield
March 2014	577	Unfunded PBCE	Operations 20%	Greenfield
July 2014	189	Unfunded PBCE	Operations 20%	Brownfield (refinancing)
Aug 2014	429	Unfunded PBCE	Operations 20%	Greenfield
Feb 2015	339	Unfunded PBCE	Operations 15%	Brownfield
July 2015	504	Unfunded PBCE	Operations 10%	Brownfield
Aug 2015	255	Unfunded PBCE	Operations 15%	Brownfield
Jan 2016	145	Unfunded PBCE	Operations 20%	Greenfield
April 2016	830	Unfunded PBCE	Construction 15% Operation	Brownfield

Note: it is possible here to include two boxes with the descriptions of two projects that benefitted from the EIB PBI (e.g., A11 motorway and Castor Gas storage).

Source: European Commission (2016); Moody's (2016).

## 5.2 Emerging Markets

We analyze instruments introduced in emerging countries that have mainly used bond financing accordingly to the data that we downloaded from Dealogic Project Ware. They are: Brazil, Malaysia, Peru, and Mexico, and India.

Table 12 reports the use of project bonds in these countries by considering only projects in which bonds exceed loan financing.

**Table 12: Number and Amount of Bond Tranches in Select Emerging Countries**  
(in January 1994 constant USD billion)

	Oil and Gas		Power		Renewable	
	Num	Amount	Num	Amount	Num	Amount
Brazil	9	4.2	18	2.1	47	1.5
Peru	3	0.9	8	1.4	5	0.9
Mexico	7	2.2	7	1.6	3	0.4
Malaysia	2	1.9	8	5.3	1	0.8
India			2	0.1	8	0.8

	Transport (excl. Roads)		Roads		Other	
	Num	Amount	Num	Amount	Num	Amount
Brazil	7	0.8	13	1.5	2	0.76
Peru	2	0.2	8	2.2	3	0.5
Mexico	3	1.6	4	1.1		
Malaysia	1	0.1	2	0.3		
India	4	1.1	7	0.4		

Source: Selected data, based on Bloomberg, Datastream, Dealogic Project Ware, FRED, World Bank.

In Brazil the government offered a tax break for bondholders, which proved effective only after the abolition of subsidized loans from the national development bank. In Peru the government offers a credit enhancement, linked to the advancement of construction milestones, that increases the rating of the project bond to the level of the Peru government's rating. In Mexico, the development bank, along with its fund for infrastructure offers traditional credit enhancement to facilitate the bond financing. The abundant use of project bonds in Malaysia is driven, on one hand, by its growing and stable economy, and by through Islamic finance modalities.

### 5.2.1 Brazil

Infrastructure investment was driven by the government-owned Brazilian Development Bank, Banco Nacional de Desenvolvimento Social (BNDES).<sup>31</sup> BNDES' significant role is due to the heavily subsidized interest rate offered to infrastructure projects—Taxa de Juros de Longo Prazo (TJLP)—and the long-term debt maturity of its loans.<sup>32</sup> Access to cheap credit was indeed essential for the infrastructure sector because of Brazil's high market interest rate, peaking at almost 15% in 2015, and the domestic capital market's lack of risk-return appetite for long-term debt issuances (S&P Global 2017).

<sup>31</sup> Played a key role in infrastructure by lending BRL 500 billion in the past 10 years (\$135 billion), amounting to 70%–80% of all infrastructure financing in Brazil for that period.

<sup>32</sup> The interest rate of TJLP averaged 6% since the start of 2013, compared with a yield on five-year local currency bonds of 12%. The difference between the rate at which the government financed itself and market rates represented an effective subsidy to those companies benefitting from TJLP loans.

To boost private investments in infrastructure projects, the Brazilian government created, in 2011, an income tax break for long-term bond issuances, through the “*debenture de infraestrutura*”. Thanks to this measure, infrastructure projects could issue debt in the domestic market whose pricing incorporated a tax break for individual investors, which would lower the cost of debt to the issuers. Between 2011 and September 2017, however, only BRL 22 billion (\$6 billion) was issued under this instrument. Actually, despite the expected tax advantage, BNDES’ subsidized financing was still a cheaper alternative (S&P Global 2017).

BNDES has generated a crowding-out effect from private financing in the infrastructure market. To overcome this and due to the unsustainability of the subsidized interest rate applied by BNDES, BNDES has been gradually applying the Taxa de Long Prazo (TLP), a market-based long-term interest rate starting from 2018. The introduction of TLP means that BNDES’ loans will become more expensive, and different sources of financing will tend to emerge, especially those provided by private sector banks or by the capital market. As a consequence, there is an increase in debenture issues linked to infrastructure projects. In 2018 a peak of \$6.3 billion was reached, the highest since 2011, and up 160% from 2017.<sup>33</sup>

### 5.2.2 Peru

In 2015 Peru embarked on World Bank supported reforms to attract more commercial financing for PPP projects while reducing the need for government guarantees to cover commercial risk.<sup>34</sup> In 2006, the government introduced government-backed, milestone-linked payment certificates, which were payment obligations of the government, used to support the financing of toll roads, water treatment facilities and hospitals. These certificates are (i) Certificados de Reconocimiento de Derechos del Pago Anual por Obras (CRPAOs); and (ii) Retribuciones por Inversiones según Certificado de Avance de Obras (RPICAOs).

CRPAOs are payable regardless of the subsequent completion of construction milestones and regardless of asset performance or use, once in operation. Each CRPAO constitutes an unconditional and irrevocable payment obligation for the government of Peru, denominated in US dollars. Typically, the amounts due will be paid out on a fixed schedule over the course of a pre-defined number of years. An innovative aspect is that these instruments are freely negotiable, implying that they can be assigned or sold by the holder to a third-party and later assigned to obtain ongoing financing for the remainder of the project (PFI International 2015). The proceeds collected by the concessionaire from the sale of CRPAOs could then be used to finance the next milestone of construction, thus allowing construction to proceed segment by segment.

Peruvian pension funds have accounted for much of the institutional investment in these bonds, although foreign investors have also been attracted to them (World Bank 2017). Essentially, the Peruvian approach using the CRPAOs reduces construction risk to a level equivalent to the nation's sovereign risk. Due to these features, CRPAOs have been considered a sovereign indebtedness, and therefore progressively substituted by RPICAOs, which can be considered contingent obligations – thus avoiding being treated as direct sovereign indebtedness.

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<sup>33</sup> As per Brazil's finance and capital markets association Anbima. The bond issue in 2018 represents 24% of the total bond issued according to the database.

<sup>34</sup> The vast expansion of PPP contracts in Peru was supported by government guarantees: in particular, it paid SPVs on construction milestones rather than on the basis of pre-agreed quality standards achieved or other forms of credit enhancement used, such as sovereign guarantees or standby letters of credit.

RPICAOs, unlike CRPAOs, are not granted in certificate form and do not embody direct payment obligations for the government. Instead, the government acts as a guarantor if the project cash flows are insufficient to cover the concessionaire's financing costs. An example of RPICAO-backed financing structure is that used for financing the Tobaoda water treatment facility project, which raised \$337 million through the issuance of project bonds. The bond issuance resulted from the securitization of RPICAOs issued by the state-owned water utility company Servicio de Agua Potable y Alcantarillado de Lima (SEDAPAL).<sup>35</sup> The project bonds issued for the Tobaoda project followed a traditional securitization structure. The rights to receive payments pursuant to the RPICAOs were sold by the concessionaire, Planta de Tratamiento de Aguas Residuales Tobaoda SA, to a Cayman SPV. The SPV then issues bonds backed by the RPICAOs, and uses the proceeds to pay the concessionaire for the RPICAOs. The SPV notes issuer, as the new holder of the RPICAOs, receives payments under the RPICAOs from the master trust established for the collection of water bills by SEDAPAL. These payments were then used by the SPV to fund the periodic interest and principal payments due on the bonds. In the event of a shortfall in the trust account relative to the amounts due under the RPICAOs, the Peruvian government steps in to make up the difference.

### 5.2.3 Mexico

Several development entities support infrastructure financing in Mexico. The most important is FONADIN, a fund created by a Presidential Decree in 2008 allocated within Banobras, the largest country's development bank.

FONADIN is a very flexible vehicle, offering non-reimbursable and reimbursable products across the whole project cycle in economic infrastructure and through a broad range of products. Non-reimbursable products include grants, viability gap funds and the financing of feasibility studies for government authorities. Reimbursable products mostly aim at reducing credit risk in financially viable projects through subordinated debt, partial credit and performance guarantees. It also seeks to support medium-size Mexican concessionaires in the energy and construction sector through equity investments in projects, so that they can compete with international or larger sponsors. Additionally, it supports the mobilization of capital from institutional investors by participating in the capital of CKDs (Certificados de Capital de Desarrollo, which are enlisted vehicles to allow pension funds to invest in infrastructure).<sup>36</sup>

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<sup>35</sup> The project is a BOT scheme, with the investment and running cost to be paid by the tariffs paid by local users to SEDAPAL, with a contingent guarantee for payment shortfalls provided by the government of Peru through its Ministerio de Vivienda, Construcción y Saneamiento (MVCS).

<sup>36</sup> CKDs were created in 2009 to expand the way in which pension funds could invest in infrastructure. Pension fund investment rules were amended to allow pension funds the possibility of making investments in private equity and infrastructure projects through the CKD structure. Each pension fund can invest up to 10% of its assets in them. There are two types of CKDs: (i) those issued to finance an individual company or project located in Mexico, and (ii) those issued to finance a private equity fund to invest in multiple companies or assets in Mexico based on a business plan and certain eligibility criteria determined by the sponsoring manager. Most CKDs are issued to finance a private equity fund that invests in multiple assets in Mexico based on a business plan and eligibility criteria determined by the sponsoring manager. CKDs pay dividends to their shareholders linked to the revenues of the infrastructure projects in which they are invested.

Banobras is a dominant player in infrastructure finance. It specializes in infrastructure finance directed only to financially viable projects. Most of its portfolio includes projects supported by sub-national governments or self-sustained projects. It provides two types of products: direct long-term loans and instruments for “induced lending”. The latter include indirect loans to banks participating in infrastructure projects, and partial guarantees for bank loans and capital markets instruments. Banobras has played an important role in lengthening financing tenors in infrastructure by participating in bank syndicates or co-financing with domestic and foreign banks.

Bonds in Mexico have mainly been used for brownfield projects, with credit-enhancement provided by Banobras and FONADIN (a quarter have received a partial credit guarantee). Most of these bonds are issued to refinance bank construction loans once construction is complete and the projects are in the relatively low-risk operational phase and have stable revenues. These project bonds fill a financing gap where banks would not be a financing alternative, given the large size, lower returns and longer tenors typical of mature infrastructure assets. The primary holders of these bonds in Mexico are pension funds (with around 63% of outstanding volume) and insurance companies (holding around 7%). They typically have credit ratings above AA on the national scale (often equivalent to BBB or BBB – on the global scale) and very low liquidity. The latter is acceptable to the pension fund investment profile given their buy-and-hold investor profile (World Bank 2017).

The guarantee offered by FONADIN for infrastructure bond is called “Garantías Bursátiles” (in English Securitization guarantees). This guarantee is granted to favor financial schemes through which credit securities backed by a source of own payment are issued. The guarantee offered by Banobras, called “Garantías para Deuda Bursátil” (in English Guarantees for Stock Exchange Debt), is similar to this.

#### **5.2.4 Malaysia**

In Malaysia, infrastructure bonds have also been largely used for greenfield projects, thanks to the robust structure of projects. In this regards, in 2016 the Credit Guarantee & Investment Facility, a trust fund of the Asian Development Bank, introduced the Construction Period Guarantee (CPG) to assure investors of the completion of construction works (Euromoney 2017). CPG is designed to frame the boundaries of risks during the construction period to acceptable levels and the assessment process that underpins CGIF’s CPG proves useful to drive the quality of projects to higher levels, particularly with respect to the construction phase (CGIF-ABMI 2016).

Islamic finance has emerged strongly in Malaysia and, in terms of project financing, Sukuk or Islamic bonds are the most important.

## **6. CONCLUSIONS**

Private capital can be better attracted to infrastructure under competitive regimes, dominated by listed private players, and therefore able to raise funds from capital markets. In PPP/Concession regimes, where private players are selected to build/revamp infrastructure and operate the service, bond financing represents a small fraction (about 10%) of overall debt financing. Bond investors are more reluctant to provide infrastructure funding during times of heightened global uncertainty, and in countries with worse economic prospects, while they are ready to deploy money in countries with worse credit, as well as institutional quality.

Bond financing is typically associated with large and highly leveraged projects, and with those that require refinancing. The involvement of agency lenders in the syndicate of bank lenders – probably a manifestation of ex-ante project-specific risk – discourages reliance on bond financing. The gradual phasing-in of Basel III has heightened the sensitivity of bond investors to finance projects in low creditworthy countries, while offtake contracts – which prior to Basel III constituted a positive factor for bond financing – became irrelevant. The above-mentioned positive (respectively negative) effect of project size and refinancing status (respectively agency participation) on bond financing is more modest in projects funded in Asian countries relative to those in Latin America. Moreover, projects in more indebted Asian countries attract significantly less bond financing, which suggests that bondholders may act as substitutes for public sector investment. Bond investors in Asian countries are not sensitive to offtake contracts, while these positively affect the probability of bond financing in Latin American countries.

While the qualitative analysis of Section 5 in large part corroborates the results of the empirical analysis, a more in-depth examination of some relevant cases, regarding both mature and, above all, emerging countries, shows some differences. These cases show that PPP transactions, and in particular those funded through bonds, have benefited from contractual guarantees (such as those aimed at limiting the construction risks and offtake contracts) and credit enhancement mechanism provided by MDBs. In Europe, where the regulation and market conditions are more stable, the role of such guarantees has been limited, as shown by the limited number of projects backed by these facilities.<sup>37</sup>

Bondholders prefer to invest in brownfield projects. In many countries brownfield infrastructure is related to liberalized sectors dominated by specialized industrial players (corporates) rather than by SPVs. These players issue (corporate) bonds instead of project bonds in order to fund the revamping of infrastructure they have in concession. Since our analysis is focused on project bonds and not on corporate bonds, it does not consider a portion of bonds that are in any case related to infrastructure. What may be happening is that banks are more comfortable lending to projects when there is an MDB in the consortium (IFC, EIB, and ADB, etc. participate in syndicated lending). When banks take the cream of the projects with MDB support, they virtually crowd out bonds. This is what we have seen in India and (perhaps now Viet Nam) as well. Banks re-price loans to good projects when projects want to issue bonds, thereby reducing any incentive for the projects to issue bonds. With BASEL III norms not having materially kicked in yet, banks are under no compulsion to exit projects.

MDBs need to support governments to conceive measures to reduce those risks that are perceived as very critical for bondholders, such as demand. Banks are able to affect the contractual structure of a project, and they may play a significant role during the construction phase, while bonds may be used to refinance loans. MDBs may play a role in assessing the reliability of demand forecasts in order to support bondholders in investing in demand-based projects. Availability-based payments, also temporary during the ramp-up phase, may be a good solution to neutralize the risk of demand that no investor can take because of the nature of infrastructure. It is therefore better that MDBs conceive new mechanisms to attract investors via bonds, rather than MDBs contribute to crowding out bondholders via a special relationship with banks.

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<sup>37</sup> Financial databases rarely include detailed information about the role of guarantees (contractual or financial, i.e., credit enhancement facilities) or the different role played by MDBs. This information is usually included in contractual documents and are therefore difficult to detect. The same issue emerged with regard to the type of project, i.e., greenfield or brownfield.

It is important to support the government in structuring a feasible pipeline of selected projects and reinforcing the legal framework to limit the construction risk. The use of availability charging could be a useful solution with regard to the demand risk, as experienced in Europe after the financial crisis. An availability charge could be the dominant payment mechanism of the PPP transaction, or it could be used during the ramp-up period (which can be also potentially paid out by the competent authority using a stream of tolls paid by users) with the option to switch it into regular toll-based payment cashed in by the concessionaire when the demand becomes more stable and mature.

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## APPENDIX

**Appendix Table 1: Sources and Description of Variables**

Variable	Description	Characteristic, Units*	Source
Bond financing	Equal to 1 when the amount of bond financing equals or exceeds that of loan financing, 0 otherwise	Project, dummy	ProjectWare
Term spread	10YR yield minus 2YR yield (US treasuries constant maturities)	Macro	FRED
Credit spread	Moody's Seasoned Baa corporate bond yield minus 10YR yield on US treasury constant maturity	Macro	FRED
VIX	CBOE volatility index	Macro	FRED
GDP	Real GDP per capita, year-on-year change	Country	Datastream
Inflation	CPI seasonally adjusted, year-on-year change	Country	Datastream
Govt debt	General government gross debt, % of GDP	Country	Datastream
Control of corruption (CC)	Control of corruption (estimate)	Country, range [-2.5,2.5]	World Bank
Govt effectiveness (GE)	Government effectiveness (estimate)	Country, range [-2.5,2.5]	World Bank
Political stability (PS) and absence of violence/terrorism	Political stability and absence of violence/terrorism (estimate)	Country, range [-2.5,2.5]	World Bank
Regulatory quality (RQ)	Regulatory quality (estimate)	Country, range [-2.5,2.5]	World Bank
Rule of law (RL)	Rule of law (estimate)	Country, range [-2.5,2.5]	World Bank
Voice and accountability (VA)	Voice and accountability (estimate)	Country, range [-2.5,2.5]	World Bank
Rating	Standard and Poor's long-term country rating at financial close	Country, range [1 AAA, 22 SD]	ProjectWare
Size	Log of project amount (the sum of bonds, loans, other debt, and equity) in January 1994 constant USD million	Project, logs	ProjectWare
Leverage	Ratio of the sum of bonds, loans, and other debt over project cost	Project	ProjectWare
MDB	Equal to 1 when at least one mandated arranger/bookrunner, provider, or guarantor is a multilateral development bank, 0 otherwise	Project, dummy	ProjectWare
Guarantee	Equal to 1 when there is least one guarantor for export credit, guarantee facility or L/C facility, 0 otherwise	Project, dummy	ProjectWare
Offtaking	Equal to 1 when there is at least one off-taking agreement or PPA, 0 otherwise	Project, dummy	ProjectWare
Foreign currency	Equal to 1 when at least one facility is denominated in foreign currency, 0 otherwise	Project, dummy	ProjectWare
Refinancing	Equal to 1 for refinancing status, 0 otherwise	Project, dummy	ProjectWare
Greenfield	Equal to 1 for greenfield status, and equal to 0 for brownfield	Project, dummy	ProjectWare

\* Units are decimals, unless otherwise indicated.

**Appendix Table 2: An Analysis of Greenfield vs Brownfield Projects**

	Greenfield		Brownfield		Test of differences Brownfield vs Greenfield	
	Mean	Median	Mean	Median	t-test	Wilcoxon Test
Loan amount	176.34	59.80	147.42	50.48	-0.844	-1.321
Bond amount	15.24	0	47.97	0	2.431**	1.589
Loan usage	0.931	1	0.886	1	-1.485	-1.451
Bond usage	0.075	0	0.119	0	1.409	1.380
Project cost	214.05	83.24	232.83	84.60	0.453	-0.451
Leverage	0.947	1	0.976	1	2.820***	3.821***
MDB	0.188	0	0.140	0	-1.196	-1.208
Guarantee	0	0	0	0	-	-
Offtaking	0.231	0	0.067	0	-4.311***	-4.390***
Foreign currency	0.2	0	0.140	0	-1.487	-1.505
Refinancing	0.019	0	0.415	0	10.655***	8.716***
# Obs.	160		193			

Means and medians for the subsample of Greenfield and Brownfield projects. Loan amount, bond amount and project cost are expressed in January 1994 constant USD million; loan and bond usage are the fractions of projects with positive usage of each instrument. All other variables are as in the regressions. The last two columns of the table present test statistics of the t-test and the Wilcoxon test of the differences in characteristics between the two samples. \*\*\*, \*\*, and \* denote statistical significance at the 1%, 5%, and 10% levels, respectively

Given the small size (353 observations) of sample projects with non-missing information on their greenfield/brownfield status, we refrain from multivariate analysis and report descriptive statistics for relevant characteristics for these subsamples in this table. Greenfield and brownfield projects are comparable in terms of their financial structure – reliance as well as amount of loans and bonds – as well as their size. Brownfield projects are more leveraged (97.6% vs 94.7%) and more often associated with refinancing (41.5% vs 1.9%), while greenfield projects more often involve off taking contracts (23.1% vs 6.7%).