

Infrastructure and Corporate Bond Markets in Asia

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1. Introduction

Emerging market economies in Asia find themselves caught in a puzzling situation. How can a region with such abundant savings be facing a shortage of infrastructure financing? Channelling enough savings to badly needed infrastructure investment has been extraordinarily difficult. What accounts for this failure of financial intermediation?

A clue to this failure is to be found in the way large infrastructure projects are actually financed. In emerging Asia, more so than in other regions, the large projects that do get privately financed rely heavily on bank loans. Certainly, there are projects that are financed with bonds but they are relatively few. This is telling, because infrastructure projects tend to need large sums at long maturities – requirements that would seem to favour bond financing over bank financing.

Infrastructure projects do not appear to be inherently more risky than loans to normal corporate borrowers. The risks are just different. Infrastructure projects often produce public goods or are natural monopolies. This means that the government must play a significant role in ensuring their provision and in regulating the quality and pricing of outputs. At the same time, there are efficiency gains to be realised by including the private sector. Private sector participation can help to select cost-efficient solutions, but also to ensure satisfactory operation during the project's life. This means that contracts need to be designed so as to minimise the moral hazard risks associated with private sector participation. The predictability of the regulatory and legal framework under which a project operates is therefore crucial.

Financial markets have found ways to manage the risks of large infrastructure projects. Building on project finance techniques, large projects in many jurisdictions are now typically public-private partnerships (PPPs) that raise funds through a special purpose vehicle (SPV). The SPV allows contractual structures that facilitate the credible distribution of responsibilities and cash flows, and manages the risks of moral hazard and government regulation. However, what makes the formation of these vehicles hard in practice is that the contractual structures are so complex that highly specialised expertise is invariably required to put them together.

In this paper, we first describe the nature of infrastructure finance, paying special attention to the relative strengths and weaknesses of bank and bond finance at different phases of an infrastructure project. Default and restructuring risks tend to be higher in the early stages of large infrastructure

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projects, though recoveries tend to be greater than in other sectors. We argue that an important step for most governments in emerging Asia is to build up the necessary expertise for structuring viable projects as well as a supportive legal framework. In Section 3, we analyse bond ratings for a sample of infrastructure bonds and show that while overall country risk influences the risk assessment of infrastructure bonds, political risk factors such as contract viability and bureaucratic efficiency may be even more important.

Section 4 provides a comprehensive overview of the infrastructure bond market. Infrastructure bond markets have grown larger over time, and they now tend to move in a cyclical fashion mirroring the overall bond market. The markets in emerging Asia are still relatively small and most issuance is made onshore in local currency. The further development of local bond markets is hence of great importance for infrastructure bond markets. The final section concludes.

2. The Nature of Infrastructure Finance

Attracting private funding for infrastructure projects hinges on new techniques of project finance (Brealey, Cooper and Habib 1996). These techniques entail two sets of contractual arrangements: (i) the creation of a legally and economically self-contained entity (SPV) against which all legal contracts are written; and (ii) a set of contracts dictating the distribution of risks and returns. Debt investors are serviced by the cash flows of the particular project. This structure can also help to limit agency problems, as owners and operators cannot simply divert revenues away from the project to other entities. Owners of projects are typically governments, large corporations or construction companies.¹ Debt financing is in almost all cases non-recourse, or may allow very limited recourse in some cases. Assessing the probability of repayment of a debt security hence depends to a very large extent on the viability of the project itself. Project bonds, and more specifically infrastructure bonds, are therefore different from corporate bonds, where the creditworthiness of the corporation, and not the viability of the projects, is the determining factor.

A typical infrastructure project has three distinct phases – the planning phase, the construction phase and the operational phase. Each phase exhibits different risk and return characteristics and each poses different incentive problems. Hence, each phase requires a different mix of financial instruments to cover different risk and return profiles, and so targets different types of investors (Table 1). Bonds are usually used for refinancing more seasoned infrastructure projects in the operational phase and are relatively rare in the initial planning and construction phases.

1 For a discussion of the economics of PPPs, see Engel, Fischer and Galetovic (2010).

Table 1: Phases of Infrastructure Projects and their Characteristics

Phase	Economic and contractual issues	Financial characteristics	Potential investors
Planning	Contracts are written in the planning phase and are crucial to the success of projects. The planning phase can take a long time (10 to 30 months) and the involved parties may attempt to renegotiate contract commitments. Ratings from rating agencies are important to secure interest from debt investors, as are credit insurance or government guarantees.	The procuring authority needs to find equity investors. The equity sponsor needs to secure commitments by debt investors (mostly banks). Given the long planning period, early commitments by debt investors come at a high cost. Leverage can be high (10:1 or more).	Equity sponsors need a high level of expertise. They are often construction companies or governments. In rare cases, infrastructure funds (Australia, Asia) or direct investments by pension funds (Canada) may be involved. Debt investors are mostly banks through (syndicated) loans. Bond financing is rare, as projects carry high risks in the initial phases.
Construction	Monitoring incentives are essential. Private involvement (as opposed to purely public investment) can ensure this.	This is a high-risk phase. Due to the complexity of infrastructure projects, unexpected events are likely. Default rates are relatively high. Initial commitments by debtholders must extend far beyond this stage, as a project does not generate positive cash flows in this phase.	Refinancing or additional financing is very difficult and costly at this stage. Equity sponsors may have an incentive to provide additional finance if risks materialise.
Operational	Ownership and volatility of cash flows due to demand risks are key. Models such as flexible-term present value contracts and availability-based fees reduce volatility, risk and financing costs, but have adverse incentive effects.	Positive cash flows. The risk of default diminishes considerably.	Refinancing of debt (bank loans) from the initial phase. Bonds are a natural choice, but they are not very common. Refinancing with bank loans or government funds is common.

2.1 Bond versus bank finance

Bond financing is very rare in the planning and construction phases. Several factors put bond financing at a disadvantage compared with bank loans for 'greenfield' projects. First, infrastructure bonds are mainly of interest to long-term investors such as pension funds or insurance companies, which are typically less willing or able to invest in high-risk debt securities. Second, debt restructurings are common in the initial phase of projects. Usually, restructurings would trigger selective bond defaults, whereas banks are more flexible in restructuring existing loans.

Bank loans have some key advantages over bonds in the planning and construction phases: (i) debtholders serve an important monitoring role and banks tend to have the necessary expertise in infrastructure projects; (ii) infrastructure projects need a gradual disbursement of funds and bank loans are sufficiently flexible; and (iii) infrastructure projects are more likely to require debt restructurings during the construction phase – in the event of unforeseen outcomes, banks can quickly negotiate restructurings among themselves, whereas the restructuring of bonds is complex and time intensive.

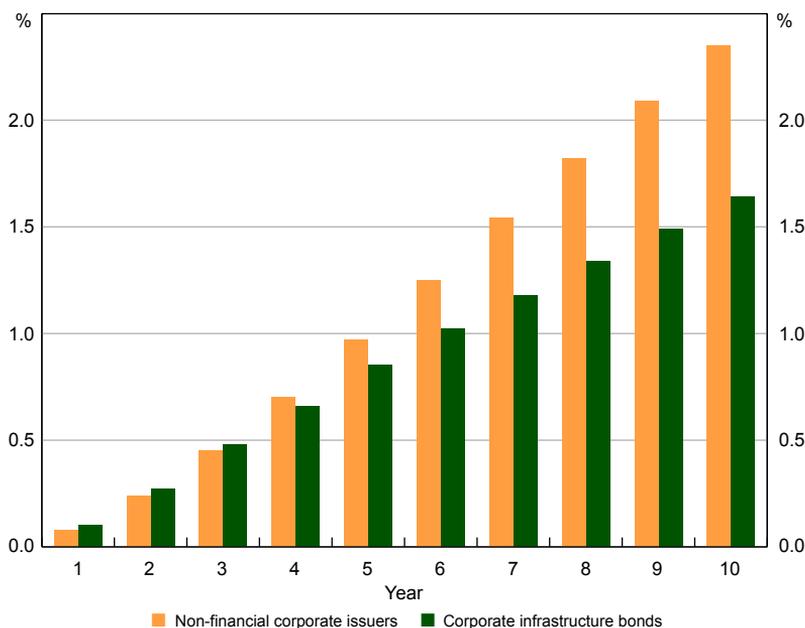
In the operational phase, however, with its stable underlying cash flows, infrastructure projects are akin to fixed-income securities and therefore bond financing is a natural and economically appropriate financing instrument. The documented default and recovery performance for infrastructure bonds is illustrative of the sector's investment properties.² The cumulative default rate of investment-grade infrastructure bonds tends to be higher than that of non-financial corporate issuers at the initial stages, but is lower from year 4 (Figure 1). This result is congruent with the fact that credit ratings are designed to be consistent measures of absolute and relative credit risk at the 3–4 year time horizon across asset classes. The greater stability over longer time horizons reflects the tendency of infrastructure bonds to become less risky at longer horizons once hurdles at the early and intermediate stages are cleared.

In the event of default, the recovery rate on infrastructure bonds is also higher than that measured for the broader universe of defaulted corporate debt (Table 2). One reason for these high recovery rates may be that when infrastructure bonds do default, they tend to default earlier, before the value of the project has had too much chance to depreciate. Another possible reason is the potential government support for high-profile projects; policymakers may decide to provide financial support to a troubled project if it is deemed to be politically advantageous.

Another feature of infrastructure bonds is that the credit ratings tend to be significantly more stable than those of non-financial corporate issuers (Moody's Investors Service 2012). In particular, ratings are more likely to remain unchanged at each letter-grade level over both the 1-year and 5-year horizon for infrastructure bonds than for non-financial corporate issuers. Lower migration rates show up as a rather narrow differential at the 1-year time horizon, but the differences are quite marked at the 5-year horizon. For instance, 56 per cent of A-rated infrastructure bond issuers were still at the A-rated level after five years, versus less than 50 per cent of non-financial corporate issuers. Of Baa-rated infrastructure issues, 53.9 per cent remained in this category relative to 48.6 per cent of non-financial corporate issuers.

² We refer here to Moody's Investors Service (Moody's Investors Service 2012), although Moody's is not the only major global rating agency to publish default and recovery statistics for infrastructure bonds. At the latest count, Moody's publishes ratings on more than 1 000 corporate infrastructure and project finance entities.

Figure 1: Investment-grade Bonds
Cumulative default rates



Source: Moody's Investors Service (2012)

Table 2: Recovery Rates for Defaulted Corporate Bonds
Average trading prices of US\$100 of issuers' bonds 30 days after its initial missed payment or bankruptcy filing

Sector	Senior secured	Senior unsecured
Regulated utilities	85.52	59.16
Unregulated utilities	60.96	41.45
Others	65.93	60.05
Corporate infrastructure bonds	68.72	53.01
Non-financial corporate issuers	49.30	36.50

Note: In cases of distressed exchange, average price one day before closing of the distressed exchange

Source: Moody's Investors Service (2012)

These characteristics would suggest infrastructure bonds are an attractive investment alternative. At the same time, institutional investors, such as pension funds, insurance companies and sovereign wealth funds, have a growing need for a diversified portfolio of long-term assets. One recent study puts this investor base at about US\$90 trillion (HSBC 2013). According to figures from the Organisation for Economic Co-operation and Development (OECD), the demand for assets from this long-term investor base has also been increasing rapidly over the last decade (OECD 2013). Nevertheless, in 2012 infrastructure debt securities amounted to only 0.4 per cent of total assets within the OECD sample of pension and pension reserve funds.

2.2 Bottlenecks

Why do potential investors in many countries hold so few infrastructure bonds? We argue that there is a lack of a pipeline of properly structured projects, which often reflects an inadequate legal and regulatory framework. Infrastructure investments entail complex legal and financial arrangements, requiring a lot of expertise. 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.

Creating a pipeline of suitable projects requires a coherent and trusted legal framework for infrastructure projects. The economic viability of infrastructure projects is often dependent on government decisions, such as pricing, environmental regulation, or transportation and energy policy. In some countries, reliable frameworks do not exist. Cases of political interference – for example arbitrary cuts in the prices private infrastructure operators are allowed to charge – greatly increase the perception of political risks, which are among the greatest concerns of private investors. But even if solid legal frameworks exist, best practices or experience with large infrastructure projects can be lacking on the side of the government. In some countries, such as the United Kingdom, central government agencies have been set up as a central point for the development of large infrastructure projects, which enables a continuous build-up of expertise. Also, in countries where infrastructure projects are undertaken by provincial authorities, such as Australia, an effective dissemination of best practice and expertise can be successfully implemented. Establishing such practices and institutions takes time, but their development can help to realise enormous efficiency gains and enables governments to successfully undertake a much larger number of projects.

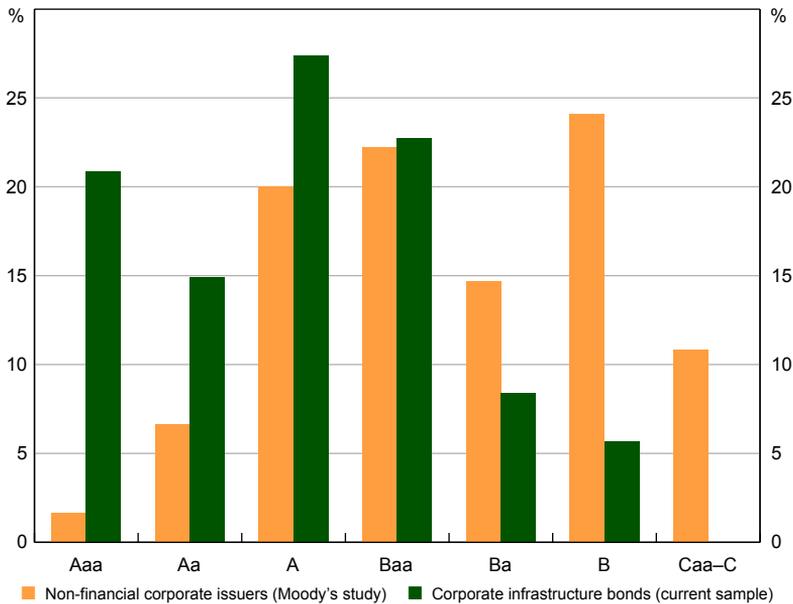
3. Country and System Risks to Infrastructure Bonds

To assess the importance of country and system risks, we examine a sample of 369 infrastructure bonds with credit ratings from the major global rating agencies (Moody's, Standard & Poor's (S&P) and Fitch Ratings).³ When we chart the distribution of issues by average rating, the highest rating (Aaa) accounts for a significant portion of issuance, though it peaks at A, while the speculative-grade categories (Ba and lower) account for 14 per cent (Figure 2). This sample is much more highly rated than other more general samples of non-financial corporate issuers, and supports the view that those infrastructure bonds that receive ratings from the major agencies tend to have relatively low credit risk.

The sample's geographic distribution has a relatively high proportion of North American and European infrastructure bonds. North America and Europe (including central and eastern Europe and the United Kingdom) account for 41 per cent and 21 per cent, respectively, while 20 per cent of the issues are from the Asia-Pacific region. The geographic dispersion of investment-grade and speculative-grade ratings is also of interest. The bonds of emerging Europe and Latin America – which constitute just 4 per cent and 15 per cent of the overall rated issues, respectively – make up 17 per cent and 52 per cent of the speculative-grade sub-sample. By contrast, there are only three issues (6 per cent) from the Asia-Pacific region in the sample that are rated speculative grade.

³ How the infrastructure bond sample is constructed, both rated and unrated, is described in more detail in Section 4 and Appendix A.

Figure 2: Distribution of Ratings – Corporate Versus Infrastructure Bonds



Notes: Sample of infrastructure bonds comprises 369 issues from 2000–2013 with global ratings; average of ratings from Fitch, Moody's and S&P taken to place sample bonds in ratings bucket
 Sources: Bloomberg; Dealogic; Moody's Investors Service (2012)

3.1 Split ratings

In our sample of rated infrastructure bonds, we find that a large proportion (two-thirds) have a rating at issue from more than one of the three agencies (Table 3). In more than one-half of those cases, there is a different rating from at least two of the agencies. To be sure, some differences of opinion are inevitable to the extent they reflect additional information and different perspectives. The frequency of disagreement for infrastructure bonds is quite similar to the frequency of split ratings that has been observed for US corporate bonds.⁴ At the same time, the frequency of ratings disagreement is much lower than that observed for financial institution ratings, where fully 92 per cent of all banks rated by more than one of the major agencies have been found to have different ratings across agencies (Packer and Tarashev 2011).

⁴ See Cantor, Packer and Cole (1997). In that paper, only Moody's and S&P ratings were used. Had the count of split-rated issues included Fitch ratings, an even larger proportion of split-rated issues would have resulted.

Table 3: Infrastructure Bond Rating

Based on Fitch, Moody's and S&P ratings

	(1) Number of rated issues	(2) Percentage of rated issues (1) with multiple ratings Per cent	(3) Percentage of multiple ratings (2) with split ratings Per cent	(4) Percentage of split rating pairs (3) that are split in the same direction as sovereign rating ^(a) Per cent
Investment grade	317	64	52	26
AAA	77	84	17	100
AA	55	64	77	53
A	101	42	69	9
BBB	84	71	63	10
Speculative grade	52	77	83	40
BB	31	87	89	23
B	21	62	69	83
Total	369	66	57	29

Note: (a) Calculated as a percentage of all possible rating pairs, which exceeds the number of issues

Sources: Bloomberg; Dealogic; authors' calculations

Consistent with the results of other studies, split ratings are least likely at the upper bound. In cases with multiple ratings where one rating was AAA, the other rating was lower than AAA only 17 per cent of the time. Split ratings were much more likely among speculative-grade credits, as 83 per cent of speculative-grade issues with multiple ratings had split ratings.

Disagreements over the creditworthiness of infrastructure bonds appear to be just as likely to reflect differences of opinion concerning the sovereign risk of the parent's home country as much as the structure of the infrastructure bond *per se*. This is particularly the case with speculative-grade bonds. Among the cases where a pair of rating agencies offered different ratings, 40 per cent had ratings of the relevant sovereign that were split in the same direction; only 2 per cent had a split in the opposite direction. Namely, the rating agency with higher (lower) ratings for the infrastructure bond often had the sovereign rated higher (lower). In nearly 90 per cent of those cases, the split was exactly the same number of notches.

That said, there appears to be plenty of room for disagreement beyond the assessment of country risk. In fully 58 per cent of the cases of split ratings on all infrastructure bonds, the corresponding sovereign ratings of the agencies were identical. And the same bond ratings did not necessarily indicate the same view on the bond net of country risk, for in 37 per cent of cases credit rating agencies had given the same rating to an infrastructure bond even though the country risk rating was different.

Despite the possibility that the ratings agencies may differ in terms of their view of the overall risk of infrastructure bonds, and the fact that the use of ratings in regulation may make issuers search

for the easier ratings, the ratings dataset does not indicate that ratings shopping of this sort is going on. Of the 127 single-rated bonds, in only 13 cases was the rating agency chosen that had the single highest sovereign rating for the country of the parent. In fact, there were 15 cases in which the related sovereign rating was lower than that of the major rating agency.

3.2 The importance of the regulatory framework

In addition to country risk, rating agencies clearly recognise the importance of regulatory factors when assigning risk assessments to infrastructure bonds. As evidence of this, one can turn to the methodology used by Moody's for calculating ratings on regulated electricity and gas utilities (Moody's Investors Service 2013). The 'legislative and judicial framework' and the 'consistency and predictability of regulation' each occupy 12.5 per cent of Moody's 'broad factor ratings'.

Moody's defines a high rating on the legislative and judicial framework as the case where '[u]tility regulation occurs under a fully developed framework that is national in scope based on legislation that provides the utility a nearly absolute monopoly ... within its service territory, an unquestioned assurance that rates will be set in a manner that will permit the utility ... [to] recover all necessary investments, an extremely high degree of clarity as to the manner ... regulated ... There is an independent judiciary that can arbitrate disagreements between the regulator and the utility ...' (Moody's Investors Service 2013, p 33).

By contrast, the lowest investment-grade rating (Baa) is only consistent with a 'strong monopoly ... *that may have some exceptions* ... a general assurance that, *subject to prudence requirements that are mostly reasonable*, rates will be set in a manner that will permit the utility to recover investments, *reasonable clarity* as to the manner [of regulation and rate setting] ... an independent judiciary ... *regulation has been applied* ... *such that redress to an independent arbiter has not been required* [italics added]' (Moody's Investors Service 2013, p 33).

The second sub-factor, consistency and predictability of regulation, is also illustrative in its differences between the highest and lowest investment-grade rating description. The Aaa category indicates that '[t]he issuer's interaction with the regulator has led to a strong, lengthy track record of predictable, consistent and favorable decisions. The regulator is highly credit supportive of the issuer and utilities in general' (Moody's Investors Service 2013, p 34). The Baa category instead reads: '[t]he issuer's interaction with the regulator has led to an *adequate* track record. The regulator is *generally* consistent and predictable, *but there may be some evidence of inconsistency or unpredictability from time to time* ... [italics added]' (p 34).

3.3 Metrics of system risk

The above discussion suggests that there is an array of factors beyond financial ratios and other credit fundamentals that affect the creditworthiness of infrastructure bonds. At the same time, the country risk rating of the parent of the project alone may be an inexact proxy for the risks that might particularly influence the performance and creditworthiness of infrastructure bonds.

To confirm whether more finely defined qualitative measures might help to explain the creditworthiness of infrastructure bonds more generally, for each domicile of the issuer, we take

the following country risk measures from the International Country Risk Guide (ICRG) at the time of issuance (The PRS Group 2013):

- (i) *Political risk*. Together with the economic and financial risk ratings, the political risk rating is one of the major components of the ICRG composite country risk rating. The overall political risk rating aggregates 12 component factors, including government stability, socioeconomic conditions and the three factors mentioned below – corruption, bureaucracy quality and contract viability/expropriation.
- (ii) *Corruption*. As described by the ICRG, corruption within the political system ‘... distorts the economic and financial environment; it reduces the efficiency of government and business by enabling people to assume positions of power through patronage rather than ability; and ... [it] introduces an inherent instability into the political process’ (p 4).
- (iii) *Bureaucracy quality*. The ICRG explains its importance as follows: ‘The institutional strength and quality of the bureaucracy is a shock absorber that tends to minimize revisions of policy when governments change ... In these low-risk countries, the bureaucracy tends to be somewhat autonomous from political pressure ...’ (p 7).
- (iv) *Contract viability/expropriation risk*. This variable is also one of the components of the overall political risk rating. It reflects the risk of unilateral contract modification, cancellation or outright expropriation.

For each measure, a higher value reflects lower risk.

In Table 4, we examine the rank-order correlations of the various country risk measures with the corresponding sovereign rating, as well as with the average credit rating of the three major credit rating agencies for each of the 369 infrastructure bonds in our sample. If the bond is a local currency bond, the local currency sovereign rating is used in the calculations; otherwise the foreign currency rating is used. We report rank-order correlations for the total sample, as well as the subset of issues rated investment grade and speculative grade.

All of the measures of country risk are highly correlated with the sovereign rating, both for the total sample and the investment-grade and speculative-grade sub-samples (Table 4). It would appear that among the selected four attributes, it is the quality of bureaucracy that is the most consistently highly correlated with the sovereign rating, with correlations of 0.77 for the investment-grade sub-sample, 0.88 for the speculative-grade sub-sample, and 0.82 overall. However, political risk is more highly correlated for the speculative-grade sub-sample (0.95). In any event, correlation for all of the variables with the country sovereign rating is high and significantly so.

Interestingly, the sovereign credit rating generally shows lower correlation with the infrastructure issue rating than the other measures of country risk: it scores the lowest pair-wise correlation in the case of investment-grade issues (0.06), and almost the lowest correlation coefficient for the whole sample (0.30). The highest correlations with issuer ratings are exhibited by the metric of contract viability/expropriation risk, scoring 0.47 for the whole sample, followed by political risk (0.41) and quality of bureaucracy (0.33). (Contract viability/expropriation risk also has the highest correlations with the issue rating for the investment-grade and speculative-grade sub-samples.) This suggests that contract viability/expropriation risk, political risk and quality of the bureaucracy may be country characteristics that are highly likely to influence the infrastructure bond rating.

Table 4: Infrastructure Bond Ratings and Measures of Country Risk
Rank-order correlation

	Sovereign rating			Issue rating ^(a)		
	Investment grade	Speculative grade	All	Investment grade	Speculative grade	All
Sovereign rating	na	na	na	0.06	0.21	0.30
Political risk	0.64	0.95	0.74	0.27	0.09	0.41
Corruption risk	0.76	0.85	0.79	0.07	0.23	0.23
Quality of bureaucracy	0.77	0.88	0.82	0.12	0.00	0.33
Contract viability/ expropriation risk	0.48	0.82	0.61	0.31	0.37	0.47

Notes: A higher value for any country risk metric is indicative of lower risk and higher quality

(a) Issues with ratings below B- are not included

Sources: Bloomberg; The PRS Group (2013)

To be sure, an exact assessment of the relative contribution of any particular risk factor to the issuer bond rating should be estimated simultaneously in a multivariate framework, ideally one that controls for other observable country characteristics such as per capita income or growth. Nonetheless, these rank-order correlations are strongly suggestive that the sovereign credit rating is unlikely to be a sufficient statistic when evaluating the effect of country risks on infrastructure bonds, and that more granular country risk characteristics are likely to be useful as well.

4. The Markets for Infrastructure Bonds

To analyse infrastructure bond markets, we construct a database of corporate issues that includes 1 625 infrastructure-related deals in different parts of the world. We ask three questions regarding the role of bonds in infrastructure finance. First, how have the global and regional bond markets for infrastructure evolved in recent years? Second, how important have the bond markets been relative to syndicated loans for infrastructure financing? Third, in raising infrastructure funds, how do economies in emerging Asia differ in their reliance on bond markets, including how they choose between onshore and offshore bond markets?

4.1 Assembling a database of infrastructure bonds

We take a relatively broad definition of infrastructure when assembling the dataset. In general, infrastructure can be divided into two types: (i) economic infrastructure, such as roads or electricity grids; and (ii) social infrastructure, such as schools or health care. We include both types in our definition. We exclude, however, the oil, gas and mining industry, which in most cases is dominated by large international corporations with easy access to capital markets. As our focus is on infrastructure bonds as a means to finance the large future demand for economic and social infrastructure, we do include project bonds issued by national government agencies and multilateral development banks. While not all projects undertaken by these institutions are necessarily infrastructure related, they are, however, important players in the infrastructure market in general.

With respect to the type of security, we also take a broad definition. Hence, our sample includes debt securities with different degrees of seniority, fixed-maturity and callable bonds, perpetual bonds and medium-term notes. All of these securities have in common the fact that they are tradeable securities, which can be held by any investor, not only by banks.

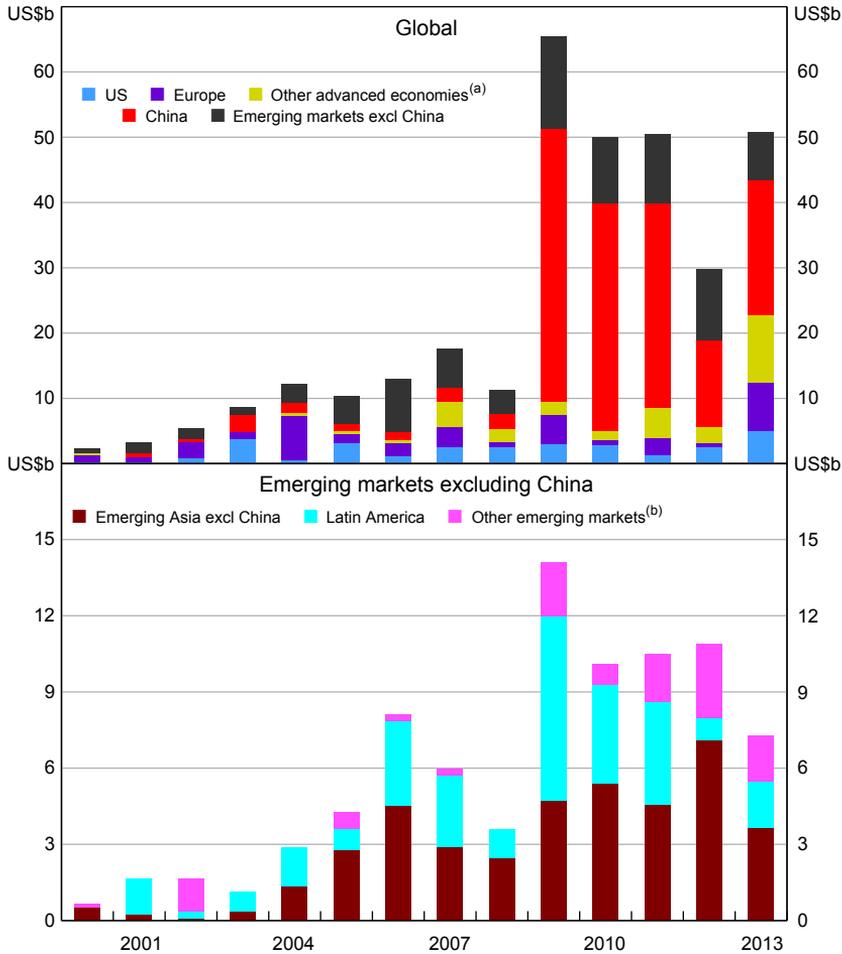
Our dataset merges two sources of data. The first source is Dealogic BondWare, which covers 1 008 deals over the period from 1 January 2000 to 31 December 2013. The second source is Bloomberg, which covers a considerably larger sample of 8 140 deals, also between 2000 and 2013. Merging the two sources together provides us with a total of 8 973 observations, including 174 observations that are common to the two sources. We define the country as the location of incorporation of the issuer in the case of Dealogic and as the domicile of the issuer in the case of Bloomberg. Then, to identify the infrastructure-related part of project debt securities, we rely on the issuer industry classification. The classifications differ between Dealogic and Bloomberg, and are generally more granular for Dealogic. Restricting our sample to infrastructure-related industries leaves us with 1 625 infrastructure-related debt security deals, which define our 'market for infrastructure bonds'. Appendix A provides a full list of the industries we classify as infrastructure related, as well as additional information on the construction of the dataset.

4.2 Global and regional market developments

First, we examine global and regional developments in infrastructure bond markets. As shown in Figure 3 (top panel), the global market for infrastructure bonds has grown rapidly since 2008. Since the global financial crisis, the issuance of global infrastructure bonds has risen to be roughly three times its pre-crisis levels. In 2009, annual global issuance topped US\$60 billion, although it has since fallen back modestly to around US\$50 billion. These developments have evidently been strongly influenced both by the financial cycle and a structural shift towards greater issuance in China by state-owned entities.

In terms of volumes of issuance, China has been in a class by itself. In 2010, it alone accounted for 70 per cent of the global issuance and since then has maintained a global market share of more than 40 per cent. Largely because of China, the share of infrastructure bond issuance by emerging markets rose from 30–60 per cent prior to 2009 to 80 per cent since the financial crisis. Without China the share of emerging markets would have remained at around 20 per cent after 2008. Nonetheless, in 2013 advanced economies posted record issuance, driving down emerging markets' share of overall issuance.

Figure 3: Developments in the Market for Infrastructure Bonds
Aggregate issuance



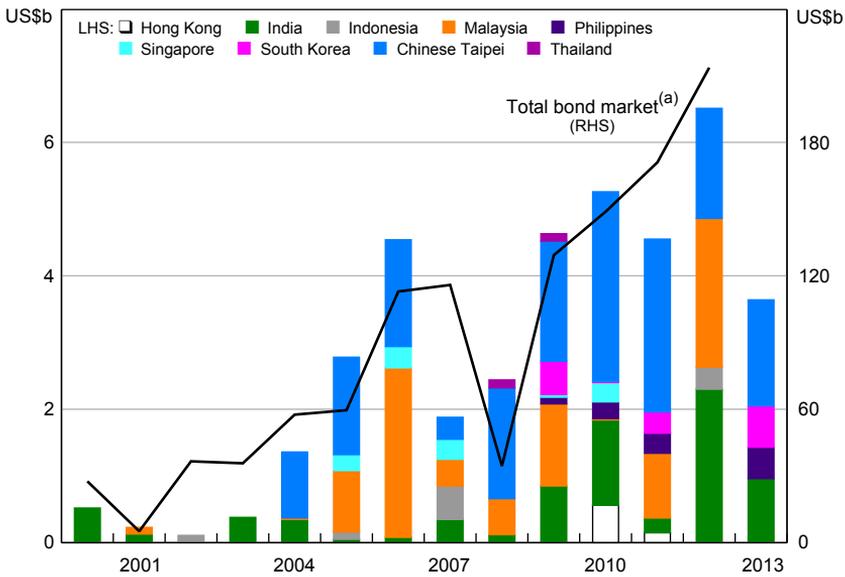
Notes: Definitions of the geographical regions are given in Appendix A
 (a) Excluding the US and Europe
 (b) Africa, central and eastern Europe, and the Middle East
 Sources: Bloomberg; Dealogic; authors' calculations

Two developments stand out for emerging markets excluding China. Issuers from both emerging Asia and Latin America issued increasing amounts of infrastructure bonds over the sample period (Figure 3, bottom panel). At the same time, the volume of such issuance has been subject to the global financial cycle, hence mirroring capital flows in and out of emerging markets. This cycle has recently been analysed by Bruno and Shin (2013) and Rey (2013), who find that it is related to investor risk appetites, as proxied for by the VIX index. Prior to the global financial crisis, emerging bond markets attracted strong capital inflows, which correspond to the rise in infrastructure bond issuance from 2004 to 2007. As capital flows to emerging market economies in general reversed sharply in 2008, so did issuance volumes of infrastructure bonds. As capital inflows into

emerging Asia and Latin America surged again between 2009 and 2013, infrastructure bond issuance reached record highs.

The growth and cyclical nature of emerging economies' infrastructure bond markets in general also applies to emerging Asia more specifically (Figure 4). From 2008 to 2009, issuance almost doubled from around US\$2.5 billion to US\$4.7 billion. In 2012, major emerging Asian economies excluding China posted record aggregate issuance of US\$6.5 billion, but this fell to US\$3.6 billion in 2013. These periods of rapid change reflect similar movements in total bond markets and the infrastructure bond markets. This co-movement is especially remarkable given the fact that issuing infrastructure bonds tends to entail longer lead times than issuing other emerging market bonds. When it comes to hot and cold markets in bond issuance, infrastructure bonds appear no different from emerging market bonds in general.

Figure 4: Infrastructure Bond Market and Total Bond Market Developments in Major Emerging Asian Economies
Aggregate issuance



Notes: (a) Aggregate net issuances based on the BIS' debt security statistics for issuers residing in the respective regions; data for India are not available, hence the aggregate volume is under-represented

Sources: BIS; Bloomberg; Dealogic; authors' calculations

4.3 Bonds versus syndicated loans

How important have the bond markets been in the overall financing raised for infrastructure? An important fact to keep in mind is the changing roles of bond markets and banks over the life cycle of a project, as discussed earlier. Bonds tend to provide financing for 'brownfield' projects, namely those that are largely in place and for which the cash flows are already reasonably predictable. Bank loans tend to play a larger role for 'greenfield' projects, namely those that are still in the construction stage. As explained above, banks tend to have special expertise in monitoring the progress of projects at this stage and allow more flexibility if restructuring of the financing becomes necessary. Nonetheless, there seems to be some scope for substitution between bonds and bank loans in the financing of infrastructure projects.

In what follows, we assess the importance of bond markets in a limited way, specifically by asking how much infrastructure financing tends to be in the form of bonds versus syndicated loans from banks. Note that syndicated project loans would typically only be a subset of all bank loans for infrastructure projects. That said, syndicated project loans are likely to represent a major share of bank loan financing in terms of the overall volume, given that they are more likely to be used for very large loans. We rely on Dealogic for the syndicated loan data and apply the same industry groups as we have for the project bonds to identify infrastructure-related deals.⁵

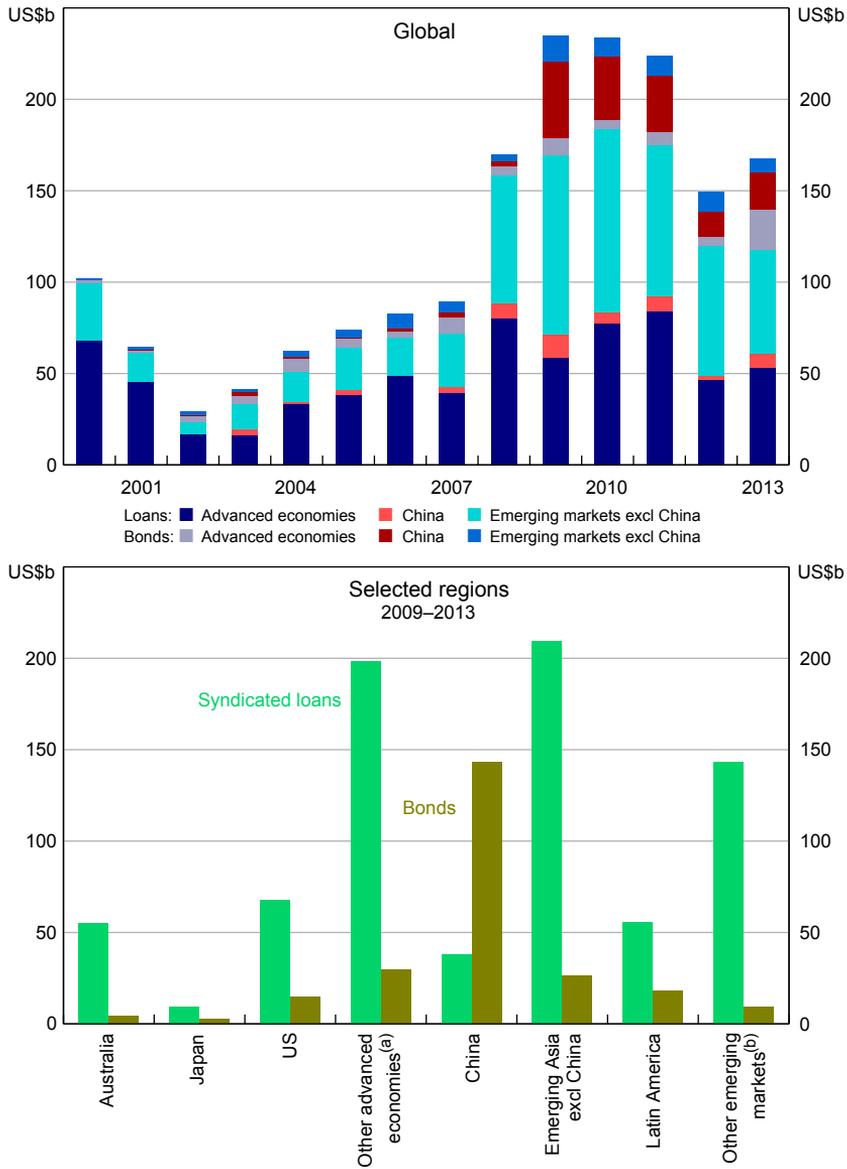
Since 2000, syndicated loans have dominated private sector infrastructure finance in both emerging and advanced economies; however, bonds have become increasingly important over time (Figure 5, top panel). The ratio of bonds to loans over the past five years has hovered between 30 per cent and 40 per cent, a range that well exceeds the average of the whole period. As market conditions have improved and investor interest in emerging bond markets has increased since 2009, so has the ratio of bond finance to syndicated loan finance. This general trend holds true both with and without the observations from China. In the case of advanced economies, an increased reliance on bonds relative to syndicated loans is evident in Europe, Canada and Australia, all of which posted record infrastructure bond issuance in 2013.

We observe significant differences in the importance of bonds relative to syndicated loans when comparing regions. Bonds play a prominent role in US projects and those in other advanced economies. The ratio of bond to syndicated loan finance between 2009 and 2013 was around 1:5 in the United States and 1:6 in other advanced economies (excluding Australia, Japan and the United States) (Figure 5, bottom panel). In emerging Asia excluding China, where bank financing has traditionally been dominant, this ratio is about 1:8. Interestingly, in Latin America the ratio is 1:3, the highest among the emerging market regions.⁶ This difference may be due to Latin America's relatively good access to international bond markets, as discussed below.

⁵ A more detailed description is given in Appendix A.

⁶ In general, issuers from the Middle East and Africa have placed some large project bonds in this period, but they were mainly related to oil and gas exploration and the mining industry, which we do not count as infrastructure-related and are usually done by very large international corporations or quasi-government SPVs.

Figure 5: A Comparison of Infrastructure-related Project Bond and Syndicated Loan Finance
Aggregate issuance



Notes: Definitions of the geographical regions are given in Appendix A
 (a) Excluding Australia, Japan and the US
 (b) Africa, central and eastern Europe, and the Middle East
 Sources: Bloomberg; Dealogic; authors' calculations

4.4 Infrastructure bond financing in emerging Asia

Across individual economies in emerging Asia, the reliance on bond markets for infrastructure finance varies considerably. Table 5 summarises some of the differences. Among the nine jurisdictions we look at, the three most successful ones in terms of the number and volume of bond issues have been China, Chinese Taipei and Malaysia. One feature these three jurisdictions have in common is that they tend to issue in their onshore bond markets. This is indicated in part by the share of infrastructure bond issuance in local currencies, which is virtually 100 per cent for each of the three jurisdictions. Other economies also tend to issue in local currency, although they have done so only in relatively small amounts. In our data, only two jurisdictions tend to issue in foreign currencies, namely Hong Kong and the Philippines. In doing so, however, they have been able to issue only a few infrastructure bonds. In examining what determines the choice between onshore and offshore markets for corporate bonds more generally, Mizen *et al* (2012) find the depth and liquidity of the onshore market to be of overriding importance.

When the onshore market lacks depth and liquidity, going offshore can make sense given the amounts needed for infrastructure project bonds and the desirability of long maturities. However, there are in fact two distinct offshore markets, and one is more accessible than the other. There is the US market, which can accommodate the largest issues and the longest maturities. It is also the market with the investor base that is most willing to consider special sectors, including the infrastructure sectors. The other offshore market is the Eurobond market, which is also deep and liquid, but not to the same degree as the US market.

Going to the US market, however, means adhering to the more demanding 144A disclosure standard. The 144A standard is much more demanding because of the broad anti-fraud provisions of US securities law. In practice, these anti-fraud provisions lead to enhanced underwriter due diligence, including a request for '10b disclosure letters' from the company's US lawyers, which are negative assurance letters attesting to the absence of any misstatement or omission. The 144A standard also requires the management's description of the business, the drafting of which consumes large amounts of management time.

The Eurobond alternative to the US market follows the Regulation S disclosure standard. This standard is less demanding than 144A. Issuing in this market means giving up access to the broad US investor base. Nonetheless, the size threshold for the Regulation S standard seems to have grown in recent years, allowing issues as large as US\$3 billion. Compared with 144A issuance, the issuance value of Regulation S has been significant for the Philippines and Singapore. But compared with Latin America or advanced economies, the share is still miniscule for the region as a whole.

Table 5: Overview of the Characteristics of Infrastructure Bonds in Emerging Asia

Value-weighted, per cent unless stated otherwise, 2009–2013

	CN	HK	ID	IN	MY	PH	SG	TH	TW	Emerging Asia	Latin America	Advanced economies
Number of deals	340	3	28	1	76	6	2	4	64	551	71	190
Value – US\$b	142.1	0.7	5.6	0.3	4.5	1.1	0.3	0.1	10.5	167.5	17.9	51.4
Share of total project bond market	21.3	10.7	79.1	16.6	64.2	62.5	90.1	41.3	95.4	23.6	37.4	39.6
Average maturity – years	9.1	8.9	12.1	15.0	11.5	9.3	5.0	7.7	7.5	9.1	14.2	18.3
Average coupon	5.2	4.0	8.9	6.0	4.8	6.5	1.9	3.6	1.5	5.1	7.6	4.5
Share in local currency	99.9	0.0	94.7	100.0	100.0	24.5	100.0	100.0	100.0	98.2	26.6	91.9
Share in US\$	0.1	0.0	5.3	0.0	0.0	75.5	0.0	0.0	0.0	1.2	71.7	31.6
Share in Regulation S	0.1	21.5	5.3	0.0	0.0	75.5	88.1	0.0	0.0	1.4	50.3	25.2
Share in 144A	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	18.5	24.2

Note: See Glossary for a listing of country codes

Sources: Bloomberg; Dealogic; authors' calculations

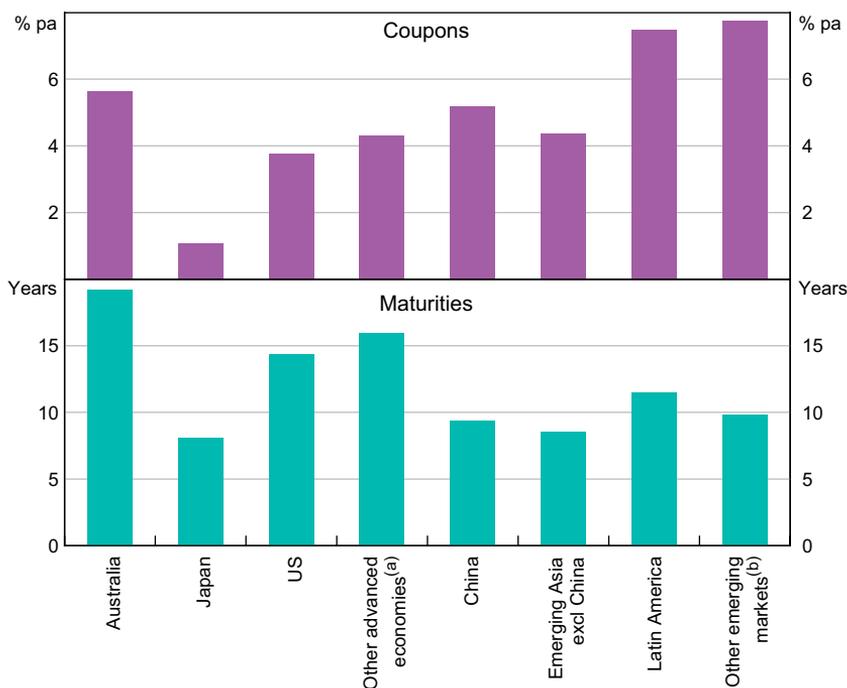
The demanding standards of the US market are reflected in the very low share of 144A compliant issues. Even in Latin America or advanced economies, 144A compliant bonds make up a relatively small share. The amount of 144A issuance by emerging Asian borrowers has also been miniscule. Issuers that go offshore generally prefer to issue under the Regulation S standard.

As revenues from infrastructure projects mostly come in local currency, the potential for infrastructure bonds is greatly increased by deep and liquid local bond markets. Hence, factors related to local bond market development are likely to be of particular importance to emerging markets. Gochoco-Bautista and Remolona (2012) and Packer and Remolona (2012) have identified such factors.

4.5 Maturities and pricing

In spite of the fact that most infrastructure bonds from emerging Asia are issued in the onshore market, the cyclicity of such issuance is related to the global financial cycle. This cyclicity is also reflected in the maturities and coupons of infrastructure bonds. In terms of the coupons that issuers need to pay, conditions in emerging markets, and emerging Asia in particular, are comparable to those in advanced economies (Figure 6, top panel).

Figure 6: Average Coupons and Maturities of Infrastructure Bonds
Value-weighted averages, 2009–2013



Notes: Definitions of the geographical regions are given in Appendix A

(a) Excluding Australia, Japan and the US

(b) Africa, central and eastern Europe, and the Middle East

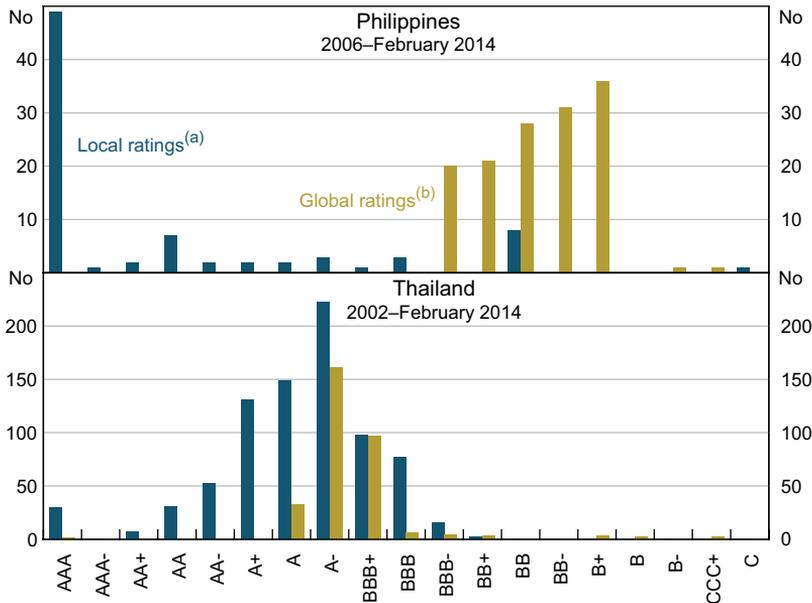
Sources: Bloomberg; Dealogic; authors' calculations

Major differences are apparent in the maturities of these bonds (Figure 6, bottom panel). Whereas in advanced economies the average maturity of issued infrastructure bonds is around 15 years, in emerging Asia it is only around 8 years. Central and eastern European and Latin American issuers have been able to secure slightly higher maturities (10–11 years), whereas average maturities in Africa are only 7.5 years. Overall, this suggests that the conditions of issuance are not as good as in advanced economies. Issuers with access to bond markets seem to be able to secure relatively good conditions. However, the total volume of issuance in emerging market economies is still quite low. It thus seems likely that some issuers may have been deterred by unfavourable conditions, or the lack of depth in bond markets, in particular at longer maturities.

4.6 The evidence from local ratings

Local rating agencies provide ratings for issuers who only want to access local bond markets and are therefore important for developing onshore bond markets and also potentially for attracting foreign investors to the market. For the jurisdictions of the Philippines and Thailand, we examine 81 and 815 issues with local ratings, respectively. In Figure 7, we illustrate the number of infrastructure bonds with local ratings and the number with global ratings.

Figure 7: Distribution of Local and Global Ratings
Number of issues rated



Notes: (a) For the Philippines, ratings from PhilRatings; for Thailand, ratings from TRIS Rating
(b) Average of ratings from Fitch, Moody's and S&P
Sources: Bloomberg; PhilRatings; TRIS Ratings; authors' calculations

In general, the ratings of the local agencies and the global agencies cover different issuers. For example, in the Philippine sample, only one issuer had both global ratings (BB) and local ratings (AAA). In this case, the issue ratings did not overlap, however, as the ratings proffered by the global ratings agency were only on US dollar issues.

In addition, the local ratings tend to be higher than the global ratings. This is partly because the sovereign rating generally caps how high any individual corporation will be rated by global rating agencies. In the Philippines, most local ratings are bunched at the higher end of the rating scale – 50 out of the 81 issues are rated at AAA, while a further 11 are rated at AA- and there are no speculative-grade ratings, other than for securitised tranches. In contrast, most ratings from global rating agencies are speculative grade.

In Thailand, the local ratings agencies' ratings cover a wider range. Only 30 of the 815 issues, or less than 4 per cent, are rated AAA and another 90, or 12 per cent, are rated AA (either AA+, AA or AA-). The peak of the distribution is in the A category (A+, A or A-) with 502 issues, or 61 per cent of all issues. A further 191 issues are rated BBB (23 per cent), while only 2 are rated below investment grade. Although there is greater overlap in Thailand than in the Philippines, the distribution of global ratings again lies clearly to the lower end of the local rating agencies' ratings, as ratings are capped by sovereign ceilings in the A range.

Rating distributions that differ widely across agencies are potentially relevant to the development of local bond markets. In particular for infrastructure bonds, which are subject to project-specific risks and have a long maturity, the availability of transparent metrics of credit risk are often essential to convince investors to take exposure. As the local rating scales are often significantly higher than those of the international agencies, international investors may discount the information content of local ratings given the increased difficulty of comparing them with international benchmarks. On the other hand, the targeted investor group might only be interested in a single country's corporate bonds, and find the increased granularity that comes from the absence of a sovereign ceiling quite helpful. In any case, the publication of studies by local agencies that document the association of particular ratings with default and subsequent ratings migration is highly recommended to facilitate a mapping from one scale to another so as to attract global investors to domestic markets.

5. Conclusion

What makes bond financing of large infrastructure projects so hard? We argue that there are four possible reasons. The first reason is that infrastructure projects are complex and require highly specialised expertise both on the side of governments and investors. Promoting and enhancing the development of this expertise will contribute to a pipeline of bankable projects. Once investors see such a pipeline, they will in turn have the incentive to hire the specialists that can assess the risks of those projects.

Second, infrastructure projects have special risks, some of which are beyond a sponsor's control. The fact that infrastructure projects often produce public goods or are natural monopolies means that the government inevitably plays a critical role and therefore can be an important source of risk. In this paper, we report correlations between infrastructure bond credit ratings and qualitative

indicators of governance at the national level, which point to contract viability and bureaucratic inefficiency as two important risks for infrastructure financing.

A third potential reason for the lack of bond financing is the cyclical nature of bond markets. As finance for infrastructure projects is time sensitive and involves large amounts and long maturities, a change in market conditions can greatly affect the conditions or even the success of infrastructure bond issuance. In this respect, bond financing is more feasible for mature projects, where the refinancing of existing debt can be timed more flexibly.

The fourth reason for the lack of infrastructure bond financing in Asia is the lack of depth and liquidity of onshore local currency bond markets – in particular at long maturities. As revenues from most infrastructure projects are denominated in local currencies, infrastructure bonds are in most cases denominated in local currency. Some infrastructure projects have been financed in offshore corporate bond markets, which have had the depth and liquidity to provide large sums at long maturities for special sectors. Such financing is most feasible when the country has a high sovereign rating, especially when this reflects a credible legal framework, political stability and a reasonably efficient bureaucracy. It also helps to have well-functioning markets for hedging currency risks.

Overall, it would be better if large infrastructure projects could be financed in a deep and liquid onshore corporate bond market. In this case, the sovereign ceiling would be less of a constraint and currency risk would not be an issue. But this requires solid legal frameworks in the host countries. Indeed, the last few years have seen a surge in such onshore financing in Asia. This trend is expected to continue, as countries in the region foster the development of their onshore bond markets.

Appendix A: Dataset Methodology

A.1 Country abbreviations and regions

All two-digit country codes used are based on the ISO 3166-1 alpha-2 standard. The definitions for the regions underlying the figures and tables in this paper are given in Table A1.

Table A1: Definition of Geographic Regions

Region	Included economies
Advanced economies	AD, AT, AU, BE, CA, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IS, IT, JE, JP, LU, MC, MT, NL, NO, NZ, PT, SE, US
Africa	AO, BF, BI, BJ, BW, CD, CG, CI, CM, CV, DJ, DZ, EG, ER, ET, GA, GH, GM, KE, LR, LS, MA, MG, ML, MR, MU, MW, MZ, NA, NE, NG, RW, SC, SD, SL, SN, SS, TD, TG, TN, TZ, UG, ZA, ZM, ZW
Central and eastern Europe	AL, AM, AZ, BA, BG, BY, CZ, EE, GE, GL, HR, HU, LT, LV, MD, ME, MK, PL, RO, RS, RU, SI, SK, TR, UA
Emerging Asia	BD, BN, BT, CN, HK, ID, IN, KG, KH, KR, KZ, LA, LK, MH, MM, MN, MO, MV, MY, NP, PG, PH, PK, SG, TH, TJ, TM, TW, UZ, VN
Europe	AD, AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE
Latin America	AG, AN, AR, AW, BB, BM, BO, BR, BS, BZ, CL, CO, CR, CU, DO, EC, GD, GN, GQ, GT, GU, GW, GY, HN, HT, JM, KN, KY, LC, MF, MX, NI, PA, PE, PR, SV, TC, TT, UY, VE, VG, VI
Middle East	AE, AF, BH, IL, IQ, IR, JO, KW, LB, LY, OM, PS, QA, SA, SY, YE

Note: See Glossary for a listing of country codes
Source: authors' selections

A.2 Dataset details

Merging the datasets on project debt security data from Dealogic BondWare and Bloomberg requires the identification of duplicate values. We identified 174 duplicates by exact matching of issue date, maturity date, issue amount, issue currency and country of issuer. For 116 observations this method of identification is not distinct. In those cases we also look at the name of the issuer and define duplicates as securities where the issuer appears to be identical.

Both datasets provide data on the initial amount, the issue date and maturity date, indicators for Regulation S and 144A compliance, as well as the initial and issuer ratings from the three major rating agencies. Only Bloomberg, however, provides consistent data on coupon rates of debt securities. Bloomberg provides data on the issuance amount only in the currency of denomination of the debt security. The US dollar value is calculated on the basis of the BIS long time series on daily exchange rates, matched with the issue date of the debt security. Where daily exchange rates were not available from the BIS database, we used daily exchange rate data from national central banks or from Datastream.

The list of infrastructure-related industries is presented in Table A2. For Dealogic, the list also represents the definitions for industries for infrastructure-related syndicated project loans from

Dealogic LoanWare. The sample of syndicated project loans comprises 15 845 total project finance deals from 1 January 2000 to 31 December 2013. Based on the industry classification in Table A2, we obtain a total of 8 778 observations for infrastructure-related syndicated project loans, compared with 1 624 infrastructure bond deals in our sample.

Table A2: Classification of Infrastructure-related Industries

Dealogic	Bloomberg
Construction/building products – infrastructure	Aerospace and defence
Finance – development banks/multilateral agencies	Cable and satellite
Finance – export credit agencies	Communications equipment
Finance – government-sponsored entities/ credit agencies	Educational services
Government – central authorities	Government agencies
Government – local authorities	Government development banks
Government – provincial authorities	Governments regional/local
Healthcare – hospitals/clinics	Healthcare facilities/services
Healthcare – miscellaneous services	Managed care
Healthcare – nursing homes	Railroad
Healthcare – outpatient care/home care	Renewable energy
Professional services – schools/universities	Sovereigns
Telecommunications – cable television	Supranationals
Telecommunications – equipment	Utilities
Telecommunications – radio/TV broadcasting	Waste and environment service equipment & facilities
Telecommunications – satellite	Wireless telecom services
Telecommunications – services	Wireline telecom services
Telecommunications – telephone	
Telecommunications – wireless/cellular	
Transportation – airports	
Transportation – rail	
Transportation – road	
Transportation – ship	
Utility and energy – diversified	
Utility and energy – electric power	
Utility and energy – gas	
Utility and energy – hydroelectric power	
Utility and energy – nuclear power	
Utility and energy – waste management	
Utility and energy – water supply	

Sources: Bloomberg; Dealogic; authors' selection

References

- Brealey RA, IA Cooper and MA Habib (1996)**, 'Using Project Finance to Fund Infrastructure Investments', *Journal of Applied Corporate Finance*, 9(3), pp 25–39.
- Bruno V and HS Shin (2013)**, 'Capital Flows and the Risk-Taking Channel of Monetary Policy', NBER Working Paper No 18942.
- Cantor R, F Packer and K Cole (1997)**, 'Split Ratings and the Pricing of Credit Risk', *The Journal of Fixed Income*, 7(3), pp 72–82.
- Engel E, R Fischer and A Galetovic (2010)**, 'The Economics of Infrastructure Finance: Public-Private Partnerships versus Public Provision', *EIB Papers*, 15(1), pp 40–69.
- Gochoco-Bautista MS and E Remolona (2012)**, 'Going Regional: How to Deepen ASEAN's Financial Markets', ADB (Asian Development Bank) Economics Working Paper No 300.
- HSBC (2013)**, 'Infrastructure and PPP Bonds: Capital Markets and How to Access Institutional Capital', Presentation to European Bank for Reconstruction and Development workshop, March.
- Mizen P, F Packer, E Remolona and S Tsoukas (2012)**, 'Why Do Firms Issue Abroad? Lessons from Onshore and Offshore Corporate Bond Finance in Asian Emerging Markets', BIS Working Paper No 401.
- Moody's Investors Service (2012)**, 'Infrastructure Default and Recovery Rates, 1983–2012H1', Special Comment, 18 December.
- Moody's Investors Service (2013)**, 'Regulated Electric and Gas Utilities', Ratings Methodology, 23 December.
- OECD (Organisation for Economic Co-operation and Development) (2013)**, 'Annual Survey of Large Pension Funds and Public Pension Reserve Funds', Report on Pension Funds' Long-Term Investments, October.
- Packer F and E Remolona (2012)**, 'Attracting Foreign Participation in Asian Local Currency Bond Markets: The Case of the Asian Bond Fund 2 Initiative', *Pacific Economic Review*, 17(3), pp 415–433.
- Packer F and N Tarashev (2011)**, 'Rating Methodologies for Banks', *BIS Quarterly Review*, June, pp 39–52.
- The PRS Group (2013)**, 'International Country Risk Guide Methodology'. Available at <<https://www.prsgroup.com/about-us/our-two-methodologies/icrg>>.
- Rey H (2013)**, 'Dilemma not Trilemma: The Global Financial Cycle and Monetary Policy Independence', Paper presented at the Federal Reserve Bank of Kansas City Economic Policy Symposium on 'Global Dimensions of Unconventional Monetary Policy', Jackson Hole, 22–24 August.