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The nature of credit risk in project finance[1]

In project finance, credit risk tends to be relatively high at project inception and to diminish over the life of the project. Hence, longer-maturity loans would be cheaper than shorter-term credits.

JEL classification: F34, G12, G28, G32.

For decades, project finance has been the preferred form of financing for large-scale infrastructure projects worldwide. Several studies have emphasised its critical importance, especially for emerging economies, focusing on the link between infrastructure investment and economic growth. Over the last few years, however, episodes of financial turmoil in emerging markets, the difficulties encountered by the telecommunications and energy sectors and the financial failure of several high-profile projects[2] have led many to rethink the risks involved in project financing.

The question whether longer maturities are a source of risk per se is crucial to understanding the distinctive nature of credit risk in project finance. Large-scale capital-intensive projects usually require substantial investments up front and only generate revenues to cover their costs in the long term. Therefore, matching the time profile of debt service and project revenue cash flows implies that on average project finance loans have much longer maturities than other syndicated loans.[3]

This special feature argues that a number of key characteristics of project finance, including high leverage and non-recourse debt, have direct implications for the term structure of credit risk for this asset class. In particular, a comparative econometric analysis of ex ante credit spreads in the international syndicated loan market suggests that longer-maturity project finance loans are

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[2] Three spectacular recent financial failures are the Channel Tunnel linking France and the United Kingdom, the EuroDisney theme park outside Paris and the Dabhol power project in India.

[3] The average maturity of project finance loans in the Dealogic Loanware database is 8.6 years, against only 4.8 years for syndicated loans in general.

not necessarily perceived by lenders as riskier compared to shorter-term credits. This contrasts with other forms of debt, where credit risk is found to increase with maturity, ceteris paribus.

Financing high-profile infrastructure projects not only requires lenders to commit for long maturities, but also makes them particularly exposed to the risk of political interference by host governments. Therefore, project lenders are making increasing use of political risk guarantees, especially in emerging economies. This special feature also provides a cross-country assessment of the role of guarantees against political risk and finds that commercial lenders are more likely to commit for longer maturities in emerging economies if they obtain explicit or implicit guarantees from multilateral development banks or export credit agencies. This is shown to further reduce project finance spreads observed at the long end of the maturity spectrum.

After a brief review of the history and growth of project finance, the second section illustrates the specific challenges involved in financing large-scale capital-intensive projects, while the third section explains how project finance structures are designed to best address those risks. The core of the analysis, in the fourth and fifth sections, shows how the particular characteristics of credit risk in project finance are consistent with the hump-shaped term structure of loan spreads observed ex ante for this asset class. The conclusion summarises the main findings and draws some policy implications.

Recent developments in the project finance market

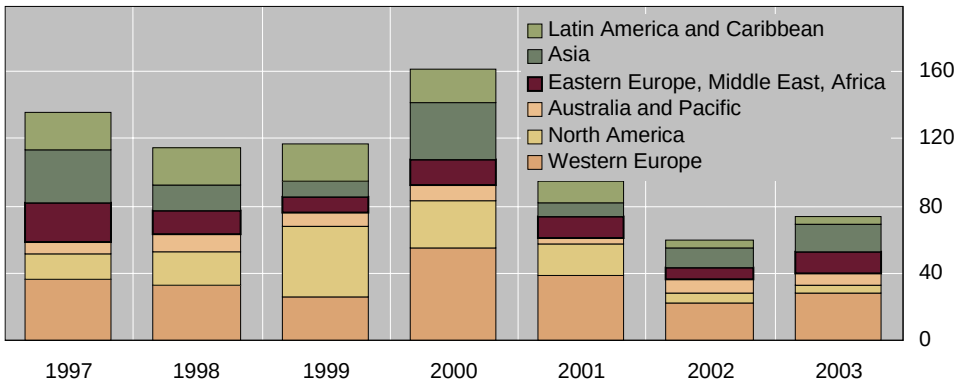
Project finance involves a public or private sector sponsor investing in a single-purpose asset through a legally independent entity. It typically relies on non-recourse debt, for which repayment depends primarily on the cash flows generated by the asset being financed.

A global market emerged in the 1990s ...

Since the 1990s, project finance has become an increasingly diversified business worldwide. Its geographical and sectoral reach has grown

Project finance global lending by region

In billions of US dollars



Note: The amounts shown refer to new bank loan commitments for project finance by year and region.

Source: Dealogic ProjectWare database. Graph 1

considerably, following widespread privatisation and deregulation of key industrial sectors around the world.

… with its ups and downs …

In the years following the East Asian crisis (1998–99), financial turmoil in emerging markets led to a global reallocation of investors' portfolios from developing to industrialised countries. New investments, notably in north America and western Europe, more than offset the capital flight from emerging economies, such that total global lending for project finance rebounded from a two-year slump, reaching a record high in 2000 (Graph 1).

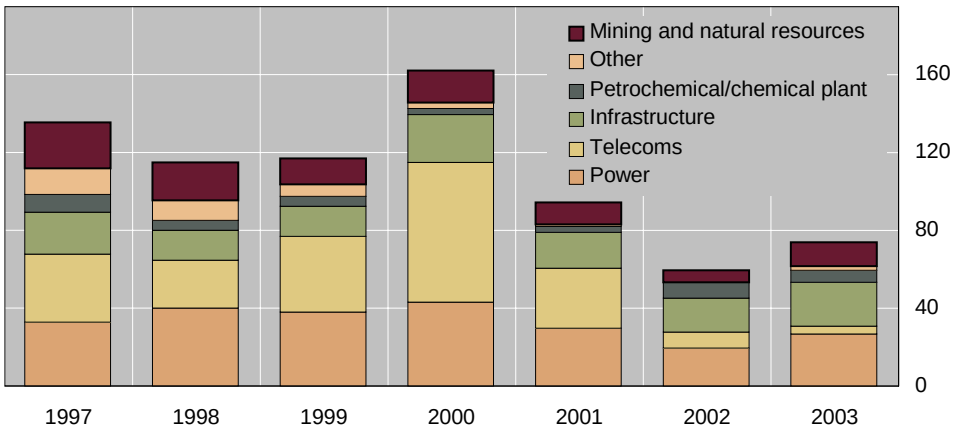
Since 2001, the general economic slowdown and industry-specific risks in the telecoms and power sectors have led to a substantial decline in project finance lending worldwide (Graph 2). The power sector has been particularly hurt by accounting irregularities and high volatility in energy prices: the debt ratings of 10 of the leading power companies fell from an average of BBB+ in 2001 to B– in 2003. Telecoms firms have been penalised for sustaining onerous investments in new technologies (like fibre-optic transmission or third-generation mobile licences in Europe) that have not yet generated the expected returns. Over 60 telecoms companies filed for bankruptcy between 2001 and 2002 as overcapacity led to price wars and customer volumes failed to live up to overoptimistic projections.

… but continued importance

Despite the recent downturn, the long-term need for infrastructure financing in both industrialised and developing countries remains very high. In the United States alone, between 1,300 and 1,900 new electricity generating plants need to be built in order to meet growing demand over the next two decades (National Energy Policy Development Group (2001)). For developing countries, an annual investment of $120 billion would be required in the electricity sector until 2010 (International Energy Agency (2003)).

Project finance global lending by sector

In billions of US dollars



Note: The amounts shown refer to new bank loan commitments for project finance by year and sector.

Source: Dealogic ProjectWare database. Graph 2

The main challenges of financing large-scale projects

Projects like power plants, toll roads or airports share a number of characteristics that make their financing particularly challenging.

First, they require large indivisible investments in a single-purpose asset. In most industrial sectors where project finance is used, such as oil and gas and petrochemicals, over 50% of the total value of projects consists of investments exceeding $1 billion.

Second, projects usually undergo two main phases (construction and operation) characterised by quite different risks and cash flow patterns. Construction primarily involves technological and environmental risks, whereas operation is exposed to market risk (fluctuations in the prices of inputs or outputs) and political risk, among other factors.[4] Most of the capital expenditures are concentrated in the initial construction phase, with revenues instead starting to accrue only after the project has begun operation.

Third, the success of large projects depends on the joint effort of several related parties (from the construction company to the input supplier, from the host government to the off-taker[5]) so that coordination failures, conflicts of interest and free-riding of any project participant can have significant costs. Moreover, managers have substantial discretion in allocating the usually large free cash flows generated by the project operation, which can potentially lead to opportunistic behaviour and inefficient investments.

The key characteristics of project financing structures

A number of typical characteristics of project financing structures are designed to handle the risks illustrated above.

Coping with agency problems by means of …

In project finance, several long-term contracts such as construction, supply, off-take and concession agreements, along with a variety of joint-ownership structures, are used to align incentives and deter opportunistic behaviour by any party involved in the project. The project company operates at the centre of an extensive network of contractual relationships, which attempt to allocate a variety of project risks to those parties best suited to appraise and control them: for example, construction risk is borne by the contractor and the risk of insufficient demand for the project output by the off-taker (Graph 3).

… a network of contracts …

Project finance aims to strike a balance between the need for sharing the risk of sizeable investments among multiple investors and, at the same time, the importance of effectively monitoring managerial actions and ensuring a coordinated effort by all project-related parties.

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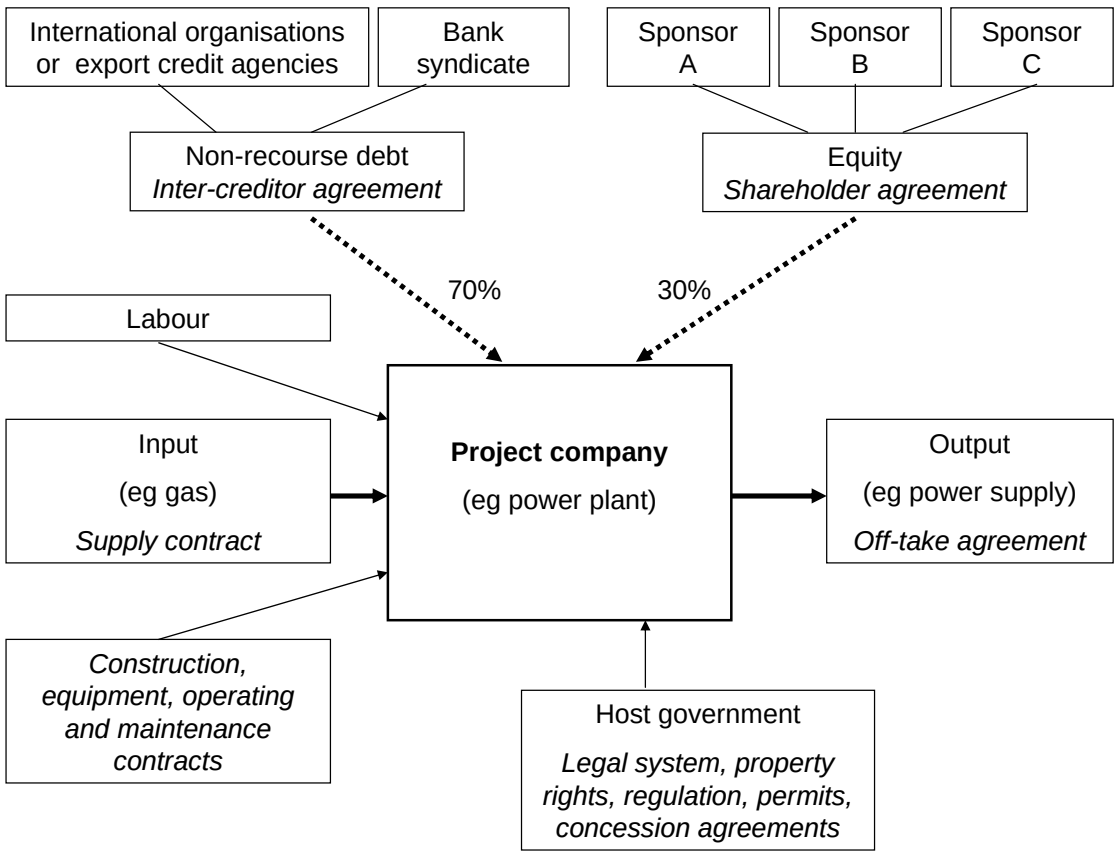
[4] Hainz and Kleimeier (2003) identify three broad categories of "political risk". The first category includes the risks of expropriation, currency convertibility and transferability, and political violence, including war, sabotage or terrorism. The second category covers risks of unanticipated changes in regulations or failure by the government to implement tariff adjustments because of political considerations. The third category includes quasi-commercial risks arising when the project is facing state-owned suppliers or customers, whose ability or willingness to fulfil their contractual obligations towards the project is questionable.

[5] The off-taker commits to purchase the project output under a long-term purchase (or off-take) agreement.

Typical project finance structure



Note: A typical project company is financed with limited or non-recourse debt (70%) and sponsors' equity (30%). It buys labour, equipment and other inputs in order to produce a tangible output (energy, infrastructure, etc). The host government provides the legal framework necessary for the project to operate.

Source: Adapted from Esty (2003). Graph 3

Large-scale projects might be too big for any single company to finance on its own. On the other hand, widely fragmented equity or debt financing in the capital markets would help to diversify risks among a larger investors' base, but might make it difficult to control managerial discretion in the allocation of free cash flows, avoiding wasteful expenditures. In project finance, instead, equity is held by a small number of "sponsors" and debt is usually provided by a syndicate of a limited number of banks. Concentrated debt and equity ownership enhances project monitoring by capital providers and makes it easier to enforce project-specific governance rules for the purpose of avoiding conflicts of interest or sub-optimal investments.

… close monitoring of managerial discretion …

The use of non-recourse debt in project finance further contributes to limiting managerial discretion by tying project revenues to large debt repayments, which reduces the amount of free cash flows.

… and non-recourse debt …

Moreover, non-recourse debt and separate incorporation of the project company make it possible to achieve much higher leverage ratios than sponsors could otherwise sustain on their own balance sheets. In fact, despite some variability across sectors, the mean and median debt-to-total capitalisation ratios

for all project-financed investments in the 1990s were around 70%. Non-recourse debt can generally be deconsolidated, and therefore does not increase the sponsors' on-balance sheet leverage or cost of funding. From the perspective of the sponsors, non-recourse debt can also reduce the potential for *risk contamination*. In fact, even if the project were to fail, this would not jeopardise the financial integrity of the sponsors' core businesses.

… and with the lack of diversification by means of …

One drawback of non-recourse debt, however, is that it exposes lenders to project-specific risks that are difficult to diversify. In order to cope with the asset specificity of credit risk in project finance, lenders are making increasing use of innovative risk-sharing structures, alternative sources of credit protection and new capital market instruments to broaden the investors' base.

… hybrid risk-sharing structures …

Hybrid structures between project and corporate finance are being developed, where lenders do not have recourse to the sponsors, but the idiosyncratic risks specific to individual projects are diversified away by financing a portfolio of assets as opposed to single ventures. Public-private partnerships are becoming more and more common as hybrid structures, with private financiers taking on construction and operating risks while host governments cover market risks.

… political risk guarantees …

There is also increasing interest in various forms of credit protection. These include explicit or implicit political risk guarantees,[6] credit derivatives and new insurance products against macroeconomic risks such as currency devaluations. Likewise, the use of *real options* in project finance has been growing across various industries.[7] Examples include: refineries changing the mix of outputs among heating oil, diesel, unleaded gasoline and petrochemicals depending on their individual sale prices; real estate developers focusing on multipurpose buildings that can be easily reconfigured to benefit from changes in real estate prices.

… securitisation and new capital market instruments

Finally, in order to share the risk of project financing among a larger pool of participants, banks have recently started to securitise project loans, thereby creating a new asset class for institutional investors. Collateralised debt obligations as well as open-ended funds have been launched to attract higher liquidity to project finance.[8]

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[6] The explicit guarantee is a formal insurance contract against specific political risk events (transfer and convertibility, expropriation, host government changing regulation, war, etc) provided also by some commercial insurers. The "implicit guarantee" instead works as follows. The financing is typically divided into tranches, one of which is underwritten by the agency. The borrower cannot default on any tranche without defaulting on the agency tranche as well. The agency represents a G10 government or supranational development bank with a recognised preferred creditor status. Defaulting on the agency has additional political and financial costs that the host country would not want to incur since agencies are usually lenders of last resort for host countries in financial distress.

[7] Analogous to *financial options*, ie derivative securities which give the holder the right but not the obligation to trade in an underlying security, *real options* provide management with the flexibility to take a certain course of action or strategy, without the "obligation" to take it (in both cases options are exercised only if deemed convenient ex post).

[8] Among the new capital market instruments used for project financing: *revenue bonds* and *future-flow securitisations* are debt securities backed by an identifiable future stream of revenues generated by an asset; *compartment funds* offer to different types of investors shares with different levels of subordination and are dedicated to make equity investments.

The term structure of credit spreads in project finance

The term structure of spreads is affected by …

The specific risks involved in funding large-scale projects and the key characteristics of project financing structures illustrated in the previous sections (in particular high leverage and non-recourse debt) have important implications for the term structure of credit spreads for this asset class.

… high leverage ratios …

First, based on the widely used framework for pricing risky debt originally proposed by Merton (1974), we should expect to observe a hump-shaped term structure of credit spreads for highly leveraged obligors (Graph 4). In this approach, the default risk underlying credit spreads is primarily driven by two components: (1) the degree of firm indebtedness or leverage and (2) the uncertainty about the value of the firm's assets at maturity. Given Merton's assumption of decreasing leverage ratios over time, postponing the maturity date reduces the probability that the value of the assets will be below the default boundary when repayment is due. On the other hand, a longer maturity also increases the uncertainty about the future value of the firm's assets. For obligors that already start with low leverage levels, this second component dominates, so that the observed term structure is monotonically upward-sloping. For highly leveraged obligors, instead, the increase in default risk due to higher asset volatility will be strongly felt by debt holders at short maturities, but as maturity further increases, the first component will rapidly take over, thanks to the greater margin for risk reduction due to declining leverage. This leads to a hump-shaped term structure of credit spreads for highly leveraged obligors.[9]

… timing and uncertainty of project cash flows …

Second, despite the extensive network of security arrangements illustrated in Graph 3, the credit risk of non-recourse debt remains ultimately tied to the timing of project cash flows. In fact, projects which are financially viable in the long run might face cash shortages in the short term. Ceteris paribus, obtaining credit at longer maturities implies smaller amortising debt repayments due in the early stages of the project. This would help to relax the project company's liquidity constraints, thus reducing the risk of default. As a consequence, long-term project finance loans should be perceived as being less risky than shorter-term credits.

Third, the credit risk of non-recourse debt might be affected not only by the timing but also by the uncertainty of project cash flows and how the latter evolves over the project's advancement stages. In fact, successful completion of the construction and setup phases can significantly reduce residual sources of uncertainty for a project's financial viability. Arguably, extending loan maturities for any additional year after the scheduled time for the project to be completely operational might drive up ex ante risk premia but only at a decreasing rate.[10]

… and political risk guarantees

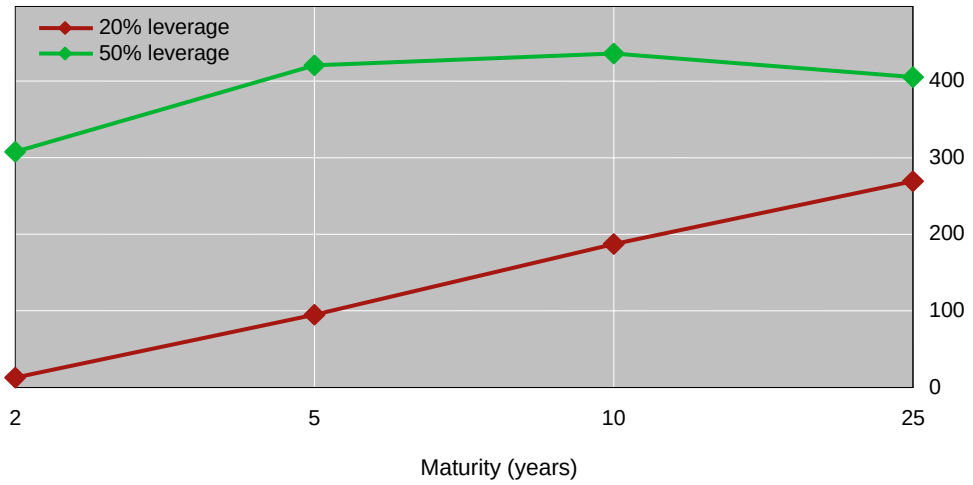
Finally, the term structure of credit spreads observed in project finance is likely to be affected by the higher exposure of large infrastructure projects to political risk and by the availability of political risk insurance for long-term project finance loans. While long maturities and political risk represent in principle

[9] With leverage ratios approaching 100%, the second component completely dominates and the term structure becomes downward-sloping.

[10] This is consistent with the hypothesis of sequential resolution of uncertainty in Wilson (1982).

Term structure of credit spreads

In basis points



Note: Volatility of firm's asset value is set at 20% per unit of time. Leverage is defined as the ratio of debt to the current market value of the assets, where debt is valued at the riskless rate.

Source: Merton (1974). Graph 4

separate sources of uncertainty, commercial lenders are often willing to commit for longer maturities in emerging economies only if they obtain explicit or implicit guarantees from multilateral development banks or export credit agencies. As political risk guarantees are most often associated with longer maturities,[11] lenders should not necessarily perceive political-risk-insured long-term loans as being riskier than uninsured short-term loans, ceteris paribus.

A comparative analysis of credit spreads in the international syndicated loan market

As argued above, several peculiar characteristics of project finance would imply that the term structure of credit spreads for this asset class need not be monotonically increasing as observed for other forms of financing. This section will attempt to substantiate this claim empirically.

Project finance spreads exhibit a hump-shaped term structure

Graph 5 illustrates the pricing of a few representative loans for projects both in industrialised and in emerging economies, which have received funding in tranches with different maturities. The general pattern shown in the graph suggests that the term structure of loan spreads in project finance may be hump-shaped.

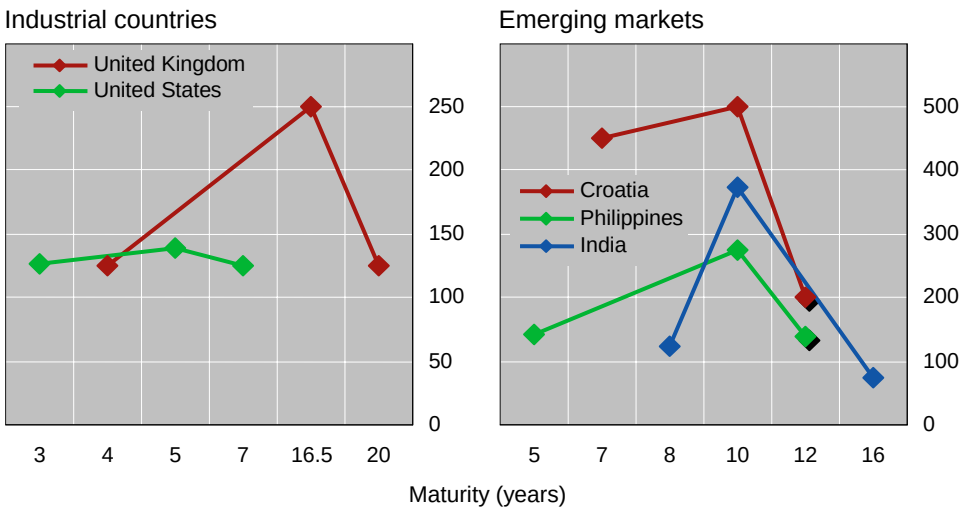
In order to test this hypothesis, the ex ante credit spreads over Libor for a large sample of loans[12] are extracted from the Loanware database compiled by Dealogic, a primary market information provider on syndicated credit facilities.

[11] For example, the World Bank has launched a programme of partial credit guarantees that cover only against default events occurring in the later years of a loan. This encourages private lenders to lengthen the maturity of their loans.

[12] International syndicated bank loans accounted for about 80% of total project finance debt flows over the period 1997–2003 (source: Thomson Financial).

Term structure of loan spreads in project finance

Spread over Libor, in basis points



Note: The connected diamonds represent different loans to the same project. Five representative projects are illustrated from both industrial and emerging economies. The shaded points indicate coverage by political risk guarantee.

Source: Dealogic ProjectWare database. Graph 5

They are regressed on several micro characteristics of the loans (such as amount, maturity, third-party guarantees, borrower business sectors, etc) along with several control variables including the macroeconomic conditions (eg real GDP growth, inflation and current account balance) prevailing in the country of the borrower at the time of signing the loan, plus global macroeconomic factors (such as world interest rates and the EMBI index).

Estimated coefficients for loan maturity and its logarithmic transformation reported in Table 1 suggest that the relationship between ex ante spread and maturity for project finance loans is indeed hump-shaped,[13] while for all other loans it appears instead monotonically increasing.[14] This result applies to industrialised as well as emerging economies and is found to be robust to a large number of sensitivity tests.[15]

Agency guarantees mitigate political risk in emerging markets …

The regressions in Table 1 also control for the impact on loan spreads of political risk and political risk guarantees. Political risk is proxied by the corruption index provided by Transparency International.[16] Results suggest that while corruption is not a significant problem for project finance in industrialised

[13] At short maturities, the positive logarithmic term prevails and accounts for the upward-sloping part of the term structure. As maturity increases, the negative linear term dominates and explains the downward-sloping section of the term structure.

[14] The corresponding estimated coefficient on "log maturity" in Table 1 is not statistically significant. The same result is found using alternative non-linear functions of maturity (eg quadratic or square root).

[15] Including tests for endogeneity and sample selection as well as robustness checks for the range of maturities analysed, repayment schedules, bond ratings, loan covenants and fixed vs floating rates. See Sorge and Gadanecz (2004) for more details.

[16] In the reported regression, a higher score on the index indicates a higher degree of corruption in the political system of the host country.

Microeconomic determinants of loan spreads			
Dependent variable: spread	Project finance loans		Other loans
	Industrialised countries	Emerging markets	
Maturity	–5.258**	–5.039*	7.066**
Log maturity	52.426**	33.184**	–0.761
Corruption index	–0.792	19.340**	13.339**
Agency guarantees	11.872	–58.324**	–48.147**
Number of observations	331	687	12,393
Adjusted R^2	0.259	0.337	0.329

Note: Only regressors of interest are shown. * and ** indicate statistical significance at the 5% and 1% confidence levels, respectively.

Source: Sorge and Gadanecz (2004). Table 1

countries, lenders financing projects in emerging markets systematically charge a higher premium on borrowers from countries characterised by a higher political risk. However, this risk appears to be effectively mitigated by the involvement of multilateral development banks or export credit agencies. In fact, Table 1 shows that loans with political risk guarantees from these agencies are priced on average about 50 basis points cheaper, ceteris paribus.

… and allow longer maturities

The evidence also suggests that the availability of agency guarantees effectively lengthens maturities of project finance loans in emerging markets. However, even taking this effect into account through the inclusion in the regressions in Table 1 of an interaction term between maturity and agency guarantees, the estimated relationship between spread and maturity for project finance loans remains hump-shaped.[17] This is consistent with the hypothesis that, while it is true that lenders especially use political risk guarantees for longer-term loans, the observed hump-shaped term structure of credit spreads may be due to more fundamental characteristics of project finance.

Conclusion

This special feature has analysed the peculiar nature of credit risk in project finance. Two main findings have emerged, based on the analysis of some key trends and characteristics of this market. First, unlike other forms of debt, project finance loans appear to exhibit a hump-shaped term structure of credit spreads. Second, political risk and political risk guarantees have a significant impact on credit spreads for project finance loans in emerging economies.

These results need to be taken with some caution. In the absence of project-specific ratings, the analysis relies on a number of micro- and macroeconomic risk characteristics that are admittedly imperfect proxies for the credit quality of individual projects. Moreover, loan spreads at origination are only ex ante measures of credit risk. In the future, the development of a

[17] See Sorge and Gadanecz (2004) for more details.

secondary market for project finance loans would allow more light to be shed on the time profile of credit risk for this asset class.

A deeper understanding of the risks involved in project finance and their evolution over time is important for both practitioners and policymakers. In particular, further research in this area might help in the implementation of risk-sensitive capital requirements providing market participants with the incentives for a prudent and, at the same time, efficient allocation of resources across asset classes. This is particularly relevant, given the predominant role of internationally active banks in project finance and the fundamental contribution of project finance to economic growth, especially in emerging economies.

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