

## Risk and capital structure in Asian project finance

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**Abstract** We develop and test hypotheses derived from a multi-level theoretical framework for understanding factors shaping the credit risk and capital structure of a quintessentially Asian form of investment known as project finance. It differs from other corporate financing approaches. A project company is separate and bankruptcy remote from the investing firm sponsors that create it. The project company relies extensively on debt capital provided by creditors to fund project operations. Creditors provide more (less) debt as a percentage of overall project capital when there is less (more) risk of project failure and non-repayment. We define a target risk framework identifying country-, industry-, syndicate-, firm-, and project-related factors shaping Asian project finance company credit risk and thus, project debt. In a sample of 238 project finance companies announced in 13 Asian countries from 1995–2004, we observe substantial effects on project capital structure with respect to country-level factors linked to institutional and macroeconomic theories, syndicate structure factors linked to agency theory, and lead sponsor experience and project size factors linked to learning and transaction cost theories. We argue that these and other determinants of project finance company credit risk and capital structure in Asia since the mid-1990s anticipate similar relationships now emerging elsewhere around the globe.

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This study examines risk and capital structure in an investment structure historically popular in Asia and known as project finance. With project finance, an investing firm or “syndicate” of investing firms create a separate legal entity called a project company focused on one construction and operation activity, often in an infrastructure industry. Project construction and operation time horizons are often several years or even decades and project costs can run in the hundreds of millions or even billions of dollars. A stand-alone project company is typically funded to a large extent by debt extended by banks and other specialized lenders. Yet, the project company is bankruptcy-remote from parent firm assets, so creditors are limited to project assets for security on their loans should the project fail. Sponsoring parent firms are not guarantors of project company solvency, but mere project sponsors with risk limited to the extent of their respective equity investments (Buljevich & Park, 1999; Esty, 2002, 2003, 2004; Finnerty, 1996; Lang, 1998; Vaaler, 2007). The project company is akin to a single business-unit firm with substantial transparency regarding the mix of creditor debt and sponsor equity making up the project capital structure. In this context, we ask the following research question: How do we explain links between risks of project failure and non-payment faced by creditors and project company capital structure in Asia?

We have known for at least two decades that risk of failure and non-payment to creditors is reflected in firm capital structure. In the mid-1980s, Myers (1984: 581) described a corporate “capital structure puzzle” that led him to conclude that “[r]isky firms ought to borrow less, other things, equal.” The 1990s and 2000s saw substantial follow-on empirical research in finance (Harris & Raviv, 1991; John & John, 1991) and management (Balakrishnan & Fox, 1993) documenting capital structure differences based on industry- and firm-specific factors affecting the corporate risk profile. By contrast, there has been a dearth of cross-country evidence linking risk factors to firm capital structure. Rajan and Zingales (1995) and Booth, Aivazian, Demircug-Kunt, and Maksimovic (2001) document differences in firm capital structure related to differences in country-risk and other firm-specific factors affecting the likelihood of failure. Yet, their studies do not account for the frequent case when capital structure of an individual business is linked to differences tied to multi-business diversification of its parent corporation and or to differences tied to the international diversification of its multinational corporate (MNC) parent. More focused research by Rajan and Pangarkar (2000) finds that MNCs contribute more equity to a country subsidiary as MNC experience in the country increases. Yet, these findings yield little broad insight on risk factors affecting the debt-equity mix of individual MNC subsidiary businesses. We attribute this dearth of cross-country evidence to an inability to observe with clarity and precision capital structure and risk of failure in individual domestic businesses separate from risks of domestic multi-business firms and or internationally-diversified MNCs to which the individual domestic businesses often belong.

We respond with the first cross-country study of capital structure based on observation and analysis of credit risk-related factors in project finance companies.

Because of their legal separation and bankruptcy remoteness, the capital structure of project companies can be observed separately from domestic parent corporations or MNCs, and analyzed relatively “cleanly” for variation in capital structure tied to country-, industry-, investing syndicate-, lead-sponsoring firm-, and project-specific factors shaping credit risk.

Project finance-based investment in Asia presents an ideal setting for such study. Asia has, perhaps, the longest experience with project finance.<sup>1</sup> Since the mid-1990s, project finance has comprised a substantial segment of overall FDI in many Asian countries. Nearly 900 new project finance companies were announced in Asia from the 1970s through the 1990s, a total surpassing project finance company announcements in either Europe or the Americas over the same period. From the 1970s through the mid-2000s the total estimated cost of projects undertaken by these companies exceeded \$2.05 trillion in Asia, compared to \$1.71 trillion in Europe and \$1.62 trillion in the Americas over the same period. Project finance-based FDI is now a worldwide phenomenon but its historical roots and dominance are in Asia. Here is an opportunity to meet Meyer’s (2006) challenge to use the Asian experience to understand emerging global research trends linking risk and capital structure.<sup>2</sup>

In meeting this challenge, we endeavor to make at least two research contributions. Theoretically, we develop a novel, multi-theoretical framework to identify and explain factors shaping project credit risk and their impact on the amount of debt creditors are willing to contribute as a percentage of overall project capital. We draw on Lessard’s (1996) taxonomy of off-shore project risk to develop a “target risk” framework with concentric rings for country-, industry-, syndicate-, firm- and project-level risk factors. Isolating these multiple risk “rings” parallels previous management research that has examined the influence of country-, industry-, and project-level factors on private versus state ownership of infrastructure projects (Doh, Teegan, & Mudambi, 2004). To derive specific hypotheses linking these factors to variation in project finance company capital structure, we draw on institutional (North, 1990), macroeconomic (Cantor & Packer, 1996), agency (Jensen & Meckling, 1976) and transaction cost (Williamson, 1988) perspectives.

This leads to our second research contribution. We undertake a methodologically rigorous empirical investigation of evidence related to 12 hypotheses derived from our target risk framework through analyses of project finance company leverage, that is, debt as a percentage of total project capital, observed for 238 announced deals worth more than \$100 billion in 13 Asian countries from 1995–2004. Consistent with our hypotheses, we observe higher leverage indicative of lower risk to creditors for announcements of project finance company: (1) in Asian countries with greater wealth, lower external debt, Anglo-American common law systems, stronger creditor

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<sup>1</sup> IB researchers familiar with a classic teaching case of FDI and political risk in a decolonizing Papua New Guinea in the early 1970s, Bougainville Copper Ltd. (Hammond & Allan, 1974), may be surprised to learn that Bougainville Copper was itself a project finance company with the Australian MNC parent, Rio Tinto, as its lead sponsor.

<sup>2</sup> The potential of our Asian empirical setting to inform research in other parts of the world underscores Peng’s (2005) point of how China strategy research has made theoretical contributions to global strategy research.

rights, and faster adjudication of legal disputes; (2) when syndicate ownership is concentrated in fewer equity-holding firms; (3) when the lead sponsoring firm has previous Asian country and or industry experience; and (4) in smaller (lower cost) projects. These results vindicate our focus on project finance in Asia, and point to several avenues for broadening this research from Asian to global scope.

## Research setting

### Project finance and Asia

Why is project finance so important in Asia? We note a confluence of trends. Developing countries in Asia have historically faced severe capital limitations mitigated only partially by family connections, clan membership, local bank capital, and intrusive but chronically under-funded state agencies. With deregulation and privatization in the 1980s and 1990s, a surge of much-needed infrastructure investment highlighted these limitations. In contrast to projects located in the United States and Western Europe, projects in many Asian countries face greater country-level risks due to political instability and weak regulatory and legal frameworks. Project finance structures mitigate the down-side risk and make investment in risky but also potentially rewarding Asian countries more attractive for sponsors and the lenders they recruit to fund their projects.

Lang (1998) provides case studies of several Asian project-financed investments illustrating this point. We summarize one illustrative case study, the AES Pak Gen Project involving a \$350 million oil-fired power station located in the Punjab province of Pakistan. The lead sponsor for this project finance company was the US-based MNC, AES Corporation. It arose from the Pakistani government's 1993 invitation to foreign firms to create independent power projects in response to chronic power outages, particularly in rural areas. Initial financing for the AES Pak Gen Project consisted of 28% equity and 72% debt. AES held approximately 25% of the project finance company equity, while the International Finance Corporation (IFC), a division of the World Bank, held the remaining 3%. Debt financing comprising the other 72% of project capital came from loans provided by a syndicate of ten banks and the Export and Import Bank of Japan (JEXIM). The Bank of Tokyo, together with Deutsche Bank and Sanwa Bank, co-managed the lending syndicate.

Figure 1 outlines the essential characteristics of project finance, illustrates these characteristics in the AES Pak Gen Project, and suggests how such characteristics might differ if AES Pak Gen investment were organized and funded through traditional corporate finance rather than project finance company structures. AES Pak Gen Limited is organized as a separate project company, alternatively referred to as a "special purpose vehicle" (SPV), owned by sponsors AES and the IFC. The bank syndicate supplies 72% and the two sponsors provide 28% of the total capital to fund construction and start-up operations. A 30-year concession with supply agreements committing Pakistani state energy agencies to buy power within pre-set quantity and price ranges mitigates market risks. Third-party contracts with construction firms from Japan and with the lead sponsor, AES, provide for specialized construction and operation expertise.

Project Finance-Based FDI	Asian Example: AES Pak Gen Project Province of Punjab, Pakistan: 365 MW Oil-Fired Power Station, Total Cost: \$350 Million	If Alternative Corporate Finance-Based FDI Were Utilized
1.) Subsidiary project company legally separated from any investing sponsor	1.) AES Pak Gen Limited	1) Subsidiary company legally separated from investing parent firm(s)
2.) Subsidiary project company owned by a small syndicate of limited liability sponsors (equity holders)	2.) US-based MNC, AES: 90% International Finance Corp ("IFC"): 10%	2) Subsidiary company owned by investing firm(s) with joint and several liability for all claims against the subsidiary company
3.) Credit provided to subsidiary project company by syndicate of lending banks with limited (to project company asset) recourse in the event of project default	3.) Syndicate of 10 commercial banks and Export and Import Bank of Japan (JEXIM) provided loans to project company bankruptcy remote from corporate assets of AES and IFC	3) Credit provided to subsidiary company by syndicate of lending banks with recourse to subsidiary assets <i>and</i> parent firm assets as guarantor in the event of subsidiary default.
4.) Highly leveraged (high debt as percentage of total capital) project company capital structure	4.) Debt financing: 72% Equity financing: 28%	4) Leverage of subsidiary company based on leverage of parent firm(s) and extent of parent firm guarantees
5.) Limited subsidiary project company scope of business and term of operations	5.) 30 year concession agreement with Government of Pakistan	5) Subsidiary company with multiple projects of indefinite business scope and term of operations
6.) Extensive contracting relationships between subsidiary project company and various third-parties	6.) a.) 30 year input supply agreement with Pakistan State Oil Company b.) 30 year off-take power purchase agreement with Pakistan Water and Power Development Authority c.) EPC agreement with Japanese contractor d.) Operation agreement with AES	6) Less extensive contracting relationships between subsidiary company and third parties. Greater percentage of project production and distribution internalized by parent firm(s)

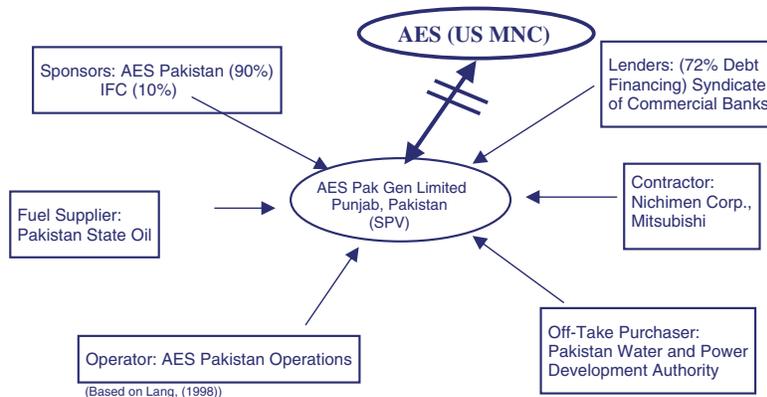


Figure 1 AES Pak Gen project finance structure

The basic features of the AES Pak Gen Project, including concentration of equity ownership in only two sponsors and non-recourse debt financing, are typical of project finance company investments in Asia. These features contrast sharply with alternatives we might observe if traditional corporate finance rather than project finance structures were utilized. Instead of a separate project company with AES and the IFC as limited liability sponsors, AES Pak Gen could have been structured as a subsidiary operation with AES and/or the IFC as guarantors of AES Pak Gen's solvency. Instead of entering into third party contracts with outside construction firms, AES Pak Gen could have left construction, operation and related services to the parent, AES. The choice to structure AES Pak Gen as a project finance company rather than as a corporate finance-based subsidiary means that the operation is effectively separated from the risk profile of its MNC parent, and can be analyzed as if it were a domestic stand-alone single-business firm.

#### Project company capital structure and credit risk

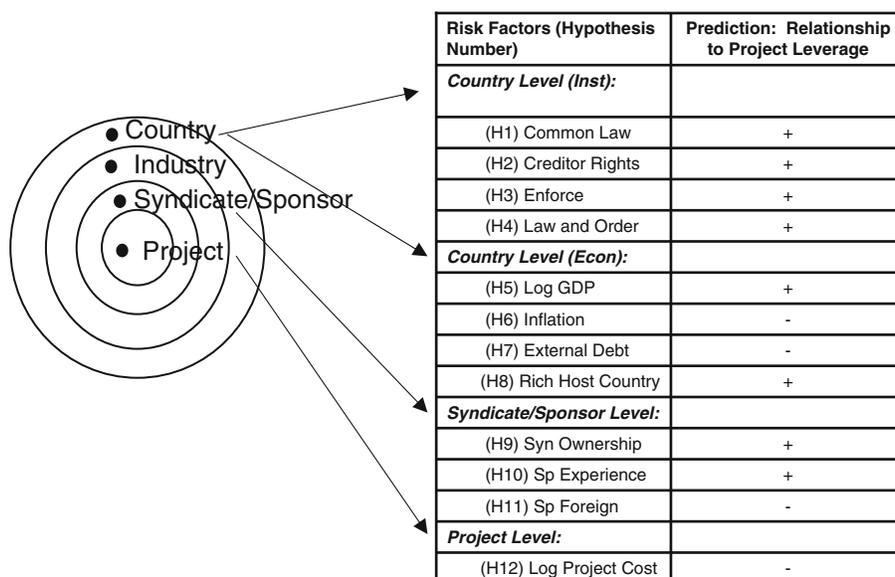
The AES Pak Gen vignette suggests an important and transparent proxy for understanding credit risk in a project finance context. Finance research has a rich history investigating links between risk and capital structure in firms. Modigliani and Miller (1958) demonstrated that, in the absence of bankruptcy costs and tax subsidies, firm value is independent of its financial structure. But this seminal insight has prompted a generation of scholars to analyze the effects of tax shields, subsidies, bankruptcy and a host of factors shaping firm capital structure.<sup>3</sup> Central to this research stream is the assumption that a higher risk of failure threatens the firm's willingness and capability to service debt obligations. This, in turn, deters creditors from lending firms in start-up stages or in high-tech settings. Consequently, such risky firms have less debt and more equity as a percentage of total capital, while established and/or low-tech firms have more debt and less equity other things being equal (Myers, 1984; Williamson, 1988). In a cross-country context, this logic implies that project companies will have more debt and less equity as a percentage of total capital as credit risks due to various country-, industry-, sponsoring syndicate, firm-, and project-level factors decrease.

### Theoretical framework and hypothesis development

#### Target risk framework

Lessard's (1996) taxonomy of off-shore project risks provides a starting point for defining our own project finance "target risk" framework. Lessard notes that offshore project characteristics reflect a host of risks, including those related to broad institutional and macroeconomic factors in the project's host country, to mid-range factors related to the project's industry, to more idiosyncratic factors linked to the project's lead-sponsoring firm and to the project's size. Figure 2 illustrates our application of Lessard's organizing logic to a project finance setting. It is a set

<sup>3</sup> See, e.g., Breal and Myers (2006) for an overview of this research.



**Figure 2** Target risk framework and derived hypotheses

of concentric circles where each circle represents categories of factors affecting risk from a creditor's perspective. It goes from the broadest and most general (country) factors, to the narrowest and most specific (project) factors affecting that creditor calculus.

#### Country-level institutional risks

We work “from the outside in” of our target risk framework and begin with country-level institutional risks. As Aguilera and Jackson (2003) and Peng (2003) have proposed, institutional factors constitute the country backbone supporting company expectations and strategic decisions. Meyer and Peng (2005) emphasize that institutions are much more than background conditions. They may have a direct impact on the constraints that firms face and the strategic options they can exercise. Law and finance researchers have found that countries with Anglo-American common law legal institutions provide better protection to creditors than do countries with Continental European civil law institutions (Coffee, 1999; Reynolds & Flores, 1989, 2003; LaPorta, Lopez-de-Silanes, Shleifer, & Vishny, 1998; Ribstein, 2005). Common law principles originating in England rely substantially on judicial precedents to resolve financial disputes arising from company failure quickly and equitably as opposed to explicit and often inflexible codes enunciated occasionally by legislators and enforced by executives or bureaucrats. Thus, common law nurtures the organic evolution and timely application of practical heuristics enforced by politically independent decision-makers.

Such institutional distinctions matter in Asia. Project finance companies since the 1970s have been established in both former British colonial territories inheriting the common law system, such as Australia, Singapore and India, and territories inheriting civil law systems such as Japan, Korea and China. The legal system

providing better general protection to financiers should decrease overall project risk to creditors and engender higher debt as a percentage of total capital, thus:

**Hypothesis 1** Projects located in common law countries will have higher debt.

Differences in legal system matter for project risk and capital structure, but so might norms of enforcement -rule of law- no matter the system involved. This logic follows from institutional economics and legal perspectives that focus more on norms of respect and enforcement for law and law enforcers rather than what laws may actually be “on the books” (Libecap, 1989; North, 1990). We investigate three such institutional factors which previous theory, empirical research and intuition suggest have a substantial impact on project risk; strength of creditor rights, law enforcement rates, and the overall integrity of the legal system.

There is substantial cross-country variation in creditor rights (LaPorta et al., 1998). Some countries permit creditors to foreclose on borrower assets easily, while other countries make it all but impossible even though foreclosure laws are on the books. LaPorta et al. (1998) show that countries with stronger creditor rights in practice also have better developed bank-lending and debt markets. Stronger creditor protection should decrease risk to prospective project finance company lenders. Even with the most transparent project finance company structure, residual concerns of moral hazard or adverse selection may render borrowers more willing to risk company failure (Harris & Raviv, 1991). Stronger creditor rights in this case give additional assurance of redress in the event of failure and make debt more easily available, thus:

**Hypothesis 2** Projects located in countries with stronger creditor rights will have higher debt.

We also expect that speed of enforcement in contract disputes will affect project finance company capital structure. Law and finance researchers document a positive relationship between the ease of enforcing debt contracts when breached and the broader availability of credit within a country (LaPorta et al., 1998; Djankov, McLiesh, & Shleifer, 2007). Djankov et al. (2007) measure enforcement as the number of days required to settle a debt contract dispute and measure credit availability as the ratio of a country’s private credit claims from commercial banks and other financial institutions to the country’s GDP. The expectation of speedier adjudication in the event of disputes between project finance company sponsors and creditors or other third party service providers should decrease overall risk of project-related losses, thus making it easier to obtain capital and third-party commitments necessary to begin projects:

**Hypothesis 3** Projects located in countries with faster contract enforcement will have higher debt.

The general integrity and respect for law within a country is also likely to matter for credit risk and capital structure in project finance companies. Pistor and her colleagues (Pistor, Raiser, & Gelfer, 2000) construct a legal enforcement index based on survey data for transition countries from Central and Eastern Europe (CEE). Regression analyses of data from 22 CEE countries from 1994–1998 suggest that private credit availability is explained substantially by the level of respect for rule of law and law enforcement officials. Hadfield (2005) echoes these points in holding

that investor protection across the non-industrialized world is reliant on basic institutional concerns about the quality of judicial norms of practice and the transparency of legal dispute resolution processes. Based on such logic and evidence, we predict that project finance companies located in countries with stronger law and order impose less risk to creditors, thus:

**Hypothesis 4** Projects located in countries with stronger law and order will have higher debt.

The macroeconomic environment can also substantially affect project company risk reflected in project capital structure. Credit rating agencies such as Moody's and Standard and Poor's assign sovereign ratings gauging the ability and willingness of governments -and by implication, other sub-sovereign businesses and individuals- to honor their financial obligations. These ratings are important because private companies or other institutions within a particular country are unlikely to receive credit ratings higher than the sovereign rating of the country in which they are domiciled, and thus credit ratings are indicative of a country's attractiveness for lending. Cantor and Packer (1996) and Vaaler, Schrage, and Block (2006) have shown that these sovereign risk assessments improve for countries with larger economic size (GDP), lower inflation, low (but not extremely low) external debt levels, and greater wealth. Similarly, Vaaler (2007) has shown that such macroeconomic terms also explain substantial variation in the annual count of new project finance companies in developing countries during the 1980s and 1990s. These regularities suggest:

**Hypothesis 5** Projects located in countries with larger economies will have higher debt.

**Hypothesis 6** Projects located in countries with lower inflation will have higher debt.

**Hypothesis 7** Projects located in countries with low to moderate levels of external debt will have higher debt.

**Hypothesis 8** Projects located in wealthier countries will have higher debt.

Industry-, syndicate-, lead-sponsoring-firm, and project-level risks

As we move from the outer to inner rings of the target risk framework, our credit risk categories become increasingly specific to the project company and its sponsoring firms. Extensive evidence indicates that capital structure varies across industries (Harris & Raviv, 1991) due in large part to industry-based differences in asset intensity and asset value volatility. As we noted earlier, Williamson (1988) treats debt and equity not only as alternative financial arrangements but also as alternative governance structures and argues that each type of financing is dependent upon the nature of the assets. Debt is more appropriate for firms in more low tech industries with less volatility and risk of failure. The case for debt is even stronger where firm failure still permits low-cost redeployment of failed firm assets. By contrast, the case for greater reliance on equity strengthens in high-tech industries where asset re-deployment upon failure can be costly and induces greater asset value volatility.

This logic helps explain industry-based differences in capital structure. Industries with greater asset intensity and volatility indicate greater risk and typically mandate less use of debt (Lessard, 1996). We make no formal predictions regarding industry effects. Rather, we engage in an exploratory analysis of differences in leverage and leverage determinants for energy generation and transmission projects compared to the total sample from all industries. This industry represents the largest and most thoroughly studied industry in project finance (Esty, 2002).

The next ring in our target risk framework pertains to project syndicate and lead-sponsoring firm factors. Project finance companies are characterized by highly-concentrated equity ownership, with syndicates typically comprising two or three sponsoring firms (Esty, 2004). Esty and Megginson (2003) suggest that more concentrated ownership and smaller syndicates reduces agency costs through better incentives alignment and oversight of managers by owners with a larger stake in the success of business operations (Jensen & Meckling, 1976). Thus, we predict that more concentrated project ownership syndicates indicate lower project finance company risk of failure and non-payment to creditors:

**Hypothesis 9** Projects with higher ownership concentration will have higher debt.<sup>4</sup>

Our target risk framework also implies differences in project finance company credit risk and capital structure linked to lead-sponsoring firm characteristics. We identify the lead-sponsoring firm's previous country and or industry experience as an important differentiating factor. Previous industry experience lowers production costs (Lieberman, 1989) and gives incumbents greater flexibility regarding whether and when to enter a related market segment (Mitchell, 1991). Host country experience also helps a firm overcome its inherent liability of foreignness (Zaheer, 1995). It provides MNCs with crucial market knowledge (Johanson & Vahlne, 1977), affects decisions about whether and where to locate overseas operations (Henisz & Delios, 2001), and improves survival and profitability prospects in foreign markets (Luo & Peng, 1999; Shaver, Mitchell, & Yeung, 1997; Wang, Huang, & Bansal, 2005). The project finance company benefits from lead-sponsor local knowledge and relationships due to previous industry and host country experience. Creditors and other stakeholders have less uncertainty about how well the lead-sponsor will direct the project. Accordingly, we predict that:

**Hypothesis 10** Projects led by sponsoring firms with previous industry or host country experience will have higher debt.

Even though host country experience mitigates the liability of foreignness, it may not negate it completely. Vaaler (2007) documents that annual counts of new project

<sup>4</sup> This agency-based prediction competes with an alternative view also proposed by Esty and Megginson (2003) in the related context of bank lending syndicate size and risk. They conjecture that banks create larger lending syndicates in order to deter strategic default by borrowers, because the larger the syndicate the more expensive it is for borrowers to restructure. We note this alternative prediction but think it less apt in the case of equity-holding syndicates. Here, default concerns do not implicate borrowers, but perhaps, default by third-party service providers. Individually, such default is not likely to result in major project re-structuring. Indeed, it is a common project finance practice to engage alternative third-party service providers on a stand-by basis to fill in the event of non-performance by an active service provider (Finnerty, 1996).

finance companies lead-sponsored by MNCs vary significantly as the level of country political risk varies, but counts of new projects led by domestic firms do not vary with changes in political risk. His finding implies that, at the margin, project finance companies lead-sponsored by domestic firms are less sensitive to changing risk of failure, thus:

**Hypothesis 11** Projects led by domestic lead-sponsoring firms will have higher debt.

Finally, idiosyncratic project-specific attributes may matter for project company credit risk and capital structure. We focus on one project-specific factor, project size. Larger projects represent harder-to-reverse commitments (Ghemawat, 1991) if poorly planned or implemented. By implication, smaller projects are easier to reverse, re-deploy or liquidate upon project company failure, thus:

**Hypothesis 12** Smaller projects will have higher debt.

## Methods

### Empirical equation

To investigate evidence related to these 12 hypotheses derived from our target risk framework, we define the following equation for estimation:

$$\begin{aligned} \text{Leverage}_{ijklt} = & \beta_0 + \sum_{m=1}^4 \beta_{1-4} \text{HostCountryInst}_l \\ & + \sum_{n=1}^5 \beta_{5-9} \text{Macroeconomic}_{nt} + \beta_{10} \text{SyndicateOwnership}_{ijklt} \\ & + \beta_{11} \text{SponsorExperience}_{ijklt} + \beta_{12} \text{Foreign}_{ijklt} + \beta_{13} \text{Cost}_{ijklt} + \varepsilon_{ijklt} \end{aligned} \quad (1)$$

In Eq. 1, *Leverage* is our dependent variable and measures the ratio of debt to total capital invested in project finance company *i*, sponsored by syndicate *j* with lead sponsoring firm *k*, located in country *l*, and announced in year *t*.

We specify several right-hand-side variables to explain *Leverage* consistent with our target risk framework development immediately above. The expected signs for these 13 right-hand-side variables are given in Figure 2 and in parentheses below. Again, proceeding from the outermost to innermost concentric rings of our target risk framework, we start with four *HostCountryInst* ( $\beta_1$ – $\beta_4$ ) country variables *l* familiar to law and finance research linking differences in cross-country economic phenomena to cross-country institutional differences (LaPorta et al., 1998; Djankov, La Porta, Lopez-de-Silanes, & Shleifer, 2003; Djankov et al., 2007). Measures for these four terms are fixed over project finance companies *i*, syndicates *j*, lead-sponsoring firms *k* and years *t*. They include:

- *Common Law* ( $\beta_1$ ) (+): This is a dummy variable that equals 1 if the host country *l* has a common law legal system and equals 0 if it has a civil law system. *Common Law* is expected to be positively related to *Leverage* indicative of lower project credit risk.

- *Creditor Rights* ( $\beta_2$ ) (+): This is an aggregate index measure running from 0 (weak creditor rights) to 4 (strong creditor rights) for each host country  $l$ . *Creditor Rights* is expected to be positively related to *Leverage* indicative of lower project credit risk.
- *Enforce* ( $\beta_3$ ) (-): This is the natural log of the number of days to resolve a payment dispute through the courts for each host country  $l$ . *Enforce* is expected to be negatively related to *Leverage* indicative of higher project credit risk.
- *Law and Order* ( $\beta_4$ ) (+): This is a measure of the integrity of the legal system for each host country  $l$ , a 10 point scale, with a higher number indicating greater integrity. *Law and Order* is expected to be positively related to *Leverage* indicative of lower project credit risk.

Next, we include five *Macroeconomic* ( $\beta_5$ – $\beta_9$ ) country variables  $l$  familiar to international economics (Cantor & Packer, 1996) and business (Vaaler, 2007; Vaaler & McNamara, 2004; Vaaler et al., 2006) research linking differences in cross-country lending and investment risk to cross-country macroeconomic differences. These five terms are fixed over project finance companies  $i$ , syndicates  $j$  and lead-sponsoring firms  $k$  but vary over years  $t$ . Indeed, we use two year moving averages (years  $t$  and  $t-1$ ) of these macroeconomic terms for smoothing purposes. These four terms include:

- *Log GDP* ( $\beta_5$ ) (+): This is the two-year moving average of the natural log of the gross domestic product (GDP) in current \$US of host country  $l$ . *Log GDP* is expected to be positively related to *Leverage* indicative of lower project credit risk.
- *Inflation* ( $\beta_6$ ) (-): This is the two year moving average annual percentage change in consumer prices in host country  $l$ . *Inflation* is expected to be negatively related to *Leverage* indicative of higher project credit risk.
- *External Debt* ( $\beta_7$ ) (-): This is the two year moving average sum of public, publicly guaranteed, and private non-guaranteed long-term debt, use of IMF credit, and short-term debt divided by GDP for host country  $l$ . *External Debt* is expected to be negatively related to *Leverage* indicative of higher project credit risk.
- *External Debt Squared* ( $\beta_8$ ) (-): This is the squared value of *External Debt* for country  $l$  in year  $t$ . It permits investigation of possible non-linear (quadratic) effects. *External Debt Squared* to be negatively related to *Leverage* at average and higher levels of *External Debt* indicative of higher project credit risk at average and higher levels.

A fifth macroeconomic term is a 0–1 dummy related to differences in host country  $l$  wealth. It does not vary across project finance companies  $i$ , syndicates  $j$ , lead-sponsoring firms  $k$  and years  $t$ :

- *Rich Host Country* ( $\beta_9$ ) (+): This is a dummy variable that equals 1 if the host country  $l$  is either Australia, New Zealand, Japan, Hong Kong, or Singapore. *Rich Host Country* is expected to be positively related to *Leverage* indicative of lower project credit risk.

A tenth right-hand-side variable, *SyndicateOwnership* ( $\beta_{10}$ ) (+) is measured as the Herfindahl index of equity ownership by all equity sponsors in syndicate  $j$  for project finance company  $i$  in country  $l$  of year  $t$ . We sum the square of each sponsor equity share in the syndicate to arrive at a number between 1, where there

is a sole sponsor, and nearly 0, where the syndicate is large and ownership diffuse. In line with our agency-based view of risk and syndicate size, we expect that *SyndicateOwnership* will be positively related to *Leverage* indicative of lower project credit risk.

An 11th variable, *SponsorExperience* ( $\beta_{11}$ ) (+) is a dummy variable that equals 1 if the lead-sponsoring firm  $k$  (defined by largest equity interest) in syndicate  $j$  for project finance company  $i$  in country  $l$  of year  $t$  has previously participated in a similar project syndicate. We define similarity first based on whether the lead sponsor has previously been part of a project syndicate in the same industry within the same country. We also explore alternative definitions that are less specific - previous syndicate membership within the same country (no matter the industry), or previous syndicate membership in the same industry (no matter the country). For any of these formulations *SponsorExperience* is expected to be positively related to *Leverage* indicative of lower project credit risk. A 12th variable, *Foreign* ( $\beta_{12}$ ) (-) is a dummy variable equaling 1 when the parent firm of the lead-sponsoring firm  $k$  is domiciled outside the project host country  $l$ . This term can and does vary across project finance companies  $i$ , syndicates  $j$ , countries  $l$  and years  $t$ . *Foreign* is expected to be negatively related to *Leverage* indicative of higher project credit risk.<sup>5</sup>

Finally, we include a 13th right-hand-side term for that innermost category, *Cost* ( $\beta_{13}$ ) (-), which is the natural logarithm of the total project cost in millions of dollars for project finance company  $i$  sponsored by syndicate  $j$  and lead-sponsoring firm  $k$  in country  $l$  of year  $t$ . *Cost* is expected to be negatively related to *Leverage* indicative of higher project credit risk.

#### Estimation strategy

We are estimating a cross-section of project *Leverage* measures on several right-hand-side terms differing primarily across countries but also syndicate structure, lead sponsor characteristics, project size and even industry differences. Accordingly, we rely primarily on a generalized least squares (“GLS”) estimator with clustering on countries. The clustering adjustment uses robust (wider) standard errors and deals with possible lack of independence among the error terms due to unobserved effects that may be unique to a particular host country.

*Leverage* measures range from 19 -meaning that 19% of total capital is debt- to approximately 100 with a mean of approximately 75. Several observations are very near 100, the highest value *Leverage* can take.<sup>6</sup> Thus, we have the possibility of right (upper-limit) censoring on the dependent variable that could bias estimates. To investigate that possibility, we also use an alternative Tobit estimator to check the consistency of results obtained from GLS estimation. Tobit estimation does not permit clustering adjustments, thus we trade precision in treatment of standard errors for greater confidence in coefficient estimate magnitude and sign if indeed there is censoring-related bias.

<sup>5</sup> Where project equity is split equally between a foreign and domestic sponsor, we code the observation as 0 indicative of domestic lead sponsorship.

<sup>6</sup> Projects occasionally begin with approximately 100% debt-capitalization. In these cases, the nominal equity sponsor or sponsors are also temporarily substantial project creditors.

Finally, we implement several non-parametric bivariate analyses described as locally weighted scatter plot smoother (“Lowess”) estimations. Lowess analyses compute linear regressions around each observation,  $x_{ijklt}$ , with neighborhood observations chosen within some sampling bandwidth and weighted by a tri-cubic function. Based on the estimated regression parameters,  $y_{ijklt}$  values of *Leverage* are computed. These  $x, y$  combinations are then connected yielding a Lowess curve. A higher bandwidth results in a smoother Lowess curve. We use the Lowess estimator to examine in detail specific bivariate relationships between *Leverage* and key right-hand-side variables across the broad sample, and for a sub-sample drawn from the power generation industry only. GLS, Tobit and Lowess estimations are performed with Stata Version 9.2 (Stata Corp, 2005) using the commands “reg” (with “cluster” option) and “tobit” and “lowess” respectively.

#### Data sources and sampling

Data for our sample come from several sources. Our primary source is the Thomson-SDC Project Investment online database (Thomson-SDC, 2006). This database provides information on specific project financed investments, or project companies, across a large number of industries and countries. Some of the variables specific to our study include the announced date of the project, the country where the project is located, the industry or sector of the project, the size of the project (cost), the capital structure of the project, the distribution of the original equity ownership of the project, the parent firms of the sponsors, and the home nation of the sponsor and sponsor parent firms. From this primary source, we identify 238 projects announced from 1995–2004 for 13 Asian countries with complete data for all terms in our empirical equation.<sup>7</sup> All information for our dependent variable, *Leverage*, and our right-hand-side terms, *SyndicateOwnership*, *SponsorExperience*, *Foreign* and *Cost*, come from Thomson-SDC.

Data for the *Common Law* term come from LaPorta et al. (1998), while the source for *Creditor Rights* and *Enforce* is Djankov et al. (2007). Djankov et al. (2003) provide measures for *Law and Order*. The World Bank’s World Development Indicators (WDI, 2006) provide data on country and year-specific macroeconomic variables *Log GDP*, *Inflation*, *External Debt* and *External Debt Squared*.

## Results

#### Descriptive statistics and pair-wise correlations

Descriptive statistics and correlations for our sample of 238 projects are reported in Table 1. They largely follow intuition. Again, the mean value of *Leverage* is 75.02. On average, projects located in Asian countries from 1995–2004 are financed about 75% by debt and 25% by equity. This sample mean compares well to Esty (2002),

<sup>7</sup> Those 13 countries are: Australia, Azerbaijan, Bangladesh, China (PRC), Hong Kong, India, Indonesia, Japan, New Zealand, Pakistan, Philippines, Singapore, and South Korea.

**Table 1** Descriptive statistics and pair-wise correlations.

Variables	Mean	Std. dev.	Min.	Max.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
1. Leverage (dep. var.)	75.02	18.50	19	100	1.00														
2. Common law	0.67	0.47	0	1	0.19	1.00													
3. Creditor rights	2.56	0.71	1	4	0.23	0.43	1.00												
4. Enforce	5.58	0.57	3.91	6.35	-0.16	-0.42	-0.46	1.00											
5. Law and order	7.01	2.51	3.33	10	0.20	0.63	0.51	-0.82	1.00										
6. Log GDP (\$US)	26.24	0.89	23.46	28.21	0.05	-0.21	-0.07	-0.16	0.38	1.00									
7. Inflation	6.29	6.19	-3.84	39.44	-0.20	-0.45	-0.45	0.51	-0.48	-0.04	1.00								
8. External debt	0.41	0.21	0.10	1.33	0.08	-0.16	-0.02	0.44	-0.39	-0.46	0.33	1.00							
9. External debt squared	0.21	0.24	0.01	1.77	.02	-0.26	-0.09	0.42	-0.39	-0.37	0.50	0.94	1.00						
10. Rich host country	0.36	0.48	0	1	0.25	0.52	0.62	-0.82	0.83	0.15	-0.51	-0.19	-0.23	1.00					
11. Syndicate ownership (Herf index)	0.69	0.28	0.17	1	0.26	0.02	0.04	-0.07	0.07	0.09	-0.06	0.15	0.14	0.11	1.00				
12. Sponsor experience	0.39	0.49	0	1	0.14	0.01	0.03	0.00	0.07	0.15	-0.01	0.03	0.05	0.08	0.01	1.00			
13. Foreign	0.33	0.47	0	1	-0.03	0.07	-0.01	-0.15	0.12	-0.02	-0.03	-0.01	0.00	0.13	-0.01	0.03	1.00		
14. Log project cost (\$US)	5.58	1.30	1.39	8.56	-0.12	-0.05	0.09	0.04	-0.06	-0.01	0.01	0.03	0.03	0.01	-0.14	0.18	-0.01	1.00	

N=238.

Correlations greater than 0.11 or less than -0.11 are significant at 10% level ( $p < 0.10$ ) (one-tailed test).

Correlations greater than 0.14 or less than -0.14 are significant at 5% level ( $p < 0.05$ ) (one-tailed test).

Correlations greater than 0.18 or less than -0.18 are significant at 1% level ( $p < 0.01$ ) (one-tailed test)

who notes 70% average leverage in a global sample of projects announced during the 1990s. The 0.67 sample mean for *Common Law* indicates that about 67% of our projects are located in host countries with a common law legal system. This percentage is substantially higher than in other regions of the world where British colonial heritage and lingering cultural and economic interests had less influence.

The 0.69 sample mean for *Syndicate Ownership* follows from Herfindahl calculations where there are typically only two or three sponsors and one is dominant as the lead sponsor. *Sponsor Experience* of 0.39 tells us that this lead sponsor has previous experience as a member of a project syndicate in country  $i$  in the same industry in only 39% of the projects sampled. Even in Asia where project-based FDI has the longest history, we find that most of the lead sponsors in our sample have never before participated in a project syndicate. We attribute this to Asian privatization policy trends in the 1990s that opened up new industry segments to foreign project investment and investors for the first time. The 0.33 sample mean value of *Foreign* indicates that for about 33% of the projects, the parent of the largest equity shareholder is foreign. Of course, many projects include foreign syndicate members other than the lead sponsor. In our sample, the average foreign ownership as a percentage of total ownership is 41%. Again, our *Foreign* dummy captures foreign project *leadership*, not merely participation. *Log Project Cost* (US\$ million) has a mean value of 5.58. The average project cost is US\$ 545 million and the total cost for the 238 projects in our sample is US\$ 130 billion.

### Regression results

Shown in Table 2, overall results support predictions derived from our target risk framework. The first three columns of Table 2 report GLS estimations using alternative definitions of *SponsorExperience*. In Column 1, the dummy equals 1 when the lead sponsor has previously been a member of a project syndicate in the same industry within the same country. In Column 2, we broaden *SponsorExperience* so that the dummy equals 1 as long as the lead sponsor has been a member of a project syndicate in any industry within the country. In Column 3, *SponsorExperience* is one as long as the lead sponsor has previously been a member of a project syndicate in the same industry, no matter the country.

Results from GLS estimation in all three columns are consistent and substantially in line with our framework. Three country-level institutional variables, *CommonLaw*, *Creditor Rights*, and *Enforce*, exhibit predicted signs and are statistically significant either at 10% or higher levels. Results in Columns 1–3 suggest, for example, that *Leverage* increases approximately 10 percentage points for projects located in *Common Law* countries of Asia. Again, higher leverage indicates lower overall project credit risk. Similarly, we find positive signs on coefficients for *Creditor Rights* and negative signs on coefficients for *Enforce*, both in line with framework predictions and statistically significant at 10% or higher levels. If creditor rights are stronger, they are more willing to lend to projects. If time to enforce their rights increases, they are less willing to lend to projects located in Asian countries. These results support Hypotheses 1–3.

Only *Law and Order* exhibits a contradictory sign compared to prediction in Hypothesis 4. Increasing respect for the legal system and its enforcers in country  $i$  decreases *Leverage* indicative of greater project credit risk. We note that *Law and*

**Table 2** Regression results: leverage for all projects announced in Asian countries, 1995–2004.

Empirical models and estimators→	(1) (Experience is industry in country) GLS	(2) (Experience is country) GLS	(3) (Experience is industry) GLS	(4) (56 right censored obs) Tobit regression	(5) (Experience is country and industry) GLS
Variables ↓					
Constant	-35.41 (44.09)	-47.70 (45.61)	-50.22 (43.40)	-58.66 (67.67)	-134.01 (45.27)
Common law ( $\beta_1$ )	10.14** (3.91)	10.70** (4.09)	10.76** (3.90)	12.47* (6.82)	24.05*** (5.87)
Creditor rights ( $\beta_2$ )	2.67* (1.48)	2.75* (1.54)	2.84* (1.48)	3.25 (2.64)	-1.40 (1.59)
Enforce ( $\beta_3$ )	-8.51* (4.71)	-8.60* (4.81)	-8.77* (4.80)	-11.05 (7.71)	-20.14*** (5.69)
Law and order ( $\beta_4$ )	-2.79* (1.39)	-3.05* (1.41)	-3.08** (1.39)	-3.64 (2.21)	-11.00*** (2.84)
Log GDP (\$US) ( $\beta_5$ )	5.73** (2.62)	6.26** (2.73)	6.39** (2.59)	7.22** (3.55)	13.73*** (3.14)
Inflation ( $\beta_6$ )	-0.096 (0.16)	-0.089 (0.17)	-0.101 (0.165)	-0.036 (0.350)	-0.046 (0.156)
External debt ( $\beta_7$ )	45.37*** (9.56)	44.48*** (10.20)	45.01*** (10.24)	57.44** (27.52)	14.53 (10.95)
External debt squared ( $\beta_8$ )	-24.89*** (7.60)	-23.71** (7.92)	-24.20*** (7.69)	-32.91 (23.30)	0.630 (8.51)
Rich host country ( $\beta_9$ )	3.63 (2.33)	4.43* (2.22)	4.26* (2.23)	6.73 (7.07)	26.73*** (6.72)
Syndicate ownership (Herf Index) ( $\beta_{10}$ )	11.53*** (2.92)	11.25*** (3.14)	11.62*** (3.13)	16.45*** (5.44)	15.94*** (4.27)
Sponsor experience ( $\beta_{11}$ )	4.86** (1.76)	3.92* (1.96)	3.51** (1.59)	6.29** (2.97)	5.12* (2.64)
Foreign ( $\beta_{12}$ )	-1.37 (2.31)	-0.88 (2.48)	-2.20 (2.53)	-0.91 (3.02)	-0.70 (3.57)
Log project cost (\$US) ( $\beta_{13}$ )	-1.76* (0.84)	-1.79* (0.85)	-1.70* (0.78)	-2.63** (1.12)	-0.86 (1.27)
Power sector dummy					120.09 (100.62)
Power*Common law					-15.47 (8.90)
Power*Creditor rights					8.28*** (2.41)
Power*Enforce					0.17 (12.62)
Power* Law and order					8.47** (3.17)
Power*Log GDP					-7.24 (6.10)
Power*Inflation					0.77* (0.39)
Power*External debt					116.90*** (34.93)
Power*External debt squared					-102.27*** (23.87)
Power*Rich host country					-36.99*** (10.04)

**Table 2** (continued)

Empirical models and estimators→	(1) (Experience is industry in country) GLS	(2) (Experience is country) GLS	(3) (Experience is industry) GLS	(4) (56 right censored obs) Tobit regression	(5) (Experience is country and industry) GLS
Variables ↓					
Power*Syndicate ownership					-8.44 (7.70)
Power*Sponsor experience					-1.04 (2.92)
Power*Foreign					-0.37 (3.69)
Power*Log project cost					-1.80 (1.19)
<i>N</i>	238	238	238	238	238
$R^2$ (Wald $\chi^2$ )	0.19	0.19	0.19	1,125***	0.26

Columns 1–5 report regression coefficients and semi-robust standard errors (in parentheses).

\* $p < 0.10$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$

*Order* exhibits higher pair-wise correlations with *Common Law*, *Creditor Rights*, and *Enforce*. We conjecture that these three terms are picking up effects that might otherwise pool into *Law and Order*. Indeed, dropping *Law and Order* from our estimation does not change results for these other three institutional terms.

Four of our five country macroeconomic variables exhibit signs predicted by our framework. *Log GDP* is consistently positive and significant at the 5% level in support of Hypothesis 5 derived from our framework. Asian countries with larger economic size attract projects with more leverage and less risk. *Inflation* exhibits the predicted negative sign, but is not significant at commonly accepted levels of support for Hypothesis 6. But *Rich Host Country* is positive and significant in Columns 2–3 at the 10% level consistent with Hypothesis 8. Projects in Australia, New Zealand, Japan, Hong Kong, or Singapore, industrialized exceptions to a developing region rule, tend to have higher leverage and lower overall credit risk.

That leaves *External Debt* and *External Debt Squared*, for which we predict negative signs in Hypothesis 7. Only *External Debt Squared* exhibits the predicted negative sign at 5% or higher levels of significance. By contrast, the linear term, *External Debt* is positive (not negative) and significant. We can reconcile this apparent contradiction by interpreting these two terms together. At low levels, a little more external debt may be good for country investment generally and project investment in particular. Increasing external debt represents an “opening up” of current and capital accounts beneficial to foreign investment including project-based investment. But at higher levels captured by the quadratic term, *External Debt Squared*, the benefits of liberalization increase less, and concerns about illiquidity and default increase. Together, we see some support for Hypothesis 7, though it is less clear than for *Log GDP* or *Rich Country*.

Coefficients on syndicate, lead sponsor and project-specific terms also indicate support for our target risk framework. *SyndicateOwnership* is positive and

significant at the 1% level across Columns 1–3 in support of Hypothesis 9. This is consistent with our agency view emphasizing the importance of alignment and oversight incentives rather than an alternative risk-spreading logic we also noted above. *Leverage* increases and project credit risk decreases with smaller syndicate size. *SponsorExperience* is also positive and significant at 10% or higher levels, no matter how we measure previous lead sponsor experience. *Leverage* increases from approximately four to five percentage points in Columns 1–3 consistent with Hypothesis 10. By contrast, the *Foreign* nationality of a lead sponsor does not appear to influence credit risk as reflected in project capital structure. This lack of support for Hypothesis 11 could mean that there is no significant liability of foreignness to incur in Asian project finance, at least from a creditor's perspective. On the other hand, Makino and Beamish (1998) note that certain developing countries, including Asian countries in our sample, have foreign ownership restrictions that could confound our examination of ownership and project credit risk. Finally, we note that *Log Project Cost* has the negative sign and significance at 10% or higher levels consistent with Hypothesis 12. Larger projects are more risky commitments for creditors and have lower leverage. Thus, we find support at commonly accepted statistical levels for nine of the 12 hypotheses derived from our target risk framework.

These results are largely confirmed in Column 4 where we list results from Tobit estimation. We have *Leverage* measures of approximately 100 for 59 of the 238 projects, thus there is concern that right-hand (upper-limit) censoring is biasing our GLS estimates. But results in Column 4 are largely consistent with GLS estimates in Columns 1–3, though levels of significance may be lower most likely because of the inability to cluster as with GLS estimations. Possible censoring on the dependent variable is unlikely to have biased our estimates, thus providing even more support for our target risk framework explaining credit risk in Asian project finance.

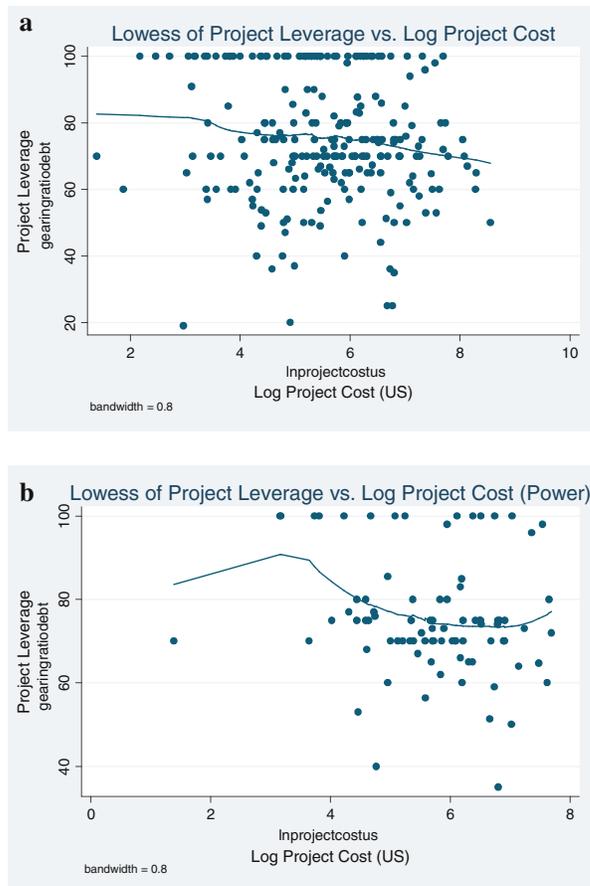
We also seek an understanding of possible industry effects on *Leverage* and thus risk. We gain that understanding in Column 5 of Table 2. There, we implement another GLS estimation but include a 0–1 dummy that takes the value of one for all projects listed by Thomson-SDC as being in the “Power” industry. That dummy is interacted with each of the terms in our equation to understand how the impact of these terms may differ, if at all in the case of power projects. Interaction results vary. Six right-hand-side interaction terms differ significantly in effect on *Leverage* in the power industry. *Power* dummy interactions with *Creditor Rights* (8.28,  $p < 0.01$ ), *Law and Order* (8.47,  $p < 0.05$ ), *Inflation* (0.77,  $p < 0.10$ ), *External Debt* (116.90,  $p < 0.01$ ), and *External Debt Squared* (−102.27,  $p < 0.01$ ) are all significantly more positive than their effects on *Leverage* in other industry settings. *External Debt* and its quadratic interaction terms exhibit particularly large point estimates. Indeed, near maximum levels of *External Debt* (1.33), the net effect of linear and squared terms becomes negative, indicating that concerns of illiquidity and default are, perhaps, more acute in power than in other industry settings where governments are less important as consumers and regulators of project activities. A similar conjecture may explain the significantly more negative effect on *Leverage* for power projects in rich host countries. When *Power\*Rich Host Country* equals 1, *Leverage* decreases by approximately 37% (−36.99,  $p < 0.01$ ), indicating substantially greater project credit risk.

### Graphical illustrations

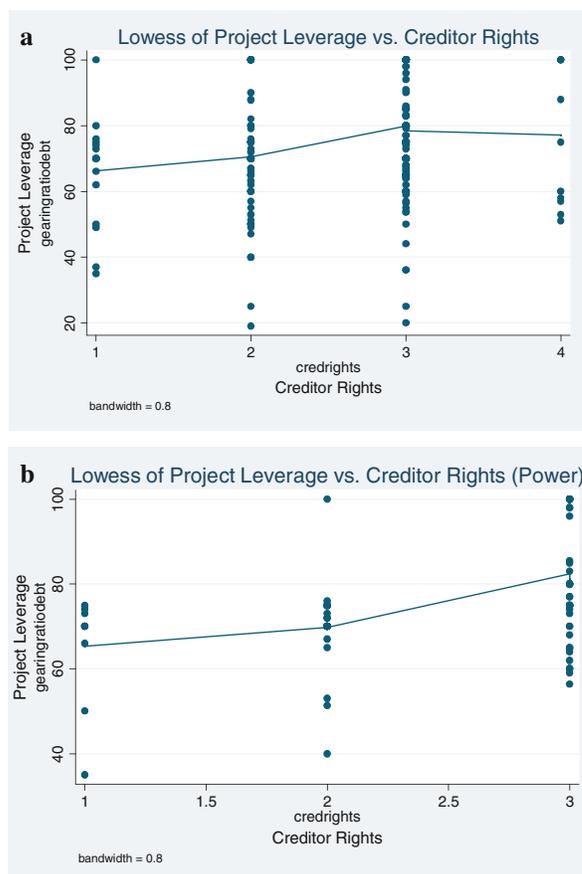
Lowess analyses provide helpful graphical complements to the multivariate analyses summarized above. They illustrate non-parametric relationships between *Leverage* and several key right-hand-side variables in Figures 3a, b, 4a, and b. Figure 3a and b illustrate the relationship between *Leverage* and *Log Project Cost* for our entire sample (Figure 3a) and for power projects only (Figure 3b). Consistent with Hypothesis 12, we see clear negative trends in both figures, with a more pronounced dip for power projects. Again, this is consistent with the greater credit commitment and credit risk involved in power projects, particularly in developing countries of Asia.

Figure 4a and b illustrate the relationship between *Leverage* and *Creditor Rights* for our entire sample (Figure 4a) and for power projects only (Figure 4b). Now the trend in both figures is positive, consistent with Hypothesis 2 again. For the entire sample (4A), *Leverage* increases from about 70 to 80% as *Creditor Rights* strengthen from 2 to 3. For power projects, the same strengthening in *Creditor*

**Figure 3** **a** Project leverage and cost for all projects sampled  
**b** Project leverage and cost for projects sampled from power industry



**Figure 4** **a** Project leverage and creditor rights for all projects sampled **b** Project leverage and creditor rights for projects sampled from power industry



*Rights* increases *Leverage* slightly above 80%, again indicating greater sensitivity in power to changes in project risk. Together, our Lowess analyses confirm earlier GLS and Tobit results and broaden support for our target risk framework explaining Asian project finance credit risk and capital structure. Country-, industry-, syndicate-, lead sponsoring firm- and project-related factors all shape project credit risk perceptions and capital structure responses.

## Discussion and conclusion

### Key findings and contributions

To paraphrase Myers (1984), our study sought insight on a capital structure puzzle in a cross-country setting in Asia, and proposed that project finance companies more vulnerable to failure ought to borrow less other things being equal. Project finance companies and structures present us with a novel setting to observe with clarity and

analyze with precision variation in capital structure tied to country-, industry-, syndicate-, firm-, and project-specific factors shaping that vulnerability and related threat to lenders seeking repayment. Theoretically, we contribute to management research by developing a framework of credit risk factors grounded in institutional, macroeconomic, agency, and transaction cost theories. Empirically, we contribute to management research with a rigorous test of hypotheses derived from this framework using a sample of project finance companies and their announced capital structure from 1995–2004.

Results generally support our framework, follow intuition, and demonstrate that risk factors located in different rings of our framework have statistically significant and practically substantial links to project finance company capital structure. Indeed, certain credit risk factors apparently matter more than others. *Leverage* for projects located in countries with common law systems increases by a substantial 10 percentage points. Differences in legal system apparently matter substantially more than differences, say, in country economic factors such as *Inflation*, or in lead sponsor factors such as *Sponsor Experience*. This point supports, in the sphere of project finance, Peng's (2003) broader proposal that cross-country institutional differences have direct and substantial effects on firm strategy and performance. We show again that "institutions matter" for firm financing decisions. Following Wright, Filatotchev, Hoskisson, and Peng (2005), we also show *how* in terms of coefficient sign and *how much* in terms coefficient magnitude they matter.

Results for *SyndicateOwnership* and *SponsorExperience* are also noteworthy. Projects with more concentrated syndicates and lead sponsors with previous experience both saw higher *Leverage* indicative of reduced project finance company credit risk. We advise caution in interpreting these results. Syndicate size and lead-sponsor firm experience may not only explain variation in capital structure, but *vice versa*. To the extent we have the model correctly identified, then we have made substantial progress at demonstrating the importance of lead-sponsoring firm experience under alternative definitions. We found statistically significant and practically substantial effects on *Leverage* whether experience was defined on an industry, country or industry-within-country basis. Such evidence builds on proposals by Peng and Delios (2006) that the operational scope of firms active in Asia can have important spillover effects. Cross-industry experience by lead sponsoring firms within countries and cross-country experience by lead-sponsoring firms within industries can both have spillover effects reducing perceived credit risks and changing capital structure. But this conjecture about experience might be extended to *all* syndicate members, not just the lead sponsoring firm. Future research might address this alternative and decidedly collective formulation of project finance company experience.

#### Limitations and future research

Indeed, we see several promising avenues for future research on Asian project finance organization, strategy, and credit risk. Exploration of syndicate structure and characteristics beyond mere size and diffusion of ownership holds tremendous

potential for understanding more clearly and deeply project finance company organization and strategy. Collective syndicate experience, foreignness and familiarity are all likely to matter for how a project is capitalized and what that means for project credit risk. Previous syndicate “success” at constructing and operating a project may matter more than mere experience. The syndicate unit of analysis is neither an alliance nor a network nor other cooperative form of doing business that previous management researchers have studied in depth. Syndicate structures and dynamics are unknown territory that Asian project finance may help us finally explore. Since this investment form accounts literally for billions of dollars in Asian economic activity, there is some practical urgency for such exploration.

We did not examine changes in credit risk and capital structure in individual project companies *over time*. Insights from longitudinal research of one or a few project companies from initial announcement to financing, to construction, operation and conclusion could contribute to understanding whether and how the relative importance of country-, industry-, syndicate-, lead-sponsoring firm-, and project-factors shaping credit risk and capital structure evolve.

Our study included only one project-specific factor in explaining *Leverage*, project size. Surely management research can and should uncover other project-specific factors to join size. We think there is great value in looking more deeply into the distinct patterns of contracts linking the company and its sponsors to creditors. This sort of research extension is unlikely to begin with large-sample statistical studies as we have just executed. The next logical step may be thick descriptive case study of two or three recent Asian projects and their respective loan agreements. Indeed, a broader research agenda for project finance in Asia should include substantial qualitative work complementing broad sample quantitative studies. That way, the Asian past and present experience with Asian project finance can continue to inform future research both for Asia and the world.

## Conclusion

We developed and tested a framework linking credit risk to capital structure in project finance companies active in Asia from 1995–2004. We found support for hypothesized relationships derived from our framework, particularly with respect to country-level factors linked to institutional and macroeconomic theories, syndicate structure factors linked to agency theory, and lead sponsor experience and project size factors linked to learning and transaction cost theories. We observed substantial effects on project finance company capital structure linked to country institutional credit risk factors, but also note the importance of syndicate structure and previous sponsor experience. The Asian experience with project finance can shed important new light on how companies respond to credit risk at different levels through variation in capital structure. Asia’s recent history with project finance and the novel syndicate and sponsor structures related to project finance merit greater attention from researchers working at the intersection of FDI, corporate finance and risk assessment. Our study takes a first step and urges other management researchers to stride further within Asia and around the world.

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