The Economic Motivations for Using Project Finance *

by

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Abstract

One of the key assumptions underlying Modigliani and Miller's irrelevance proposition is that financing structures do not affect firm value. Yet the rise of project finance, from less than $10 billion per year in the late 1980s to almost $220 billion in 2001, provides strong *prima facia* evidence that financing structures do, indeed, matter. Analysis of sponsoring firms and project companies illustrates how financing structures affect managerial investment decisions and subsequent cash flows. Project finance creates value by reducing the agency costs associated with large, transaction-specific assets, and by reducing the opportunity cost of underinvestment due to leverage and incremental distress costs. Besides describing the economic motivations for using project finance, this paper provides institutional details on project companies and sheds new light on existing theories of capital structure, corporate governance, and risk management.

1. Introduction

Modigliani and Miller (1958) show that corporate financing decisions do not affect firm value under certain conditions. Their "irrelevance" proposition is powerful because it highlights the factors that make financing decisions value relevant. One of the key assumptions underlying their irrelevance proposition is that that financing and investment decisions are separable and independent activities. When this assumption holds, various financing decisions such as the firm's organizational, capital, board, and ownership structures do not affect investment decisions or subsequent cash flows.

The rise of project finance, defined as the creation of a legally-independent project company financed with nonrecourse debt, provides strong *prima facia* evidence that financing structures do, indeed, matter. Total project-financed investment has grown from less than $10 billion per year in the late 1980s to almost $220 billion in 2001 (Esty, 2002a). Within the United States, firms financed $68 billion of capital expenditures through project companies in 2001, approximately twice the amount raised in initial public offerings (IPOs) or invested by venture capital firms.[1] While considerably smaller than the U.S. leasing, asset-backed security, and corporate debt markets—$240 billion, $354 billion, and $434 billion, respectively, in 2001—project finance is, nevertheless, one of the most important financing vehicles for investments in the natural resources and infrastructure sectors such as power plants, toll roads, mines, pipelines, and telecommunications systems.[2] Despite an estimated 40% decline in the use of project finance during 2002, it is likely to grow in the coming years as cash-strapped governments in both developed and developing countries seek ways to finance desperately needed infrastructure investments with private sector participation and capital.[3]

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[1] The total amount raised in initial public offerings in 2001 was $37.5 billion according to Thompson Financial Securities Data; the total amount invested by venture capital firms was $36.4 billion according to VenturExpert—both were down sharply in 2001.

[2] The data on corporate bonds and asset-backed securities comes from Thompson Financial SDC while the data on leasing comes from the Equipment Leasing Association.

[3] According to the World Bank, Asian countries alone, which historically have accounted for only 15% of the project finance market, need to invest $2 trillion in infrastructure over the next decade to maintain their current rate of development (Yin, 1998). Within the United States, Vice President Cheney's National Energy Policy Report (2001, p. xi) estimates that the U.S. needs to build at least 1,300 new

Given the fact that it takes longer and costs more to structure a legally independent project company than to finance a similar asset as part of a corporate balance sheet, it is not immediately clear why firms use project finance. For it to be rational, project finance must entail significant countervailing benefits to offset the incremental transaction costs and time. Yet these benefits are not well understood nor have they been accurately described in the academic or practitioner literatures. Nevitt and Fabozzi (2000, p. 5), for example, claim that, "Project financing can sometimes be used to improve the return on the capital invested in a project by leveraging the investment to a greater extent than would be possible in a straight commercial financing of the project." While it is true that leverage increases expected equity returns, this motivation for using project finance fails to recognize that higher leverage also increases equity risk and expected distress costs. By itself, this explanation does not provide a compelling reason to use of project finance.

Drawing on existing finance theory, detailed case studies, and extensive field research, I describe the three primary motivations for using project finance. The motivations explain why financing assets separately with nonrecourse debt creates value, and why it can create more value than financing assets jointly with corporate debt, the most likely financing alternative. I argue that project finance solves two financing problems: 1) it reduces the cost of agency conflicts inside project companies; and 2) it reduces the opportunity cost of underinvestment due to leverage and incremental distress costs in sponsoring firms.

Before describing these motivations, I need to highlight an important assumption underlying my analysis and arguments. Project finance involves both an investment decision involving a capital asset and a financing decision. Looking first at the investment decision, McConnell and Muscarella (1985) show that firms experience positive and significant returns when they announce increases in capital expenditures. This finding differs from the announcements regarding acquisitions: Jensen and Ruback (1983) show that merger announcements generate non-positive returns for acquirers. Whereas investment decisions, particularly the decision to acquire, could reflect empire

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power plants over the next 20 years to avoid crises like the one that recently occurred in California. Most of these plants will be financed through project companies.

building by managers, it is more difficult to imagine reasons why a manager might overspend on financing an acquisition or an investment or what personal benefits he or she could derive from such a financing choice. For this reason, I assume the decision to use project finance—a change away from the traditional way of financing investment opportunities—reflects an attempt by managers to reduce total financing costs. Alternatively, one can interpret the decision to use project finance as a neutral mutation with no effect on firm value or as a manifestation of value destroying agency conflicts implemented by managers guided by personal, not firm, objectives. The amount of money at stake makes it likely the financing decisions are careful and deliberate, not expedient. The need to raise external capital, typically from banks, makes it significantly more difficult to finance negative NPV projects. Convincing bankers, who have limited upside potential yet bear significant downside exposure, to provide the majority of the capital is an important constraint on the investment process. In fact, Bharadwaj and Shivdasani (2003) show that the returns to firms announcing cash tender offers increase proportionally with the amount financed by bank debt. Under the critical assumption that financing choices reflect rational attempts to increase firm value, I describe how project finance can reduce the financing costs associated with new capital investments.

The first motivation to use project finance, the *agency cost motivation*, recognizes that certain assets, namely large, tangible assets with high free cash flows, are susceptible to costly agency conflicts. The creation of a project company provides an opportunity to create a new, asset-specific governance system to address the conflicts between ownership and control. In many ways, the observed governance structures in project companies resemble leveraged-buyouts (LBOs) and achieve many of the same results described by Jensen (1989) and Kaplan (1989 and 1991). What makes project companies a particularly attractive setting in which to study free cash flow problems is the fact that they have few growth options. Most projects are, in fact, wasting assets (e.g., a gold mine) that optimally need to shrink over time.

Project structures can also reduce agency conflicts between owners and related parties. The transaction-specific nature of project assets creates a need to deter strategic behavior by suppliers of critical inputs or expropriation by host governments. The threat of opportunistic behavior or "hold-up" is especially severe in project companies where

the deals typically involve negotiations between bi-lateral monopolists. Project companies utilize joint ownership and high leverage to discourage costly agency conflicts among participants. Today, these agency cost motivations remain the most important reasons why firms use project finance.

In contrast to the agency cost motivation, which relates to the asset being financed, the two underinvestment motivations relate to the firms making the capital investments—these firms are known as "sponsoring firms" or "sponsors." Although underinvestment in positive net present value (NPV) projects can occur for many reasons, I focus on the effects of leverage and incremental distress costs as two important reasons, and show how project finance mitigates both effects. Project finance solves leverage-induced underinvestment by allocating project returns to new capital providers in a way that cannot be replicated using corporate debt. This *debt overhang motivation* is similar to the motivation described by Stulz and Johnson (1985) for using secured debt, but it is even more effective because it eliminates all recourse to the sponsor's balance sheet and it eliminates the possibility that new capital will subsidize pre-existing claims with higher seniority or reduce the value of junior claims (Myers, 1977). While it is true that the origin of the debt overhang problem is also an agency conflict, I distinguish the debt overhang motivation from the agency cost motivation because the conflict occurs at the sponsor rather than the project level.

The third motivation, *risk management*, recognizes that investing in risky assets can generate incremental distress costs for sponsoring firms. When these indirect or collateral distress costs are sufficiently large, at least in expectation, they can exceed the asset's net present value (NPV), thereby turning a positive NPV project into a negative investment (the total NPV is negative). By isolating the asset in a standalone project company, project finance reduces the possibility of risk contamination, the phenomenon whereby a failing asset drags an otherwise healthy sponsoring firm into distress. It also reduces the possibility that a risky asset will impose indirect distress costs on a sponsoring firm even short of actual default. For example, Lamont (1997) shows how a shock to oil prices affected investment decisions in nonoil subsidiaries. Similarly, a large loss on a corporate-financed asset could affect investment decisions in the sponsor's other divisions, or investment decisions by related firms involved in joint production with the

sponsoring firm. Even when project debt is fairly priced, the expectation of costly externalities of this kind can discourage investment.

Although I cast the risk management motivation in terms of a rational manager rejecting a positive NPV asset because of the incremental distress costs it imposes on the sponsoring firm, I can, alternatively, describe this motivation in terms of a risk averse manager seeking to protect his or her poorly diversified human capital. While the end result is the same—failure to invest in positive NPV projects—the underlying causes are different. In the former case, it is about a rational, risk-neutral manager avoiding a negative NPV investment due to the incremental distress costs while in the latter case, it is about an agency conflict between ownership (risk neutral shareholders) and control (risk averse managers).

Compared to the first two motivations, what is different about the risk management motivation is the interaction between the sponsoring firm and the asset: the agency cost motivation addresses the asset while the debt overhang motivation addresses the sponsoring firm. The risk management motivation has not been described previously in the finance literature, yet it is consistent with an emerging literature on the magnitude of investment distortions (Parrino, Poteshman, and Weisbach, 2002). It is also consistent with Stulz's (1999) observation that the same market imperfections we readily incorporate into capital structure and risk management theories, such as distress costs, are often ignored in capital budgeting analysis. Project finance differs from traditional risk management strategies because it involves a change in organizational form rather than the use of financial instruments or derivatives. Risk management via organizational form is more appropriate for situations where the financial instruments do not exist or are expensive to purchase, or where the possibility of a total loss exists (i.e., the distribution of possible losses exhibits large negative skewness).

The risk management motivation is intriguing because it generates counter-intuitive implications. For example, the benefits of diversification are a cornerstone of portfolio theory. But in the context of financing and investment decisions, financing assets jointly (corporate finance) permits risk contamination and is a necessary condition for debt overhang. Whereas diversification can be costly, specialization—financing assets separately through project companies—limits the amount of collateral damage a

failing investment can impose on a sponsoring firm, and prevents sub-optimal investment strategies due to debt overhang.

In addition to describing each of the motivations, I illustrate them with specific examples and, where possible, with data from larger-sample research. Although I use the case studies to develop and illustrate the ideas in this paper, their consistency does not constitute a statistical test of validity. Instead, support for the ideas comes from a much larger set of detailed case studies (Esty, 2003a) as well as interviews with more than 150 practitioners including project finance bankers, advisors, lawyers, and corporate executives. Clinical research of this nature has proven useful in other settings such as Donaldson's (1961) analysis of corporate debt policy and Sahlman's (1990) analysis of venture capital organizations. It has also proven useful as a way to study contractual agreements [see Smith and Warner (1979) on bond covenants] and organizational structures [see Mian and Smith (1992) on accounts receivable management.]

The paper contains five sections. Section 2 defines project finance and describes the key structural features that characterize project companies. In addition to providing basic institutional details that are necessary to understand the arguments made later in the paper, this section provides new data on the structural attributes of project companies and contrasts them with what we observe in public corporations. I describe the agency cost and underinvestment motivations for using project finance in Sections 3 and 4, respectively, and conclude in Section 5. Throughout this paper, I refer to various Harvard Business School case studies by their shorthand names and an assigned case number [e.g., Mozal, case **#C-7,** instead of "Financing the Mozal Project"). The **Appendix** provides a list of these case studies and a brief description of each one.

2. Defining Project Finance

Project finance involves the creation of a legally independent project company financed with nonrecourse debt for the purpose of investing in a capital asset, usually

with a single purpose and a limited life.[4] One of the most important aspects of this definition is the distinction between the asset (the project) and the financing structure. Whereas both firms and assets can have exogenous characteristics that make them appropriate candidates for project finance, the financing structures themselves are endogenous responses to these asset characteristics and the contracting environment. I argue, in Sections 3 and 4, that project finance reduces the net cost of financing these assets. In other words, project companies have evolved as institutional structures that reduce the cost of performing important financial functions such as pooling resources, managing risk, and transferring resources through time and space (Merton and Bodie, 1995). As a foundation for the theoretical arguments made later in the paper, I begin by describing some basic institutional details on the structure of project companies.

2.A. Structural Attributes of Project Companies

Figure 1 shows a typical gas-fired power plant and illustrates the unique structural attributes that characterize project companies. Where possible, I illustrate some of these structural features using cross-sectional data from a large sample of projects contained in the Thompson Financial SDC Project Finance Database.

- **Organizational Structure**: Project companies involve separate legal incorporation—the power plant is legally independent from the three sponsoring firms. Special purpose vehicles (SPV's, or special purpose entities, SPE's) created to facilitate asset securitization share this feature of separate incorporation. Secured debt, a corporate obligation, does not.

- **Capital Structure**: Project companies employ very high leverage compared to public corporations. **Figure 2** shows the average (median) project company has a book value debt-to-total capitalization ratio of 70.0% (70.0%) compared to 33.1% (30.5%) for similar-sized firms listed in the Compustat database. Whereas few project companies have leverage ratios below 50%, almost 30% of public

[4] A recent article in the *Wall Street Journal* on Enron Corporation illustrates the confusion that exists in practice surrounding the definition of project finance. The article defined project finance as, "…a term that typically refers to money lent to build power plants or oil refineries." (Pacelle et al., 2001)

corporations have leverage ratios less than 5%. From this perspective, project companies resemble leveraged buyouts (LBOs).

- **Ownership Structure**: Project companies have highly concentrated debt and equity ownership structures. Most of the debt comes in the form of syndicated bank loans, not bonds, and is nonrecourse to the sponsoring firms (Esty, 2001b). As a result, creditors must look to the project company itself for debt repayment.

  In terms of equity ownership, the typical project company has from one to three sponsors, and the equity is almost always privately held. Looking only at the concentrated equity ownership structure, project companies resemble venture-backed companies. **Figure 3a** shows that the average (median) project has 2.7 (2.0) sponsors. **Figure 3b** shows that a majority shareholder controls most projects. In the average project company, the largest single sponsor holds 65% of the equity; in 30% of all projects, a single sponsor holds all of the equity. The concentrated equity ownership resembles pre-IPO venture-backed companies, except that managers do not typically own any project equity.

- **Board Structure**: Project boards are comprised primarily of affiliated (or "gray") directors from the sponsoring firms. According to **Table 1**, 83% of the directors are affiliated with the project company compared to 37% in reverse LBOs (Gertner and Kaplan, 1996), 25% in IPO firms (Baker and Gompers, 2001), and 10% in large public companies (Yermack, 1996). In terms of size, the typical project board has 9.8 members, a number that is overstated because my sample includes mostly large projects (average total cost is $1.9 billion) and there is a weak, but significant positive relation between project size and board size.

- **Contractual Structure**: Project finance is sometimes referred to as "contract finance" because a typical transaction can involve as many as 15 parties united in a vertical chain from input suppliers to output buyers through 40 or more contractual agreements.[5] The four major project contracts govern the supply of inputs, purchase of outputs (known as off-take or purchase agreements), construction, and operations. Larger deals can have several hundred and up to several thousand contracts.

[5] According to the Australian Contractors Association, the Melbourne City Link Project, a A$2 billion road infrastructure project, had over 4,000 contracts and suppliers (see the 2002 award finalists at www.constructors.com.au).

At first, many of these structural features appear counter-intuitive especially when compared to the alternative of using corporate finance. Creating a stand-alone project company takes more time (from 6 to 18 months more) and requires significantly greater transaction costs than financing an asset on an existing balance sheet. Klein, So, and Shin (1996) find that total transaction costs for infrastructure projects average 3% to 5% of the amount invested, but can be as high as 10% for smaller and unique or first-of-a-kind projects. Project debt is often more expensive than corporate debt—spreads (promised yields) can be 50 to 400 basis points more—because creditors cannot rely on the cross-collateralized cash flows and assets the way they can with corporate debt (Lewellen, 1971). Finally, the combination of high leverage and extensive contracting severely restricts managerial discretion. For long-term projects with uncertain futures, managers of both sponsoring firms and project companies might prefer greater discretion. In reality, however, the individual structural components fit together in a very coherent and symbiotic way, and can reduce the net financing costs associated with large capital investments. To make this argument, I use the following framework.

2.B. Framework for the Analysis

The key to understanding why project finance creates value is to recognize that firms bear "deadweight costs" (DWC) when they invest in and finance new assets. These deadweight costs (transaction costs, agency costs, distress costs, information costs, and taxes) result from capital market imperfections or frictions. To illustrate how project finance creates value, I break the analysis into components in an approach that resembles Myers' (1974) adjusted present value (APV) methodology. The value of a new capital investment equals the present value of project cash flows (the optimal value in a frictionless setting) minus the deadweight costs associated with the project and with the sponsoring firm.

Investment value = (Project value) - (Project DWC) - (Incremental Firm DWC)

For the sake of simplicity, I assume that only the deadweight costs change under alternative financing structures; the project NPV is positive and does not change. Because the project has a positive NPV by itself, the firm should undertake the investment as long as the sum of the deadweight costs does not exceed the project's NPV. Financing decisions matter because they affect the existence and the magnitude of the deadweight costs. Although these deadweight costs are difficult to quantify in practice, this framework helps identify the factors that drive financing decisions.

Sponsors should use project finance whenever the total deadweight costs are lower than the total costs under corporate-financed alternatives. To see when this occurs, recall that structuring a project company entails very significant transaction costs. In the absence of other benefits, firms would never use project finance. For exactly this reason, BP Amoco (**Case #C-2**) has a policy statement that says never use project finance except in a few very special situations. But there are other benefits: financial structure can reduce deadweight costs. When these costs are sufficiently large under a corporate-finance structure, project finance can be an attractive alternative. In the following sections, I analyze three reasons why project-financed investment creates value, and why it might create more value than corporate-financed investment.

3. Project Structure Reduces Costly Agency Conflicts

Certain characteristics make assets prone to costly agency conflicts. Assets that generate high operating margins and significant amounts of cash flow can lead to sub-optimal effort and excessive perquisite consumption (Jensen and Meckling, 1976). More importantly, assets that generate free cash flow—cash flow in excess of what is needed to fund all positive NPV projects—can lead to inefficient investment and value destruction on a much larger scale (Jensen, 1986; Harford, 1999; and Blanchard, Lopez-de-Silanes, and Shleifer, 1994). A typical project such as the $3.4 billion Chad Cameroon Pipeline (case **#C-4**) generates EBITDA margins of 80-85% and up to $1 billion of cash flow per year for 30 years or more. Even smaller projects that purchase commodity inputs, such as a $250 million gas-fired power plant (see the Calpine case, **#C-3**), generate EBITDA

margins on the order of 30-50% and up to $25 million of cash flow annually. Because project assets have limited lives—they either wear out, become obsolete, or become depleted—they typically have few positive NPV growth options. As a result, it is optimal for them to shrink and return free cash flow to the capital providers rather than growth through reinvestment. Costly agency conflicts arise when managers, who control investment decisions and cash flows, have different incentives from capital providers.

Another asset characteristic, asset specificity, can also lead to costly agency conflicts between transacting parties in the form of *ex ante* underinvestment and *ex post* opportunistic behavior, also known as "hold-up" (Williamson, 1985; Klein, Crawford, and Alchian, 1978). The decision to locate a coal-fired power plant next to a coal mine, for example, leaves the owners of the power plant vulnerable to expropriation and *ex post* renegotiation (Joskow, 1985). Producing specific outputs, like requiring specific inputs, can also leave a firm exposed to opportunistic behavior. When assets have either transaction or relationship-specific uses, they become susceptible to incentive conflicts.

Because project companies are new and independent firms, project sponsors have the opportunity to create asset-specific governance systems to address these agency conflicts in ways that cannot be replicated under corporate finance. If the same assets were financed using corporate finance, then the company's existing structure would govern the asset and its cash flows. In most cases, the existing governance system was not designed to address asset-specific agency conflicts. By tailoring the governance structure to fit the specific application, sponsors can minimize the costs associated with agency conflicts. In doing so, they increase the asset's expected cash flows and the likelihood sponsors will earn an appropriate return on their invested capital, which is exactly what Shleifer and Vishny (1997) say governance systems should do.

3.A. Conflicts Between Ownership and Control

Solving the problems associated with the separation of ownership and control is particularly important in project companies where few of the traditional sources of discipline are present or effective. The takeover market is essentially non-existent

because project equity is privately held, which means information is relatively scarce and shares are difficult to purchase. As described in the next section, project equity is concentrated and privately held to ensure that critical deal participants do no act opportunistically. Diffuse equity ownership will not induce optimal behavior and will result in lower project value even if it is more efficient in terms of risk bearing. Product markets do not exert much influence on project companies because they are, once complete, low-cost producers. As a general rule, bankers will not finance a project unless it is expected to be in the bottom 25% of the industry cost (supply) curve. Reputation plays a very limited role in project finance. At the sponsor level, reputation effects are nullified by the nonrecourse nature of project loans; reputation is only a factor for sponsors that repeatedly enter the project finance market. At the project level, reputations do not exist because most projects are greenfield entities. And as soon as they are completed, the assets begin to lose value as most of them have limited lives. For this reason, the benefits of constrained behavior diminish through time and will unravel from the end through backwards induction for projects with fixed lives.

Even the mechanisms used to discipline managers of start-up firms—the opportunity for a liquidating event such as an IPO or an acquisition (Baker and Montgomery, 1994) and the threat of staged financing with contingent ownership (Gompers, 1995; Kaplan and Strömberg, 2002; and Sahlman, 1990)—are less effective in the context of project companies. Liquidating events are neither common nor possible because most projects have limited lives. As a result, asset values decline to zero over time (or less than zero in the case of projects with substantial remediation costs such as mines). Staged commitment is not an acceptable disciplinary mechanism because most projects are not worth much prior to completion (e.g., a half finished bridge, tunnel, or pipeline is much less valuable than a going concern) and the equityholders, who typically put their money in first, lose bargaining power once they have invested. Moreover, staging is most valuable when you can learn something about project or managerial performance. In the context of a toll road or power plant, however, you do not learn much, if anything, about underlying demand until the project has been completed and is operational. Because few if any of these traditional governance mechanisms work, sponsors must create alternative, project-specific governance structures to curb

managerial discretion. When the opportunity for costly incentive conflicts exists, it is worth incurring the transaction costs to minimize the agency costs.

Finnerty (1996) and Kensinger and Martin (1988) note that sponsors structure project companies to limit managerial discretion over free cash flow. First, they use contracts to constrain managerial discretion. Contracts both prescribe and proscribe certain actions by involved parties. One of the fundamental contracts in every project company is the "cash flow waterfall," which prioritizes claims on cash flows and allocates cash flows accordingly. Through the waterfall, parties agree in advance to virtually all capital expenditures, maintenance expenditures, debt service, reserve accounts, and shareholder distributions. Although contracts work well as a first line of defense, they are, inevitably, incomplete even when the documents extend for thousands of pages. Unforeseen outcomes, unspecified situations, costly enforcement, and asymmetric information all leave the sponsors vulnerable to agency conflicts. As underlying uncertainty increases, whether at the project, sponsor, industry, or country level, the probability that a long-term contract will remain intact decreases. As a result, sponsors use other aspects of project structure to "complete" the contracts *ex post*.

Sponsors use concentrated ownership, unique boards of directors, separate legal incorporation, and high leverage to limit managerial discretion. Concentrated debt and equity ownership provide critical monitoring of managerial actions. By using bank debt instead of public bonds, sponsors gain the benefits of creditor monitoring as described by Diamond (1984) and Esty (2001b), and demonstrated by James (1987). Similarly, concentrated equity ownership gives sponsors the incentive to monitor managerial actions while board membership—recall that boards are comprised almost entirely of gray directors from sponsoring firms—gives them the ability to hire and fire senior managers, and to approve important operating decisions. With only a few shareholders, free riding on the efforts of other sponsors is less of a concern. Finally, separate legal incorporation significantly reduces the cost and difficulty of monitoring managerial actions and assessing performance. Rather than monitoring co-mingled cash flows from numerous assets, and trying to sort out noisy signals on managerial skill, the capital providers monitor relatively simple cash flow streams from a single asset.

The last, yet probably most important, line of defense is capital structure. High leverage forces project managers to disgorge free cash flow (Jensen, 1986; Stulz, 1990). Because the repayment of project debt is totally dependent upon project cash flows, it has a much stronger incentive effect on project managers than corporate debt, whose repayment occurs through corporate cash flows. In essence, the corporate balance sheet provides a safety net even when the debt is allocated internally against specific assets, projects, or divisions. The incentives to generate cash are less acute in the presence of a safety net. In addition to leverage, the use of senior (i.e., "hard") bank debt in particular forces managers to generate and pay out cash flow in the early years (Hart, 1993; Hart and Moore, 1995). Even though long-term bonds provide a better match with the duration of project cash flows—projects have lives ranging from 10 to 50 years—sponsors use shorter term bank debt with maturities ranging from five to 15 years.[6] Thus, both the *amount* and the *type* of debt reinforce contractual payouts mandated by the cash flow waterfall.

In summary, this combination of structural features (extensive contracting, concentrated debt and equity ownership, separate legal incorporation, and high leverage) effectively controls managerial discretion at the project level. Relative to corporate governance systems, project governance systems are much more effective at eliminating wasteful expenditures, discouraging sub-optimal investment, and inducing coordinated, value increasing effort.

One indication that project governance systems work is the fact that project managers have relatively "flat" pay-for-performance compensation schemes. The typical chief executive of a project company receives (1) a base salary; and (2) a performance bonus equal to a relatively small fraction (0-50%) of the executive's base salary. Although the absence of high-powered incentives is consistent with the resolution of agency conflicts by other means, an alternative interpretation is that high-powered incentives are not needed in the first place. Like managers of regulated businesses, project managers make very few, if any, strategic decisions. Most of the important

[6] To solve the problem of interest rate risk stemming from variable rate bank loans, projects typically enter into fixed-for-floating rate swap contracts. Another reason, besides a longer maturity, sponsors might prefer to use bonds over bank loans is because bonds typically have fixed rates, thereby eliminating interest rate exposures.

strategic decisions (e.g., should we build the pipeline? over which route? with which partners, how big? etc.) are made before the project begins. Instead, project managers make tactical and day-to-day operating decisions. Baker and Hall (1998) and Palia (2000) hypothesize that managers of regulated firms have lower marginal products of labor and, therefore, require less pay-for-performance compensation. Compared to venture-backed firms where managers are responsible for managing growth options and for transforming *small* amounts of capital into large companies worth 100 to 1000 times the original investment amount, project company managers are responsible for transforming *large* amounts of capital into something worth just a little more (Esty, 2002c). The "best case" valuation scenarios in project finance are often only two to 10 times the "base case" scenarios.

3.B. Conflicts Between Ownership and Related Parties (Opportunistic Behavior)

A second type of agency conflict, opportunistic behavior by related parties, also threatens sponsors' abilities to capture project cash flows, thereby reducing expected returns as well as ex ante incentives to invest. The two most common culprits are related parties that supply critical inputs or buy primary outputs and host nations that supply the legal system and contractual enforcement. Because so many projects involve bargaining situations between bilateral monopolists, there is a need to discourage opportunistic behavior before making a large, durable, indivisible capital investment. The potential for opportunistic behavior is a key feature that distinguishes project finance from general-purpose commercial real estate finance.

Sponsors use long-term contracts to avoid the "fundamental transformation" that takes place following investment in transaction-specific assets (Coase, 1937; Williamson, 1985). The "bidding situation" that exists before the investment is made becomes a "bargaining situation" after it is made. Joskow (1987) shows that contract duration between coal mines and nearby power plants increases with asset specificity. In a related study, Joskow (1985) finds that vertical integration is more common than contracting as a solution to hold-up problems, at least for mine mouth coal plants. But vertical integration

is not always possible or desirable; many companies prefer not to hold large risky assets on their balance sheets (see the risk management motivation in Section 4 below). As a result, sponsor must use long-term contracts backed up with joint ownership structures to induce optimal behavior. This allocation of project ownership recognizes the importance of both residual cash flow rights (Jensen and Meckling, 1976) as well as asset control rights (Grossman and Hart, 1986) in resolving agency conflicts among deal participants.

Sponsors then use high leverage to enforce the contracts. In the presence of high leverage, even small attempts to appropriate value will result in costly default and, possibly, a change in control. Consistent with this idea, Bronars and Deere (1991) find that unionized firms tend to have higher leverage than non-unionized firms as a way to deter expropriation of firm value and increase perceived "toughness" in union negotiations.[7]

The Petrozuata project (Esty, 1999; and case **#C-8**), which consists of an inland oil field and a pipeline to the coast, clearly manifests concerns about opportunistic behavior. Rather than having separate owners for the oil field and the pipeline, the sponsors own them both. They do not, however, own the ships that transport the heavy crude from the Venezuelan coast to refineries in the United States because ships are not specific to this transaction. Project ownership also reflects concerns about hold-up by downstream partners because only a few refineries can process the output, a heavy form of crude oil. The project has a 35-year off-take agreement (purchase contract) with Conoco whose Lake Charles refinery is one of the closest refineries that can process the oil.[8] Despite having a long-term contract with Conoco, PDVSA (the Venezuelan national oil company) still wanted Conoco to be an owner in part to avoid the potential for ex post conflicts between them as bilateral monopolists.

A second example is the critical role played by the owners of landing stations in the Australia-Japan Cable case (AJC, case **#C-1**). While the project sponsors could easily buy and install the $500 million submarine telecommunications cable, they were

[7] In related arguments, Baldwin (1983) shows how firms can use inefficient technology to deter wage renegotiations following investment in durable capital while Smith (1986) shows how regulated utilities use high dividend payouts to discourage reductions in allowable rates of return.

[8] Long-term off-take contracts with high-rated firms can boost a project's credit rating considerably. Dailami and Hauswald (2001) analyze the Ras Gas project and show that the off-taker's credit rating affects the project bond's prices because of the long-term offtake contract.

beholden to on-shore telecommunications firms to provide connections into the local phone networks—these connection occur through landing stations. Landing stations, however, are in very short supply and it is extremely difficult to get permission to build new ones near major cities. The problem is even more severe because submarine cable operators require, for redundancy reasons, multiple connections into local networks. To prevent the possibility of hold-up by landing station owners, the lead sponsor (Telstra) expanded the ownership group to include landing station owners along the route (Australia, Guam, and Japan). Telstra created the joint ownership structure even though could and did signed long-term "landing party agreements" with each party. As with the Petrozuata example described above, Telstra enforced the contracts with a capital structure comprised of 85% debt. Interestingly, AJC has been able to withstand the downturn in the telecommunications market largely because it signed pre-sales contracts with each of its major sponsors obligating them to buy capacity on the system.

Similar concerns exist about transaction-specific *inputs* from upstream suppliers. In the Equate case (case **#C-5**), production requires access to ethane gas and proprietary technology. Petrochemical Industries Company (PIC) has a large ethane plant in Kuwait while Union Carbide possesses proprietary technologies for making petrochemicals, respectively. Together they formed the Equate project and signed a long-term supply agreement for both inputs. Once again, long-term contracts combined with joint ownership mitigate potential hold-up problems by inducing optimal behavior in situations where contracts are incomplete.

Like upstream or downstream parties, host governments can also behave opportunistically because they, too, provide a critical input, namely the legal system and the protection of property rights. When corporate law does not exist or when property rights are not strictly enforced, sponsors are vulnerable to expropriation by host governments. Though not confined to developing countries, these problems are far more prevalent in developing countries. Referred to as "sovereign" or "political" risk, the end result of either direct expropriation in the form of asset seizure or creeping expropriation

in the form of increased tax or royalty rates is a decrease in project cash flows available to capital providers.[9]

The Mozal project (case **#C-7**), a $1.4 billion aluminum smelter in Mozambique, provides an example of how project structure can be used to mitigate sovereign risk. First, the sponsors insisted the Mozambican and South African governments sign an agreement to protect cross-border investments. Second, the sponsors created a stand-alone project company so that acts of expropriation or other forms of sovereign interference would be highly visible to the outside world. Third, the sponsors adopted a highly leveraged capital structure as a way to discourage expropriation. Leverage forces the project company to disgorge excess cash, thereby leaving less in the host country as a temptation for expropriation, and "hardens" the contractual terms. Leverage also lowers reported profits; high profitability is often a lightening rod for emerging markets projects.[10] And finally, the sponsors assembled a group of international lenders comprised of major financial institutions, development banks, export credit agencies, and multi-lateral agencies [e.g. the International Finance Corporation (IFC) and the World Bank—the "lender of last resort" for developing countries] as a deterrent against expropriation. This financing strategy shows that not all capital is created equal; the identity of capital providers is an important determinant of project success. In summary, this structural and institutional approach to risk management discourages sovereign interference by making it more costly to do (see Fruhan, 1979; and Moran, 1973).

This structural and institutional approach to risk management stands in sharp contrast to the financial approach commonly used in practice. In the face of considerable sovereign risk, managers typically increase the project's hurdle rate, often by some arbitrary amount, and accept only high-return projects. Accordingly, these high returns compensate the firm for bearing substantial risk. The structural approach, in contrast,

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[9] In a recent paper (Esty, 2003b), I analyze the determinants of foreign bank participation in the financing of large domestic projects. I find that foreign bank participation is positively related to the strength of creditor rights and the enforcement of contract law. Megginson and Esty (2003) also show that syndicated loans are more concentrated in countries with strong creditor rights and enforcement.

[10] When Bougainville Copper, the owner of a large copper mine in Papua New Guinea, announced the largest annual profit ever made by an Australian company in 1974, its stock price fell almost 14% (*The Economist*, 1974). Following the announcement, government officials from Papua New Guinea said they would begin renegotiating the company's mining agreement within six weeks. Previously, the mining agreement had been described as "exceptionally favorable" to Bougainville Copper.

recognizes that high returns can actually induce high risk as the perception of gouging a desperate host nation or local constituency increases. Wells and Gleason (1995) call this phenomenon the "paradox of infrastructure investment." Rather than increasing required returns, a better solution is to reduce the risk through careful structuring. As the sovereign risk falls, the appropriate required return falls, and the threat of ex post renegotiation falls. The Mozal (case **#C-7**) and Petrozuata (case **#C-8**) cases illustrate this structural approach to risk management.[11]

In conclusion, the probability that opportunistic behavior or expropriation will reduce cash flows intended for capital providers is a function of project structure. Corporate-financed transactions are more susceptible to expropriation and hold-up for many reasons. They generally do not involve joint ownership and even when they do (i.e. equity joint ventures) they are susceptible to free cash flow problems unless they raise external debt tied to the project. Second, expropriation can occur in corporate-financed transactions without triggering an event of default because multiple corporate assets and cash flows cross-collateralize each debt obligation. In contrast, even small acts of creeping expropriation can cause a highly leveraged project company to default. Quick detection and prompt corrective action can reduce the ultimate loss in value, something Wruck (1990) points out in the context of corporate bankruptcies. In fact, projects are designed to have defaults with quick resolution to prevent significant loss in value (Esty, 2002b). Third, important multi-lateral lenders such as the IFC, which provide critical deterrence against expropriation and contract repudiation, lend only to project companies but not to corporations. And fourth, the discipline of nonrecourse debt is stronger than the discipline of corporate debt. A manager, knowing that a corporate safety net does not exist (i.e. cash flows from other divisions or assets are not available to cross-subsidize project cash flows), has stronger incentives to generate cash flow to meet debt obligations. This ability to create new, and possibly quite different project governance structures allows sponsors to mitigate opportunistic behavior more effectively than alternative corporate governance structures.

[11] While the problem of expropriation and contract renegotiation [e.g., Enron's Dabhol plant in India is commonly associated with developing countries, it can also be a problem in developed countries. For example, Calpine (case **#C-3**) signed long-term power contracts with the state of California at the height of the power crisis in the spring of 2001 worth almost $10 billion. The state, after declaring the contracts to be "unjust and unreasonable," has unilaterally abrogated the contracts (Hunt, 2002).

3.C. Conflicts Between Debhtholders and Equityholders

Debtholder/equityholder (lender/sponsor) conflicts typically revolve around the distribution and re-investment of cash flow, and the restructuring of distressed firms. Lenders, like sponsors, benefit by project structures that limit managerial discretion over cash flow. Debate surrounding the structure of the cash flow waterfall is extensive and intense in virtually all projects. In the end, lenders impose stringent contractual provisions as a way to protect their investments from managerial actions. Sponsors agree to these provisions as a way to lower the project's borrowing cost.

Although high leverage can lead to risk shifting and underinvestment in many corporate settings (Jensen and Meckling, 1976), these distortions are less important in the context of project finance. With few valuable growth options available, the opportunity cost of underinvestment due to leverage is essentially negligible in project companies. Similarly, the opportunities for risk shifting do not exist because the cash flow waterfall restricts investment decisions while concentrated ownership ensures close monitoring and adherence to the prescribed "rules." This absence of agency costs of debt combined with the presence of significant agency costs of equity and free cash flow problems, explains why project companies use highly leveraged capital structures.

Whereas sponsors select and then apply project finance to assets that are less prone to investment distortions and more amenable to contract-based governance systems, they design liability structures to minimize debtholder/equityholder conflicts in distress situations. First, projects rely primarily on bank debt, which is much easier to restructure than bonds. Second, sponsors minimize the number of creditor classes—typically there is only a single class of bank debt with a small group of "instructing banks" which have the ability to approve waivers and other changes to loan documents (see Esty, 2001b). When there are multiple classes of bank debt, they usually agree to *pari passu* treatment in default situations. For reasons described by Gertner and Scharfstein (1991), resolution is quicker and cheaper when there are fewer classes of creditors. Consistent with this proposition, Gilson, John, and Lang (1990) find that resolution occurs faster when there are fewer classes of creditors. When there are

multiple classes of debt, it is often the sponsors themselves that provide subordinated debt (see the Equate case, case #**C-5**). Thus, there are still only two classes of capital providers even though there are three types of capital (senior bank loans, subordinated debt—also known as "quasi equity", and equity) in what is a form of "strip" financing commonly used in buyout transactions. Corporate structures, by way of contrast, tend to have many more classes of debt and make greater use of bond finance. Moreover, corporate assets typically incorporate a far greater proportion of growth options relative to assets-in-place and, therefore, are more prone to investment distortions. For all these reasons, debtholder/equityholder conflicts are more severe in corporate settings. In fact, according to the available evidence, project loans have higher recovery rates and lower probabilities of default than unsecured corporate loans (Esty, 2002b).

4. Project Structure Reduces Costly Underinvestment

In addition to reducing agency conflicts in project companies, project finance reduces the opportunity cost of underinvestment by sponsoring firms.[12] Previous research shows that firms with high leverage (Myers, 1977), risk averse managers (Stulz, 1984; Smith and Stulz, 1985), and asymmetric information (Myers and Majluf, 1984) are more prone to underinvestment. A fourth reason, incremental distress costs associated with corporate financed investment, can also lead to underinvestment, but has not been fully described or modeled in the finance literature. Project finance can be used to mitigate each of these causes of underinvestment, yet sponsors normally use it to mitigate the effects of leverage and distress costs (note that managerial risk aversion is a variant of the distress cost argument and is discussed below). Nevertheless, I briefly mention how it can also be used to reduce underinvestment due to asymmetric information.

[12] At the same time, project finance can stop over-investment at the sponsor level. The need to raise *external* finance introduces a critical review of the project and its prospects that can result in better capital allocation (Kensinger and Martin, 1988). Separate legal incorporation also segregates project cash flows thereby preventing inefficient investment or cross-subsidization of other divisions (Scharfstein, 1998; Scharfstein and Stein, 1998).

Project finance reduces asymmetric information by eliminating the need to value assets-in-place.[13] Myers and Majluf (1984) show that underinvestment occurs only when capital providers have asymmetric information about both assets-in-place and investment opportunities. In addition to maintaining sufficient financial slack to avoid underinvestment, they also recommend separation as a possible solution. While financing assets separately clearly improves information flow, the information-based motivation has trouble explaining why nonrecourse debt, the *sine quo non* of project finance, is needed. Most of the information advantages could be obtained with corporate debt (e.g. secured debt) or some form of equity restructuring (e.g. equity carve-out, targeted stock, etc.).

4.A. Leverage-Induced Underinvestment (The Debt Overhang Motivation)

In contrast to firms that generate significant amounts of free cash flow, which can finance investment opportunities internally, highly leveraged firms have more trouble financing attractive investment opportunities. Project finance helps highly leveraged firms avoid this opportunity cost of underinvestment. It also allows firms with moderate leverage to raise funds and invest without becoming highly leveraged. The ability to preserve corporate debt capacity is particularly important when the assets should, ideally, be financed with high leverage for agency or tax reasons.[14, 15] Using corporate debt for

[13] Shah and Thakor (1987), in one of the first articles on project finance, assert that sponsor use project finance to minimize the cost of revealing inside information. Interestingly, the managers at BP Amoco (case **#C-2**) claim the opposite: project finance requires them to disclose *more* proprietary information than they would have to disclose under corporate finance. The BP Amoco view is more consistent with my interviews with other corporate finance executives.

[14] Besides reducing costly agency conflicts, as discussed in Section 3, another reason to use high leverage is to generate interest tax shields. Unlike the agency motivation where project debt is more effective than corporate debt at mitigating these conflicts, corporate and project debt generate the same interest tax shields, with a few exceptions that can tilt the advantage in either way. The desire to generate interest tax shields is a reason to use high leverage, but is not a reason to use project finance. Firms use project finance to achieve high leverage at the project level while avoiding the debt overhang problem at the sponsor level. Thus the reason for using project finance is to avoid underinvestment.

[15] In general, agency theory in the presence of incomplete contracts provides a better explanation than the trade-off theory for the highly-leveraged capital structures and the use of short-term bank debt. Despite having long lives, most projects pay down their debt relatively quickly, which is not optimal from a tax perspective (see the Petrozuata **case #C-8**). Moreover, the trade-off theory of capital structure cannot explain why certain projects such as Iridium (**case #C-6**) with many years of net

these kinds of assets can increase corporate leverage and leave the firm vulnerable to underinvestment. In contrast, using project debt allows the firm to preserve scarce corporate debt capacity and borrow more cheaply than it otherwise could.

Stulz and Johnson (1985) show that secured debt reduces leverage-induced underinvestment by allocating returns to new capital providers. Using similar logic, Berkovitch and Kim (1990), John and John (1991), Flannery *et al.* (1993) show that project finance achieves the same result through separate incorporation and nonrecourse debt. Project finance is more effective than secured debt (a form of corporate finance) because it eliminates all recourse back to the sponsoring firm; secured debt leaves a residual claim against the corporate balance sheet and, therefore, uses up corporate debt capacity. Besides secured debt, other corporate finance options include senior bank debt, which is often precluded by covenants on pre-existing loans, or a junior security such as subordinated debt or equity. Neither subordinated debt nor equity investors are likely to invest because their investments will be used to subsidize more senior claims. The only way to raise new equity is to issue it at a discount. Yet managers of highly leveraged firms, acting in the interest of existing shareholders, will not issue equity to avoid diluting the existing shareholders.

Calpine Corporation (case #**C-3**) provides a good example of a firm that uses project finance to avoid the opportunity cost of leverage-induced underinvestment. In the early 1990s, Calpine used project finance to finance new generating plants. Despite having a consolidated debt-to-total capitalization ratio as high as 95%, Calpine was regularly able to raise funds in the project loan market for new plants. During the late 1990s, Calpine adopted a high-growth strategy in an attempt to "re-power" America in the wake of power shortages in California and elsewhere. Given the first mover advantages in building plants, obtaining site permits, and securing generating turbines, underinvestment would have been extremely costly. At the time (1998), Calpine hoped to build or acquire 25 new generating plants at a cost of $6 billion, yet it was a sub-investment grade firm with a debt-to-total capitalization of 79% and only $2 billion of assets. Through the use of project finance and other hybrid structures, structures with

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operating losses (and a low, 15%, tax rate in future years), Mozal (**case #C-7**) with many years of tax concessions, or Equate (**case #C-5**) in a country (Kuwait) with no income taxes would adopt highly-leveraged capital structures.

elements of both corporate and project finance, Calpine grew from $2 billion to $23 billion in assets in only four years. Like most companies in the U.S. power industry, however, it has suffered since Enron declared bankruptcy in 2001. Nevertheless, Calpine provides a vivid example of how project finance can be used to avoid leverage-induced underinvestment.

4.B. Underinvestment Due to Distress Costs (The Risk Management Motivation)

The third motivation for using project finance is to reduce the potential collateral damage that a high-risk project can impose on a sponsoring firm. In the extreme, a failing project can cause an otherwise healthy sponsoring firm to fail.[16] This phenomenon, known as risk contamination, must be balanced against the benefits of co-insurance received from the project (Lewellen, 1971). The easiest way to understand this argument is to consider an all-equity firm deciding whether to use corporate debt to finance a large, risky project with a marginally positive NPV absent market frictions. Without investment and the assumption of incremental corporate debt, the all-equity firm's expected distress costs are essentially zero because it cannot default. With corporate-financed investment and the concomitant increase in leverage, the sponsor's expected distress costs increase because risk contamination becomes possible. In addition, the sponsor may have to give, but will not receive, co-insurance benefits. Thus, corporate-financed investment has increased the firm's expected distress costs. Assuming the project's NPV is marginally positive in the absence deadweight costs, and the financing costs are large, then the <u>total</u> combined NPV will be negative. Facing this situation, a rational manager will forgo the investment. By investing through a separately incorporated project company financed with nonrecourse project debt, the sponsoring firm can dramatically reduce the potential for risk contamination and the need to supply co-insurance. For investments with high expected distress costs, project finance may

[16] The causality can run the other direction, too, in a corporate financed deal: a failing company can drag down an otherwise healthy project. In contrast, when Enron failed in 2001, it did not contaminate the $2 billion project-financed Bolivia-Brazil pipeline in which it was one of the leading equity investors.

reduce the incremental distress costs to the point where the total combined NPV is positive.

Far more common than actual failure is the possibility that a sponsoring firm will incur indirect distress costs on its existing assets even if the new capital raised to finance the risky project is priced fairly by the market. These indirect costs come in many forms.[17] First, the addition of risky project cash flows to more stable corporate cash flows can cause the volatility of the combined cash flows to exceed the volatility of the corporate cash flows in the absence of investment. This increased volatility makes external finance more costly and increases the probability of cash flow shortfalls that require the firm to raise external finance. If large enough, the higher volatility can jeopardize on-going investment programs (Froot, Scharfstein, and Stein, 1993; Lamont, 1997; Minton and Schrand, 1999). Second, the risk of default may discourage suppliers and customers from transacting with the firm (Titman, 1984). For example, downstream customers may be unwilling to make transaction-specific investments if an upstream firm has a high enough probability of defaulting. Third, employees will be reluctant to make institutional-specific human capital investments if there is a chance they could be lost in a default situation. To offset this increased risk, firms must pay incremental wages or provide additional benefits. And fourth, increased cash flow volatility can reduce the expected value of interest tax shields as the probabilities of both generating losses and of failing increase. The magnitude of these and other deadweight costs can easily exceed the net present value of a new investment. As a result, a value-maximizing manager will rationally choose to forgo investment if corporate debt is the only option and the risks are largely unhedgeable with financial contracts.

In contrast to corporate-financed investment, which exposes a sponsoring firm to losses up to the project's total cost, project-financed investment exposes the firm to losses only as large as its equity commitment. Given the high leverage ratios used in project-financed transactions, the equity commitments are a small fraction of the project's total

[17] My analysis of litigation participation securities (Esty, 2001a), securities that give holders a share in the outcome of a lawsuit, provides a related example of how holding a high-risk asset can impose indirect costs on a company. Savings and loan associations with large potential claims against the government became more attractive (and more likely) acquisition targets after issuing these litigation securities. A similar logic regarding the costs of holding risky assets helps explain why many banks have adopted "good bank/bad bank" strategies to deal with their troubled loans.

cost (30% on average—see **Figure 2**). Through the project structure, sponsors are able to share project risk with other sponsors, with related participants (e.g. contractors, customers, suppliers, etc.), and with debt holders. There is an important assumption here: the relationship between incremental distress costs and investment size is positive and convex. This assumption implies that the distress costs associated with a single firm making a large investment are greater than the sum of the distress costs associated multiple capital providers making investing in the same asset. One reason why this might be the case is that large, risky investments either increase leverage or firm volatility. As described in most corporate finance textbooks (e.g. Brealey and Myers, 2003, pp. 497-498), the relationship between distress costs and leverage is positive and convex (so that the relationship between firm value and leverage is concave). When this assumption holds, risk sharing with other sponsors or debtholders reduces incremental distress costs.

Managers at BP Amoco (Case **#C-3**) describe the decision to use project finance as equivalent to the decision to buy a "walkaway" put option on project assets. Even if the put is priced fairly, the sponsoring firm may be willing to buy it as a way to reduce the incremental distress costs. The cost of the put could easily be less than its value to the sponsoring firm because of these incremental distress costs—the banks, which are selling the put, collectively bear lower incremental distress costs. Of course, if the sponsoring firm does not have the ability and the willingness to exercise the put option, then it does not make sense to buy the put (i.e., to use project finance). Having the option to walk away at some point in the future can be valuable even if the sponsoring firm would not or cannot walk away at the present time. Because BP Amoco considers its investments in oil field development to be "strategic assets," which means it would not walk away from most of them, it rarely uses project finance. It uses project finance only when the assets are very large or subject to significant sovereign or technical risk, in which case a project failure could impose substantial distress costs on the firm.

Consistent with the risk management motivation for using project finance, Parrino, Poteshman, and Weisbach (2002) analyze investment distortions including underinvestment and risk shifting using numerical simulations. They show that risk neutral managers with equity-based compensation will prefer to invest in low-risk rather than high-risk projects even though risk shifting can increase equity value. Using

parameter values determined from public firms, the authors show that the lost value from interest tax shields plus the incremental distress costs far exceed potential wealth transfers from debtholders to bondholders. The incentives to invest in low-risk rather than high-risk projects are even stronger when managers are risk averse.

A good example of the risk management motivation is Motorola's decision to use project finance for Iridium, the $3.4 billion satellite telecommunications system (case **#C-6**). (The final cost of the project was almost $6 billion when it was completed. The value was approximately $25 million after it failed.) Motorola was, at the time, a AA-rated firm with $9 billion in assets when it financed Iridium on a project basis. While risk contamination is a real possibility with an investment of this size—a project worth almost 40% of a firm's total assets—it is important to note that much smaller investments can, nevertheless, impose significant deadweight costs. BP Amoco (case **#C-2**) considers using project finance whenever a proposed investment exceeds approximately 5% of its total assets. For a AA-rated firm with $85 billion of assets, $11 billion of debt, an equity market capitalization of $141 billion in 1998, this limit appears surprisingly low. What it shows, however, is just how costly capital market imperfections can be. Other high-rated sponsors such as Telstra (in the Australia-Japan Cable case **#C-1**) and DuPont/Conoco (in the Petrozuata case—case **#C-8**) have also used project finance to protect the corporate balance sheet against risks associated with large projects.

The idea that organizational form in general and project finance in particular can be used as a risk management tool is new to the field of finance and rests on the assumption that risk management is value enhancing.[18] According to Stulz (1996), risk management helps eliminate the distress costs associated with "lower-tail outcomes." The organizational approach, as it turns out, is particularly effective in the case of binary risks (e.g. did the event happen or not) where there is the potential for a total loss. In contrast with more symmetric risks such as increases or decreases in output prices, binary risks such as direct expropriation or technology failure can render a project virtually worthless. There are often few hedging or insurance options available to cover these

[18] See, among others, Smith and Stulz (1985); Nance, Smith, and Smithson (1993); Tufano and Headley (1994); Fite and Pfleiderer (1995); and Stulz (1984) for other reasons why risk management is value enhancing. For empirical evidence on the importance of <u>total</u> risk, see Froot (2001), Goyal and Santa-Clara (2002), and Shin and Stulz (2000).

kinds of risks, particularly large ones, which makes the organizational approach to risk management an attractive alternative. While firms can buy insurance against certain political risks, political risk insurance is expensive, relatively scarce, and often does not cover the full investment. Moreover, Froot (2001) shows that insuring large, catastrophic risks is extremely costly, especially when the exposures involve uncertain or ambiguous outcomes (Kunreuther et al., 1993).

One interesting implication of the risk management motivation is that diversification (financing with joint incorporation, or corporate finance) can be less valuable than specialization (financing with separate incorporation, or project finance). This insight runs contrary to the traditional view that diversification is beneficial: the Capital Asset Pricing Model (CAPM), for example, is built on the idea that diversification eliminates idiosyncratic risks and that investors are compensated for bearing the residual systematic risk. The insight is, however, consistent with the existence of a conglomerate discount (Lang and Stulz, 1994; Berger and Ofek, 1995) and the idea from options pricing theory that a portfolio of options is more valuable than an option on a portfolio.[19]

As a final point, it is worth noting that the risk management motivation can also be viewed as an agency conflict between ownership and control. Rather than casting the risk management motivation in terms of a risk neutral manager trying to minimize distress costs, where forgoing corporate-financed, but not project-financed, investment is optimal from the firm's perspective, one can cast the motivation in terms of a risk averse manager trying to minimize threats to his or her poorly diversified human capital. In either case, the implications are the same: firms may forgo risky positive-NPV investments if they must be financed on balance sheet using corporate debt. Consistent with the idea that managers dislike risk and that their resource allocation decisions are influenced by concerns about risk, Tufano (1996) and Schrand and Unal (1998) find that hedging increases with managerial ownership in the gold and savings and loan industries,

[19] Khanna and Palepu (1997) conclude that conglomerates (financing assets jointly) create value in emerging markets because they provide their own internal labor, product, and capital markets to sidestep inefficient external markets. What is different about project companies is that they have few, if any, valuable growth options. Instead, most of the investment is done upfront. For companies that need to raise capital, allocate personnel, and develop new products, the conglomerate structure may be a superior organizational form.

respectively. Project finance with its separate incorporation shields risk averse managers in sponsoring firms from bad outcomes at the project level more effectively than corporate finance (Chemmanur and John, 1996; Brealey, Cooper, and Habib, 1996). Although managers do not often publicly admit to using project finance for this reason, they will more readily admit to this concern in private conversations.

5. Conclusion

Project finance is a relatively new, yet large and rapidly growing field of finance. Despite the size, there has been very little academic research on project finance. This paper is an attempt to fill that void and to explain what project finance is and why firms use it. I argue that project finance reduces the net cost of financing particular assets. In particular, firms use project finance to reduce costly agency conflicts and the opportunity cost of underinvestment in positive NPV assets. The agency cost motivation for using project finance recognizes the benefits of creating an asset-specific governance system to mitigate free cash flow problems and prevent opportunistic behavior. At the sponsor level, project finance helps reduce the investment distortions cause by debt overhang and incremental distress costs—the debt overhang and risk management motivations, respectively. The fact that the motivations for using project finance relate to the asset (agency cost), the sponsoring firm (debt overhang), and an interaction between the two (risk management), helps explain why previous attempts to create a single, universal reason for using project finance have failed. Understanding these various motivations explains why such a wide range of firms (from low rated firms trying to avoid the debt overhang problem to high-rated firms trying to minimize distress costs) use project finance for a variety of assets (from pipelines to mines to toll roads) in a variety of countries (from developed countries like the U.S. to developing countries like Chad and Azerbaijan).

The arguments in this paper should interest both practitioners and academics alike. For practitioners, the paper provides a framework for understanding why project finance creates value and when to use it. For academic researchers, the paper provides a

set of examples that show why financial structures matter and how. Contrary to the perfect markets example developed by Modigliani and Miller (1958), financial structures matter because they affect investment incentives, deadweight costs, and asset cash flows.

This analysis also provides new insights for the field of finance. The idea that organizational structure can be used to manage risk and to help raise capital improves our understanding of what determines the boundaries of the firm, a lingering question from industrial organization economics. Another attribute of project companies, leverage, provides some of the strongest empirical evidence for agency-based theories of capital structure (Jensen and Meckling, 1974), particularly in the presence of incomplete contracts (Hart and Moore, 1995). Other capital structure theories have trouble explaining why project companies have highly-leveraged capital structures and why they use relatively short-term bank debt. Finally, project finance illustrates the strengths and weaknesses of contract-based governance systems. These applications are just a few of the many areas where project finance has the ability to inform and refine existing theories of corporate finance. The nascent state of research on project finance necessarily implies that there are many fertile topics yet to be explored.

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Figure 1 Typical Project Structure (Independent Power Producer—IPP)

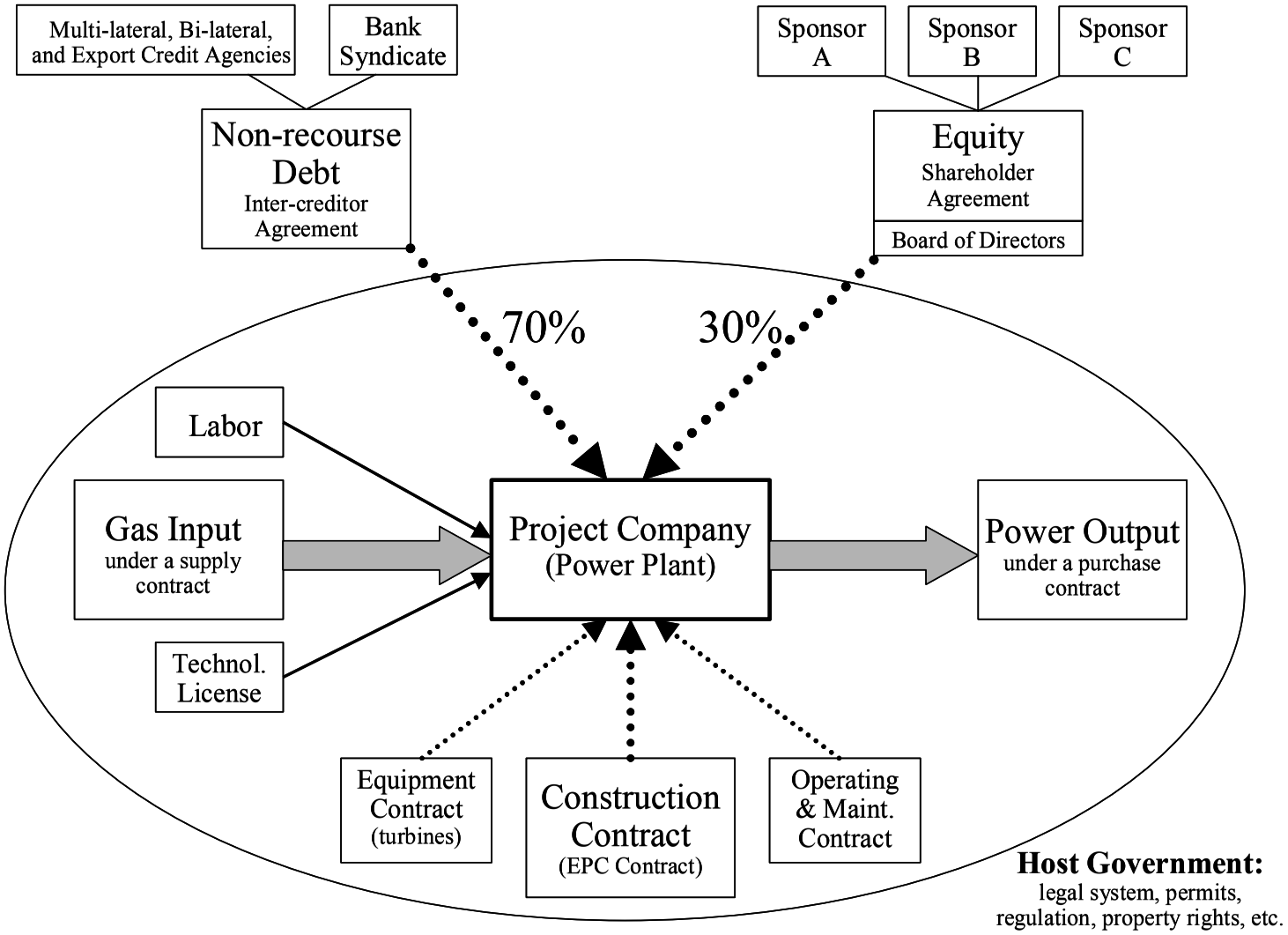
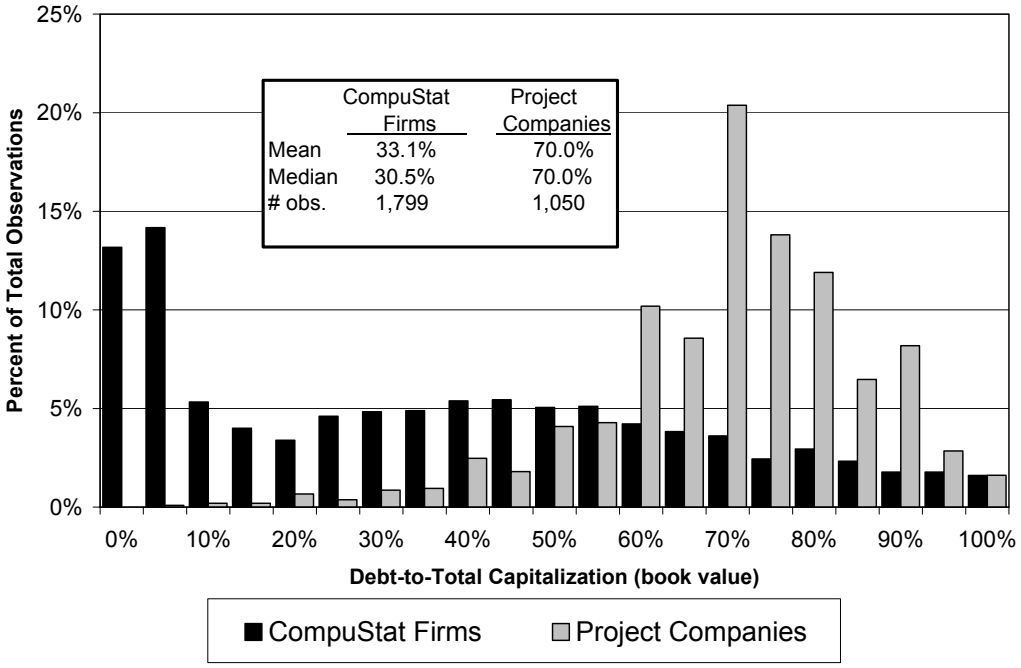


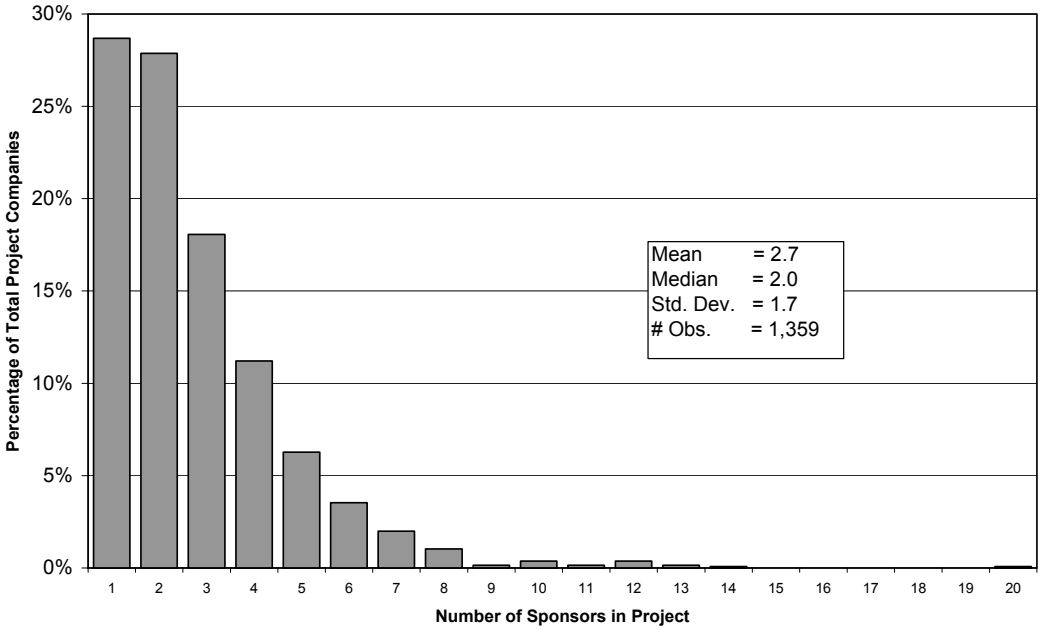
Figure 2
Debt-to-Total Capitalization Ratios: Project Companies vs. Corporations

This figure shows the distribution of debt-to-total capitalization ratios at book values for project companies and corporations. The corporations are Compustat firms with total assets between $100 million to $2 billion in 2001. The project companies are listed in Thompson Financial Securities Data Project Finance Database (TFSD) and were financed between 1990 and 2001.



Figures 3a
Distribution of Projects by the Number of Sponsors

This figure shows the distribution of the number of sponsors per project. The project companies are listed in Thompson Financial Securities Data Project Finance Database (TFSD) and were financed between 1990 and 2001.



Figures 3b
Distribution of Projects by Largest Sponsor's Ownership Share

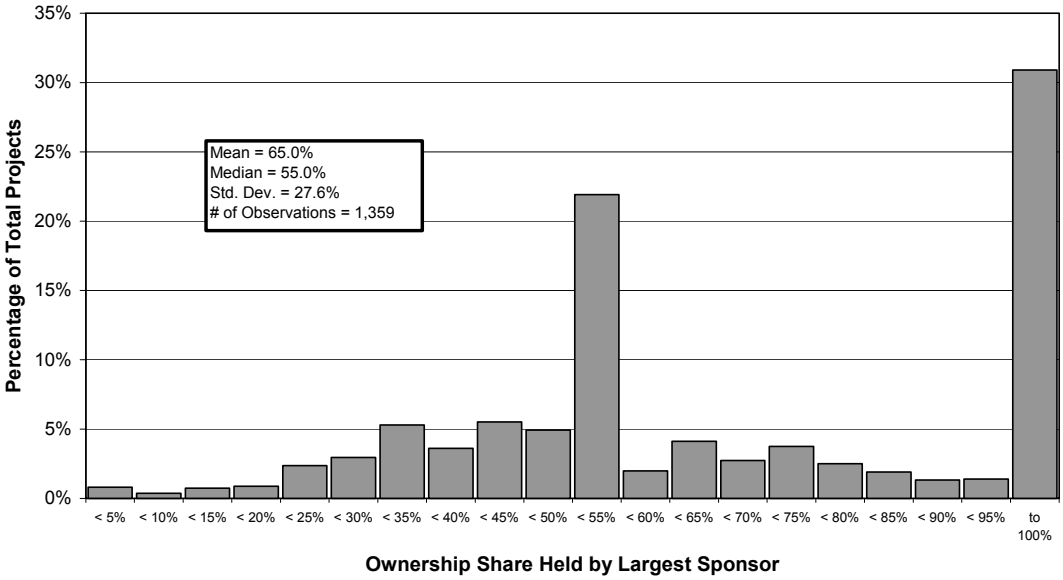


Table 1
Project Company Board Size and Composition

This table presents descriptive statistics on the size and composition of project boards of directors, and compares them with statistics from corporate boards. Gertner and Kaplan (1996) analyze 59 reverse LBO firms from 1987 to 1993; Baker & Gompers (2001) analyze 1,116 IPO firms from 1978 to 1987; and Yermack (1996) analyzes 452 Fortune 500 firms from 1984 to 1991. The project company sample contains 40 projects financed from 1989 to 2000. In describing board composition of project companies, "inside" directors includes officers of the project company, "gray" directors includes representatives of sponsoring firms or other affiliated parties (e.g. law firms, financial advisors, etc.), and "outside" directors are people without a direct link to the firm (i.e. independent directors).

	Number of Directors			
	Project Companies	**Reverse LBOs at IPO (Gertner/Kaplan)**	**Initial Public Offerings (Baker/Gompers)**	**Large Public Corporations (Yermack)**
Board Size				
Mean	9.8	8.1	6.1	12.3
Median	9.0	8.0	6.0	12.0
Minimum	4	n/a	1	4
Maximum	29	n/a	15	34
Std. Deviation	5.80	2.05	1.87	0.43
Board Composition (means)				
% Inside directors (officers)	12%	29%	54%	36%
% Gray/Affiliated directors	83%	37%	25%	10%
% Outside directors	5%	33%	22%	54%
# Observations	40	59	1,116	3,438 [a]
Avg. Assets ($ millions)	$1,904	$1,578	$95	n/a

Notes
[a] Yermack analyzes 452 companies in the Fortune 500 from 1984 to 1991, giving him a total of 3,488 firm-year observations.

Appendix
Case Descriptions

#C-1: Australia Japan Cable: Structuring a Project Company, HBS #202-115

The lead sponsor in this project, Telstra (the Australian telecommunications firm), has just gotten the results from the feasibility study it commissioned on the proposed Australia-Japan cable project. The general conclusion is that this $520 million project can withstand the competition in the rapidly changing telecom market and still generate attractive returns. It is now up to Telstra to structure the project company. To do so, it must select an ownership structure (which sponsors, how many, and what share allocations?), a financial structure (should it use project finance or corporate finance, and what kind of debt?), and a governance structure (the size and composition of the board, the nature of managerial compensation, etc.). These choices will affect managerial incentives as well as the project's overall performance.

#C-2: BP Amoco (A): Policy Statement on the Use of Project Finance, HBS #201-054

Following the BP/Amoco merger in December 1998, CFO David Watson asked Bill Young to recommend when and under what circumstances the firm should use external, project finance instead of internal corporate funds to finance new capital investments. As part of this assignment, Young and his team must review each firm's current policy regarding project finance and evaluate the various rationales used to justify its use. Young and his team created a new policy statement recommending that BP Amoco finance capital expenditures using corporate funds except in three special circumstances. The three exceptions were: mega projects, projects in politically volatile areas, and joint ventures with heterogeneous partners. Whether the general rule of using corporate funds and whether the specific exceptions to the rule are appropriate for the merged entity are subjects for class discussion.

#C-3: Calpine Corporation: The Evolution from Project to Corporate Finance, HBS #201-098

In early 1999, Calpine Corporation's CEO Pete Cartwright adopted an aggressive growth strategy with the goal of increasing the company's aggregate generating capacity fivefold in five years to capture a fleeting opportunity to re-power America. To achieve the goal, Calpine will have to build 25 power plants at a total cost of $6 billion. For a company with assets of $1.7 billion, a sub-investment grade debt rating, a debt-to-capitalization ratio of 79%, and an after-tax cash flow of $143 million in 1998, funding this business strategy was going to be a formidable challenge. The case opens with Calpine's finance team trying to decide how to finance four power plants currently under development. Should they use project finance, corporate finance, or a new hybrid structure with elements of both project and corporate finance. Knowing the importance of speed, feasibility, and efficiency, the finance team must select a financial strategy that not only supports the company's high-growth competitive strategy, but also maximizes firm value.

#C-4: The Chad-Cameroon Petroleum Development and Pipeline Project (A), HBS #202-010

On June 6th 2000, the World Bank's Board of Directors was scheduled vote on whether to approve funding for the $4 billion Chad-Cameroon Pipeline project. The project was a unique opportunity to

alleviate poverty in Chad, one of the poorest countries in the world. Chad, however, had a President who had been described as a "warlord" and had been associated with various human rights violations. One of the most contentious issues in structuring the deal was how Chad would handle its newfound wealth—the project would increase Chad's annual government revenues by more than 50% (up to $125 million per year). To address this issue, the Bank had proposed a novel Revenue Management Plan (RMP) that would isolate Chad's project revenues and target them for poverty reduction programs. Whether this plan would work and what would happen if it did not were two questions that the directors had to resolve before they could approve the deal. Faced with a high-risk, but potentially high-return opportunity to improve conditions in Chad and Cameroon, students, as World Bank Directors, must decide whether to approve the funding.

#C-5: The International Investor: Islamic Finance and the Equate Project, HBS #200-012

Equate Petrochemical Company is a joint venture between Union Carbide and Petrochemical Industries Company (PIC) for the construction of a $2 billion petrochemical plant in Kuwait. The sponsors began construction in August 1994 using a bridge loan and are in search of permanent, nonrecourse finance. As part of the permanent financing, the sponsors want to use a tranche of Islamic finance—funds that are invested in accordance with Islamic religious principles known as *Sharia*. The sponsors hired Kuwait Finance House, which, in turn, approached The International Investor (TII is a Kuwaiti investment bank) to assist in placing the Islamic tranche. The case is set in early December 1995, as members of The Institutional Investor's Structured Finance Group are deciding whether the proposed deal structure makes sense and how large a commitment to make on behalf of their investors. This case provides an introduction to Islamic finance in general and Islamic project finance in particular. It describes the primary instruments used by Islamic investors and challenges students to develop a financing plan that is consistent with *Sharia's* prohibition against the payment of interest (*riba*) while at the same time appropriate for a large, long-term capital project. The case also explores the complications of integrating Islamic and conventional Western financial instruments in a single transaction as well as some of the possible solutions.

#C-6: Iridium LLC, HBS #200-039

This case is set in August 1999, just after Iridium, a global satellite communications firm, declared bankruptcy. Although the case describes Iridium's creation, development, and commercial launch, it concentrates primarily on the firm's financial strategy and execution as it raised more than $5 billion of capital. The case describes the specific securities Iridium issued, the sequence in which it issued them, and the firm's financial performance prior to bankruptcy. Using analyst forecasts, students can also value the firm prior to bankruptcy, but will recognize how difficult it is to value technology start-ups given the uncertainty in demand. The Iridium case is intended to challenge existing theories of capital structure. Is Iridium's target capital structure of 60% debt optimal? The case helps students understand the benefits and limitations of issuing different kinds of securities (e.g. cash-pay vs. zero coupon bonds, bank debt vs. public bonds, etc.), and the complexity of sequencing different kinds of securities. The overall objective is to help students understand the relevant issues in financing large, greenfield projects.

#C-7: Financing the Mozal Project, HBS #200-005

The case is set in June 1997, with a project team from the International Finance Corporation (IFC) recommending that the board approve a $120 million investment in the Mozal project, a $1.4 billion aluminum smelter in Mozambique. Several factors make this investment controversial: it would be the IFC's largest investment ever, it was approximately the size of Mozambique's gross domestic project (GDP), and it came closely on the heels of a 20-year civil war. Despite these concerns, the

sponsors want to structure a limited recourse deal with participation by the International Finance Corporation (IFC). After reviewing deal, the IFC team is recommending the investment, but the board must decide whether it is the right time and the right project to make such a large investment. The case presents an extreme example of political risk in a developing country setting and contrasts the older, financial approach to risk management against a newer, structural approach. The case also highlights the various roles multilateral development institutions, in general, and the IFC, in particular, can play in financing major projects.

#C-8: Petrolera Zuata, Petrozuata C.A., HBS #299-012

Petrolera Zuata, Petrozuata C.A. (Petrozuata) is a proposed $2.4 billion oil-field development project in Venezuela. The case is set in January 1997 as the project sponsors (DuPont and PDVSA) are developing the project's financing structure. According to the current plan, the sponsors hope to raise at least a portion of the $1.5 billion debt financing in the capital markets using project bonds. To facilitate a bond offering in the Rule 144A market, the deal must secure an investment-grade rating, yet neither PDVSA nor Venezuela is investment-grade. The key questions facing the sponsors are whether the project will achieve an investment grade rating and, if not, how to finance the deal so that it remains economically and operationally attractive to the sponsors. The case illustrates an extremely well crafted deal that "pierced the sovereign ceiling" (the project had a higher debt rating than the host country's rating on long-term foreign currency debt obligations).

#C-9: Contractual Innovation in the UK Energy Markets: Enron Europe, The Eastern Group, and the Sutton Bridge Project, HBS #200-051

In December 1996, Enron Europe and The Eastern Group were on the verge of signing an innovative financial transaction. Eastern wanted to buy a long-term option to convert natural gas into electricity from Enron, thereby giving it the economic right to operate a "virtual" power station. Enron planned to hedge its exposure under this contract by constructing an actual power station and by trading in the gas and electricity markets. While Eastern's right to receive power proceeds and Enron's right to operate the plant were similar in character, there would be no legal or physical connection between Enron's physical plant and Eastern's virtual plant. This structure was vastly different from the traditional independent power plant (IPP) structure, and the executives involved had to convince their superiors of its wisdom before they could proceed. This case illustrates a new paradigm in the electric power industry: the creation of *virtual* power stations backed by *physical* power stations with merchant exposure. It allows students to value the spread option between gas and electricity, known as a "spark spread", and to appreciate the complexity involved with valuing real options in the rapidly evolving gas and electricity markets.