Limited- and Nonrecourse Project Finance: a Survey

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Extracto

Este artículo revisa la literatura en financiamiento de proyectos sin protección o con respaldo limitado. Esta área presenta un enfoque especial de financiamiento para el desarrollo de proyectos, en el cual los fondos están ligados a los flujos de caja del proyecto.

El trabajo contiene una revisión literaria comprensiva del tema de financiamiento de estos proyectos. La literatura se analiza en relación con riesgos y posibilidades de cobertura, participantes, marco legal de la compañía asociada al proyecto, elementos financieros y un modelo especial de financiamiento. A continuación se revisa, en particular, la literatura académica que considera el financiamiento de proyectos como un elemento de la estructura de endeudamiento de equilibrio.

Abstract

This paper reviews limited- and non-recourse project finance, a special financing approach for newly to be developed projects where the funds are directly linked to the cash flows of the project.

This survey comprises a comprehensive literature review on project finance. Practitioner literature is reviewed with respect to project risks and hedging possibilities, project participants, the legal framework of the project company, the financial elements, and a special form of

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project finance: the build-operate-transfer model. Next to practitioner oriented literature, the academic literature is reviewed which models project finance as an element of a capital structure equilibrium.

An appendix lists references of practitioner's articles on project finance and thus allows the reader to gather information about specific areas in project finance, for example with respect to requirements for project finance in various industries or countries.

1.   Introduction

This paper reviews the field of project finance (PF), a relatively new technique to finance high-risk, capital intensive investments. The central issue in PF is the fact that the repayment of the loan depends primarily on the assets and cash flows of the project and not on the overall financial strengths of the sponsor. In the context of this study, PF is defined as *limited- or nonrecourse financing through the establishment of a vehicle company*. PF originated in the production loans to U.S. oil companies during the 1940's and 1950's. These loans were solely dependent on the cash flows from production of the oil company. Later, combining production and development loans formed the first PF contracts. In the 1970's, the North Sea oil and gas field developments offered a wide range of applications for PF and various new contractual structures were developed. Today, PF is used for projects in various industries and countries as table 1 in Appendix 1 shows. The sample represented here is collected by cross-checking a variety of journal articles that discuss PF. This strategy was necessary since no comprehensive statistical publication exists which provides information on the population of PF or a representative subsample. The sample consists of 585 project loans to 562 different projects. Due to the above mentioned collection process, the amount of information differs significantly from project to project. For some projects only basic data such as the year, the lead manager, or the type of project are available. Other projects are highly publicized and a complete history of the project is available. Some of these better known projects are the Eurotunnel, Eurodisney, the North-South Highway in Malaysia, or the Woodside Natural Gas and Oil Field in Australia.

Table 1 structures the 585 PF into three broad categories: financing characteristics, location of the project, and industrial type of project. The first category provides information about a variety of characteristics. The PF included in this sample fall into the time period of 1975 to 1992, with most projects

occurring in the later part of the sample period. The size of the loans indicate the use of PF for large developments with a mean size of US$ 392 million. Furthermore, PF is a long term financing approach with an average loan term of 10 years. Two observations with respect to sponsors are possible based on this sample: multiple sponsors are common in PF with the average project having 3.4 sponsor companies. Secondly, sponsors are rather large when measured in terms of total assets of US$ 10.9 billion (mean size) and US$ 3.9 million (median size). The second category listed in panel B of table 1 refers to the regions or countries which host more than 10 projects during the sample period. Most PF are located in Western industrialized countries such as the United States, Australia, the North Sea region, the United Kingdom, or Canada. But PF is also feasible in the newly industrialized countries, such as Indonesia, Thailand, or Malaysia. Overall, PF included in this sample could be allocated to 71 different countries or regions. Thus, PF is a truly international approach to finance newly to be developed projects and adaptable to a country's specific legal, financial, economic, or political environment. PF is furthermore feasible in a variety of industries as panel C of table 1 shows. Most projects occur in the industry of oil and gas extraction and electricity generation, followed by mining or chemical projects. PF is, however, not only useful for industrial projects, but also feasible for infrastructure projects, i.e., road or bridge projects. For these, PF often takes the form of a build-operate-transfer project to allow the government, as the essential sponsor, a temporary privatization of the project.

Triggered by this increasing use of PF, a large body of literature developed which describes the uses and characteristics of PF. Only few researchers, however, attempt to analyze PF from a theoretical point of view. Both strands of literature will be reviewed and summarized in sections 2 and 3 of this paper. Starting in section 2 with a definition and a discussion of the basic concept, the focus lies on the determinants of PF, legal considerations, financial tools and contractual means. As a special form of PF, the BOT model is discussed in detail. In section 3, the theoretical literature on PF which analyzes it as an element of a capital structure equilibrium is reviewed. Section 4 concludes the paper. In appendix 2, a bibliography of practitioners' articles relating to PF is listed. This bibliography covers articles from 1975 to the present and provides an extensive source of information about all types of PF related issues. For example: industry specific issues (airline PF, infrastructure PF, etc.); country specific issues (PF in China, Russia, etc.); case reviews (Eurotunnel, Midland cogeneration, etc.), and

many more. Due to the limited theoretical research in the field of PF, only practitioners' articles are listed in this bibliography.

2.   Characteristics of Project Finance Arrangements

DEFINITIONS

Project finance was briefly defined in the introduction as "limited- or nonrecourse financing through the establishment of a vehicle company". This definition comprises the fundamentals of PF. There are, however, more specific characteristics about PF to which this definition does not refer. These will be discussed here by looking at the definitions other studies use. In his definition, Nevitt 1983 focuses especially on the ability of the project to generate sufficient cash flows for loan repayment and on the limited recourse position of the sponsor:

> A financing of a particular economic unit in which a lender is satisfied to look initially to the cash flows and earnings of that economic unit as the source of funds from which a loan will be repaid and to the assets of the economic unit as collateral for the loan [...] The key to a successful project financing is structuring the financing of a project with as little recourse as possible to the sponsor, while at the same time providing sufficient credit support through guarantees or undertakings of the sponsor or third party, so that lenders will be satisfied with the credit risk.

Kensinger and Martin 1988 focus more on the conditions which enable a project to be financed with a PF approach. In order to be financed by PF, the project must be independent in the sense that its investment is clearly defined and can be structured as a separate legal entity. Furthermore, the project's cash flows and assets have to be sufficient to support the amount of borrowing, since they are the only claims for the creditors. Barkas 1981 explains further that sponsors are attracted to PF by their interest in limiting their exposure to the project risk. Lenders, however, are only willing to finance credit risk and not equity risk. Therefore, lenders require credit support in addition to the project's

assets and cash flows. This support can be given in the form of guarantees, contractual commitments from sponsors and third parties, such as suppliers or purchasers of the project's product. Clearly, the interests of sponsors and lenders differ with respect to risk taking. Sponsors want to shift the project's risk away from themselves and develop the project with no recourse, whereas lenders are only willing to bear credit risk and not equity risk. Thus, PF can only be successful if sufficient credit support can be obtained from third party participants. Smith and Walter 1990 point out that it is up to the financial advisor to identify the different project risks and their quantity, to analyze which risks are acceptable to each participant and finally to merge the interests of all parties, given the risks, financing sources and hedging tools. With respect to risk distribution, it can be concluded that the financial advisor has to allocate the specific risks to that participant which is most efficient in bearing this special type of risk.

PROJECT RISKS AND FEASIBILITY STUDY

As the above definitions show, risk is the sponsor's and lender's main concern when evaluating a project. Nevitt 1983 distinguishes three risk periods: the engineering and construction phase, the start-up phase, and the operations phase. The engineering and construction phase is characterized by a high level of risk. During planning and construction of the project, the lender already has to provide funds for material, labor, and equipment while the project does not generate any cash flows. During the start-up phase risk decreases. The construction is completed and production starts. The first cash flows are generated and debt can be repaid. However, cost overruns, completion delays, and operations insufficiencies can reduce cash flows. During the final phase, the operations phase, the lender faces virtually no more risk. With flawless operation of the project, all debt will be repaid and the cash flows are finally available to the sponsors.

Due to the complexity and high risk levels of PF, a feasibility study has to be performed prior to the initiation of each project. Its objective is to evaluate the project's sensitivity to outside factors and to distribute risks such that the project becomes feasible to lenders and sponsors. Within the feasibility study, the project's cash flows are analyzed under different scenarios. Outside factors like interest rates, inflation, political factors, input and output demand and prices

and their influence on project's cash flows are modelled. Should the project be financially feasible even in the worst case scenario, a decision has to be made with respect to the amount of debt the project can support, the amount of equity required, the necessary hedging tools, and so on. The risks influencing a project's feasibility can be summarized in a risk matrix. Based on Nevitt's description of PF criteria and supplementary material from, for example, Rendell and Nichuss 1983, a risk matrix is constructed in table 2 in Appendix 2 showing the different risks and corresponding hedging tools.

PARTICIPANTS IN PROJECT FINANCING

Participants in PF include sponsors, lenders, managers of the project company, contractors or suppliers, purchasers of output, governments or government agencies, lessors, guarantors, and financial advisors. Each of these groups has its own reasons for engaging in the project. According to Nevitt 1983 sponsors want to realize an investment opportunity without assuming liability or risk, but they want to be the final owner of the project after its debt is repaid. Lenders are interested in PF due to the high income a successful project generates. They are also looking at their share in the PF market. Next to sponsors of PF, lenders play a major role among all participants in PF. The task of these two groups can be described as a four step process starting with the preliminary project analysis, followed by the planning stage, the arrangement of the financing, and finally the monitoring and loan administration. The involvement of the potential lenders starts with the project proposition by the sponsor. Potential lenders are offered full information about the project. Thus, asymmetric information is not a problem in PF, as it is in traditional lending (TL). Kensinger and Martin 1988 mention a case where Tenneco provided lenders with so much information that it would have cost $ 20m to analyze every detail. As the second main participant group, sponsors are often supported by financial advisors in their relationship with the lenders. Financial advisors usually do not lend to the project but provide the sponsor with analysis of lenders proposition, own feasibility studies, etc. If a financial advisor is also lender to a project, a clear case of conflict of interest arises. Other project participants include contractors, suppliers, and purchasers of output. Since a project is demanding their product or service, these groups have an economic interest. The cost for them arises in the form of guarantees they have to provide. Governments or government agencies might also be found

among the participants. They look at the economical, social, and political impact of the project on their country and decide on that basis whether to become involved in PF. A graphical representation of the PF structure and its participants is presented in figure 1 of Appendix 1.

RISK SHIFTING IN PROJECT FINANCE

Techniques and instruments used in PF to shift risk from the sponsor to other participants can be categorized in different ways. There are financial instruments such as swaps or futures and nonfinancial instruments such as guarantees, insurance, or contractual arrangements. The risk matrix in table 2 presents these instruments categorized by the type of risk they are reducing. The current discussion focusses on the use of only one instrument, the guarantee as a risk reduction tool. An overview of the different classes of guarantees and the examples which will be discussed in this part is given in table 3 (based on Nevitt 1983).

Different project participants can take the position of guarantors. Sponsors can issue a guarantee to lenders. In case of a direct guarantee, however, the off balance sheet character of the PF arrangement would be eliminated, since the guarantor has to include the obligation out of the guarantee in his balance sheet. The use of contingent or indirect guarantees evades this problem and is therefore more useful for PF. Suppliers, contractors or purchasers of output can be approached by the project management to provide guarantees as additional support of the project. Common in PF are supply or off-take contracts which fix the amount or price of the purchased supply or sold output. The project, i.e., the sponsors and lenders, benefit from these types of guarantees, since the project's cash flow has been stabilized. Since the guarantors have an economic interest in the project, they are often willing to provide guarantees. Additionally, parties which do not participate in the project can provide guarantees. These include government agencies or commercial guarantors which supply a variety of guarantees with respect to political, sovereign, country, construction and completion risk, or performance bonds, letters of credit, and others.

Some specific types of guarantees which are often used in PF will be described in the following part. As Smith and Walter 1990 state, a completion guarantee falls into the class of unconditional guarantees with respect to

performance quantity, quality, timing, minimum period of operation and coverage of all cost overruns. Thus, a completion guarantee will not only cover the completion within the expected time period and for a certain cost but also the operational efficiency of the project. Usually, a completion test is specified which analyzes whether the expected amount can be produced at the expected cost. The guarantor (that is, the project sponsor) has to step in when the project does not pass the completion test. Since sponsors depend on a construction company with respect to completion and operational efficiency of the project, they often want to protect themselves as completion guarantors against performance failure from the constructor. This can be done by purchasing bonds issued by surety companies or banks. These bonds pay a predetermined fraction of the contract price contingent upon failure of project completion.

The other four types of guarantees which will be discussed bind the supplier or purchaser of output to the project. Nevitt 1983 defines the four contract types as follows. A take-or-pay contract unconditionally obligates the purchaser of the project's output to periodic payments for a minimum amount of output at a fixed price. Payments have to be made whether the purchaser actually buys the output or not. The unconditional character of this contract is established through the fact that the purchaser has to pay under a take-or-pay contract even if the output cannot be supplied. This contract provides a high level of credit support for the lenders, because a minimum payment which is sufficient to cover the project's operating expenses can be insured. Very similar to the take-or-pay contract is the take-and-pay contract. The difference, however, is that this guarantee is conditional on the actual supply of the output. Thus, under a take-and-pay contract, the guarantor does not have to pay if the output could not be provided by the project. If lenders receive additional credit support in the form of a completion guarantee or if the lender relies on the operator's reputation, then a take-and-pay contract can be sufficient as credit support from the purchasers of output. In a throughput contract it is not the purchase of a product which is insured but the use of a service provided by the project, for example the use of a pipeline. For infrastructure contracts the throughput contract is more appropriately referred to as a tolling agreement. As in the case of the take-or-pay contract, this guarantee is unconditional and therefore provides strong credit support for the project. Contrary to these three guarantees, the put-or-pay contract binds the suppliers to the project. If the supplier does not provide energy, raw material, or other specified materials as stated in the put-or-pay contract, then the supplier has to pay the difference of

his price to the market price which the project managers had to pay in order to obtain the supply. This contract ensures supply in the long run. Through a fixed price element, the put-or-pay contract also fixes production and construction cost.

THE LEGAL FRAMEWORK FOR THE PROJECT

Due to the complexity of PF arrangements, there exists no standard approach to legally structuring a project. At least four legal fields have to be considered, according to Harries 1989. These are the relationships among project sponsors and the legal entity of the project or vehicle company (VC), the relationship between VC and the local government, the financial arrangements, and finally the sales agreements for the project's products and services. Due to the complex legal requirements of PF, detailed documentation is necessary. According to Rendell and Niehuss 1983, the principal documents are the basic agreement with the host government; the loan agreements; the intercreditor agreement, in the case of multiple lenders; the construction contract; the long-term sales contracts; the assignment of proceeds; the third party support agreements, like the completion guarantee; the investment guarantee, or the host country assurances.

The legal entity of the VC of special of interest, since the sponsor achieves its nonrecourse position to the project's liabilities through the establishment of the VC. Five legal forms are basically possible: the VC can be structured in the form of a corporation, a general partnership, a limited partnership, a joint venture, or a trust. The choice among these five alternatives will have significant impact on the tax and accounting environment of the project, the recourse to the sponsors and the possibilities to structure intersponsor relationships. In the sample described in the introduction, information about the exact legal structure is available only for a small number of projects. Mostly, only the names of sponsors but not their positions in the VC are mentioned publicly. Additionally, if a VC is named, it is often referred to as a joint venture which may not be accurate. Thus, no overall statistics on the use of the different legal forms can be provided for the sample of PF arrangements. In general, corporations seem to be the most widely used form of VC, whereas partnerships are rare. A VC usually includes three or more sponsors, a fact which will not imply that sponsors do not hold more than 50% of the VC's shares. There are as many cases where sponsors hold about equal shares as there are cases where one sponsor is dominating and

holding more than 50% in the VC. It is also observed that not the sponsor directly but its subsidiary is holding the share in a VC. This indirect shareholding might be used to restrict recourse to the parent. Very often local companies are seen as shareholders in the VC. This is beneficial in cases where tax benefits or government support depends on domestic shareholding in a company. Others parties which appear as sponsors are contractors and governments. Lenders rarely become sponsors, with the exception of supranational agencies, like the International Monetary Fund.

Financial Elements in the Finance Structure of the Project

The financial tools included in a PF structure can be distinguished into two groups: 1) financing instruments, like debt, equity, leasing, 2) risk reduction instruments, like swaps, futures, or options. Nevitt 1983 distinguishes three basic groups of financing instruments: equity, quasi equity, and debt. Equity plays two roles in PF. On the one hand, it establishes the ownership proportions among multiple sponsors; on the other hand, it is required by lenders as a signal for sponsor involvement. The level of equity differs from project to project. In general, it can be said that no project is 100% debt financed. Equity levels can, however, be reduced when sufficient credit support is available. Quasi-equity can occur under two different forms: subordinated loans or advances to the project. Advances will usually be given by investors, sponsors or guarantors, to cover cost overruns or to maintain the debt-to-equity ratio. Quasi-equity is in its position within the financial structure senior to equity but junior to senior or secured debt. Senior debt commonly accounts for the majority of funds in a PF arrangement. Its main characteristic is that senior debt has first priority for repayment. This is exactly the position lenders in PF want to hold. Senior debt occurs in unsecured or secured form. Unsecured loans are usually junior to secured loans and provided by sponsors. They might be included in the PF structure in cases of cost overruns. Most senior debt, however, in PF is secured, since lenders can only rely on the project for repayment. Thus, security is obtained so that lenders can take the project over in case of financial distress. It is very important that the security rights of the lenders are enforceable. This can be difficult when the project is located in a foreign country. Also, different legal systems in international PF have to be recognized.

An alternative to structure a project's finance is leasing. Nevitt 1983 categorizes leases with respect to the purchase options which are available to the lessee. True and operating leases include the true market value of the purchase option, whereas conditional sale leases, safe harbor leases, and tax benefit transfer leases entitle to nominal purchase options. The use of leasing is mainly tax-motivated. In the case of a true lease, the lessor uses accruing tax benefits, investment tax credits (ITC), and depreciation benefits which he transfers into a lower lease payment for the lessee. This setup is beneficial if the lessee cannot benefit directly from the tax credits, ITC, and depreciating if he would own the asset. The employment of leasing allows the lessee to benefit indirectly. A special form of the true lease is the leveraged lease, which is often used in PF. It includes next to the lessee and lessor another participant: the long-term lender. The special characteristics of a leveraged lease lies in the fact that the lender, and not the lessor, provides the majority of the funds which are needed to purchase the assets. The lender provides nonrecourse funds which are collateralized by the assets and the assignment of lease and its payments. The lessor benefits from a leveraged lease in the form of a tax shelter. He can claim 100% of the tax benefits despite the fact that he provides less than 100% of the funds. This structure is, as its nonrecourse character shows, very adaptable to a PF setup, which explains its frequent use in PF.

THE BOT MODEL

BOT stands for Build-Operate-Transfer, a special type of PF also known as concession financing. It developed in the late 1980's, when no public financing was available for infrastructure projects. As this development indicates, BOT is strongly related to government projects. A graphical representation of the BOT model is presented in figure 2 in Appendix 1. Sington 1989 defines BOT according to the three-step process as indicated by the name BOT:

1. Build: A project company constructs and finances the project. As opposed to standard PF, the project company's shareholders are banks, equity investors and contractors, but usually not the sponsor (who is in these cases the host government).

2.   Operate: The project company runs the project for a given period of time, until debt is repaid and company shareholders have earned their required rate of return.

3.   Transfer: Finally, the project is transferred to the sponsor (government).

As presented here, BOT is structured as 100% nonrecourse. However, recourse may be included in BOT through government guarantees or equity, where equity signals the government's support of the project. The recourse to the government can be structured as a repayment guarantee, but then the project would lose one of its main advantages: it would no longer be off balance sheet financing. Thus, recourse is obtained through subordinated loans from the government, which are available when additional financing is needed. The government can also maintain a reserve account, provide cash deficiency guarantees, indemnity, or standby equity, to name just a few alternatives.

What projects are ideal for BOT? Practitioners do not agree on one answer to this question. Norton 1989 argues that BOT is ideal for infrastructure projects with fixed assets and the right to earn revenue, such as roads, bridges, mass transit systems, tunnels, pipelines, telecommunication facilities, refuse treatment plants, power stations, and water supply projects. However, BOT is not useful for projects involving the sale of output in international markets, like petrochemicals, refineries, coal mines, iron and steel plants. Barett 1987 proposes the ideal project for BOT to be a co-generation plant, due to its certain income stream, no unusually complex building requirements, and small number of participants. Barett 1987 also quotes several bankers who have different opinions on how to use BOT. According to them, ideal projects are those related to transportation, such as bridges and roads. Tunnels, however, are less than ideal for BOT, since the toll has to be relatively low, which puts downward pressure on returns to lenders. Oil projects are feasible for BOT, since lenders have long term experience in financing these projects. Furthermore, BOT is presented as inadequate for projects in less developed countries. The additional political risk increases the already high risk to be taken by lenders above the feasible level.

The sample collected for this study includes 29 BOT projects located in 15 different countries. Eleven of these countries are categorized as less developed countries (LDC) or newly industrialized countries (NIC), and 4 as developed countries (DC). One BOT project occurs in LDC, 22 in NIC and 6 in DC. Host country to most BOT projects is Thailand, with 6 projects, followed by Pakistan

(5 projects) and the United Kingdom (4 projects). From my point of view, this sample cannot support the view that the BOT approach is only feasible in DC, but it clearly reveals a tendency towards the use of PF in NIC rather than in LDC countries. This tendency can be explained by the requirement, in a PF structure, that the project has to generate by itself sufficient cash flows to service the loan. Given the economic environment of LDC, this requirement often may not be met and therefore PF become not feasible in LDC. With respect to the use of the BOT approach for different types of projects, this sample supports the use of BOT for transportation projects. Among the total of 29 projects, 11 projects can be categorized as transportation projects, including 2 bridge projects, 2 road projects, 4 rail and/or subway projects, and 3 tunnels. Power plants constitute another large group of PF: 11 power plants are financed with BOT. The remaining projects are production plants (4), commercial buildings (2), and one water supply project. No natural recourse projects were financed with BOT. This is understandable, since cash flows from these projects are more uncertain and less insurable than cash flows from transportation or power projects. For the two latter groups the cash flows required to service the debt can easily be insured through power off-take contracts or minimum toll income contracts supported by the host government. In these cases, BOT becomes an attractive financing alternative.

3.   Optimal Capital Structure
Including Project Finance

Despite the large amount of attention given to PF in the applied literature, very few researchers provide theoretical explanations for the existence and features of PF. Thus, the academic literature on this topic is still sparse. Only a small number of theoretical studies exist that analyze PF as part of the optimal capital structure. Thus, the present section can review only a handful of articles: Shah and Thakor (1987), John and John (1991), and Chemmanur and John (1993), as theoretical capital structure studies, and Kleimeier (1994) as an empirical study. Models proposing optimal capital structures are commonly driven by one of the following factors: taxes, bankruptcy cost, asymmetric information, agency cost, or corporate control issues.[1] Categorizing the three PF studies with respect

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[1] In addition to these factors, some studies derive an optimal capital structure by simultaneously solving the investment and financing decision.

to these factors reveals that Shah and Thakor's (1987) model is driven by taxes and asymmetric information, John and John's (1991) model by agency cost of debt, and Chemmanur and John's (1993) model by corporate control issues. Due to the small amount of studies and their different conceptual approach to the topic, the studies are presented in sequential order, starting with the earliest study.

Shah and Thakor 1987 want to explain two issues in their model: first, why PF commonly allows for higher debt financing than conventional loans, and second, why PF is used for riskier investment projects. To pursue these objectives, the authors assume an economy which contains project sponsors and creditors. Sponsors are shareholders of the firm and have the choice to realize projects. Creditors are bondholders of the firm. The return from a firm's production is random. However, firms or projects can have the same mean return but different variances, thus different risks. Creditors face an asymmetric information problem, since they know the mean return but not the specific risk of the firm. Information production is prohibitively costly and cannot be used to solve the asymmetric information problem. The problem can, however, be solved in a reactive capital structure equilibrium (RCSE) which develops as a revelation game. Each creditor offers publicly a different set of capital structure contracts. Once a firm selects a creditor, such firm has to reveal its risk (it might signal falsely) and is endowed with a certain capital structure contract by the creditor. Shah and Thakor 1987 show that for any offered capital structure contract the amount of debt financing and the interest rate increase with the level of risk. Also, the face value of debt, the firm's equity and asset value increase with the level of risk.

To include PF into the capital structure model, costly information production about project and firm characteristics is allowed. The firm has to carry the cost of information production and can choose between obtaining capital through information production or the above described revelation game. The sponsor can also choose whether to incorporate the new project into the existing firm or to structure it separately via PF.

In the case of symmetric information, PF is no part of the equilibrium structure. In an asymmetric information environment, however, there are two sets of circumstances when PF can increase project value and thus be beneficial. In the case of information production, PF can increase the equity value of the project, due to lower information cost. It is cheaper to produce information for a separate project than for a firm as a whole. In the case of the revelation game,

PF can attract higher leverage when the project's risk is lower than the firm's risk. Higher leverage, in turn, increases project value.

From their theoretical model, the authors draw the following hypotheses: creditor involvement in the project decreases with project risk and increases with the level of debt financing. Furthermore, high risk investments will always use PF. *Ex post*, PF investments should be riskier and have a higher level of debt than traditionally financed investments. Overall, the authors conclude that PF is used to minimize adverse effects of asymmetric information and is not a means to obtain off balance sheet financing for the sponsors.

John and John 1991 derive a model of optimal capital structure which is driven by agency cost of debt and tax deductibility of interest payments. In this context the authors show under what conditions it is optimal to finance a new project via nonrecourse PF. They extent their theoretical model by providing empirically testable hypotheses with respect to the characteristics of new projects that will be financed via PF, the wealth gains to sponsors, and the optimal allocation of debt between project and firm.

The two factors which are driving the model will be described first. In a firm which has debt outstanding, one effect of the debt is the tax deductibility of interest payments. This tax shelter favors the use of debt in the capital structure of the firm. On the other hand, agency cost of debt can arise in the form of underinvestment, which discourages the use of debt in the capital structure. Myers 1977 developed the concept of this underinvestment problem: when managers act in the interest of current stockholders, they invest only in those projects whose present value covers not only the initial investment but also the interest payments to debtholders. Thus, projects are rejected when they have a positive net present value with respect to the investment but do not cover interest cost. In John and John's (1991) model, these two effects from taxes and agency cost offset each other and lead to an optimal internal capital structure of the firm. In their model, the firm operates in a two period economy which is set up as an Arrow Debreu state preference model. The firm, furthermore, faces a constant tax rate where all investments and debt payments are deductible. Managers of the firm act in the best interest of current stockholders. They face an investment opportunity in period two and have to decide whether to raise equity and invest or not to invest. This decision is made after the state of the world for period two is revealed. From the proceeds of the investment the debt, issued in period one, can be repaid. The current stockholders receive the remainder. If no investment is made, the firm defaults. Note that bondholders

cannot include covenants which would influence the investment decision and thereby prevent the underinvestment problem.

In the case of straight debt financing, managers only have the choice to invest in both assets in place and the new project, and receive the tax subsidy, or not to invest and default. In the case of default, managers forgo the benefits of the tax subsidy. If PF is allowed in the model, managers can decide on investments in assets in place and the new project separately. In one case, they may invest, take the tax subsidy and repay the borrowers, but in the other case they choose not to invest and default.

John and John 1991 show, in a simple mathematical example, that this separation can increase the combined value of assets in place and the new project as compared to the straight debt case. Theoretically, they show that this increase in combined value is caused by a change in incentives under a PF arrangement. PF can reduce agency cost for one investment while increasing agency cost for the other. At the same time, the value of the tax benefits changes. Overall, this effect has a positive impact on the combined value. Note that these gains are not dependent on the amount of debt used in the straight debt case. The authors also compare the amount of debt used in both investments and can show that the larger amount of debt is assigned to the investment with the more profitable technology.

Based on their theoretical results, John and John 1991 provide empirical implications with respect to four fields. First, with respect to PF incentives they derive the following: when the difference between the growth options of two investments is large, the increase in value caused by PF is large also. Thus, the difference in combined value between straight debt financing and PF increases with the difference in growth options between the two investments. To empirically test this implication, the authors propose research and development expenditures, SIC codes, and tangibility of assets as proxies for growth options. Second, John and John (1991) predict a positive announcement effect for sponsor's stocks when deciding to use PF. The reason lies in the increase in combined value caused by PF as described above. Furthermore, the announcement effect should increase with the difference in growth options between the two investments. Third, the model predicts that less debt should be used for projects with higher growth options. This prediction is supported by observations in PF lending. PF loans are often used in the public utility industry, which shows low growth options. It is, however, never used for projects which require new technology and thus may carry high growth options. Finally, John

and John 1991 also provide certain accounting implications which will not be discussed in detail at this point.

The analysis of PF is only one objective in Chemmanur and John's (1993) study. The authors develop a model which incorporates choices with respect to corporate, ownership and capital structure for an entrepreneur who has access to several projects. He is maximizing his control and security benefits in his decisions about incorporation of both projects in one firm (joint firm) or spin-off, the amount of debt financing, the debt structure (choosing straight debt in joint firm or spin-off with straight debt or limited recourse PF), and his wealth position in each firm. The driving factor in this model is the market for corporate control. Implications not only for the use of PF but also with respect to the capital structure and ownership characteristics for takeover activities are derived.

Three types of investors, all of them risk-neutral, are assumed in the model. One is an entrepreneur (incumbent) who alone has access to two positive net present value projects. He or she has to choose whether to run both projects in a joint firm or to set up two separate firms. Additionally, there are outside investors who do not try to gain control of the incumbent's firm(s). However, there exists a rival who buys equity from passive investors to gain control of the firm(s). The cash flows from the projects depend on the management in control and are known to all investors. The incumbent obtains funds to finance both projects from his own wealth and the sale of securities to passive investors. These securities consist of voting equity and non-voting debt which can be combined with a chosen corporate structure to obtain one of the following corporate and financial structures:

- Joint firm with straight debt: combine both projects in one firm and issue equity and debt on the joint firm.
- Joint firm with limited recourse PF: combine both projects in one firm, issue equity on the joint firm, and issue two debt claims, each of which relies on the cash flows of one project.
- Spin-off with straight debt: set up two firms with one project each and sell separate debt and equity claims on each firm.

It must be recalled that the cash flows from the projects depend only on the ability of the management in place and not on the financial and corporate structure. However, the value of debt and equity depends on the financial and

corporate structure. Since cash flows are not affected, and equity is the residual value of net cash flows after payments to debt holders, the value of equity increases with firm value for a given debt level.

In order to take over the firm, the rival has an endowment and the ability to borrow, so that he can purchase equity from passive shareholders. Motivation to obtain control arises from the benefits of control which accrue only to management in place. Due to the consequences of debt issuance, such as monitoring actions undertaken by bondholders, reduction of free cash flows through interest payments, and increases in bankruptcy risk, the benefits of control decrease with increasing debt levels. Next to these control benefits, management is also influenced by security benefits through the market value of their equity investment. However, it is assumed that control benefits dominate security benefits. Passive investors, as the third participant group in the model, are not interested in control of the firm(s). As equity holders, however, they have the right to vote in a corporate control contest. They have symmetric information about managerial abilities and vote in favor of the incumbent if the value of the firm with incumbent management is at least as large or larger than the value of the firm with rival management.

Equilibrium is reached in this model through the following process: the incumbent initially has access to two projects and invests part of his own wealth in these projects and sells zero net present value debt and equity claims to passive outsiders. In this corporate and financial decision, the incumbent has symmetric information about his and the rival's management abilities and the rival's financial endowment. After the incumbent makes his decisions, the rival buys equity from the passive investors and tries to take over control of the firm through a proxy contest. If more than 50% of the stockholders vote for the rival, management of the firms is transferred to him. In choosing a corporate and financial structure, the incumbent maximizes the benefits from his equity position in the firm (security benefits) and control benefits dependent on the debt level chosen. Since corporate and financial structures influence the outcome of the control contest, they also influence the control benefits of the incumbent. Thus, by maximizing control and security benefits, the corporate and financial choice is an element of the maximization decision. The rival has to maximize his control benefits obtained in the case of successful takeover. He does not obtain security benefits since equity claims are fairly priced.

Based on this model, Chemmanur and John 1993 describe different equilibria with equity alone and debt and equity combined. They derive

conditions for optimal joint incorporation versus optimal separate incorporation, optimal choice of financial structure in case of joint incorporation, optimal debt allocation among projects in cases of PF and spin-off. Since the rest of the review focusses on Chemmanur and John's (1993) PF related results, the main results of their study are described below:

- Joint incorporation is preferred over separate incorporation when the incumbent has similar management abilities across projects. When management abilities differ and the takeover activity is high in the incumbent's industry, separate incorporation is chosen.
- Joint incorporation with straight debt is optimal when similar management abilities and control benefits across projects exist. Limited recourse PF, however, is chosen in case of comparable abilities but different control benefits across projects. Finally, when both managerial abilities and control benefits are different, spin-off with straight debt is optimal for the incumbent.
- In the case of PF, control benefits determine the allocation of debt across projects such that more debt is allocated to the project where the sensitivity of control benefits to debt is smaller.
- Managerial abilities affect the debt allocation in the case of spin-offs. Higher levels of debt can be allocated to projects for which the incumbent has lower ability since low ability transforms into a lower sensitivity of control benefits to debt.

Although an equilibrium with equity is possible only in Chemmanur and John's (1993) model, there are conditions under which an equity issue alone is not sufficient for the incumbent to maintain control of the projects. In this case, debt becomes a part of the equilibrium structure. Since debt reduces the benefits of control, the incumbent issues only as much debt as needed to stay in control. In order to decide on this corporate and financial structure, the incumbent maximizes his control benefits for a given corporate structure first. Thus, for both joint incorporation and spin-off, he finds the optimal debt structure and allocation and the optimal wealth allocation. Then, he will choose the corporate structure which maximizes his overall control benefits. Only in the case of joint incorporation limited recourse PF might be an equilibrium choice.

In general, joint incorporation with PF is preferred to spin-off when the incumbent has similar management abilities for both projects. To remain in

control of the projects the incumbent needs less debt in case of joint incorporation than in the spin-off case. This is due to the size effect of joint incorporation, which makes it more difficult for the rival to take over. With his restricted wealth and borrowing, the rival might be able to take over one of the two firms but not the joint firm. If joint incorporation is optimal, PF is chosen over straight debt when expected control benefits from the joint firm with straight debt are lower than those from PF. This might be the case when the structure of control benefits differs significantly across projects and cash flows are more uncertain for the project with lower control benefits. If PF is optimal, the project for which control benefits decrease less strongly with increasing debt level will have the higher debt level. For this project, staying in control through the issuance of debt is less costly for the incumbent, since control benefits do not fall that much. Thus, he is better off by placing a larger share of his funds in the equity of the other project to maintain control and use debt for the control of this project. Finally, under certain conditions it is optimal to allocate high levels of debt to projects with low control benefits.

At this point, Chemmanur and John 1993 are able to derive several, empirically testable predictions, two of which are related to PF. In reality, an entrepreneur in an existing firm will face the situation of having a new project available. The first prediction in this case is that limited recourse PF will be used when the level of control benefits for the project is lower than the average level in the existing firm.[2] Second, if several projects are available to the entrepreneur and PF is his choice, then lower levels of debt will be found for projects with higher levels of control benefits. The level of debt will, however, be much higher in PF than in the existing firm.[3] To test their predictions empirically, the authors also provide proxies for the level of control benefits. Based on Jensen 1986, they argue that benefits of control increase with the level of free cash flow. Controversially, the complexity and restrictiveness of contracts reduce the freedom of the incumbent and thus his ability to extract benefits of control. The same is true for projects involving multiple sponsors and highly regulated industries. Referring to Hart 1983, the authors interpret a high level of competition in the industry as an indicator for low levels of control benefits. Monopoly power in an industry can be approximated by a high Tobin's q, thus approximating the benefits of control. Using these proxies, Chemmanur and John predict that the level of debt per dollar of value used in project financing

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[2] Based on Chemmanur and John's (1993) implication 2.
[3] Based on Chemmanur and John's (1993) implication 4.

is a function of free cash flow, Tobin's q, the complexity of contractual covenants, and the extent of regulation. The direction of the relationship is indicated in parentheses.

$$\frac{\text{Level of debt}}{\text{Dollar of value}} = Fct \left[\frac{(-)}{\text{Free cashflow}} , \frac{(-)}{\text{Tobin's } q} , \frac{(+)}{\text{Complexity of covenants}} , \frac{(+)}{\text{Extent of regulation}} \right]$$

In their paper, Chemmanur and John 1993 do not explicitly state their first prediction in terms of the proxies. It must be recalled that this first prediction states that the level of control benefits for the project is lower than the average level in the firm: if the level of control benefits per dollar of value (*pdv*) is lower for the project than for the existing firm, project finance will be used. If this hypothesis is correct, project financing will be used when:

Free cash flow PDV (project)	<	Free cash flow PDV (firm)
Tobin's q PDV (project)	<	Tobin's q PDV (firm)
Complexity of covenants (project)	>	Complexity of covenants (firm)
Extent of regulation (project)	>	Extent of regulation (firm)

The three reviewed studies establish the starting point for further investigations in the theoretical foundation of PF. The interested reader can review the original articles, identify yet undiscussed features regarding PF as an element of an optimal capital structure, and proceed with the development of his/her own model. Another approach to the analysis of PF in this context is provided by the predictions of the three reviewed studies. Based on a sample of PF and traditional on balance sheet financing structures for projects (traditional financing, TF), the interested reader can empirically test whether: PF are riskier and have a higher level of debt than TF; PF primary function is to reduce asymmetric information rather than to provide off balance sheet financing (both proposed by Shah and Thakor 1987); growth options are the driving factor to use PF over TF; sponsor's experience positive stock price reactions upon announcement of PF; the level of debt in PF is a decreasing function of the growth options of the project (all three proposed by John and John 1991); PF is used when the project exhibits a lower level of control benefits than the existing firm; the level of debt in PF decreases with increasing levels of control benefits (both proposed by Chemmanur and John 1993).

The challenge in pursuing this path of research on PF lies in the availability of data regarding PF. As mentioned in the introduction, no

comprehensive database on PF exists. Thus, finding proxies for the variables included in the theoretical models will be a primary concern of any empirical research project regarding PF. Kleimeier 1994 provides an event study analysis of PF and tests among other hypotheses John and John's (1991) prediction of positive stock price reactions for sponsors upon PF announcement. Based on an initial sample of 562 PF with 585 separate loans, full data was available for only 29 sponsor-related announcements and 33 lender-related announcements. Kleimeier's (1994) results of the sponsor related event study lead to a rejection of John and John's (1991) hypothesis, since insignificant abnormal returns were found for sponsors. On the basis of these results, PF can be seen as truly off balance sheet financing structures, since they have no effect on the sponsor's stock price. Furthermore, the study finds insignificant abnormal returns for lenders upon PF lending announcements. This result leads to the conclusion that PF loans are fairly priced and that lenders receive a return that is sufficient for the risk they are bearing when lending to PF. An argument often found in practitioners' articles stating that banks receive too little return regarding the high risk in PF lending should have resulted in negative abnormal returns for lenders and can therefore be rejected. Next to the empirical results regarding John and John's (1991) prediction, the rest of predictions from the three studies remain to be tested empirically.[4]

4.   Conclusions

The survey of the existing literature on PF has revealed the large existence of applied literature which focusses in general on the descriptive discussion of PF. The academic literature analyzing PF is, however, limited, to the extent that only a few capital structure related studies exist. Thus, the topic of PF is an open field for academic researchers and offers opportunities for research in various directions.

One area of research directly linked to this survey would be the extension of the optimal capital structure models and the empirical testing of their implications as indicated at the end of the previous section. Next to capital structure considerations, theoretical research regarding PF could also focus on pricing models for PF loans, or the implications of the competitive bidding

[4]Note that Chemmanur and John 1993 list studies by Chen, Kensinger and Martin 1989 and Wynant 1980 as providing preliminary support for their predictions.

process with which projects are awarded. In both fields studies exist that look at other types of loans or projects, but no specific attention has been given to PF. Thus, interested researchers could expand these strands of literature into the field of PF. Empirical research on PF, on the other hand, will always be limited by the amount of data on these types of loans that is publicly available.

With respect to the difficulties to collect a consistent sample of limited- or nonrecourse PF arrangements, the sample described in this survey is unique and provides first insights into the empirical analysis of PF. Due to its uniqueness, this sample will be used to derive further empirical results about PF.

Overall, the field of PF can be recommended to any researcher interested in finance. With respect to a specific empirical study, however, those researchers with contacts in the financial industry will find it easier to collect data on PF loans than researchers who cannot rely on data provided by co-authors from the financial industry. Thus, most of the future empirical research on PF can be expected to come not from academic researchers but from practically oriented researchers who work within the financial industry.

APPENDIX 1

Figure 1
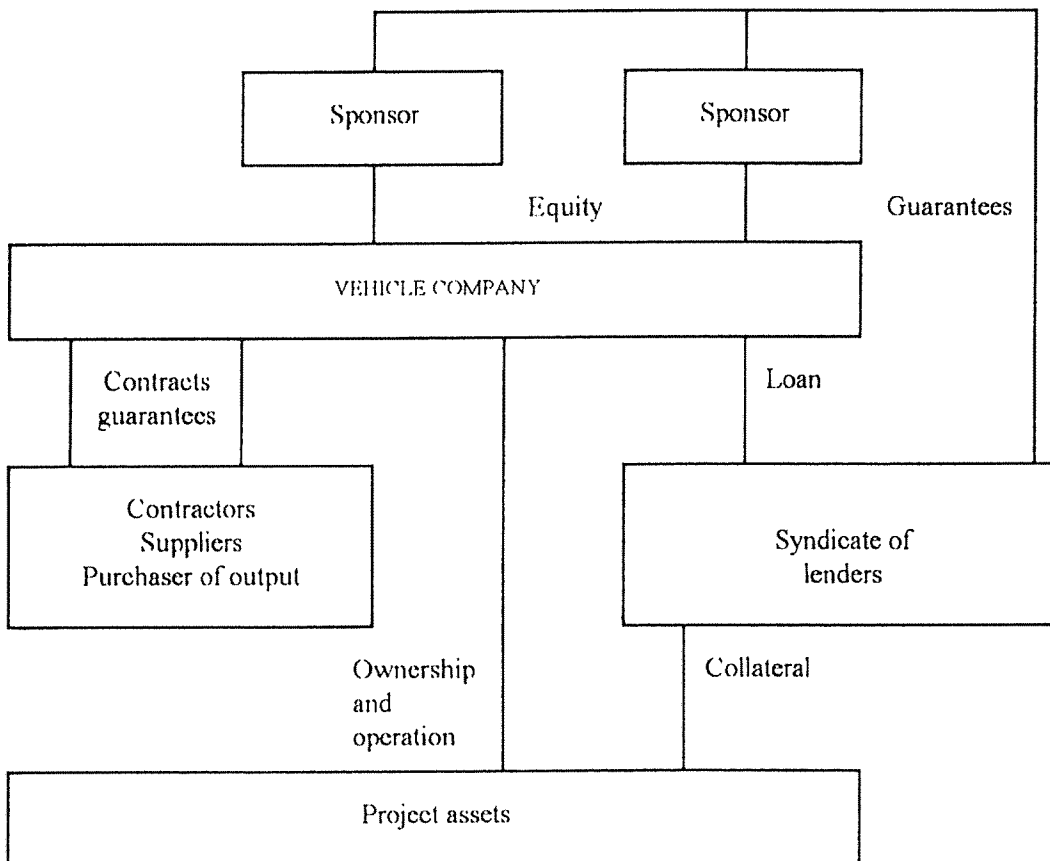
The Project Finance Structure

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                ┌──────────────────────────────────────────────────┐
                │                                                  │
         ┌──────┴──────┐            ┌───────────────┐              │
         │   Sponsor   │            │    Sponsor    │              │
         └──────┬──────┘            └───────┬───────┘              │
                │      Equity               │   Guarantees         │
     ┌──────────┴───────────────────────────┴──────────┐          │
     │                 VEHICLE COMPANY                  │          │
     └───┬──────────────────────┬──────────────────────┘          │
         │                      │        Loan                      │
    Contracts                   │                                  │
    guarantees                  │                                  │
     ┌───┴───────────┐     ┌────┴──────────────┐                   │
     │  Contractors  │     │   Syndicate of    │                   │
     │  Suppliers    │     │     lenders       │───────────────────┘
     │  Purchaser of │     └────────┬──────────┘
     │  output       │              │  Collateral
     └───────────────┘              │
          Ownership                 │
          and                       │
          operation                 │
     ┌────────────────────────────────────────┐
     │              Project assets             │
     └────────────────────────────────────────┘
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Figure 2

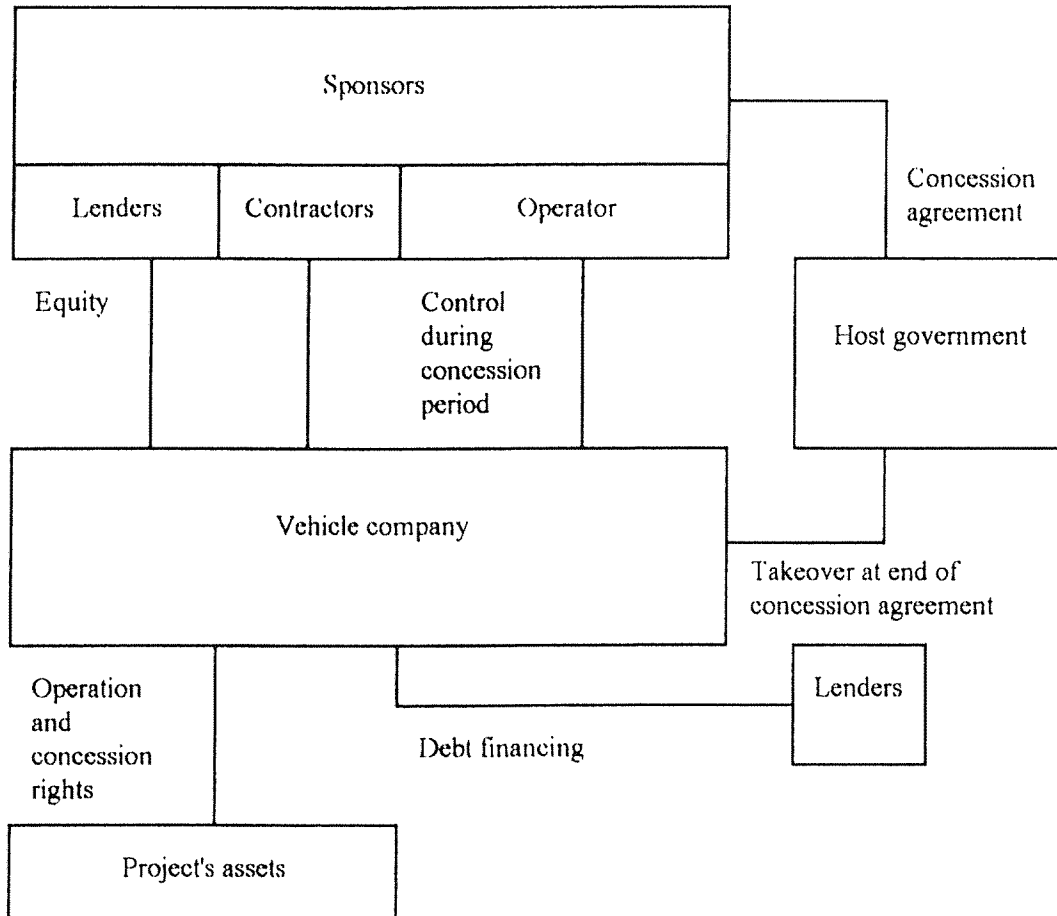## *The Build-Operate-Transfer Structure*

Table 1

The Project Finance Sample

PANEL A: FINANCING CHARACTERISTICS OF THE PROJECT FINANCE SAMPLE

Characteristic	n^1	Mean	Median	Minimum	Maximum
Size of loan in US$ m	117	392	150	9	6,720
Year in which loan was signed	123	1988	1990	1975	1992
Time to maturity of loan in years	112	10	10	1	18
Number of sponsors in project	38	3.4	3	1	14
Size of sponsor as given by total assets in US$ bn	39	10.9	3.9	0.02	84.4

PANEL B: LOCATION OF THE PROJECTS[2]

Country or Region	Number of Projects in this Country or Region
United States	111
Australia	63
North Sea	52
Indonesia	32
United Kingdom	32
Canada	23
Canada - United States	3
Thailand	20
China	17
Malaysia	15
Turkey	10

PANEL C: TYPE OF PROJECT BY INDUSTRY[3]

Industrial Group	Number of Projects in this Group
Electric, gas, sanitary services	127
Oil and gas extraction	90
Chemicals and allied products	49
Coal mining	32
Pipelines	30
Metal mining	30
Primary metal industries	28
Petroleum refining / related industries	28
Transportation / infrastructure	24
Hotels	16
Other industries[4]	95
Not identifiable[5]	36

[1]n = number of PF observations in the subsample of each characteristic.

[2]Only those countries are listed which host more than 10 projects.

[3]Industrial groups are derived from the Standard Industrial Classifications as used on the COMPUSTAT tapes. This classification distinguishes 83 different industries. From the total sample, the PF observations could be allocated to 31 of these 83 industries.

[4]This category includes PF observations for industries with less than 16 observations per industry.

[5]This category includes PF observations which could not be categorized due to lacking information.

Table 2

Risks and Hedging Tools in Project Finance

PANEL A: CONSTRUCTION AND COMPLETION RISKS

Risk	Hedging Tool	Participant who Provides Hedge
Supply, raw material and availibility of building material	Supply-or-pay contract	Supplier
Adequate communication	Project network	Sponsor
Contractor performance	Feasibility study	Sponsor
Force majeure	Insurance	Insurance agency
Cost overruns	Completion guarantee standby credit	Contractor lender
Delays	Completions guarantee	Contractor

PANEL B: OPERATION RISKS

Risk	Hedging Tool	Participant who Provides Hedge
Energy supply	Long-term supply contract	Electricity supplier
Output demand	Take-or/and-pay contract throughput contract	Purchaser of output
Transportation of product to market	Long-term transportation contract	Transportation company
	Project transportation means	Sponsor
Adequate communication	Project network	Sponsor
Operator performance	Feasibility study compensation scheme	Sponsor

Management performance	Feasiblity study compensation scheme	Sponsor
New technology	Reject project	-
Sponsors	Contracts to ensure stability of vehicle company	Sponsors
Resources	Feasibility study	Sponsors
Force majeure	Insurance	Insurance agency

PANEL C: RATE VARIABILITY RISKS

Risk	Hedging Tool	Participant who Provides Hedge
Exchange rate risk	Financial hedging tools, such as currency options, currency futures, swaps	Financial institutions
Inflation rate risk	Long-term supply and output contracts	Supplier and purchasers
Interest rate risk	Financial hedging tools, such as fixed rate loans, interest rate ceilings	Financial institutions, lenders

PANEL D: POLITICAL RISKS

Risk	Hedging Tool	Participant who Provides Hedge
Availability of licences and permits	Good working relationship with government	Sponsor
Expropriation	Project structure that includes local sponsors, lenders, government agencies, international agencies	Sponsors
Country risk	Feasiblity study insurance	Sponsor insurance company
Sovereign risk	Feasibility study structure project to include government	Sponsor

Table 3

Guarantee as Risk Reduction Instrument in Project Finance

GUARANTEE CATEGORIES	GUARANTEE FORMS[1]
Direct, unconditional	Completion guarantee
Limited - amount - time	Take-or-pay contract
	Throughput contract
Indirect	Put-or-pay contract
Contingent	Take-and-pay contract
Implied	Comfort letters

[1]Depending on the details in the guarantee contract, each form of guarantee can fall into a different category. An exclusive relationship between form and category cannot be established.

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