# Alternate Financing Strategies for Build-Operate-Transfer Projects

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**Abstract:** This paper contains a study of build-operate-transfer (BOT) project financing strategies from the perspective of project sponsors. The financing strategy for a BOT project includes the selection of the appropriate mix of equity and debt financing, and the identification of appropriate financing sources. Project sponsors typically wish to minimize their financing costs to ensure their tenders are competitive. Thirteen transportation and power-generation BOT projects in North America and Asia were analyzed. Important considerations and financing strategies were identified and examined. The findings suggest that project risks, project conditions, and availability of financing are the major considerations in selecting a financing strategy. The project risks that were determined to be most significant in financing strategy selection were political, financial, and market risks. Based on the study findings, a decision model was developed that can be used by BOT project sponsors in selecting appropriate financing strategies.

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## Introduction

The build-operate-transfer (BOT) delivery method has been used for many infrastructure projects, both within the United States and internationally. Under this approach, a private sponsor finances, designs, and builds the project and then operates it for a specified concession period. During this concession period, the sponsor collects revenues from operating the project to recover its investment and earn a profit. At the end of the concession period, ownership of the project is transferred to the granting authority. The first successful modern BOT project was the Suez Canal, completed in 1868 (Levy 1996). In the succeeding years, many other successful BOT projects have been completed.

Project participants include the granting authority, usually a government agency; the project sponsor; and usually one or more financial institutions. The granting authority identifies project requirements, establishes the concession period, solicits tenders, and awards the contract. The project sponsor typically is a consortium or a joint venture of engineering, construction, and venture capital firms. Investment capital may come from commercial banks, insurance companies, or the sale of bonds.

Three of the major challenges facing a prospective sponsor are estimation of project costs, projection of revenues during the concession period, and selection of an appropriate financing strategy. This paper addresses the third challenge, that of financing. Thirteen BOT projects were analyzed to determine the risks faced and the financing strategies used. Based on this analysis, a decision model for BOT project financing was developed. Financial terms used are explained in the glossary toward the end of the paper.

## Risk Analysis

The major risks a project sponsor faces are political, financial, construction, operational, and market risks. Political risk comes from the potential occurrence of political events such as war, revolution, expropriation of assets, tax code revisions, currency devaluation, foreign exchange control problems (convertibility and availability), export restrictions, and any other government action that could influence the profitability of a project (Lang 1998). Political risk may be significant when considering projects in developing countries with unstable governments (Tam 1999). A change in government can affect government policy and project sponsorship.

Financial risk relates to fluctuations in currency exchange rates, inflation, and cost of capital (interest rates). Foreign exchange risk often is high in developing countries, especially those experiencing rapid inflation. The cost of capital risk may not be related to the country in which the project is to be constructed, but it will be a factor in the countries where project financing is obtained.

Construction risk primarily relates to delays in completion and cost overruns. Construction delays may be caused by technical difficulties, by poor management, or by a combination of both. Since BOT investors rely on income from the completed project to recover their investment, any delay in completion will delay the generation of revenue. Cost overruns will impact the profitability of the project by increasing construction and financing costs.

Operation risk relates to the cost of operating the completed facility. Actual operation and maintenance costs may exceed those anticipated during project planning. Unanticipated operation costs also will adversely impact the profitability of the project.

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Market risk consists of a demand risk and a price risk. The demand risk is the uncertainty regarding the demand for the product or service provided by the completed project. The price risk is the price that realistically can be charged for the product or service. The price may be set by the granting authority, as in the case of a toll road, or competition, as in the case of a power plant.

Understanding project risks is critical in the selection of an appropriate financing strategy. Lenders and investors tend not to participate in risky projects unless they receive a high rate of return. BOT project sponsors need to select appropriate risk mitigation strategies to minimize their financing costs to ensure their tenders are competitive (Tiong 1995b, 1996). A major component of risk mitigation planning is the selection of an appropriate financing strategy.

## Alternate Financing Strategies

The financing of a BOT project typically is not based on the credit rating of the sponsor or the value of the project's physical assets, but depends on the anticipated financial performance of the project. Lenders consider the project's earnings as the source of repayment and the project's assets as collateral. The collateral value does not need to be sufficient to cover the value of the loans, but it is viewed as security to prevent third parties from interfering with the project. BOT project loans are considered ''off-balance-sheet'' loans by participants in the sponsoring consortium, since the loans do not affect their credit rating or borrowing capacity. Because of the length of most concession periods, BOT project loans tend to have longer maturities and higher interest rates than do traditional business loans (Lang 1998).

BOT projects usually are funded with both equity and debt. The capital structure in most BOT projects is highly leveraged. Equity financing typically covers only 10–30% of total project costs, while debt financing is obtained for the remaining 70–90% (Levy 1996). While the debt/equity (D/E) ratios of different projects vary, a common strategy is to utilize as much debt as the project cash flows can justify to provide an attractive rate of return to equity investors. However, a low percentage of equity financing provides more risk to project profits and investor dividends. Thus, an appropriate balance between equity and debt is needed.

Equity investors may be those who are solely interested in a return on their investments, such as public shareholders and institutional investors, or those who have direct interest in project operation, such as general contractors, designers, and operation and maintenance firms (Tiong 1995a). Granting authorities and lenders inevitably are concerned about the equity level in evaluating the risk and viability of the project. A significant level of equity investment is a competitive advantage when tendering a BOT project, because it demonstrates a high level of commitment by the project sponsors (Tiong 1995a).

Nonrecourse debt instruments are used for debt financing of BOT projects to ensure that lenders have no recourse against the participants in the sponsoring consortium; instead, they must rely on the revenue generated by the project as the source for loan repayment. The objectives that BOT project sponsors try to achieve in structuring the debt financing are maximization of long-term debt, maximization of fixed-rate financing, and minimization of refinancing risk (Tiong and Alum 1997).

BOT projects can be viewed as two distinct projects—a high-risk construction project in the first phase, and a relatively low-risk operation and maintenance project in the second phase. Many lenders do not want to undertake the construction risks. In some cases, long-term nonrecourse debt financing cannot be obtained until construction is completed. Project sponsors may use equity to finance the construction and refinance with debt financing or public sale of stock once the major construction is completed.

## Case Studies

Thirteen BOT projects constructed in North America and Asia were selected and studied in an attempt to understand the criteria used in selecting the financing strategy for a BOT project. Information on project characteristics, financing structure, risks and mitigation methods used, and financial performance was assembled and analyzed. The projects were divided into two categories—transportation projects and power generation projects. Table 1 shows the general information about the projects, and a brief description of each of the projects follows.

### *Project Summaries*

**Highway 407 Express Toll Route, Canada**
Highway 407 runs east and west near Toronto. Its first 69 km section was constructed by the Province of Ontario, Canada, and has been operated by the province since 1997. In 1999, a concession was awarded to 407 International Inc., who paid $3.1 Canadian billion for the completed section of highway and are to construct an additional 39 km. The toll rate is subject to contractual terms and does not require government approval. Bridge loans that were provided by local banks were refinanced by the sale of bonds (''Highway 407'' 2000).

**Dulles Greenway, Virginia**
The Dulles Greenway is a 22.5 km extension of the Dulles Toll Road connecting Washington Dulles International Airport with Leesburg, Va. (Levy 1996). Toll Road Investors Partnership II is the project sponsor. The project debt was refinanced in 1999 to lower the interest cost and to reschedule the repayment after the project experienced low traffic volume during its initial operation (Toll 1999).

**State Route 125 South Tollway, California**
State Route 125 is a 17.7 km toll road project in southern California (Levy 1996). The state government is constructing the 2.4 km northern section of the highway; a private consortium, California Transportation Ventures, Inc. (CTV), is responsible for the 15.3 km southern section. CTV will transfer ownership of the southern section, as well as tort liability, to the state upon the completion of construction and will lease the facility for the 35-year concession period.

**Cross Harbour Tunnel, Hong Kong**
The Cross Harbour Tunnel was the first fixed link connecting Victoria, Hong Kong, and Kowloon, Hong Kong (Walker and Smith 1995). The Cross Harbour Tunnel Co. acquired foreign-currency-denominated loans from the United Kingdom, backed by export credit guarantees. The project enjoyed high traffic because it was the only highway crossing and the economy was growing rapidly (Tam 1999).

**Western Harbour Crossing, Hong Kong**
The Western Harbour Crossing was the third tunnel built between Hong Kong and Kowloon. It connects the island to the new Chep

**Table 1.** Summary of Case Studies

| Project | Country | Contract signed | Completion | Concession period (year) | Total project cost (U.S. million dollar equivalent) |
|---|---|---|---|---|---|
| (a) Transportation projects | | | | | |
| Highway 407 Express Toll Route | Canada | 1999 | 2002[a] | 99 | 2,700 |
| Dulles Greenway | United States | 1988 | 1995 | 40 | 340 |
| State Route 125 South Tollway | United States | 1991 | 2004[a] | 35 | 464[a] |
| Cross Harbour Tunnel | Hong Kong | 1965 | 1972 | 30 | 28 |
| Western Harbour Crossing | Hong Kong | 1992 | 1997 | 30 | 965 |
| North-South Highway | Malaysia | 1988 | 1995 | 30 | 3,192 |
| Second Stage Expressway System | Thailand | 1989 | 1996 | 30 | 1,350 |
| Bangkok Mass Transit System | Thailand | 1992 | 1999 | 30 | 1,300 |
| Guangzhou-Shenzhen-Zhuhai Superhighway | China | 1987 | 1994 | 30 | 1,900 |
| (b) Power generation projects | | | | | |
| Subic Power Plant | Philippines | 1993 | 1994 | 15 | 142 |
| Paiton I Power Plant | Indonesia | 1994 | 1999 | 30 | 2,500 |
| Shajiao B Power Station | China | 1984 | 1987 | 10 | 512 |
| Rizhao Power Plant | China | 1995 | 2000 | 20 | 660 |

[a]Estimated.

Lap Kok Airport. The contract allowed toll adjustment based on an agreed range of net revenue (Levy 1996). With two other tunnels in operation, the project is in a competitive environment.

**North-South Highway, Malaysia**

The North-South Highway runs approximately 900 km from the Thai border to Singapore. The estimated project cost of U.S. $1.3 billion escalated to U.S. $3.2 billion due to construction difficulties and exchange rate fluctuation (Walker and Smith 1995). The government helped the project sponsor, Projek Lebuhraya Utara Selatan, by providing loans (Fisher and Babbar 1996). All toll adjustment requires Malaysian government approval.

**Second Stage Expressway System, Thailand**

The 40.5 km Second Stage Expressway System (SES) connects metropolitan Bangkok, Thailand, with growing suburban areas (Tam 1999). Tolls for the SES are collected jointly with the First Stage Expressway System under a revenue sharing arrangement. A major restructuring in 1994 made the major project participant leave the project due to unresolved disputes between the sponsor and the granting authority (Ongpipattanakul 1999). The government delayed a toll increase, and the poor revenues caused insufficient cash flow problems, which resulted in another debt repayment rescheduling in 2000.

**Bangkok Mass Transit System, Thailand**

The Bangkok Mass Transit System is a 23.5 km system in central Bangkok. The civil structure was transferred to the Bangkok Metropolitan Authority at the completion of construction, but the project sponsor, Bangkok Mass Transit System Co., is to operate the system for a 30-year concession period. Lenders required that the debt-to-equity ratio not exceed 1.75 during construction and 1.85 during the operation phase (Pricewaterhouse 2000).

**Guangzhou-Shenzhen-Zhuhai Superhighway, China**

The 122.8 km Guangzhou-Shenzhen-Zhuhai (GSZ) Superhighway links Hong Kong and the Guangzhou region. The project sponsor is a joint venture of the Guangdong Provincial Highway Construction Company, which is responsible for construction and relations with Chinese government authorities, and Hopewell China Development (Superhighway) Limited, which is responsible for providing funding (Lang 1998). The percentage of ownership for the two organizations varies over time, based on the joint-venture contract.

**Subic Power Plant, Philippines**

Subic Power Plant is a 113.4 MW bunker-oil-fired power plant with eight generators situated at the Subic Bay Freeport in Olongapo City, Philippines (Lang 1998). The government promised to supply fuel to the project sponsor at no charge throughout the 15-year concession period.

**Paiton I Power Plant, Indonesia**

The Paiton I Power Plant is a 1,230 MW coal-fired power plant in East Java, Indonesia (Lang 1998). The project sponsor is PT Paiton Energy Company. Perusahaan Listrik Negara Persero (PLN), the state-owned electricity authority, is to purchase all of the electricity generated under the power purchase agreement. All tariff rate changes require PLN's approval. The economic downturn and political changes in Indonesia after 1998 caused severe problems when PLN failed to make full contractual payments (Cahill et al. 2001). The devaluation of the local currency also adversely affected the sponsor's ability to service the project's foreign debt. The contract is being renegotiated.

**Shajiao B Power Station, China**

Shajiao B Power Station is a 700 MW coal-fired plant located in Guangdong, China. The project sponsor is a joint venture of Shenzen Special Economic Zone Power Development Co. (SPDC) and Hopewell Power (China) Ltd. (HPC) (Walker and Smith 1995). HPC was responsible for financing all construction costs, while SPDC is the interface with government and provincial agencies. Revenues were structured in both local and foreign currency. Guangzhou International Trust and Investment Company provided guarantees on the power purchase agreement and coal supply agreement (Lang 1998).

**Rizhao Power Plant Project, China**

The Rizhao Power Plant is a 700-MW coal-fired power station in Shandong Province (Lang 1998). The joint venture contract re-

**Table 2.** Risk Level and Financing Methods of BOT Transportation Projects in North America

| Project | PR | FR | MR | D/E ratio | Equity financing | Debt financing |
|---|---|---|---|---|---|---|
| Highway 407 Express Toll Route | 1 | 1 | 2 | 2.33 | $1,550 million (Canadian dollars) (minimum required by government): SNC-Lavalin, 23%; Cintra-Ferrovial, 61%; Caisse, 16%. Equity provided in cash [$650 million (Canadian dollars)] and several forms of subordinated debt [$900 million (Canadian dollars)]—including eight-year extendable debt and convertible subordinated debentures. | $2.3 billion (Canadian dollars) short-team floating-rate senior bridge loan and $150 million (Canadian dollars) junior bridge loan. All bridge loans were expected to be refinanced by bonds. Series of bonds issued to refinance bridge loan—some with five-year repayment holidays and swapped U.S.-pay conditions. |
| Dulles Greenway | 2 | 2 | 3 | 3.08 | U.S. $84 million: Lochnau, 57%; Autostrade, 19.2%; Kellogg Brown & Root, 13.8%; miscellaneous investors, 10%. Lochnau provided initial equity injection. Autostrade increased its equity to 29.3% after completion. | U.S. $202 million long-term fixed-rate notes, U.S. $10 million contingency credit facility, and U.S. $57 million senior loans. Restructuring in 1999 with U.S. $333 million senior limited-recourse revenue bonds (the interest rate was reduced, and the insufficient cash flow problem was solved). |
| State Route 125 South Tollway | 2 | 1 | 3 | 2.82 | U.S. $122 million: Parsons Brinckerhoff, 43%; Egis Projects, 35%; Koch, 16%; Fluor, 6%. U.S. $25 million initial equity injection for development processes. Shareholder loans supported the initial phase. | Transportation Infrastructure Finance and Innovation Act loan: U.S. $94 million loan; U.S. $37 million contingency line of credit. U.S. $250 million toll revenue bonds to be issued. |

Note: PR = political risk; FR = financial risk; MR = market risk; D/E ratio = debt-to-equity ratio (Klein and Fielding 1992; ''Innovative'' 1993; Dafoe and Connell 1999; Mendoza et al. 1999; Toll 1999; Loop 2000; Olsen and Stoll 2000; Reinhardt 2000).

quires Shandong Electric Power Company to provide equity in Chinese renminbi and to be in charge of licensing and obtaining permits, while foreign parties provide U.S. dollar funding and arrange debt financing. Contrary to other projects in China, the Rizhao project was able to acquire limited-recourse debt financing without direct guarantees from Chinese authorities.

### *Project Risks*

Analysis of the risks project sponsors faced in the 13 case studies indicated that construction and operation risks were more manageable than other types of risks. Most of the project sponsors in these case studies handled construction and operation risks similarly by contracting out the responsibilities and using advanced, well-proven technology. The major considerations in the selection of a financing strategy, therefore, were political, financial, and market risks. Understanding these risks is vital to the success of a project, but they are difficult to forecast and manage. These three risk categories were analyzed in each case study to understand how they influenced the financing strategies that were used.

### *Risk Analysis*

The political, financial, and market risks faced by project sponsors in each of the case studies were rated on a scale of 1–5, with 5 being high risk. The risk rating assigned to each of the projects was subjectively selected based on analysis of project histories and records, and evaluation of the following criteria:

- Characteristics and conditions of the host country and the region,
- Characteristics and nature of the project,
- Contractual terms, and
- Capability of project sponsors to mitigate risks.

The risk evaluations and financing strategies for each project are shown in Tables 2–4.

Projects in the United States and Canada have low political risks because they have good legislative frameworks, detailed contracts, and strong government support. The political risk faced by the sponsor of the Western Harbour Tunnel project was related to the turnover of Hong Kong to China. Projects in Southeast Asia and China have high political risks, which result from the lack of concession legislation, contractual details, and government guarantees.

The financial risk of a BOT project depends on the host country's financial condition as well as the contract provisions and the availability of financing sources. Projects in the United States and Canada have low financial risk because of the financial stability of the host countries and the availability of financing. The high financial risk scores for projects in Southeast Asia are mainly because of the host countries' economies. The high scores for projects in China are due to government control and limited local financing sources. Hong Kong has moderate financial risk because its economy and financial market have grown rapidly in the last few decades. The Shajiao B Power Project received an exchange rate guarantee from the Chinese government. Contractual language regarding revenue collection is a strong factor in determining a project's financial risk. Highway 407, State Route 125, Western Harbour Crossing, Subic Power Plant, Second Stage Expressway System, Bangkok Mass Transit System, and the Rizhao Power Plant are projects that allow sponsors to increase tolls or electricity charges without seeking government approval. The remaining projects require government approval for any rate increases.

The market risks faced by the project sponsors were judged on market demand, market competition, purchase agreements, contractual provisions, and government guarantees. Power plant projects have lower market risk, since their power purchase agreements typically have a fixed capacity fee paid by the granting authority as well as a rate for the sale of energy. Transportation projects have higher market risks, since they may not achieve their forecasted traffic volumes. Exceptions are the Cross Harbour Tunnel, which was the only harbor crossing for 15 years, and Highway 407, which was partially completed and in operation

**Table 3.** Risk Level and Financing Methods of BOT Transportation Projects in Asia

| Project | PR | FR | MR | D/E ratio | Equity financing | Debt financing |
|---|---|---|---|---|---|---|
| Cross Harbour Tunnel | 3 | 3 | 2 | 3.70 | £4.0 million: Wheelock Marden, Hutchison International, Kwong Wan, Sir Elly Kadoorie Successors; 25% IPO (1974) | £14.7 million floating-rate international bank loan backed by United Kingdom Export Credit guarantees |
| Western Harbour Crossing | 3 | 2 | 4 | 2.13 | HK $2.4 billion: Adwood Company, 50%; Cross Harbour Tunnel Company, 37%; China Merchants Holdings (HK), 13%. Sponsor-provided guarantee: five-year minimum continuation of shareholders and obligation to equity-finance any cost overrun. | HK $5.2 billion floating-rate syndicated bank loan facilities, including HK $3.2 billion precompletion facility, and HK $2 billion revolving credit facility; fixed-rate swap facility covering 50% of the loan amount |
| North-South Highway | 5 | 4 | 3 | 3.00 | U.S. $775 million: Mitsui, Taylor Woodrow International; Dragage et Travaux; three Malaysian companies. Subcontractors were partially paid in equity stocks; IPO by completion. | U.S. $2.3 billion: U.S. $870 million foreign syndicated loan, U.S. $807 million local syndicated loan, U.S. $634 million government subordinated soft loan. Major debt portions are floating rated. Local government provided a soft loan to mitigate exchange rate and traffic volume problems. |
| Second Stage Expressway System | 5 | 4 | 4 | 2.50 (1997); 2.97 (2000) | Bt 4.1 billion (1992): Kumagai Kumi, 70%; Ch. Karnchang, 6%; four domestic banks, 24%; Bt 5.5 billion (1994). After restructuring: Kumagai Kumi, 0%; Ch. Karnchang, 41%; four domestic banks, 59%; IPO in 1996. | Bt 14 billion domestic syndicated loan, U.S. $250 million international syndicated loan, and U.S. $30 million Asian Development Bank loan. After 1994 restructuring: Foreign debts were retired by Bt 3.3 billion bridge loans and Bt 23.9 billion floating-rate domestic syndicated loans. The repayment schedule was postponed in 2000 due to low revenue. |
| Bangkok Mass Transit System | 4 | 4 | 4 | 1.85 | Bt 18 billion (2000): Tanayong, Italian-Thai Development, International Finance Corporation of Thailand. Tanayong injected initial equity. Project sponsors provided subordinated convertible debentures and shareholder loans to support cost increases. The IPO has been postponed by economic crisis and low revenues. | Bt 15 billion Siam Commercial Bank (SCB) syndicated facilities, U.S. $550 million KfW and ÖKB facilities, and U.S. $50 million International Finance Corporation facility. As of March 2000: Bt 11.2 billion SCB syndicated loan, U.S. $458 million KfW syndicated loan, U.S. $80 million International Finance Corporation loan, and U.S. $9 million supplier loans. |
| Guangzhou-Shenzhen-Zhuhai Superhighway | 5 | 4 | 5 | 1.37 | U.S. $210 million (U.S. $90 million registered capital and U.S. $120 million shareholder loan). All equity and credibility for senior debt were provided by Hopewell China Development. Hopewell provided additional shareholder advances and a U.S. $630 million shareholder loan to support the negative cashflow. | 1987: U.S. $800 million floating-rate full-recourse loan provided by international lenders. 1997: U.S. $600 million unsecured notes subordinated to senior loans were issued to refinance the shareholder loans. |

Note: PR = political risk; FR = financial risk; MR = market risk; D/E ratio = debt-to-equity ratio; Bt = Baht; HK = Hong Kong; IPO = initial public offering of equity; KfW = Kreditanstalt fur Wiederaufbau; ÖKB = Osterreichische Kontrollbank Aktiengesellschaft (Bangkok Expressway 1994, 2000; Walker and Smith 1995; Fisher and Babbar 1996; Lang 1998; Olson 1999; Ongpipattanakul 1999; Tam 1999; Bangkok Mass Transit System 2000; Pricewaterhouse 2000).

**Table 4.** Risk Level and Financing Methods of BOT Power Generation Projects in Asia

| Project | PR | FR | MR | D/E ratio | Equity financing | Debt financing |
|---|---|---|---|---|---|---|
| Subic Power Plant | 3 | 4 | 1 | 3.07 | U.S. $138.5 million reduced to U.S. $37 million after refinancing in 1993: Enron, 65%; House of Investment, 15%; Rizal Commercial Banking Corporation, 20%. Shareholder advances were refinanced with public sale of debt. | U.S. $105 million fixed-rate, limited-recourse senior secured notes issued in United States in 1993; project sponsors guaranteed the notes until completion. Enron was obligated to maintain at least 25% ownership. |
| Paiton I Power Plant | 5 | 4 | 2 | 2.70 | U.S. $680 million (consisting of U.S. $306 million shareholders' equity and U.S. $374 million subordinated debt): Mitsui, 35.7%; Edison Mission Energy, 35.7%; General Electric, 21.9%; PT Batu Hitam Perkasa (local shareholders), 6.7%. Sponsors were obligated to provide additional U.S. $300 million contingent equity. | U.S. $1.8 billion (1995): JEXIM's U.S. $540 million fixed-rate and U.S. $360 million floating-rate facility, U.S. $540 million fixed-rate USEXIM facility, U.S. $200 million OPIC facility, U.S. $180 million syndicated commercial bank loan (refinanced in 1996 with U.S. $180 million nonrecourse bonds). Due to high perceived risks, high interest rates were charged even with political risk guarantees provided by JEXIM and USEXIM. |
| Shajiao B Power Station | 4 | 3 | 2 | 3.00 | U.S. $128 million: Hopewell Holding, 50%; Chinese entities, 45%; Kamematsu Gosho (HK), 5%. These sponsors formed Hopewell Power (China), which was responsible for acquiring foreign currency loans. Shenzen Special Economic Zone Power Development Company is a joint venture partner. | U.S. $384 million: JEXIM fixed-rate supplier credit; renminbi loan from local banks; Euroyen and HK currency international syndicated bank loan. A 1987 fixed rate Euroyen loan refinanced the export credit, and the interest cost was reduced. |
| Rizhao Power Plant Project | 4 | 3 | 1 | 3.40 | U.S. $150 million: five Chinese state-owned entities, 75%; U.D.I. Ltd. (HK), 12.5%; Siemens, 12.5%. Shareholders were obligated to provide subordinate loans to support cost increases. | U.S. $510 million: U.S. $175 million KfW loan, U.S. $185 million Banco Central Hispano, and U.S. $160 million renminbi local loans. Loans are limited recourse, borrowed by the project sponsor. |

Note: PR = political risk; FR = financial risk; MR = market risk; D/E ratio = debt-to-equity ratio; HK = Hong Kong; IPO = initial public offering of equity; JEXIM = Export-Import Bank of Japan; USEXIM = Export-Import Bank of the United States; OPIC = Overseas Private Investment Corporation; Euroyen = Japanese yen traded in the Eurocurrency markets; KfW = Kreditanstalt fur Wiederaufbau (Walker and Smith 1995; Abbott and Hugon 1996; Lang 1998).

when the concession was awarded. The Western Harbour Crossing, Second Stage Expressway System, Bangkok Mass Transit System, and GSZ Superhighway are projects that have significant market risk from competitive alternative transportation systems.

## Case Study Analysis

The case studies demonstrated several characteristics that should be considered when selecting BOT project financing strategies. We found that the most important criteria in the selection of financing strategies for BOT projects are the availability of financing sources, the project conditions, and the project risks.

### *Availability of Financing Sources and Financing Strategies*

The availability of potential lenders and capital markets must be determined before a tender is submitted. The search should not be limited to local markets and lenders. International financial institutions and foreign investors often seek investment opportunities; many of them have participated in BOT projects, expecting the high return on their investments. However, when both local and international sources are available, local firms tend to understand local conditions better and may be more willing to accept the project risks.

### *Project Conditions and Financing Strategies*

Project conditions include the project sponsors' capabilities, working relationships with local firms and government authorities, governmental involvement, concession periods, contractual requirements, and technical requirements. The most important of these are the length of the concession period and the degree of government involvement. Long concession periods provide financing flexibility, and various financing strategies can be selected. However, longer concession periods may provide greater market and financial risk. Involvement of government authorities can help mitigate the political risks by assisting with legal processes and providing support, guarantees, or even financing. Most governments do not sponsor BOT projects, except in special conditions, as in China. Direct involvement can generate conflicts of interest and slow project performance.

### *Project Risks and Financing Strategies*

Overall project risks were evaluated by adding the ratings shown in Tables 2–4. Projects with the total risk scores of 8 and lower were considered low-risk projects. These projects are Highway 407, Dulles Greenway, State Route 125, Cross Harbour Tunnel, Subic Power Plant, and Rizhao Power Plant. Sponsors of low-risk projects have many options when selecting financing strategies. With low risks, the projects have high credibility with investors,

lenders, and capital markets. Therefore, project sponsors can negotiate and select favorable financing methods.

Analysis of the low-risk projects indicates that there are many similar features in the financing of these projects. These features were high leverage, low level of contingency credit facilities, use of capital markets, and no public equity. By leveraging the funding structure, project sponsors can increase the return on investors' equity. Granting authorities and lenders generally require a certain level of equity as project sponsors' commitment to the success of the projects. Low-risk projects can be more leveraged than can high-risk projects. The average debt-to-equity ratio of the low-risk projects was 3.07, while that of the high-risk projects was 2.36.

With a low risk of cost increases, a low level of project contingency credit is necessary. This results in lower financing cost. For example, the Dulles Greenway had a U.S. $10 million contingency credit facility plus U.S. $40 million in contingent equity. The Paiton I Power Plant granting authority required the project sponsor to have U.S. $300 million of contingent equity, and the Bangkok Mass Transit System granting authority required U.S. $81 million in contingency credit facilities plus U.S. $93 million equivalent of contingent equity.

Bond issuance is a long and expensive process compared to acquiring bank loans. It requires a project that is credible in the capital markets. However, bond financing often results in reduced interest cost and mitigation of the interest rate fluctuation risk. Sponsors of four of the low-risk projects used bond financing. The Cross Harbour Tunnel and Rizhao Project did not issue bonds. Sponsors of low-risk projects can use bond financing early during project development. For example, sponsors of Highway 407 issued more than $2,500 million (Canadian dollars) in bonds within 20 months after being awarded the contract. Sponsors of the Dulles Greenway, State Route 125, and Subic Power Plant projects also issued bonds before project completion. Another important criterion for bond financing is the availability of capital markets, which are still undeveloped in many nations. Six of the 13 projects issued bonds, and five of them issued bonds in the U.S. bond market. Sponsors of Highway 407 issued several series of bonds in Canada.

Sponsors of low-risk projects have the option of raising funding with both debt financing and subordinated shareholder loans. Public sale of equity may be considered an exit strategy for project sponsors once construction is completed. The Cross Harbour Tunnel was the only low-risk project that made a public offering of equity.

### High Political Risk

Political risks found in the case studies were complicated approval processes, instability of the government, government unreliability, delays, changed policies, and lack of clear legislation. Financing strategies used to mitigate the political risks were seeking assistance from influential individuals or organizations, involving international firms or organizations, and seeking government participation. Having international investors or lenders is a technique for discouraging local governments from breaking their agreements. All projects analyzed have such involvement.

Most BOT projects require political support to be successful. The Shajiao B Power Project has an influential Chinese champion who promoted the project. The Paiton I Power Plant and the North-South Highway Projects have investors who have direct political connections with the host governments. A foreign participant in the Second Stage Expressway System Project was involved in a dispute with the granting authority, and a local construction firm replaced the foreign firm and settled the dispute.

The political risks can be reduced by obtaining government support, government guarantees, clear contract provisions, or insurance from appropriate authorities. These strategies help project sponsors obtain economical financing options. The Rizhao Power Plant is an example. Its success in acquiring U.S. $360 million in limited-recourse foreign loans and achieving the debt-to-equity ratio of 3.40 is a result of meaningful support and indirect guarantees from Chinese authorities.

### High Financial Risk

Financing strategies that sponsors selected to mitigate the financial risks were use of international lending institutions, use of fixed-rate financing, denominating loans in local currency, and denominating a portion of the revenue in foreign currencies. Loans from international lending institutions usually have low interest rates and relatively flexible terms and conditions to assist the development of developing countries. Three projects in Southeast Asia used funding from international lending institutions. This type of support is available only in certain countries, depending on policies of the institutions.

Acquiring debt financing with either a fixed rate or a floating rate that is linked to a stable standardized rate, such as the Federal Reserve rate or the London Inter Bank Offer Rate, is a mitigation strategy. Four of the high-risk projects used fixed-rate financing, either wholly or partially. Fixed-rate debt hedges the interest rate risk. Fixed rates may be higher, and they limit the opportunity to take advantage of interest rate reductions.

When project revenues are denominated in local currency, structuring local currency loans to match the revenues will reduce the risk from future exchange rate fluctuation. Currency exchange fluctuation has adversely affected the performance of the North-South Highway, GSZ Superhighway, Bangkok Mass Transit System, and Paiton I Power Plant. International lenders generally do not want to assume the exchange rate risk unless they are compensated with a high markup. Project sponsors, therefore, need to seek local lenders or structure their debt to mitigate such risk.

Structuring revenues in both local and foreign currencies is a technique for mitigating currency exchange rate risks. The foreign currency-denominated portions of project revenues will be used to repay the foreign loans. This strategy is applicable to power plant projects, since their revenues come from contracts with the host government, and may be used in special cases for transportation projects. Projects that used this strategy were the Shajiao B Power Plant, the GSZ Superhighway, and the Subic Power Plant. Tolls for the GSZ Superhighway for international vehicles are paid in Hong Kong dollars, while those for Chinese vehicles are paid in renminbi.

Contract provisions can be proposed that provide a hedge against the exchange rate risk. One example is a revenue escalation provision. Such provisions should be included in the contracts when they are signed. The process of renegotiation can take time, and the desired results may be difficult to obtain. The Paiton I Power Plant, the Second Stage Expressway, and the Bangkok Mass Transit System illustrated this problem. The sponsor of the North-South Highway Project acquired government soft loan facilities to mitigate the exchange rate fluctuation and market risk.

### High Market Risk

Transportation projects generally are more exposed to the revenue risks than are power plant projects, since power plant concession agreements usually include a fixed capacity fee paid by the government entity. Transportation project sponsors have the risk re-

lating to the traffic volume that will be achieved during the concession period. Power plant projects may be subjected to fuel cost escalation while their revenues are subjected to government control. Of the four projects that had debt restructuring due to low revenue, three are transportation projects that had to postpone repayment because of the low traffic volumes.

Market risks cannot be avoided, but can be mitigated by understanding the market conditions. Marketing strategies as well as negotiating for revenue guarantees and favorable contractual provisions can also help. Project sponsors should negotiate for contract terms that provide the ability to increase toll rates or energy fees.

A strategy found to be helpful in mitigating market risks was to structure the debt repayment schedule to escalate during the initial operation years, when the risk of low revenues is high. The Dulles Greenway had its debt service restructured to increase gradually during the first four years.

In case of cash deficiency due to the underestimated revenues, refinancing and debt restructuring are usually necessary. Examples are the Second Stage Expressway, the Bangkok Mass Transit System, the Dulles Greenway, and the Paiton I Power Plant Projects. Debt restructuring usually results in additional expense.

### High Overall Risk

Other financing strategies for high-risk projects identified from the case studies were the use of equity to finance the initial phases of the project and then refinance with the sale of debt instruments, and the use of contingency credit facilities. Providing up-front equity during the development and construction phases is considered a commitment from participants in the sponsoring consortium, which raises the confidence of lenders, investors, and the granting authority. Early injection of equity was used in the State Route 125, Subic Power Plant, and Bangkok Mass Transit System Projects.

Because project risks are considered very high during the initial development phases, potential lenders and investors may hesitate to participate, which makes project financing difficult and expensive. Participants in the sponsoring consortium may need to provide initial equity or arrange short-term debt to support the project. Once the operation phase begins, the project risks are substantially lowered. Then long-term debt financing may be acquired more economically. Projects using this strategy were Highway 407, GSZ Superhighway, Subic Power Plant, Paiton I Power Plant, and Shajiao B Power Plant.

## Model Development

Based on the analysis of Tables 2–4, the decision model in Table 5 was developed. A potential project sponsor can select an appropriate financing strategy once it has assessed the risks to be faced in pursuing the project. Sponsors of low-risk projects should select financing strategies from the set listed in Column 2 opposite low risk. If the sponsor perceives that the project faces high risk in only one of the three categories, strategies should be selected in Column 2 opposite that risk category. If the project sponsor faces high risk in more than one category, a combination of strategies from Column 2 should be selected to mitigate those risks.

## Conclusions

The financing of a BOT project depends on the anticipated financial performance of the project. Investors and lenders consider the project's earnings as the source of dividends on equity and repayment of debt. BOT projects generally are highly leveraged, with 70–90% of the funding requirements being funded with debt financing. While the debt-to-equity ratios of different projects may vary, a common strategy is to use as much debt as possible while ensuring adequate sponsor equity to demonstrate a commitment to the granting authority. In structuring the debt financing for a project, a sponsor strives to maximize the use of long-term debt and fixed-rate financing and to minimize the need to refinance.

Project sponsors face many risks when undertaking BOT projects. Analysis of the case studies indicated that construction and operation risks were mitigated by contracting out the responsibilities and by using advanced, well-proven technology. Initial

**Table 5.** Recommended Financing Strategies for Different Project Conditions

| Risk conditions | Financing strategies |
|---|---|
| Low risk | • Use high debt-to-equity ratio for maximum leverage and maximum return on invested equity.<br>• Establish minimum contingency credit facilities to minimize financing costs.<br>• Use capital markets to procure debt financing to reduce interest costs.<br>• Procure long-term financing early to reduce financing costs. |
| High political risk | • Involve international firms or organizations to create leverage with local government authorities.<br>• Seek assistance from influential individuals or organizations who have rapport with local government authorities.<br>• Seek local government support and guarantees.<br>• Procure insurance from government organizations such as the Overseas Private Investment Corporation.<br>• Establish contingency credit facilities to cover unanticipated expenses. |
| High financial risk | • Obtain loans from international lending institutions.<br>• Use fixed-rate or standardized-rate debt financing.<br>• Denominate loans in local currency.<br>• Structure debt financing in the same currencies as anticipated revenues.<br>• Structure revenues in both local and foreign currencies.<br>• Seek government support and guarantees.<br>• Insert revenue escalation provision into the contract.<br>• Establish a contingency credit facility to cover unanticipated expenses. |
| High market risk | • Finance early phases with equity and temporary loans and refinance during the operation phase with lower-cost long-term debt.<br>• Structure the debt repayment schedule to start low and escalate during the initial years of operation.<br>• Negotiate contract terms that allow increases in user fees.<br>• Establish a contingency credit facility to cover unanticipated revenue shortfalls.<br>• Restructure debt, if necessary, to solve cash flow problems during the concession period. |

injection of equity commonly is used during construction to avoid high-cost debt. Once the construction is completed, lower-cost long-term debt is used to refinance the initial equity injection. The major risks considered in the selection of an appropriate financing strategy, therefore, were political, financial, and market risks. Sponsors of low-risk projects have many financing options. These projects tended to be highly leveraged with long-term debt financing and small contingency credit facilities. Sponsors of high-risk projects need to select appropriate financing strategies from Table 5 to mitigate those risks.

## Appendix: Glossary

The following terms are defined:

- Bridge loan—short-term loan used to finance the project temporarily before being replaced by a long-term loan,
- Convertible debenture—unsecured debt that can be converted into equity at the option of the holder or issuer,
- Contingency credit facility—a contingent debt facility that can be drawn upon by the borrower to cover unanticipated expenses,
- Debt facility—loan account that can be drawn upon by the borrower up to the maximum agreed amount,
- Export credit—credit from a government export credit export agency,
- Fixed-rate swap—an agreement in which one party agrees to pay a floating interest rate in return for receiving a fixed interest rate from another party,
- Full-recourse loan—debt for which the borrower is fully liable,
- Limited-recourse loan—debt for which the borrower's liability is limited (for example, the BOT project sponsor's liability might be limited to the value of the project's assets),
- Multilateral loan—loan from a multilateral institution such as the World Bank,
- Nonrecourse loan—debt for which the borrower has no liability other than the revenue generated by the BOT project,
- Off-balance sheet loan—nonrecourse loan for which the company has no corporate liability against its assets,
- Soft loan—loan with generous repayment terms, and
- Subordinated loan—loan that ranks below senior debt with respect right to company assets.

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