Avoiding Customer and Taxpayer Bailouts in Private Infrastructure Projects

Policy toward Leverage, Risk Allocation, and Bankruptcy

David Ehrhardt and Timothy Irwin[1]

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Abstract

Many private infrastructure projects mix regulation that subjects the private company to considerable risk, a government or regulator that is reluctant to see the company go bankrupt, and high leverage on the part of the company. If all goes well, equityholders make a profit, debtholders are repaid, customers pay no more than they expected, and the government is not called upon to bail the company out. If all goes badly enough, however, the prospect of bankruptcy will loom. Unwilling to see the company go bankrupt, however, the regulator will have to permit an unscheduled price increase, or the government will have to inject taxpayers' money into the firm. In other words, the combination means customers and taxpayers bear more risk than would appear from the regulations governing the private infrastructure project.

This paper examines how these problems have played out in five cases. Then it describes how governments and regulators can quantify the extent of the problems and, using option-pricing techniques, value the customer and taxpayer guarantees involved. Finally, it analyzes three options for mitigating the problem: making bankruptcy a more credible threat, limiting the private operator's leverage, and reducing the private operator's exposure to risk. The paper concludes that appropriate policy depends on the tax system, the feasibility of enforcing bankruptcy, and the benefits from transferring risk from taxpayers to the private sector.

1 Overview

Many private infrastructure projects combine the following ingredients:

- Regulation that subjects the private company to considerable risk

- A government or regulator that is reluctant to see the company go bankrupt

- High leverage on the part of the company.

The combination is a recipe for trouble. If all goes well, equityholders make a profit, debtholders are repaid, customers pay no more than they expected, and the government is not called upon to bail the company out. If all goes badly enough, however—if demand falls well short of forecasts, say—the prospect of bankruptcy will loom. Unwilling to see the company go bankrupt, however, the regulator will have to permit an unscheduled price increase, or the government will have to inject taxpayers' money into the firm.

In conjunction, the three ingredients imply that the true policy framework differs from the one set out in laws, regulations, concessions, licenses, and government budgets. In particular, the true allocation of risk differs from the apparent allocation: taxpayers and customers bear more risk, while debtholders bear less. Specifically, when the government or regulator refuses to allow the company to go bankrupt, taxpayers or customers provide an implicit guarantee of the firm's debt, the cost of which increases with the firm's leverage and the extent to which regulation transfers risk to the company (see Box 1 for definitions). As Guasch (2003) and Harris (2003) show, the risks have been realized frequently in developing countries in the past decade.

When confronted with this problem, governments and regulators have at least four options:

- Committing themselves, as far as they can, to allowing private infrastructure firms to go bankrupt—to allowing debtholders as well as equityholders to lose their investment

- Restricting the firms' leverage

- Using low-powered rather than high-powered regulation or otherwise reducing the firm's exposure to risk

- Doing nothing—that is, accepting the problem and living with it.

Box 1: Some definitions

The meanings of some of the terms used in this paper are set out below. Often, the terms are used in an "economic" sense that abstracts from institutional, legal details.

A private infrastructure firm: a private firm that has a significant economic ownership interest in an infrastructure business, whether through a lease, concession, or legal ownership of assets.

A risk: a source of risk (e.g., demand risk).

Bankruptcy: the value of the debtholders' claims exceeds the value of the firm.

Bankruptcy-shy government or regulator: a government or regulator that is for political reasons is reluctant to allow private infrastructure firms go bankrupt.

Capital structure: the shares of debtholders' and equityholders' claims in the value of the firm.

Customer bailout: an unscheduled increase in the price of the service designed to prevent the firm from become bankrupt.

Debtholder: someone who has lent money to the firm either by owning the firm's bonds or making a loan to it.

High-powered regulation: regulation that causes much risk to be borne by the equityholders and debtholders of the firm (e.g. a stereotypical price cap).

Implicit customer (debt) guarantee: a propensity of the regulator to intervene to ensure the firm meets its debt obligations, despite the absence of any legal obligation—that is an implicit promise of a customer bailout.

Implicit government (debt) guarantee: a propensity of the government to provide fiscal support to ensure the firm meets its debt obligations, despite the absence of any legal obligation—that is, an implicit promise of a taxpayer bailout.

Infrastructure: electricity, natural-gas, water and telecommunications utilities and airports, ports, railroads, and roads.

Leverage: the value of debtholders' claims on a company as a fraction of the value of the firm.

Low-powered regulation: regulation that causes little risk to be borne by the equityholders and debtholders of the firm (e.g. stereotypical rate-of-return regulation).

Regulation: the set of rules imposed by the government or its agencies that constrain the firm's freedom to choose the prices or quality of the services its provides.

Risk handback: the transfer, as a result of governments' or regulators' bankruptcy-shyness, to the government or customers of risk the government intended to transfer to the private sector

Risk: variability in the value of the claim of a stakeholder or set of stakeholders.

Stakeholder structure: the share of each stakeholder's claim in the present value of the total value added by the firm.

Stakeholder: an equityholder, debtholder, government, or customer of the firm.

Taxpayers: people who pay tax to, or receive benefits from, the government and therefore suffers a loss when the government must make a payment to a private infrastructure company, which must be paid for either by increases in tax or reductions in expenditure.

Taxpayer bailout: an unscheduled payment by the government to the firm, or reduction in a planned payment from the firm to the government, designed to prevent the firm from becoming bankrupt.

In this paper, we analyze the problem and the government's possible responses. After providing some background information on regulation, leverage, and the attitudes of governments and regulators to bankruptcy in private infrastructure (Section 2), we describe five cases that illustrate the problems set out here: public transport in Melbourne, air traffic control in the United Kingdom, tollroads in Mexico, electricity in São Paulo, and rail infrastructure in the United Kingdom (Section 3). We then set out a framework for analyzing the problem quantitatively and show how governments or regulators can estimate the extent of the risks to which taxpayers and customers, respectively, are exposed. We also show how governments or regulators can generate rough estimates of the value of the implicit guarantees they provide (Section 4). Then we discuss the advantages and disadvantages of three options for addressing the problem: making bankruptcy a more credible threat for private infrastructure firms, restricting or discouraging high leverage, and reducing the firms' exposure to risk (Section 5).

Appropriate policy depends on the circumstances, so we don't attempt to make universally applicable recommendations about most of the issues we discuss. Two sets of policies, or policy goals, however, would seem to be worth pursuing in any environment:

- First, governments and regulators sometimes appear to discriminate in favor of debt in the sense of being more willing to expropriate equityholders than debtholders. Governments and regulators should seek to remove this source of bias in favor of leverage by striving to make, and abide by, credible commitments not to expropriate equityholders' infrastructure investments— either by nationalization or by arbitrary, adverse use of regulatory powers. We don't discuss this point further, because it is well known and much has already been written on it (see, for example, Gómez-Ibáñez 2003; Levy and Spiller 1994; Smith 1997).

- Second, governments should aim to make bankruptcy a more credible threat, so that debtholders as well as equityholders are more likely to lose money if things go badly enough. We discuss this issue further in Section 5.1.

Neither of these policy goals is easy to achieve. It is often difficult for a government to persuade investors that it won't succumb to temptations to expropriate equityholders when doing so wins votes. And, as the case studies below show, even a government that has done much to make bankruptcy more credible may later bail out an infrastructure firm in financial distress: success is evidently difficult. Thus governments need to consider other options, such as mandating minimum equity levels in some way (including by means of on-balance-sheet financing, parent-company or third-party guarantees, and performance bonds) and limiting the transfer of risk to the private operator.

While these options will tend to reduce the probability of financial distress and a bailout by customers or taxpayers, they have important costs. Apart from being difficult to enforce, mandating minimum equity may, for example, prevent the host country from taking advantage of tax benefits of debt provided by foreign investors' home country governments. If the government and the regulator cannot make credible commitments not to expropriate equityholders, but can make credible commitments not to expropriate

debtholders, restrictions on leverage may also increase political and regulatory risks. Likewise, reducing the transfer of business risks to private investors tends to reduce the benefits of privatization. Moreover, if the government does not simultaneously control leverage, private investors can respond to the reduced transfer of business risks by increasing leverage, so that the probability of bankruptcy remains high. Deciding whether to adopt these options therefore requires a weighing of costs and benefits in the circumstances.

2   Background

Before analyzing the problem in detail, it is useful to consider the nature of contemporary price regulation and some information on private infrastructure firms' typical choice of leverage and governments' and regulators' expressed attitudes toward bankruptcy.

2.1   High-powered regulation

By the 1980s, many public-policy advisers working in the field of infrastructure regulation had concluded that traditional cost-plus regulation (sometimes called "cost-of-service" or "rate-of-return" regulation) made regulated firms very inefficient. To encourage greater efficiency, governments in the last 20 years or so have deregulated some industries and instead relied on competition to protect customers from high prices. Where governments have feared that competition provided too weak a constraint on firms' ability to increase prices, governments have moved from cost-plus toward fixed-price regulation (sometimes called "incentive", "price-cap", "RPI–X", or "CPI–X" regulation).

The essential element of what we are calling fixed-price regulation is that regulated prices adjust less frequently, or less fully, to changes in the regulated firm's costs and in the demand for its services. That is, regulated prices are, to some extent, fixed. Real-world regulation is never completely fixed-price or, for that matter, completely cost-plus. Under the standard fixed-price approach, regulated tariffs are set in advance in real terms for a period of, say, five years. To achieve the fixed real price, nominal prices are adjusted every six months or so for inflation.[2] Under this fixed-price approach, the regulated firm bears all risk except that of general inflation during the five-year period. If the firm's own costs increase by less than the rate of inflation, for example, the firm's profits are greater than expected; if its own costs increase by more than the rate of inflation, the firm's profits are less than expected. After five years, regulated prices are typically reset to take into account what actually happened to the firm's costs and the demand for its services, but for five years the firm bears the risks, and therefore has incentives to reduce its costs and to anticipate changes in demand.

Because of its advantages, the fixed-price approach has been adopted, to differing extents, by many countries that have formal systems of regulation. The United Kingdom was one of the first countries to adopt it, often under the name RPI–X regulation. Several regulators in the United States have also adopted it (and traditional cost-of-service regulation in the United States is not always very different from price-cap regulation as practiced, for example, in the United Kingdom). Governments in developing countries have also adopted forms of price-cap regulation, sometimes incorporating it in concession contracts. In no real-world case is the regulation completely fixed price— some costs may be treated as pass-throughs, certain changes in demand may trigger price

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[2] Frequently, the periodic adjustment subtracts from inflation a certain amount—"X"—which is set according to a forecast of how quickly the firm will be able to reduce its real costs; for our purpose, this adjustment is a detail that can be ignored here.

changes, and there are usually provisions for resetting prices according to actual costs and demand from time to time—but the approaches attempt to ensure the private firm bears significant risks.

If the approach works, it should lead to lower costs than cost-plus regulation and, in the long term, lower prices for customers. For the present purposes, the key feature of this regulatory approach, however, is that it allocates more risk to the firm and, for any given leverage, increases the risk of bankruptcy.[3]

2.2   Leverage

Available data on private infrastructure firms' leverage are limited. Below, we present some data on infrastructure companies listed in the United States and project-finance firms around the world.

To begin, Figure 1 shows information on average leverage for listed firms in the United States categorized by industry over a 20-year period ending in 1981. It shows the three industries with the highest leverage—telephone companies and electric and gas utilities (the only infrastructure industries in the sample) and airlines—and descriptive statistics for the entire sample.

Figure 1: Leverage by industry in the United States, 1962–1981
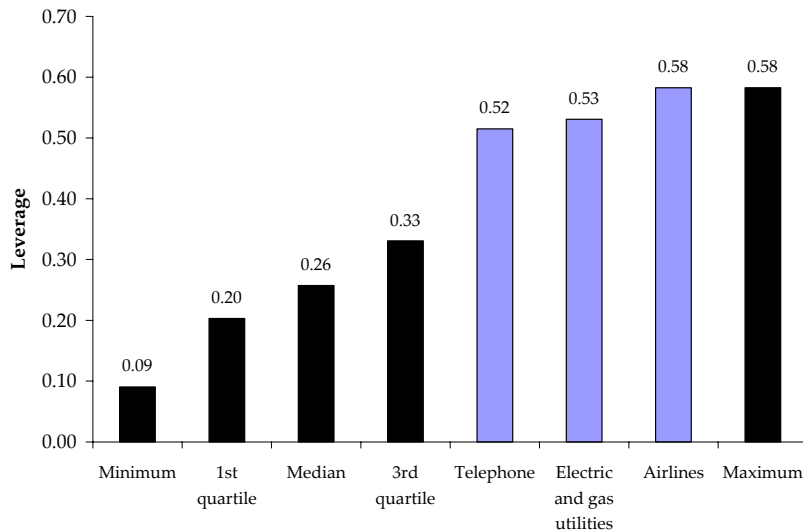
Source: Bradley and others 1984: 870.

Figure 2 shows data for selected infrastructure industries from July 2002. The data are for companies listed on stock markets in the United States and are therefore dominated by

[3] Of course, firms may change their leverage according to the regulatory regime. In particular, the move from cost-plus to fixed-price regulation may encourage them to reduce their leverage.

firms based there. Yet enough telecom firms from outside the United States are listed in the United States for them to be categorized separately. All the infrastructure industries have higher leverage than the median industry and all but "foreign" telecommunications are in the top quartile. Table 1 and Table 2 present data on the average initial leverage of a sample of project-financed infrastructure firms. For all sectors, leverage is high. For infrastructure as a whole, it reached a peak of 73 percent in 2000 and then fell to 66 percent in 2001.

Figure 2: Leverage by industry among companies listed in the United States, July 2002
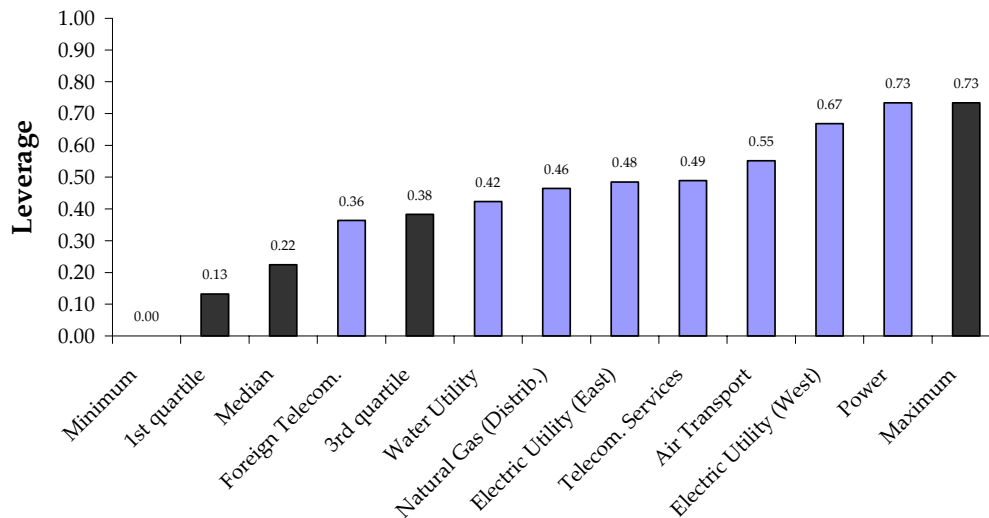
Source: www.damodaran.com. Note: the "power" industry includes firms that specialize in generation, possibly selling under power-purchase agreements, possibly selling into competitive wholesale markets. Utilities include mostly vertically integrated firms.

Table 1: Initial leverage of infrastructure project-financed firms by industry, 1997–2001

	Average debt to total capital (percent)
Power	70
Transportation	72
Telecom	66
Oil & Gas	65
Water & Sewage	76

Source: Esty and Christov 2002: 18.

Table 2: Initial leverage of infrastructure project-financed firms, by year, 1997–2001

	1997	1998	1999	2000	2001
Mean leverage (%)	68	69	70	73	66

Source: Esty and Christov 2002: 18.

Some commentators have observed that firms' capital structure tends to vary according to the way they are regulated and whether they sell their output under long-term contracts. For example, independent power producers with long-term power-purchase agreements may, according to Veron and Iaconetti (2001), be 80 percent debt financed, while merchant plants, which sell much or all of their output in spot markets, may have only 50 percent debt. Bradley and others (1984), note that regulated industries tend to have higher leverage than others and Taggart (1985) finds that the introduction of regulation is associated with increases in leverage. Dasgupta and Nanda (1993, page 489) find that firms in "more hostile regulatory environments" have higher leverage than others. Annex 1 summarizes the conclusions of these and other related studies.

We do not have enough information to conclude whether the leverage in private infrastructure projects in developing countries is often higher than optimal. High leverage in regulated US utilities may be appropriate given the maturity of the industries and the nature of US regulation. We conjecture, however, that similarly high, or higher, leverage in projects in developing countries, where cashflows tend to be more volatile, is problematic.

2.3   Governments and regulators on debt and equity

In principle, governments and regulators wouldn't have to discriminate between debt and equity. They could be "capital-structure blind", neither expressing nor revealing by their actions a preference as to the capital structure of private infrastructure firms and being just as ready to let debtholders as equityholders lose their money. In practice, governments and regulators often do discriminate in favor of debt.[4] Governments, for example, sometimes

- Differentiate between sources of capital in setting compensation policies in concession and related contracts (e.g. South Africa and, at least in the past, the United Kingdom: See Box 2)

- Guarantee debt repayments but not returns on equity

- Provide minimum-revenue or other guarantees that are linked to the repayment of debt or apparently motivated by a desire to facilitate debt finance (see Gómez-Lobo and Hinojosa 2000 and the case of Mexican tollroads discussed in Section 3.3 below).

- Stipulate capital structure constraints in laws or other regulatory documents (e.g., Spanish toll roads in Gómez-Ibáñez and Meyer 1993: 130).

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[4] Sometimes, governments and regulators have also expressed some preference for equity: Regulators have expressed concerns about thin-equity firms (OFWAT 2000 and 2002), required firms to maintain investment-grade credit ratings (OFGEM 2000: 46), and prevented utilities from increasing leverage (Taggart 1981: 390–91; Phillips 1993: 229–242).

In the next section, we review some problems that have occurred when high-powered regulation and high leverage have met bankruptcy-shy governments or regulators.

Box 2: Gaming and capital structure in UK Private Finance Initiative projects

A review of the United Kingdom's PFI (UK Government 2001: 156) noted, "in most PFI projects, equity is invested as a blend of share capital and Junior Debt. In calculating Authority Default compensation, many projects have distinguished between Junior Debt and equity. Typically, Junior Debt has been repaid in full (together with interest) while compensation for equity has been based either on its market value or on a base case return…. Since in most PFI projects, the substantial majority of "equity" is invested as Junior Debt, the effect has been to give the Contractor the opportunity of equity upside (through the market value compensation) but insulate it from downside (since Junior Debt is repaid in full)." Even for termination in the case of "Contractor Default", there have been "some contracts that virtually guaranteed (implicitly or explicitly) full payout of Senior Debt. (UK Government 2001: 167)."

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3 Examples

In this section, we look at some of the problems that have arisen in five private infrastructure projects that have combined high leverage, high-powered regulation, and bankruptcy-shy governments or regulators:

- Melbourne transport franchises

- National Air Traffic Services

- Mexican toll roads

- Electricity in São Paulo

- Railtrack.

3.1 Melbourne transport franchises

3.1.1 Background and transaction structure

In 1999 the State Government of Victoria acted to involve the private sector in provision of urban transport services. At the time, the state-owned Public Transport Corporation (PTC) ran an extensive network of tram and train services in Melbourne, the state capital. It also ran regional train services and owned the rail and tram infrastructure. Service was frequent, and important to transport throughout the city and state. However, there was dissatisfaction with the quality of the services. Ticket prices were held well below cost, and the PTC made substantial annual losses, which were covered by a recurrent subsidy.

The government decided to divide the PTC operations into five franchises: two urban rail franchises, two tram (trolley) franchises, and one contract for the regional train services. The franchise for each area required

- Operations of services at or above specified frequency and quality levels

- Maintenance of the track and other infrastructure in the franchise zone

- The financing and implementation of specified capital expenditure projects.

Each franchisee took the operating risk: it was responsible for meeting all the costs of the franchise and was entitled to ticket revenues attributable to the franchise. Ticket revenues were well below costs, but the government did not want fares to be increased, so it agreed to continue subsidizing the system. The subsidy was structured in three main parts:

- A passenger growth incentive (PGI), under which the operator would receive a top-up equal to 50 percent of the fare for all passengers above the existing level of traffic

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- A concession-fare top up, under which the government paid operators the difference between a concession fare (paid by students and pensioners, for example) and a full fare

- A fixed-but-declining subsidy, which was an annual payment intended to cover the remaining deficit after PGI payments (because of expected passenger growth and efficiency gains, the fixed subsidy started high, but declined each year).

In addition to financing working capital and specified investments, franchisees had to post substantial performance bonds and maintain minimum equity.

3.1.2   Contract award and initial results

Contracts were awarded through competitive bidding. In their bids, operators had to provide their plans for the business, and the level of fixed subsidy they would require. The subsidy bid was an important factor in evaluation of the bids. Bidding for franchises was strong. The winning bidders[5] were

- National Express (a British train and bus operator), with a tram franchise, an urban train franchise, and the regional train franchise

- Connex (a Vivendi company), with one urban train franchise

- Transdev (a French transport operator), with the remaining tram franchise.

Bidders asked for much smaller subsidies than the government had been providing, and when the new companies started operation, services and performance indicators improved.

3.1.3   Leverage and regulation

The Melbourne Transport franchises were essentially operating leases. In this sense they differ from the other case studies in that the private operators were not required to invest significant capital to purchase or build new infrastructure assets.[6] Nevertheless, the capital structure of the transaction was important in what happened later.

The government anticipated total savings with a net present value of A$1.8 billion over the life of the franchises (compared to the cost of public-sector operation). This could be achieved only if the operators served out their contracts, delivering the required services at the contracted subsidy level. Under the contract the operators took substantially all the input price risk (apart from a general inflation adjustment), all the operating risk, and all

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[5] Several of the winners were consortia—the names below identify the lead operator in the consortium.

[6] The franchisees were required to purchase new rolling-stock part way through the life of the contract. However, we abstract from this aspect of the transaction throughout the discussion, because the rolling-stock purchases were structured differently from the operating leases, and the government underwrote a great deal of the risk on the rolling-stock financing.

the demand risk. In fact, the demand risk was exacerbated by the fact that about a third of the anticipated subsidy was linked to the passenger growth achieved.

Figures for actual debt and equity levels in the franchise companies are not publicly available. Table 3 sets out relevant figures that are publicly available. It shows subsidy levels, government book values of operating and infrastructure assets transferred, and the minimum equity and performance bond requirements.

Table 3: Subsidies and leverage in the Melbourne transport franchises
A$ million, except for ratios

Lead company (and franchise)	National Express (Bayside Trains)	Connex (Hillside Trains)	National Express (Swanston Trams)	Transdev (Yarra Trams)	National Express V/line Passenger)	Total
NPV of subsidies						
Fixed	354	612	286	134	476	1,872
Variable	353	259	109	116	98	934
Total	707	880	395	251	574	2,806
Book values of assets						
Operating business at transfer						663
Land and infrastructure						3,324
Minimum equity requirements						
Minimum equity levels	10	8	5	5	8	35
Performance bonds	30	20	15	15	20	100
Minimum equity plus performance bonds as % of operating assets						20
Minimum equity plus performance bonds as % of operating plus land and infrastructure assets						3

Source: Auditor General of the State of Victoria 2000.

It is probably reasonable to assume that actual equity levels were not much above minimum required levels. Proxies for leverage could then be calculated by dividing minimum equity and performance bond levels into the book value of assets.[7] Minimum equity and performance bonds amounted to 20 percent of the book value of the operating assets transferred to the franchisees.

Greater insight can perhaps be gained by comparing equity and bond levels to the value the government hoped to secure and the risks the franchisees were taking. The government expected gains of A$1.8 billion over the contract life, but this was secured by a total of only A$135 million in capital put at risk by the operators. In other words, minimum equity and bond requirements were set at 8 percent of expected gains.

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[7] We include performance bonds as part of equity in these calculations on the grounds that like equity, the performance bonds will be lost if the company defaults on the contract. If performance bonds were excluded from the equity estimate, as is more conventional, the leverage would be even higher.

To understand equity and bond levels in relation to franchisee risk, we have developed a stylized example based loosely on figures for the National Express franchises, as shown in Table 3. Let us assume that annual revenues are A$460 million, and that all this revenue is sensitive to demand. Further, assume a performance bond and equity totaling A$88 million. Suppose demand is forecast to grow at 2.5 percent a year, and that demand does grow at 2.5 percent in every year of the 15-year franchise, except for the first year, in which there is no growth at all. Given the assumptions, revenue will remain at A$460 million in the first year instead of the forecast A$471.5. Over the whole, at a discount rate of 10 percent, the present value of this revenue loss is A$100 million—significantly more than the equity and bond. To put this in perspective, the franchisees' bids predicted passenger growth of 3.6 percent on average over the life of the franchise, while historical average passenger growth had been 1 percent. In the stylized example, it would take only one year of no demand growth to leave the franchisees facing losses (compared to forecast) greater in value than their total equity and performance bond.

In conclusion, while the franchisees did not have to take on major debt to fund investment, the government was counting on them to deliver very significant benefits under the contracts. However, equity and performance bonds levels were set at only 8 percent of the total benefits expected. Equity and performance bond levels were also low in relation to the risk the operator took under the regulatory regime. A single year without demand growth could lead to losses whose expected value over the life of the franchise would exceed the total value of equity plus the performance bond.

3.1.4   Financial difficulties

The Victorian Auditor-General noted the risks assumed by the operators his Report on Ministerial Portfolios:[8]

> Under the arrangement, the franchisees have accepted the following key commercial risks:
>
> - Failure to achieve the projected levels of growth in fare revenue and movements in the rate of fare evasion. In fact, 30 per cent of the total subsidy payments payable to the franchisees, and hence the financial viability of the commercial operation of each franchise, will depend on the achievement of these growth targets …"

The size of reduction in fixed subsidy required by the bidders surprised many observers, and the companies' problems may partly have reflected excessively aggressive bidding based on unrealistic assumptions about increases in demand and possible improvements in efficiency.

Within a couple of years, the franchisees began to hit financial difficulties. First, the strong demand growth bidders had assumed did not eventuate, and the companies' financial positions were very sensitive to demand. Lower than projected demand growth meant not only lower ticket revenues, but shortfalls on projected PGI payments. At the

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[8] June 2000, paragraph 3.3.149.

same time, costs were largely fixed, so demand shortfalls had a leveraged effect on profitability. Second, the companies were not able to cut costs by as much as expected.

National Express illustrates the problems. In 2002 National Express reported earnings before interest, tax, depreciation, and amortization of just over A$30 million on total turnover of almost A$460 million (including just under A$180 million in subsidies). Operating profit for the year was less than A$300,000 (down from A$26 million the previous year) on total reported assets of over A$430 million. At the end of 2002, National Express had outstanding obligations to creditors of A$208 million.

The franchisees notified the government of emerging financial difficulties in late 2001, and submitted a six-point plan to the regulator with proposals to resolve the situation. In February 2002, 141 claims and disputes were submitted to the government under the franchise agreements. In responding to these claims, the government's advisors identified significantly lower than forecast growth in the revenue pool and patronage growth across the network as the key factor in the franchisees' underperformance. The main reason appeared to be due to the aggressive patronage growth projections of the original bids and lower than forecast cost savings.[9]

3.1.5   Government's strategic position

On being asked to renegotiate, the government had the following strategic options:

- Hard line—the government could refuse the subsidy increase. It was likely that for some franchisees, the value of expected future losses would exceed the value of the performance bonds and any other equity remaining in the business. In that case, rather than continue to incur losses, the franchisee would terminate the franchise, and lose the performance bond. The government would then have to take back over the franchise, at least for an interim period, and then perhaps retender it.

- Renegotiate—the government could renegotiate the contract to put the franchisee back on a sound financial footing for the remainder of the contract.

- Middle road—the government could increase subsidy payments on an interim basis, to buy time while it prepared to retender the franchise.

Under any option, it was clear the subsidy would have to increase, since the performance gains on which the original subsidies had been bid seemed unattainable. However, the government hoped to limit the increase in subsidies, and also minimize transactions costs and possible disruption to service.

The hard-line option was not commercially attractive. The appetite of the big urban transport operators for international franchises had diminished significantly since the franchises were awarded, so it was not clear how much interest a retender would

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[9] Report of the Auditor-General on the Finances of the State of Victoria, 2001-02, tabled 31 October 2002.

generate. The government feared that a messy end to a franchise would send a bad signal to other potential private partners, further reducing bidding interest. It seemed quite possible that to rebid the franchise following the unplanned withdrawal of the original operator would result in few bids, from risk-averse operators, and perhaps result in the government having to pay higher subsidies than if it renegotiated.

The hard-line option was also unattractive because of the potential for service disruption and litigation. It would also mean the government would have to take back operation of the franchise, incurring additional risk and expense. Finally, there was concern that a messy termination might impact on the state's reputation as an investor-friendly place to do business.

To buy time, the government provided an interim increase in subsidy in early 2002, and continued to negotiate with the franchisees. The interim increase provided for additional payments of A$67.8 million in 2002 with annual payments of $A2.8 million over the period of the agreements. In return, franchisees were required to increase the level of performance bonds to a total of $A210 million.

Since then the government has entered into Interim Operating Agreements with Connex and Yarra Trams providing for further capped subsidies of $47 million over 12 months. The government offered National Express a subsidy of $90 million under a similar arrangement. National Express rejected this offer, requesting additional assistance including a cap on future losses. The government did not accede to this demand as it "was not prepared to offer a blank cheque to National Express".[10] As a result, National Express pulled out of the franchise in December 2002.

Government has stated that it will "take and hold" National Express' operations for the next 12 months while the entire system is restructured. It is planning to rationalize franchises into single train and tram franchises, and to re-tender these.[11] The government is currently running the three National Express franchises through a receiver. The government has signaled that it does not consider the public transport franchises to be sustainable given current subsidy levels. The Department of Treasury and Finance estimates that, to remain viable, the public transport system will require a subsidy increase of more than $1 billion over the next five years.[12]

3.1.6   Lessons

The franchising of Melbourne's trams and trains was generally well designed. The contracts had clear output definitions and made a good attempt to define maintenance and capital expenditure requirements. Subsidies were paid largely for the desired output through the PGI, with the remaining subsidy determined through least-subsidy bidding. The transaction process was professionally run, and the franchises were awarded

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[10] Minister of Transport, Media Release "Government Acts to Secure Future of Public Transport", 17 December 2002.

[11] *The Age*, 18 December 2002.

[12] Minister of Transport, Media Release "Increase in Government subsidy essential to keep trains and trams running", 14 April 20.

following a highly competitive process. Recognizing the potential for default, operators were required to post a substantial performance bond.

Despite all these good features, the contracts ran into trouble, for the following reasons:

- The value of the minimum equity and performance bond requirements was low relative to the risk assumed by the operators.

- Because of this, relatively modest deviations in demand and efficiency gains from forecast were enough to create losses whose present value exceeded the value of the equity and performance bonds. This made it credible that the operators would walk away from the franchises rather than serve them out, when these risks eventuated, and one operator in fact did so.

- As a result, the government gained very little of the expected value from the contracts. The government has had to take National Express' franchises back into public operation (which it did not wish to do) and negotiate increased subsidy payments to keep the other operators in place.

- The government is likely to restructure and rebid the contracts in a year or two. When it does so, the bids received are likely to be less favourable than those in the first round of franchising.

The key lesson is that in considering leverage issues, it is not enough just to look at the value of equity as a percentage of total assets. The capital the operator puts at risk also needs to be considered in relation to the size of the risks the operator takes on, and the value of the gains the government hopes to secure from the contract.

3.2   National Air Traffic Services

3.2.1   Background

National Air Traffic Services (NATS) is the air-traffic controller for the United Kingdom. Until 2001, it was part of the Civil Aviation Authority, a government agency that also regulated air-traffic safety and set price controls for British airports. The government was concerned, however, that this arrangement restricted NATS' ability to raise funds to finance new investment and muddied its accountability for its performance. It therefore decided to separate NATS from the Civil Aviation Authority and to seek private investment in the company.

In March 2001, NATS was partially privatized under what was described as a public–private partnership in which a consortium of seven British airlines called the Airline Group took a 46 percent stake in the company. A 5 percent stake was held for employees, while the government retained a 49 percent stake, as well as a golden share.

3.2.2 Leverage and regulation

After the partial privatization, the company was highly leveraged. Reports noted that the book value of its debt actually exceeded the book value of its assets for regulatory purposes (its "regulatory asset base"). Its balance sheet for 31 March 2002 (prepared according to ordinary accounting standards in the United Kingdom) showed total assets of 1.07 billion pounds and total equity of 0.08 billion pounds, or leverage at book values of 92 percent (National Air Traffic Services 2002).

NATS was also subject to considerable business risk. Like other regulated firms in the United Kingdom, its prices were constrained by a price cap. The price cap set the amount NATS could charge per "chargeable service unit", which is the "basic unit of charging for en route air traffic services … It takes account of both aircraft weight and distance flown. A flight of 100 [kilometers] by a Boeing 737 aircraft approximates to one [chargeable service unit] (Civil Aviation Authority 2002 May: 75)".

As is typical, the price cap was to be adjusted each year for inflation less a predetermined amount ("X") but not for changes in demand. Thus, between the five-yearly reviews of the price control, NATS was subject to all the demand risk. If flights through British airspace grew strongly, NATS would make strong profits, but if they fell it could make a loss. As is also typical, the price cap was based on, among other things, an estimate of the company's cost of capital, which in turn took account of the risks to which the company was exposed. The Civil Aviation Authority noted that the cost of capital used to set NATS' price cap assumed NATS bore volume risk (Civil Aviation Authority, 2002: 2).

3.2.3 Financial difficulties

NATS had been forecasting strong growth in demand. But then the September 11 terrorist attacks occurred, and air-traffic volumes fell below forecasts. Because of its high leverage and full exposure to demand risk, NATS' financial position quickly became precarious, and talk of bankruptcy was heard.

In February 2002, NATS applied to the Civil Aviation authority for an extraordinary price increase, under Section 11 of the Transport Act 2000, which allows the Civil Aviation Authority to modify a license if the license holder (in this case NATS) agrees to the modification.

3.2.4 The government's response

The application put the government and the regulator, the Civil Aviation Authority, in a difficult position.

On the on hand, the Civil Aviation Authority (at least) recognized the problems that could be caused by acceding to NATS' request. In a response to the request it stated,

> If the CAA were to accept NATS' application as submitted it would fundamentally, and probably irreparably, dilute the incentive properties of the price cap framework….

Moreover, to allow a price cap increase simply to ensure that NATS' current structure was sustainable in the face of the shock would create perverse incentives for NATS to persist with high gearing in the expectation that, in the future, the regulator would allow price cap increases to prevent financial difficulties (Civil Aviation Authority, 2002: 4).

On the other hand, the government and regulator were no doubt concerned about the possible consequences of NATS' financial distress. Its bankruptcy might conceivably have led to disruptions in service that would have been unpopular and the public might well have blamed them on the government. NATS' bankruptcy might have posed no risks for safety, but had any accidents occurred in such circumstances, the government and regulator may well have feared that they would be blamed. The probabilities might have been low, but the potential political costs were high.

In the end, the government and the regulator both intervened to help repair NATS' balance sheet. The government injected 100 million pounds of equity into NATS. And, in return for this and other measures, the Civil Aviation Authority agreed to a modified proposal to increase the price cap. It also changed the nature of the price cap, so that NATS no longer faced full demand risk between price reviews. For the rest of the price-control period, customers will share the risk: if volume falls, prices rise, and if volumes rise, prices fall.

3.2.5 Lessons

NATS had very high leverage and was exposed to considerable risk. If air traffic had grown strongly, its equityholders would have earned reasonable profits, and other parties would have done as well as they could have expected. Its debtholders would have been repaid and customers would have seen prices fall according to the price cap. But the downturn in traffic revealed that customers and the government were actually exposed to some of the risk that the regulatory framework on paper had allocated to the company and its debtholders. In retrospect, it seems clear that the government should either have restricted leverage or changed the nature of the price cap to reduce NATS' exposure to risk (also reducing average prices because of a lower cost of capital). Or, if neither of those options was attractive, it should have done more to reduce the political costs of bankruptcy.

3.3 Mexican toll roads

3.3.1 Background

From about 1989 to 1994, the government of Mexico undertook an ambitious program of private greenfield tollroad concessionaires. By 1995, it had awarded more than 50 concessions for about 5,500 kilometers of road.[13]

3.3.2 Leverage and regulation

The concessionaires were typically highly leveraged. In fact, the project sponsors who were the equity investors frequently contributed no equity in the form of cash at all. Instead, the sponsors, who were usually construction companies, typically provided only "sweat equity" to the concession company; that is, they constructed the road for the concessionaire in return for equity—in some case possibly inflating the costs (Ruster, 1997). According to one estimate, this sweat equity made up about 29 percent of the concessionaires' capital on average, the rest coming from debt and capital contributions from federal and state governments. Most of the debt was provided by domestic banks, and much of it was floating-rate debt: that is, interest payments were not fixed in advance, but were reset periodically according to prevailing interest rates.

High leverage was possible in part because of the government's involvement. First, the debtholders were mostly banks owned by the Mexican government, and the government may have pressured the banks to lend. In addition, the banks may have believed that the government would bail them out if problems arose. In any case, the banks arguable didn't exercise due diligence in reviewing the creditworthiness of the concession companies. (On all this, see Ruster 1997).

The concessions included some features designed to reduce concessionaires' exposure to business risks. In particular, the concession contracts provided that if traffic was lower than forecast or if construction costs were more than 15 percent above budgeted costs, the concessionaire could request an extension of the term of the concession—up to a limit that was eventually set at 30 years. But the concessionaires were still exposed to considerable risk. Extensions in the contract term would increase the present value of the concession's future cashflows (so long as projected revenues were greater than operating costs), but they couldn't overcome short-term cash problems caused by shortfalls in traffic or construction-cost overruns.

3.3.3 Financial difficulties

Many of the concessionaires soon ran into financial difficulties. Construction costs, at least as reported, were often much higher than expected, while demand was much lower.

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[13] The discussion of the old tollroad program relies on Gómez-Ibáñez, 1997 and Ruster, 1997. The new concession program is described in Secretaría de Comunicaciones y Transportes and Banco Nacional de Obras y Servicios Públicos, 2003.

Part of the problem may have been poor forecasts—that is, forecasts that didn't make the best use of the information available at the time they were made—but the problems were exacerbated by the macroeconomic crisis that hit Mexico in December 1994, which even the best forecasts would not have foreseen. The crisis led to declines in traffic and at the same time increases in interest rates, which hurt the concessionaires because of their floating-rate debt.

Before the crisis, many concessions were struggling. Afterwards, most were in trouble.

3.3.4 The government's response

The government's intervention to help the concessionaires began well before the crisis. According to Gómez-Ibáñez 1997, in the first round of assistance in the early 1990s,

> Concessions which had traffic shortfalls or cost overruns would petition the SCT [Secretaría de Comunicaciones y Transportes] for relief, which the SCT would grant on a case-by-case basis. At some point in the early 1990s, the government began contributing to the financing of already concessioned roads where the cost over runs and traffic forecasts were so severe that they could not be offset by extending the concession to the 30 year limit. The contributions took a variety of forms including loans from the national development Bank (BANOBRAS) or CAPUFE [a public road agency that ran both non-toll roads and some tollroads] or the assignment for a specified period of the toll receipts from an existing CAPUFE toll road.

In 1995, after the crisis, the government provided further assistance by granting commercial truckers and bus operators a 40 percent income tax credit for any tolls they paid, in return for agreements by many concessionaire to lower tolls. Yet many concessions remained troubled, and in 1997 the government announced a new master restructuring program, under which the government offered to take over the private concessions, assuming all their debt and all their liabilities to third parties such as construction companies. It offered no compensation to the equityholders. Twenty-five concessionaires accepted the offer, while 23 declined it, presumably because they still had positive equity. (A further four were excluded from this offer, because they had foreign as well as domestic creditors, and the government was still negotiating with foreign creditors.) In the bailout, the government took on about $7.7 billion in debt, two-thirds owing to Mexican banks and one-third to construction companies. The equityholders are estimated to have lost about $3 billion. (On all of this, see Gómez-Ibáñez 1997.)

3.3.5 Lessons

The problems afflicting the tollroad program went well beyond high leverage and high risk, as Gómez-Ibáñez 1997 and Ruster 1997 show. As in the other cases, however, the combination of high leverage and exposure to risk helped contribute to problems that were only resolved by a costly government bailout. In this case, the risks of leverage were exacerbated because the debt was floating-rate.

The government still owns and operates the roads it took over in the rescue plan, but has recently begun a new round of private tollroad concessions, in which, it argues, it has assimilated the lessons learned during the previous program. Among the features of the new program designed to limit the risk of an unscheduled bailout are the following (Secretaría de Comunicaciones y Transportes and Banco Nacional de Obras y Servicios Públicos 2003):

- The government offers to make an upfront grant to meet part of the cost of the project—the amount of the grant being determined by a form of least-subsidy bidding.

- Concessionaires are required to contribute "at least between" 20 to 25 percent of the capital cost (recall that the government also contributes capital through the grant, so leverage, measured as debt over assets, may be much less the 75 to 80 percent).

- The government has offered a form of explicit debt guarantee. Specifically, potential concessionaires can ask the government for a guarantee of debt-service payments in which the government meets shortfalls in cash available for servicing debt resulting from lower-than-expected operating profits (revenue less operating expenses). The guarantee payments are not, grants, however, but become a subordinated debt of the concessionaire and will be repaid if the concessionaire subsequently makes sufficient operating profits.[14]

3.4 Electricity in São Paulo

3.4.1 Background

Eletropaulo Metropolitana is the electricity distributor for São Paulo, Brazil's largest city. It serves around five million customers, or about 14 percent of all Brazilian electricity consumers.

The government of Brazil instituted wide-ranging reform of the electricity sector in the late 1990s, aimed at introducing competition into the sector and attracting private capital. The reforms included privatization of much of the distribution system, and around 20 percent of the country's generating capacity.

Eletropaulo Metropolitana was privatized in April 1998 and purchased by Lightgas for $1.78 billion. Lightgas was owned by a consortium of four companies, including the United States based energy company AES. AES acquired a controlling interest in Lightgas (renamed "AES Elpa") through a subsequent series of transactions. Both

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[14] In the first concession awarded under the program, the government said it award the concession to the bidder seeking the lowest subsidy, calculating the subsidy as the sum of the upfront grant and the present value of the *maximum* possible contributions under the guarantee. Unsurprisingly, bidders preferred a certain grant rather than the contingent debt offered under the guarantee and the government's guarantee was not requested.

Eletropaulo and AES Elpa are listed on the Brazilian stock exchange, and both are majority owned and controlled by AES. Figure 3 shows Eletropaulo Metropolitana's ownership structure as at 31 December 2002. While the ownership of the company is complex, the net effect is that AES owns around 70 percent of both the ordinary and the preferred shares in Eletropaulo.

Figure 3: Eletropaulo Metropolitana Shareholder Structure
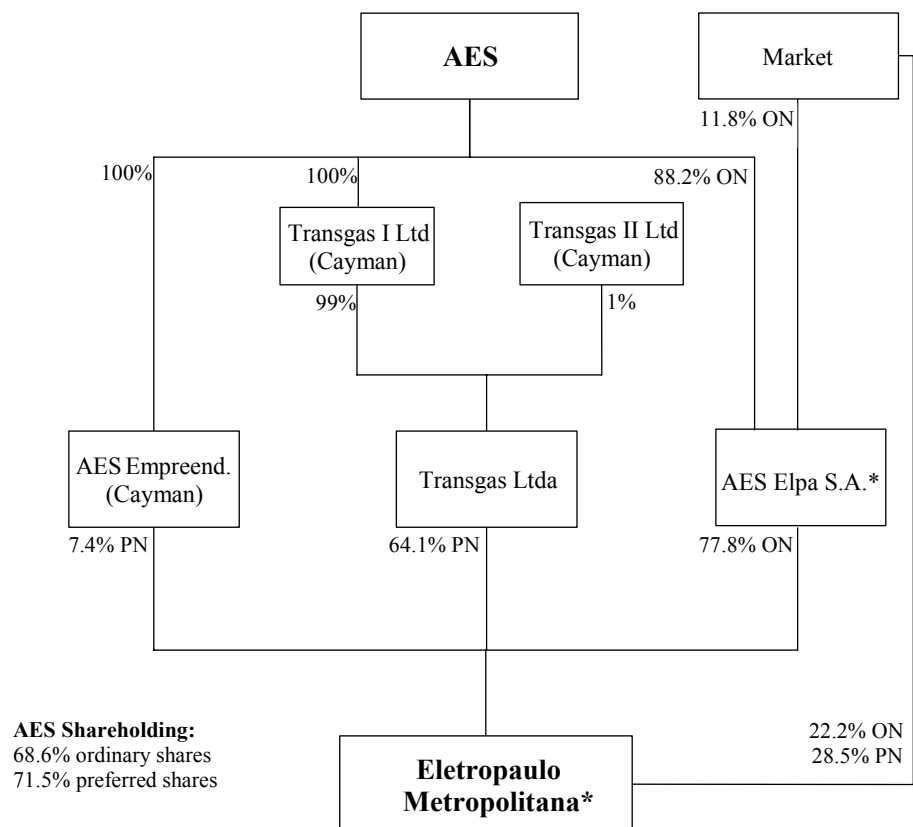
Notes: * indicates listed on the São Paulo Stock Exchange, BOVESPA. ON stands for ordinary shares. Each ordinary share entitles the holder to a minimum dividend of 25 percent of net income and to one vote at general shareholders meetings (thus ordinary shares confer control). PN stands for preferred shares. Preferred shares do not (in general) confer voting rights, but entitle shareholders to dividends 10 percent higher than ordinary shareholders and give priority rights if the company is wound-up.
Source: Eletropaulo Metropolitana Quarterly Report, 4th Quarter 2002.

3.4.2   Leverage and regulation

Eletropaulo's leverage was approximately 30 percent immediately before privatization, and increased only gradually to around 40 percent by the end of 2001.[15] A recent increase

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[15] For this purpose we measure leverage as short- and long-term debt (principal and accrued interest costs) divided by the book value of total assets. We base this calculation on the company's consolidated balance sheet (i.e. including subsidiaries).

in leverage to almost 50 percent by December 2002 is attributed largely to the impact of devaluation of the Brazilian Real over 2002 on the company's US dollar denominated debt.

To get a full picture of the total leverage created by AES' acquisition of the company, however, we need to look at debt levels in the project-financing structure—that is, the chain of companies through which AES owns its interests in Eletropaulo, as shown in Figure 3.

To help finance the purchase of Eletropaulo, the Brazilian Development Bank (BNDES) loaned $1.1 billion. This money was loaned not to AES directly, but to the entities in the financing structure. The implications of lending the money in this way were that:

- What appears as equity in Eletropaulo's balance sheet is in fact largely debt, borrowed by a company in the financing structure and then reinvested as equity in Eletropaulo.

- Because BNDES lent to the project finance companies, and not to AES itself, the loan can only be repaid if Eletropaulo generates enough dividends to allow the companies in the financing structure to service their debts. The loan is non-recourse to AES; that is, if the project finance companies default on the loan, AES is under no obligation to repay BNDES.

- The net effect of this is that an asset valued at $3.6 billion must generate enough cash to service a debt of $2.8 billion (the sum of Eletropaulo's debt and BNDES lending to the AES financing companies). As shown in Table 4, this creates effective leverage of almost 80 percent.

Table 4: Eletropaulo and AES—total debt position (as at 31 December 2002)
US$ millions

	Assets	Debt
Eletropaulo Metropolitana	$3,600	$1,670
BNDES loans		$1,120
Total	$3,600	$2790
Leverage: 78 percent		

Notes: Includes short- and long-term debt (principal and accrued interest) for Eletropaulo and its subsidiaries. Figures reported in Brazilian Real are converted at the exchange rate as of 31 December 2002, R$/US$ = 3.5333. Source: AES 2002 Annual Report, Eletropaulo Quarterly Report, 4th Quarter 2002.

BNDES' security for its loans was the equity in Eletropaulo held by the companies in the AES financing structure. The complex financing structure adopted meant that there were now two ways in which a financial crisis at Eletropaulo could trigger a default on debt:

- The company itself could default on its debts.

- Eletropaulo could fail to generate sufficient dividends to allow the AES financing companies to service their debt to BNDES. If this happened, BNDES would have

the right to take possession of the shares in Eletropaulo held by the AES financing companies. This would largely renationalize Eletropaulo.

The regulatory regime placed considerable risk on Eletropaulo. It was subject to a price cap with periodic price reviews. Between the price reviews, Eletropaulo bore risk associated with changes in demand and changes in costs deemed controllable. And although changes in power-purchase costs were deemed non-controllable and passed through to the tariff every year, the company bore the risk of such changes between annual tariff adjustments.

3.4.3   Financial difficulties

The Brazilian electricity sector has experienced considerable difficulties in recent years. In 2001, electricity supply shortages occurred in parts of the country due to a combination of slow demand growth, a lack of investment in new generation, and low rainfall (which substantially reduced the capacity of the country's hydro-reliant generation system). The government responded by introducing a rationing program, and consumption dropped sharply as a result. The government allowed an extraordinary tariff increase to mitigate the impact of the rationing program, while it was in force, but demand remained lower even after rationing ended.

The effects of rationing were compounded by wider economic problems. Economic growth was sluggish. And in 1999 the government abandoned the currency's dollar peg and the real depreciated by more than 50 percent—causing difficulties for companies, such as Eletropaulo, with US dollar denominated debt.

These factors led to a deterioration in Eletropaulo's financial performance. The company reported a loss of around $250 million in 2002. As a result, it has had difficulty servicing its debts—the value of principal payments alone due in 2002 was over $600 million. This problem has passed up the ownership chain to the AES holding companies, as Eletropaulo has not generated the surplus cashflow needed to service the outstanding loan to BNDES.

In 2002, AES negotiated with BNDES on several occasions to defer payments of principal and accrued interest. Finally, in January 2003 BNDES refused to agree to a further deferral and AES defaulted on its loan. By May 2003 the AES financing companies had defaulted on loan payments totaling over $600 million.

3.4.4   The government's response

AES' loans from BNDES are secured against its holdings of ordinary and preference shares in Eletropaulo. The default by AES in early 2003 triggered a contractual clause allowing BNDES to foreclose on the control of Eletropaulo. Rather than immediately moving to do so, however, BNDES entered into protracted negotiations with AES to reach a deal on rescheduling the debt. In January 2004 AES reached an agreement with BNDES to restructure $1.2 billion in outstanding debt. The agreement involves the creation of a new company that will own Eletropaulo and other Brazilian AES assets. The

new company will be 51% owned by AES and 49% by BNDES. In exchange the debt owned to BNDES will be reduced to $510 million. This is effectively a debt-for-equity swap, which lets AES retain control of the assets.

What is interesting here is to compare the behavior of BNDES in this case to that of a private bank. In practice, a private financier would try to reach a negotiated solution (as BNDES has done) but if that failed it would take back the shares over which the debt is secured. In contrast, media commentary suggested that BNDES was reluctant to do this because it would effectively renationalize the asset, and could undermine the wider investment climate in Brazil. For example, the *Wall Street Journal* has commented that "[AES] knows full well the government isn't prepared to allow BNDES to retake control of Eletropaulo for risk of spooking investors and creating a political firestorm."[16] The solution adopted is perhaps a compromise that mitigates negative signals to the investor community, while letting BNDES recover part of its debt through the equity in the new company owning Eletropaulo.

3.4.5   Lessons

Eletropaulo's high effective leverage, combined with its exposure to demand and foreign exchange risk, made the ownership structure highly vulnerable to shocks. The combination of the unanticipated reduction in sales volumes and currency devaluation meant that the AES financing companies which effectively own Eletropaulo were unable to service their debts.

In response, the government has made no move to assist the company through tariff adjustments or direct subsidies. Indeed, if BNDES' response was no different from what we would expect of a private financier, then this case would provide a counter example to the hypothesis put forward in this paper. However, while the ultimate outcome remains to be seen, BNDES' relatively accommodating position to date appears to have the effect of transferring risk back to the public sector to a greater extent than terms of the loans suggest. Media commentary suggests that BNDES is adjusting its response to the default to take account of broader public interest considerations. It therefore seems at least probable that the combination of high leverage, regulatory risk, and public-sector debt in this case has resulted in the government taking on more risk than initially appeared to be the case.

3.5   Railtrack

3.5.1   Background

Railtrack was the owner and operator of the national railway network in Great Britain. It was created from the mid-1990s restructuring of British Rail, the state-owned, vertically integrated rail company. British Rail was divided into a number of train and freight

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[16] "AES Brazil Unit Defaults Again, Ups Ante With Govt Bank", *The Wall Street Journal*, 16 April 2003.

operating companies, as well as rolling-stock leasing companies. The track and associated infrastructure, and responsibility for operating it, was placed in Railtrack. Railtrack was privatized in 1996.

3.5.2   Leverage and regulation

The regulatory framework applying to Railtrack was based on the standard UK framework for a utility network company. Railtrack operated under a license that specified key regulatory obligations. The bulk of Railtrack's revenue was derived from track access fees—the fees it charged train operators to use its track. These track access fees were controlled by the Office of the Rail Regulator (ORR). The ORR set maximum access fees for five years ahead, taking account of required outputs and forecasts of costs. In between five-yearly reviews, Railtrack bore the risk of any unanticipated costs. The regulatory regime approximated a revenue cap, rather than a price cap. That is, the total amount Railtrack could charge train operating companies did not increase in line with increases in the number of trains using the tracks. Railtrack was also accountable to Her Majesty's Rail Inspectorate on safety issues.

In the five years following privatization, Railtrack took on increasing levels of debt. By October 2001, Railtrack was reported as having total borrowings of £3.3 billion. This increased to £6.4 billion by March 2002, against net total regulatory assets (equivalent to equity) of £1.9 billion—leverage of approximately 77 percent.[17]

3.5.3   Financial difficulties

Immediately following privatization, Railtrack appeared to be performing well. However, demand for rail services increased more quickly than expected, especially in the South of England, where the network was already congested. The increase in traffic led to increased need for maintenance and new investment, as well as higher operating costs to co-ordinate trains. However, the regulatory regime did not allow Railtrack to recover these costs.

By 2000, a series of passenger train accidents raised questions about the condition of the network. Accidents at Southall in 1997, Ladbroke Grove near Paddington in 1999 and Hatfield in 2000 resulted in 42 deaths.[18] In addition to the loss of life, the Hatfield incident alone is estimated to have cost Railtrack around £600 million in repair costs, penalty payments, and the cost of a track repair program that was required following the crash.[19]

These events gave rise to concerns about Railtrack's ability to maintain the safety of the network. Factors cited as potential contributors to the perceived breakdown in safety include

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[17] Railtrack plc Regulatory financial statement s for the year ended 31 March 2002. Leverage calculated as debt / (debt + equity).

[18] *Financial Times*, 8 October 2001.

[19] *The Independent*, 16 January 2001.

- A management more focused on financial issues and property development than railway operations

- A highly fragmented structure with poor communications and accountability between Railtrack, train operators, the maintenance contractors to which Railtrack had outsourced track inspection and maintenance, and the regulators

- Financial stress as revenues did not increase to match rising costs caused by rising demand.

Following the Hatfield crash, the government undertook a wide-ranging review of the network, to address safety concerns. The Rail Regulator, in its 2000 regulatory review, introduced increased accountability and reporting requirements on Railtrack and required a substantial program of maintenance and renewals resulting in additional expenditure of around £700 million per annum.

In addition, the company had increasing problems containing costs. The most notable example of this is the West Coast Route Modernization project, which blew out from an initial projected cost of £2.3 billion to projected costs over £6.3 billion by 2002.[20]

In January 2001 Standard & Poor's placed Railtrack on credit watch, warning of a possible reduction in its debt-rating to below investment grade. This placed Railtrack's ability to raise finance for its future operations in doubt. The company approached the government for financial assistance. In April the government agreed to bring funding of £1.5 billion planned for after 2006 forward to the current regulatory period, in return for a number of concessions such as the inclusion of a "public interest" director on Railtrack's board, and the introduction of a set of agreed "principles" for the operation of the railway network. The first payment under this package, of £337 million, was made in October 2001.

The April rescue package proved to be insufficient to enable Railtrack to continue in business. By July 2001 the company concluded that it had insufficient revenue to cover its costs. In the absence of assistance it was facing losses of £1.7 billion by March 2002.[21] The company again approached the government for support, essentially requesting an open-ended financial commitment and suspension of economic regulation for four years.

3.5.4 The government's response

The government decided that the numbers Railtrack presented in its case for additional assistance showed that the company was unable to meet its future financial obligations. To the surprise of the company and financial markets, the government used this as grounds to put the Company into Railway Administration.

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[20] *The Guardian*, "£21bn rescue of railway – Government pledges to restore network stability, efficiency and safety by 2006", 28 June 2002.
[21] See Secretary of Transport, Statement on Railtrack, 5 November 2001, http://www.dtlr.gov.uk/about/ministers/speeches/byers/051101.htm

Railway Administration is a specific mechanism provided for in the Railways Act 1993 (as subsequently amended by the Transport Act 2000), as an alternative to conventional receivership should a railway operator fail. Its aim is to ensure that in such a case the company is not wound up, but rather that relevant services continue to be provided, and that all or part of the undertaking is transferred to another company as a going concern.[22] The Act gave the Secretary (Minister) for Transport the power to apply to the High Court to put the company into Administration if it was, or was likely to become, unable to pay its debts.

Following the administration order, the government immediately acted to reassure both creditors and employees that their interests would be protected. As the *Financial Times* pointed out at the time the government, or Railtrack's successor company, would have to rely on the capital markets in the future to finance ongoing modernization of the network. This put pressure on the government to avoid alienating financiers.[23] Accordingly, the government made a commitment to guarantee interest and principal repayments on Railtrack's debt, and payment of lease rentals, while the company was in administration provided that creditors signed a standstill agreement. Under this agreement creditors agreed not to call bonds or other credits into default as long as the government honored the debt-service obligations. The government also arranged for around £7 billion of existing debt to be assumed by Railtrack's successor company, Network Rail, and to ensure that Network Rail had a credit rating that would preserve the value of that debt for financiers.

Network Rail is a non-profit company formed to take over the rail infrastructure. It is limited by guarantee and operates at arms length from the government. Unlike a limited liability company, where shareholders' equity can be drawn on to pay creditors should the need arise, a company limited by guarantee has no shareholders. Some party, in this case the government, provides a guarantee of the company's obligations up to a specified amount. The guarantor's liability is capped by the amount of the guarantee (as shareholders' liability is capped by the amount of equity in a limited liability company). In place of shareholders, Network Rail has members drawn from the public sector, industry, and the general public.

At the same time, the government took the firm position that it would not bail out Railtrack's shareholders. The Transport Secretary's view was that "[t]he fact that Railtrack plc is in administration is a consequence of its failure to manage cost over a number of years" and that "taxpayer's money … should not be used to compensate for the poor performance of private sector companies."[24] However, ultimately the government pulled back somewhat from this position, in the face of a threat by investors to sue the government. Railtrack Group and major shareholders claimed that the government had acted illegally in obtaining the order that placed Railtrack under administration, and threatened to sue for compensation.

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[22] *Winsor v Special Railway Administrators of Railtrack Plc*, [2002] EWCA Civ 955.

[23] *Financial Times*, 8 October 2001.

[24] Department of Transport, Local Government and the Regions, News Release 2001/0425, "Statement by Stephen Byers on Railtrack Shareholder Compensation", 11 October 2001.

In 2002, Network Rail purchased the entire issued share capital of Railtrack for £500 million. £300 million of this was funded by the government in the form of a grant from the Strategic Rail Authority[25] to "reflect economic benefits accruing in the public interest from an earlier end to administration than would otherwise be the case".[26] Network Rail funded the balance of £200 million from debt. Shareholders in Railtrack are ultimately expected to receive up to £1.4 billion, made up of the £500 million purchase price combined with proceeds from the sale of assets owned by Railtrack Group, including funds from the sale of the company's concession for part of the Channel Tunnel rail link. This equates to between £2.52 and £2.60 per share, compared to the market value of £2.80 per share when trading was suspended in October 2001.[27]

The government has provided considerable support to the new operator, Network Rail. Through the SRA, it provided the guarantees necessary for Network Rail to raise around £14 billion, to refinance the £7 billion of debt transferred from Railtrack and to fund additional costs. The SRA has also provided un-drawn standby support of up to £7 billion against future unanticipated costs. In other words, the government is taking on the risk of default by Network Rail. In addition, the government is increasing the level of funding it is providing to Network Rail to cover rail investment and renewals.

3.5.5   Lessons

Railtrack's bankruptcy transferred back to the government very substantial costs. Private sector interests suffered less. Debtholders to the company were paid in full. Equity holders suffered some loss on their investment, but were eventually bought out by the government. Had Railtrack performed well, private investors would have kept all the profit, but when it performed poorly, the public sector was left with most of the loss. Could this have been avoided?

In retrospect, it seems that the regulatory regime may have exacerbated risk for the private sector. When use of the network increased, the revenue the company was allowed to earn did not increase as fast as its costs. The company was perhaps exposed to excessive demand risk, which proved unsustainable.

A requirement on Railtrack to maintain higher equity levels (lower leverage) might also have reduced the risk to government. The final phases of the Railtrack crisis started when Standard and Poor's placed the company on credit watch. This triggered a downward spiral, since with a rating downgrade threatened the company could no longer borrow on the same terms. Higher borrowing costs would further reduce the company's solvency, in a vicious circle. It is possible that with lower debt levels, the company's

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[25] The Strategic Rail Authority (SRA) was established in February 2001. It is a major source of Government funding for the sector. The SRA provides strategic direction for the railway system. It also lets and manages passenger franchises, develops and sponsors major infrastructure projects, manages freight grants, and is responsible for some aspects of consumer protection.

[26] Department for Transport, *Secretary of State for Transport Minute to House of Commons Non-Statutory Contingent Liabilities in Support of Network Rail Limited.*

[27] *The Independent*, 26 March 2002, Financial Times, 19 October 2002.

credit rating might have remained good, or the threatened downgrade been less damaging.

That said, it is not clear that higher equity levels and a less risky regulatory regime would have been enough to save the company. The magnitude of the losses and potential cost overruns might have overwhelmed even a lower risk, more conservatively financed company.

The Railtrack case is unusual in that the government did not bailout the company as a going concern, but stepped in and placed it in Railway Administration. This was achieved without serious service disruption. It illustrates that special regimes designed to manage the bankruptcy of private infrastructure companies can work effectively. However, the case also illustrates the practical limits of such regimes. In a normal bankruptcy, equityholders frequently lose everything and debtholders are not repaid in full. In the case of Railtrack, the government knew that to raise the massive amounts of finance it would need in the future it could not afford to alienate the lending community, and so assured existing debtholders that they would be paid in full. The government's original intention was that equity holders at least would not be compensated. However, the threat of legal action led the government to buy-out equity holders also. This highlights the practical risks to government under special bankruptcy regimes, and the importance of ensuring that all decisions taken under such regimes are demonstrably well considered and legally correct.

4 Analyzing leverage, regulation, and bankruptcy

In this section, we set out a framework for analyzing the effect of leverage and regulation in the presence of bankruptcy-shy governments and regulators. We show how governments and regulators can estimate the probability of bankruptcy given different degrees of leverage and risk. We explain how equityholders, debtholders, the government, and customers can all be thought of as stakeholders in a private infrastructure firm, and how the values of their respective claims can be viewed as making up the stakeholder structure of the firm. Finally, we show how governments can estimate the value of implicit debt guarantees.

4.1 Leverage, regulation, and the probability of bankruptcy

4.1.1 The model

Consider a hypothetical, highly leveraged private infrastructure company. Suppose the company's assets cost $100 million and were purchased with $10 million from equityholders and $90 million from the host country's development bank. Suppose the development bank lent to the company at the government's nearly risk-free borrowing rate, which was 5 percent, requiring the company to repay $94.5 million in one year's time ($90 \times (1 + 0.05)$). Suppose that the company's expected rate of return on assets is 10 percent and that it will make no distributions to equityholders during the year. If it achieves this expected return, it will be worth $110 million at the end of the year ($100 \times (1 + 0.10)$) and will easily be able to repay the debt. Because of their high leverage, the equityholders' claim will then be worth $25.5 million ($110 - 94.5$).

Although the expected rate of return on the firm's assets is 10 percent, the company will make more than this if it surpasses expectations in reducing costs or if demand is stronger than forecast. Likewise, the company will make less than 10 percent if costs are higher or demand is lower than expected. We suppose that a standard price cap limits the company's prices and provides for no adjustments to compensate for unexpected changes in costs or demand during the year. The company thus bears all demand and cost risks during the year.

Technically, we suppose that the company's value evolves over time in a way that is partly predictable and partly unpredictable—like a random walk with drift—in which the predictable element is the 10 percent expected return and the unpredictable element is measured by a volatility parameter. Given the underlying business risks and the price cap, we assume the volatility of the company's value is 25 percent, which is higher than for water utilities in the United States, but lower than for telecommunications firms and independent power producers in the same market. Table 5 summarizes our numerical assumptions, while Annex 2 sets out the mathematics.

Table 5: Assumptions for the example

Parameter	Value
Value of assets at the beginning of the year	$100 million
Amount contributed by equityholders	$10 million
Amount contributed by debtholders	$90 million
Required debt-repayment at the end of the year	$94.5 million
Annually compounded risk-free interest rate	5%
Expected annually compounded return on assets	10%
The volatility of the return on assets	25%

4.1.2   Probability of bankruptcy

With these assumptions, we can calculate the probability distribution of the firm's returns and hence the likelihood of bankruptcy (see Figure 4). The expected return determines the mean of the distribution shown in the figure, while the volatility parameter determines the extent of the spread. The higher the volatility, the more dispersed are the firm's returns.

The probability of the company's going bankrupt is equal to the area under the curve showing the probability distribution of returns and to the left of the line indicating the required debt repayment. It turns out to be about 31 percent (see Annex 2 for details of the calculation).

Figure 4: Probability distribution of returns and the chance of bankruptcy
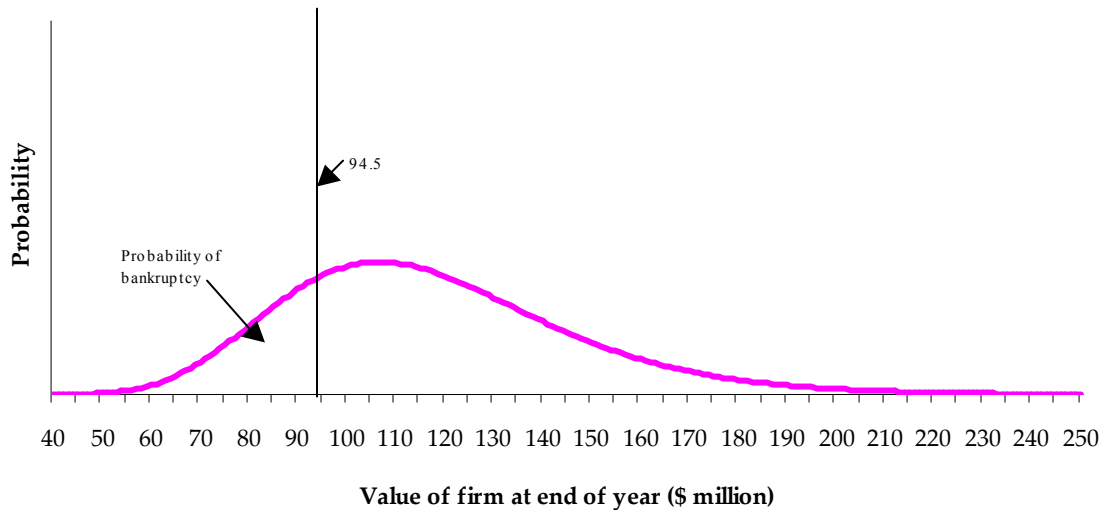
As Figure 4 illustrates, the probability of bankruptcy depends directly on leverage—reducing leverage is the same as shifting the debt-repayment line to the left. Figure 5 shows how the probability of bankruptcy varies with leverage, holding volatility constant at 25 percent.

Figure 5: Leverage and the probability of bankruptcy
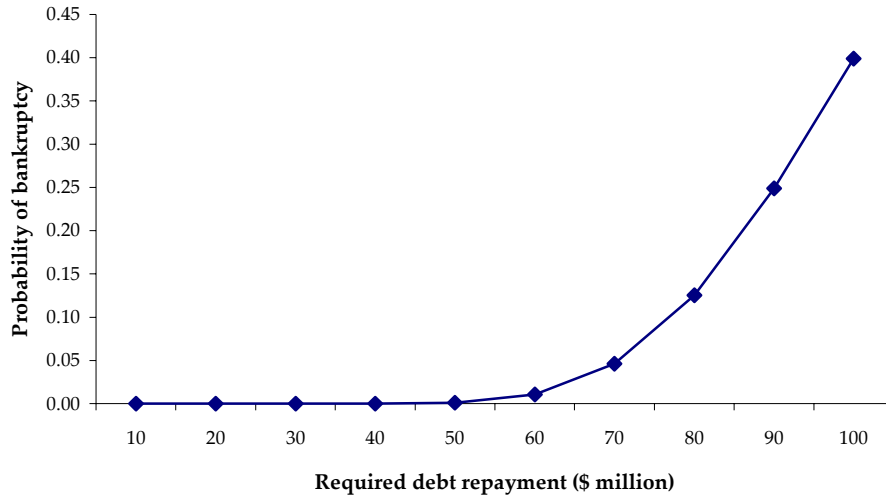
With debt repayments of $50 million or less, the probability of bankruptcy is very small. As the required payment increases, however, the probability of bankruptcy increases roughly exponentially.

By returning to Figure 4, we can also see how the probability of bankruptcy depends on volatility and therefore regulation. Reducing the dispersion of returns while holding leverage constant would also reduce the probability of bankruptcy. Figure 6 shows how the probability of bankruptcy increases with volatility, holding the amount of the required debt repayment constant at $94.5 million. Because regulation is a major determinant of volatility, we depict the relationship as being between regulation and the probability of bankruptcy.

Figure 6: Regulation and the probability of bankruptcy
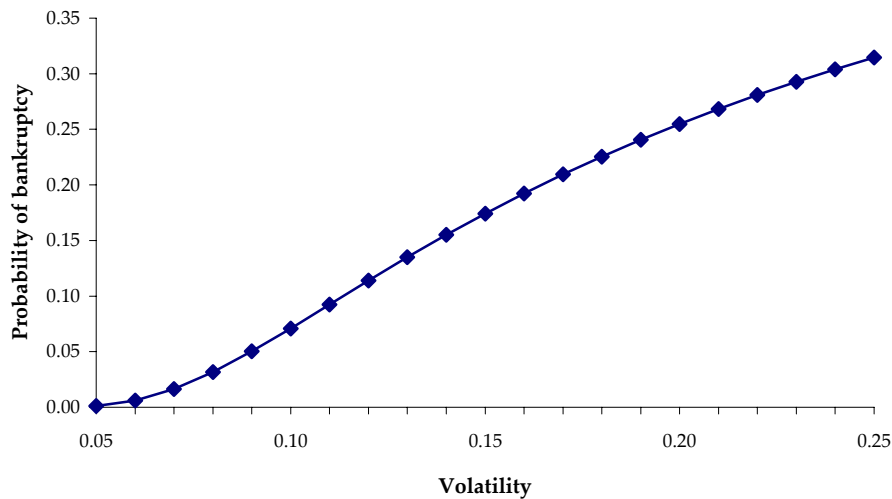
The far left of the horizontal axis, showing volatility of only 5 percent, can be thought of as a version of rate-of-return regulation—more extreme, however, than actual rate-of-return regulation as practiced in the United States. With this type of regulation, the probability of bankruptcy is virtually zero, even with the high leverage we are assuming. As we move to the right, we can think of regulation including fewer cost-plus elements—not allowing prices to adjust so frequently, or so fully, in response to changes in costs or demand. A traditional price cap might lie at the far right of the axis.

As expected, leverage and regulation (volatility) interact. The biggest problems occur when high leverage combines with high volatility (Figure 7).

Figure 7: Regulation, leverage, and the probability of bankruptcy
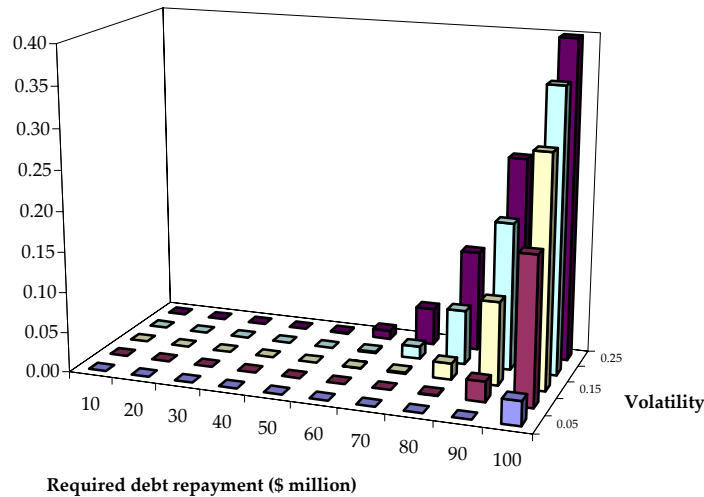
While the details will differ from case to case, governments can use essentially these techniques to get an idea of whether the structure of a proposed project—the financing and the allocation of risks created by regulation—creates a significant risk of bankruptcy.

4.2 Valuing stakeholders' claims and implicit guarantees

So far, we have used the approach only to estimate the probability of bankruptcy. By applying ideas from option pricing, we can also estimate the present value of implicit guarantees given by taxpayers or customers. We present such estimates in the next section while discussing the concepts of capital and stakeholder structure. Annex 2 again provides the mathematical details.

### 4.2.1 Analyzing capital structure

A firm's assets are typically financed by contributions from equityholders and debtholders, and capital structure can be defined as a specification of the relative amounts of these contributions. Our illustrative company received $90 million from debtholders and $10 million from equityholders; so its capital structure defined in this

way would be 10 percent equity and 90 percent debt. This approach fits nicely with historic-cost accounting, but a more useful way of looking at capital structure for our purposes is to consider market values, thus focusing on how the value of the firm is divided among equityholders and debtholders.

Because the development bank may not be repaid in full, the market value of its loan is less than its historic-cost book value of $90 million. In fact, given the assumptions about leverage and volatility, our model implies that the development bank can expect to receive only $90.3 million. That is, taking into account the 31 percent probability of the firm not being able to repay the loan in full, the "average" repayment is only $90.3 million. This is more than the bank lent, but much less than the required return on the loan, even assuming that the appropriate interest rate was the risk-free rate. The appropriate commercial interest turns out to be about 11 percent and the market value of the loan is about $84.7 million. (See Annex 2 for details.)

The value of the equityholders' equity, which is just the difference between the value of the assets and the value of the debt, is therefore $15.3 million (100 – 84.7). In other words, the cheap loan from the development bank included a subsidy worth $5.3 million to equityholders (15.3 – 10). At market values, then, the capital structure is about 15 percent equity and 85 percent debt. Figure 8 illustrates the transfer of value from the development bank to equityholders implicit in the cheap loan.

Figure 8: Capital structure according to contributions and present values
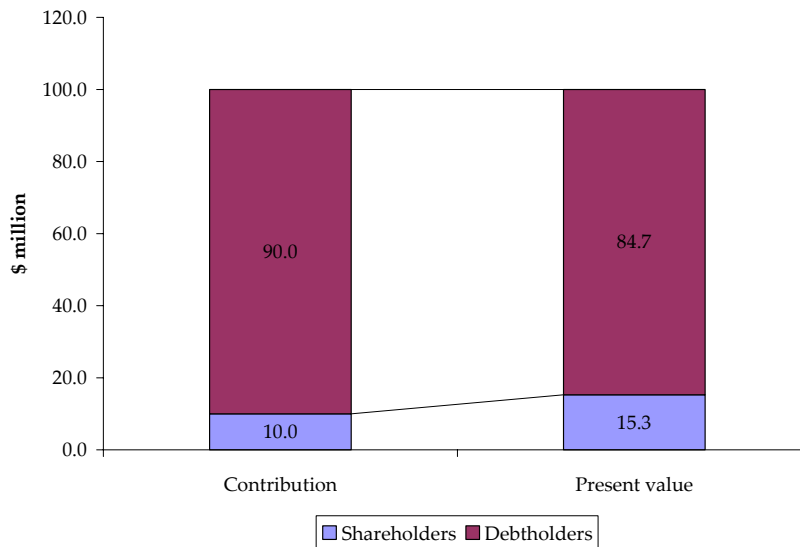
Next, we extend the idea of capital structure to include the government as a stakeholder, but first we need to consider the effect of capital structure on the company's cost of capital.

### 4.2.2 Capital structure, the cost of capital, and the government

Required rates of return on debt are typically lower than the returns required by equityholders. One view about capital structure—sometimes called the traditional view (Brealey and Myers 2000: 484)—is that debt is therefore cheaper than equity, so firms can lower their average cost of capital by increasing leverage. As Modigliani and Miller demonstrated, the traditional view is too simple: the returns required by rational equityholders increase with leverage, so the effect of leverage on the total cost of capital is not immediately clear. Indeed, in a capital market without any distortions or transaction costs, the total cost of capital is independent of leverage: as leverage rises, increases in the returns required by rational equityholders exactly offset the cost-cutting effect of increasing debt.

What happens in an idealized perfect capital market is of course of no intrinsic interest to policymakers. Modigliani and Miller's work does not show, for example, that the cost of capital is independent of leverage in the real world. Yet it does show that, *if* the cost of capital varies with leverage, it is not because interest rates are lower than the required returns on equity; it must be because of imperfections in capital markets.

One source of imperfection is the tax system. In many countries, interest payments are tax-deductible while dividends are not, but investors pay tax on both interest payments and dividends. The tax system therefore discriminates in favor of debt. In such countries, increasing debt may reduce the cost of capital. To see the role the tax system plays, it is useful to further refine our conceptualization of capital structure so that it includes the government. Through the tax system, the government acts as a sort of silent equity partner in most firms (see, e.g., Ross and others 2000). Since the government does not contribute capital, we call this extended capital structure the *stakeholder structure* of the firm.

Suppose the government imposed no taxes at the time our illustrative company invested, but is now considering a 40 percent tax on any distributions to equityholders, while continuing not to tax debt. In the absence of the tax, the value of equityholders' claim was $15.3 million; with the tax, the government would be entitled to 40 percent of that, or $6.1 million. Figure 9 illustrates the transfer of value from equityholders to the government that the tax would effect.

Figure 9: Stakeholder structure, with and without a 40 percent tax on profits
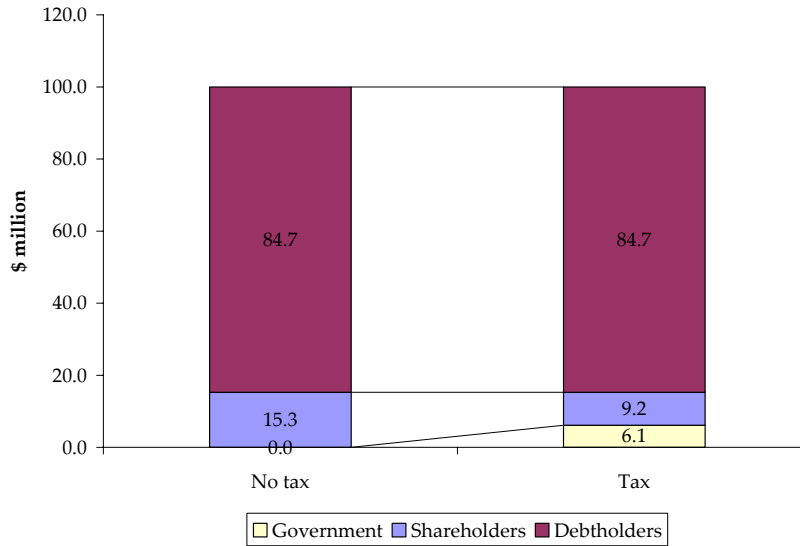
If the company's $100 million of assets had been financed by equal contributions of debt and equity, the government's share of the value would have been much larger—$20 million (0.4 × 50). If taxes make the capital market imperfect, then, leverage matters. If taxes favor debt, the company pays less tax to the government as it increases debt, so the combined value of equityholders' and debtholders' claims increases, at the expense of the government's.

If increasing leverage can reduce tax payments when taxes discriminate in favor of debt, what stops firms from increasing leverage indefinitely? Part of the answer is another market imperfection, namely the direct and indirect costs of bankruptcy. Because bankruptcy creates direct resource costs, such as lawyers' fees, increasing leverage may reduce the expected cashflows available for equityholders and debtholders. Less directly, but perhaps just as importantly, high leverage creates a conflict of interest between equityholders and debtholders. Equityholders may prefer high-risk low-value projects, since they effectively own a call option on the firm's assets, being exposed to upside risk, but protected from downside risk by limited liability. Especially when they are close to bankruptcy, equityholders can therefore increase the value of their claims at the expense of debtholders by taking on riskier projects, even if, from the firm's perspective, the returns to those projects are not commensurate with the risks.

This is the static trade-off theory of capital structure. It says that optimal leverage is determined by trading off the tax advantages of debt against the cost of financial distress. Actual leverage will be influenced by the firm's history as well as its plans. According to the "pecking-order" theory of capital structure, firms with investment opportunities prefer to finance them first with operating cashflows; once those are exhausted, firms borrow; and only once both of these source of cash are exhausted do they tap equity markets. Thus, a firm's actual capital structure depends not only on the tradeoff considered above but also on its past profitability and investment opportunities (see

Myers 2001, for example). In addition, a firm's actual debt–equity ratio will be strongly influenced by the market valuation of its equity (Welch 2002).

4.2.3 Incorporating customers' claims in the analysis

Customers typically don't receive a share of the operating profits of the firm, but for our purposes it is useful to think of them alongside other beneficiaries of the firm's activities in an expanded stakeholder structure. Customers, like equityholders, debtholders, and governments, share in the value of the services the firm produces, receiving what economists call consumer surplus. By considering the present value of customers' consumer surplus, we can interpret the stakeholder structure as the shares in the total value of the firm services received by equityholders, debtholders, government, and customers.

The value of each stakeholder's share of the value of the firm's activities is the present value of the cashflows and, particularly in the case of customers, other benefits (such as the services provided by the firm) the stakeholder expects to receive or give up, over the life the firm. The value therefore depends on the expected values of the cashflows (and other benefits) and on the risks surrounding the future cashflows.

The risks of each type of claim differ and those differences affect the values of the claims. For example, the payments to the firm's debtholders are usually less risky than the payments to its equityholders, so the value of the debtholders' claim is greater, per dollar expected, than that of equityholders. Put differently, debtholders discount their expected cashflows at a lower rate than equityholders. Although customers and governments typically do not attempt to calculate the value of their claims, these values also depend on the risk characteristics of the payments and other benefits.

4.2.4 Stakeholder strategies for claiming value

All stakeholders are interested in increasing the value of their claims. Debtholders seek to increase the probability of receiving their promised return; equityholders seek to increase the firm's profitability; governments seek to achieve their goals, while minimizing subsidies and tax exemptions; and customers seek higher-quality services and lower prices.

One strategy stakeholders can pursue to increase the value of their claim is to increase the total value added by the firm's services and ensure they get a share of the increase. In the standard metaphor, the stakeholders can try to increase the size of the pie. (Because we've used bar charts rather than pie charts—as we want to show negative claims—we might refer to increasing the size of the "bar"). Equityholders, for example, may encourage managers to innovate or invest in ways that increase profits and provide new benefits to customers.

Another strategy a stakeholder group can pursue is simply to increase their share of the value—without increasing, or even at the cost of reducing, the size of the pie. In an idealized world in which there were no transaction costs and all changes had to be

agreed by all stakeholders, everyone would understand the effect of changes on the size of the pie and changes that redistributed value at the cost of shrinking the pie would never be accepted. In reality, of course, no stakeholder has perfect information, and changes do not require everyone's agreement. The government, for instance, can claim value by increasing taxes.

Some strategies shift value in obvious ways. For example, the management of a regulated firm, representing equityholders and debtholders, can lobby the regulator for higher prices; and customers can lobby for lower prices. Firms can lobby for more subsidies, while governments can propose raising taxes or cutting subsidies. These strategies are transparent and analysts can readily understand what is going on. More problematic policy are less-transparent strategies that work by changing the risk profile of stakeholders' claims, such as increasing leverage to take advantage of implicit government or customer guarantees.

Consider the illustrative company again and suppose, to keep the analysis simple, that the government does not impose any tax. Suppose also that, in an attempt to stem the losses associated with owning the development bank, the government sells it to a private bank, which thus becomes the debtholder in the company. When the government sold the development bank, we can imagine that it emphasized that the purchaser would have to assume all the risks of the loans in the development bank's portfolio; specifically, we can imagine that it stipulated that loan repayments had no government guarantee. Yet suppose that despite these statements it has now become clear that, for the reasons discussed earlier, the government would not allow the company to go bankrupt. Figure 10 shows the implications of the government's implicit debt guarantee for the company's stakeholder structure.

**Figure 10: Stakeholder structure with and without the government guarantee**
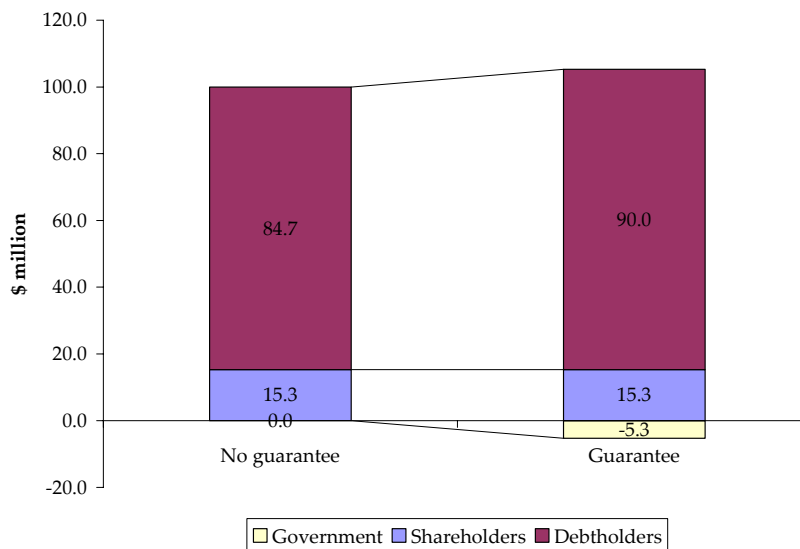
With the guarantee, the debt is now risk free and the present value of the debt repayment, discounted at the now-appropriate risk-free rate, is $90 million. The increase in the value of debtholders' claim has come at the expense of the government, so the

government has lost for a second time the $5.3 million it first lost when it made the subsidized loan. The value of the implicit guarantee must therefore be $5.3 million (see Annex 2 for details).

The way we have told the story, the debtholders benefit. Equityholders can benefit, too, however. For example, the existence of the guarantee will allow them to borrow more and at the risk-free rate.

As with the probability of bankruptcy, the value of the implicit guarantee depends on leverage and volatility (which in turn depends on the power of regulation). Figure 11 illustrates their joint effect.

Figure 11: Leverage, regulation, and the value of the implicit guarantee ($ million)

Required debt repayment ($ million)
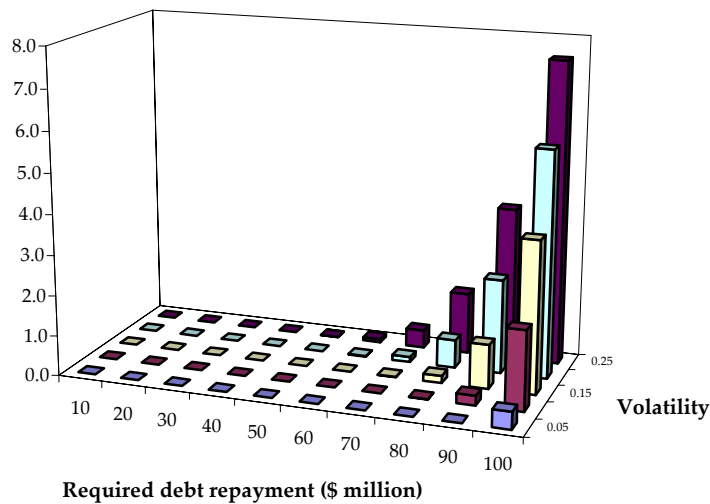
Holding volatility constant, increasing leverage raises the cost of the guarantee roughly exponentially: once the required debt repayment at the end of the year is less than $50 million, the implicit guarantee has virtually no cost, over the whole range of risk. But if leverage increases to the point where the required debt repayment is $100 million at the end of the year, and volatility is 25 percent, the value of the implicit guarantee rises to about $8 million—or 8 percent of the project's value.

(We could also suppose that it was the regulator that would refuse to allow the firm to go bankrupt and that it was customers, rather than taxpayers, who were unknowingly providing the implicit guarantee; the results would be analogous).

4.3   Applying the analysis in practice

In the example, our assumptions have simplified the problem of estimating the probabilities of bankruptcy and the value of implicit guarantee. For example, we've considered only one year and supposed that all debt must be repaid at the end of that year. The framework can be applied to more-complex real-world situations, but

estimation will be more difficult. While we have calculated the numbers underlying the example presented here analytically (that is, by means of formulas set out in Annex 2 that, once applied, directly give the answer), some real-world problems may be more easily tackled by means of simulation, in which the answers are inferred by looking at a large sample of possible outcomes and calculating average outcomes (see, for example, Benninga 2000 and Hull 2003).

Another problem that will arise in practice is estimating the volatility of the firms' returns. If the firm is new, no historical data will exist. In practice, evidence on the volatilities of comparable existing firms, subject to similar regulation, can often be used to get a rough estimate.

5 Policy options

Quantitative analysis of the type just discussed helps governments and regulators get a sense of the size of the problems that can be created by high leverage and high-powered regulation when bankruptcy is difficult to accept. Solving the problems requires governments or regulators to do one or more of the following things:

- Increase their willingness to allow private infrastructure providers to go bankrupt

- Reduce the companies' leverage by mandating minimum equity levels or taking similar actions

- Reduce explicit risk bearing by the private infrastructure company—by allocating more risk to taxpayers or customers.

And, of the course, the government may decide that the best option in the circumstances is to do nothing—to accept the problem and live with it.

5.1 Making bankruptcy a more credible threat

If governments were willing to allow private infrastructure providers to go bankrupt, the problem of unintended risk hand-back would largely disappear. In this section, we look at:

- How bankruptcy and financial restructurings work for normal businesses, and could work for private infrastructure providers

- Why governments are reluctant to see private infrastructure providers enter bankruptcy

- What could be done to make the bankruptcy of private infrastructure providers a more realistic proposition for governments.

5.1.1 How bankruptcies and financial restructurings work

If a company defaults on its debt, the debtholder generally has the right to take over management of the company, for example by appointing a receiver (or administrator). The receiver then runs the company until it can pay its debts.

When the company in receivership cannot generate enough cash to pay its debts, a financial restructuring often takes place. Typically, this would see the equity investors lose all or most of their investment. The debtholder would convert part of its debt to equity, making it the new owner of the business and reducing the debt burden to a level the company can service. The debtholder loses a portion of its investment through this

debt-to-equity conversion. After the financial restructuring, the debtholder might sell its equity to a new owner, which would take over running the company.

The precise mechanisms of bankruptcy vary from case to case. For example, many countries have regimes that allow for financial restructuring while the incumbent managers continue to run the company. Chapter 11 of the bankruptcy code of the United States is an example of this. However, the net effect of almost all regimes is that the company's losses are borne by the investors in the company, with the equity holders bearing the majority of the losses, and—crucially—the debtholders also losing as debt is reduced to a level the company can service.

It is easy to imagine bankruptcy working this way for a private infrastructure provider. For example, consider again the illustrative infrastructure company described in the preceding section, whose assets were financed by $10 million in equity and $90 million in debt. Imagine that, under the terms of a new loan, debt service is $9 million per year. Assume that there is an unexpected reduction in demand, and cashflow from operations drops from $10 million a year to $8 million a year. This would lead to a default on the debt service. In this situation, the debtholders could be expected to preserve the remaining value of their investment by taking control of the company and instituting a financial restructuring.

Suppose that with lower demand the company was now worth $80 million. The equityholders would lose the entire value of their $10 million investment and the debtholders would have the only claim on the $80 million. They would have lost $10 million as well. Under the restructuring, $20 million of the debt might be converted to equity held by the debtholders, reducing the value of outstanding debt to $60 million, with debt service of $6 million, thus restoring the company's financially viability. In this scenario, the company would continue operating as before, and the loss from the reduced demand would be borne entirely by the equityholders and debtholders through a reduction in the value of their claims on the company.

5.1.2 Why governments are reluctant to let private infrastructure providers go bankrupt

Probably the main reason why governments do not like to see private infrastructure providers go bankrupt is the fear of service disruption. There is a common perception that if a private infrastructure provider goes bankrupt, the provision of the service will stop. Since the services are typically essential, governments are reluctant to risk any disruption. Governments fear that in an uncontrolled bankruptcy the private infrastructure provider might stop paying its suppliers, which could lead to service being suspended. For example, if a water utility stops paying its chemical supplier, water may go untreated. If an electricity utility no longer has money for replacement equipment, a transformer breakdown could leave an area without electricity for an extended period. If the equity investors see no future prospects for the company, they might pull out the management team, leaving the company directionless.

There is also a tendency to associate bankruptcy with liquidation. When a debtholder takes control of the company, it may sell the company's assets, recover as much as it can through these sales, and shut the company down. In reality, liquidation is unlikely to be an attractive option for a lender to a private infrastructure provider, since the majority of the private infrastructure provider's assets will not have any use other than providing the service. For example, water pipes, electricity distribution lines, and roads cannot be sold and taken away by a new owner. This means that the way to maximize the remaining value of the company will be to continue to provide the service. Despite this, the common association of bankruptcy with asset sales and liquidations probably contributes to the government's reluctance to allow private infrastructure providers to enter bankruptcy.

5.1.3 Making private infrastructure provider bankruptcy a more realistic option

To reduce the problems associated with bankruptcy, the government can, among other options,

- Give itself the power to ensure continued service

- Work with financiers to ensure continued service.

An obvious solution to the risk of disruption is to give the government the power to intervene to ensure continued service provision in the event of financial distress. For example, the government could be given the power to appoint an administrator to run the company in the public interest in the event that the company gets into financial difficulty.

In fact governments often do have this power, but it does not seem to be effective in overcoming their reluctance to allow private infrastructure providers to go bankrupt. For example, the government of the United Kingdom had the power to take over control of NATS. As we have seen, however, the government chose to ease its price cap, rather than take control back again when NATS ran into difficulty. The same was also true of the Melbourne urban transport franchises. Water company licenses in England and Wales have a similar provision. Despite this, the water regulator in the United Kingdom has indicated that he would not allow water companies to go bankrupt.

This is probably because governments do not want take over management of a troubled private infrastructure provider. Having transferred management to the private sector, the government is unlikely to have the skills to reassume control, especially during a crisis. Nor would government want to take the risk involved in intervening in a business crisis, and possibly being sued for its actions.

One example in which the government was willing to appoint an administrator to a financially distressed private infrastructure provider was Railtrack in the United Kingdom (see Section 3.5 above). However, this may illustrate the risk involved in this approach—as the government was in fact sued.

An alternative approach would be to work with the senior lenders to the company, to provide an organized bankruptcy regime that makes lenders responsible for ensuring continued provision of service if they appoint a receiver to the company.

Lenders to concessions and other project-financed infrastructure generally have "step-in rights"—a provision in the loan agreement that allows them to take over management of the company if it appears likely to default on its debts. To reassure governments that bankruptcy will not disturb service provision, the government could require the contractual documents to give the lender an obligation, if it exercises its step-in rights, to continue to provide service. In some transactions, this is done through a "tripartite agreement" between the lender, the project company, and the government. This agreement spells out in detail a regime that will be followed in the event of default by the project company. It provides for security for the lender, while ensuring continuity of service. Box 3 provides an example.

Box 3: Enlisting lenders to ensure continuity of service

The State of Victoria (Australia) sought bids for a public–private partnership to install advanced telecommunications infrastructure in regional areas. Potential lenders to the project were willing to invest, but wanted security over the assets created by the project. The government was unwilling to offer this security. It worried that if the project company defaulted on its debts, the government would lose control of the infrastructure assets, threatening service provision.

An investment bank bidding for the project offered a solution. The bank explained that it saw its role as backing the operators of the project if they performed, and changing them if they did not. It proposed a solution in which in the event of any default—either in service provision or debt service—the lender would have the right to take control of the project, and bring in a new team to manage the project company. In this way, the lender would act as the government's agent, taking action to ensure the continued operation of the project if problems arose. Following this suggestion, the transaction was designed to allow the lenders step-in rights to take over management of the company in the event of problems, subject to an obligation to continue to provide service.

5.2   Reducing leverage

If there is a risk that government will treat debtholders more favorably than equityholders in the event of bankruptcy of the private infrastructure provider, then effective risk transfer to the private sector may require stipulations that equity exceed certain levels. The idea is that the investor put at least the specified level of capital at risk, as a way of making risk-transfer effective. In other words, the promoters of the project or other equityholders must have a significant amount at stake.

> **Box 4: How minimum equity levels work to protect the public**
>
> Imagine a situation in which a toll road is financed 90 percent by debt and 10 percent by equity. Assume traffic ends up being lower than expected. Assume also that the government will act to protect debtholders, but not equity investors. In this case, it is clear that the magnitude of the risk that can be effectively transferred to the private sector is limited to 10 percent of the value of the toll road. Any loss of value in excess of this level will not be borne by the private sector—since this would require a restructuring of the debt, and a loss to the debtholders. If the loss of value exceeds 10 percent of the value of the road, the government will protect debtholders by bearing the loss itself, for example through a subsidy to cover the debt service.
>
> Contrast this with a situation in which the government stipulated at the start that the road must be financed at least 40 percent by equity. In this case, the risk effectively transferred to the private sector is equal in magnitude to 40 percent of the value of the road—four times the level in the previous example. Where the government is likely to protect debtholders, mandating minimum equity levels is one way to ensure that risk transfer to investors works as planned

The government can take a variety of approaches to increasing the operator's financial capacity to bear risk, including the following:

- On-balance-sheet rather than project financing

- Parent-company guarantees

- Minimum equity levels in the project company (see Box 4)

- Performance bonds

- Third-party guarantees.

This section reviews these options. It then reviews the common practice of providing explicit support to debt financing, to assess whether this is likely to worsen the problem of excessive debt levels and unintended risk-handback.

5.2.1 On-balance sheet financing

Private infrastructure projects are generally "project-financed". That is, even if the operator and investor in the project is a large established company, the established company will create a new "project" company—a separate legal entity—to carry out each project. This limits the established company's risk. If the project fails, the established company can lose only what it had invested in the project company.

One way to increase the operator's financial capacity to bear risk is to forbid the use of special project companies. This would make the established company liable for project-debt if the cashflows from the project were insufficient. Requiring investors in an infrastructure project to be established companies with an equity value in excess of a specified level would be one way of doing this. We refer to this option as a requirement that the project be "on the balance sheet" of the established company.

The problem with this approach is that it increases risk for the established company. This will reduce the number of companies willing to bid for a project or increase the returns they require.

A number of mechanisms are at work here. One is that the board of an established company may well be willing to invest in a project in a developing country if the risk is capped at a specified figure, but unwilling to "bet the company" on the same project. Boards often feel that the risks of a new project in a developing country cannot be understood well enough to allow them to assume virtually unlimited liability for the project—which is what on-balance sheet financing demands. Boards may therefore refuse to invest, or will demand additional protections or large expected returns if they do invest.

Another important mechanism is the debt market and the views of the rating agencies that influence the market. The cost of borrowing for the established company is a function of its risk of bankruptcy. As noted earlier, the higher a company's leverage, the higher is its risk of bankruptcy. Infrastructure projects are generally financed largely with debt. If the project is done on-balance sheet, that debt will be debt of the established company. As the established company increases its debt levels, its debt rating will fall and the cost of its borrowing will increase. Again, this will make companies less willing to take on projects, or make them demand higher returns.

5.2.2   Parent-company guarantees

A partial solution to the problems of a requirement for on-balance-sheet financing would be to allow the investment to be carried out through a project company, but to demand that the project company be guaranteed by the established company.

The risk transfer to the established company is almost the same with a parent-company guarantee as it is with on-balance sheet financing. However, under common accounting principles the project debt may not appear on the books of the established company, making its leverage look better. Because lending decisions are often influenced by accounting information, a parent-company guarantee to a project may not have the same impact on the company's overall cost of borrowing as doing the project on-balance sheet would.

Nevertheless, boards of established companies may still be unwilling to take on unlimited liability for risks that are hard to understand and quantify—which they would be required to do by a parent-company guarantee. One way to lessen this problem would be to limit the value of the parent-company guarantee. In this way, the board would know the maximum amount that the established company could lose.

5.2.3   Project-finance with minimum equity levels

The goals of a parent-company guarantee can also be achieved by a requirement that the equity in the project company exceed a specified level. For example, instead of requiring that the parent company guarantee the obligations of the project company up to, say, $30

million, the government could require the parent company to inject at least $30 million in equity into the project company. The effect would be similar in either case: the equity investors could lose up to $30 million, after which the project company would become bankrupt.

Of course, there are problems with this approach also. Investors will argue that it increases the cost of capital. To some extent this simply reflects the effectiveness of transferring risk to the investor: if investors have to take higher risk, they will demand higher returns. Indeed, any technique that makes risk transfer effective is likely to increase the cost of capital.[28] However, requirements for minimum equity levels may increase the cost of capital in other ways, by limiting investors' flexibility to source finance in the cheapest way. In particular, it may reduce the ability to take advantage of the favorable tax treatment of debt (see Section 4.2.2).

Enforcing minimum-equity requirements may also be difficult in practice. The government will need to monitor the sources of finance for the project, and that monitoring will need to continue throughout the life of the project. For example, investors might have an incentive to reduce the equity component of the project over time, perhaps by paying out dividends in excess of profits, and increasing borrowing to provide the cash. To make minimum-equity requirements effective, government would need the power to prevent this kind of transaction, and the ability to monitor the project company's finances closely enough to catch any attempt to break the rule.

5.2.4   Performance bonds and third-party guarantees

Requiring companies to invest significantly more equity than they wish in an infrastructure project can be expensive. It may also exclude some participants from the market, reducing the range of private providers from which the government can choose. For example, some construction and engineering companies may be able to compete for build-own-operate-transfer projects and concessions on a project-financed basis, but do not have the balance sheet to invest large amounts of their own capital in each project.

An alternative approach would be to allow the project promoters to provide a source of at-risk finance from a third party. This may be in the form of a performance bond or some kind of third-party guarantee. The idea is that a bank, insurance company, or other financially strong entity would put a sum of money at risk, to be used if the project company cannot meet its obligations. The project company would pay the third party a fee for providing the bond or guarantee. For example, rather than requiring a minimum equity level of $30 million (as in the last example) the government could require a combination of equity and guarantees or bonds which together added up to $30 million.

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[28] Strictly speaking transferring risk to the operator may reduce expected cashflows without increasing the cost of capital because the transferred risks may not be systematic and therefore may not be priced. When this is the case, the risk transfer may still seem to increase the cost of capital if the cashflows used in financial forecasts are most likely cashflows rather than expected cashflows. In that case, a rational operator will discount forecast cashflows at a higher discount rate and the discount rate may be described as the cost of capital. The outcome in any case will be similar: for a given initial investment, the operator will require higher customer tariffs or higher government subsidies.

This might allow an investor to put up $20 million in equity, and the remaining $10 million in a performance bond.

From the government's or consumers' point of view, the effect is much the same as requiring $30 million in equity. In both cases, $30 million of investor money can be lost before the company enters bankruptcy.

The third party providing the bond or guarantee will assess the riskiness of the venture, and satisfy itself that the fee adequately compensates it for risk it is taking. It will make this assessment based on the reputation and track record of the promoter, as well as the specific terms of the transaction. The third party therefore performs a useful service in checking the riskiness of a proposed deal. If the project looks too risky, the third party may suggest changes, or refuse to provide the bond or guarantee—thus alerting the government to potential problems with the transaction.

The attractiveness of this approach from a project promoter's point of view is that it removes the need to put the parent company at risk, or to obtain large quantities of equity finance. Many companies are happy to pay a fee for a bond or guarantee (the cost of which is built into the return they require on the project), even when they would be unwilling or unable to provide equity finance themselves.

5.2.5   Analysis of the impact of specific government support to debt finance

The options discussed above concern ways in which governments can increase the effective equity commitment to a project (and thus reduce the debt-finance component). In practice, we observe that governments often take actions that seem to do the opposite—to encourage the use of debt rather than equity in infrastructure financing. In particular, while governments seldom guarantee returns to equity in a project, they often guarantee the project debt.

The effect of a government guarantee is to lower the cost of debt. This will encourage investors to use more debt and less equity in financing the project. We know that increasing the leverage of a project increases its risk of bankruptcy, and hence of unintentional risk hand-back. Looked at in this light, government guarantees of debt seem perverse.

The best solution is probably to avoid government guarantees for debt. If there are particular risks that the government is best placed to bear, the government should assume those risks under the transaction structure. For example, if investors are not willing to bear the full extent of the demand risk, the contract may provide for government or the consumers to bear part of that risk. This approach provides the protection investors require, but is neutral between debt and equity investors. This means it does not distort the financing structure toward excessive debt.

In other words, it is better if government guarantees certain risks for all classes of investor, rather than guaranteeing all classes of risk for only certain investors. Guaranteeing returns to one class of investor but not another will distort financing choices. If only debt finance is guaranteed, the capital structure will be distorted toward

excessive debt, increasing the likelihood of bankruptcy and unintended hand-back of risk.

On the other hand, there are some cases in which an explicit government guarantee of debt may be justified. If a government is truly not willing to let a private infrastructure provider go bankrupt, it is implicitly providing a debt guarantee. In this case, it would be better to make the guarantee explicit. The cost to government is the same in either case—if the company gets into trouble, the government will service its debt. However, if the guarantee is explicit, the government can reap the entire benefit of the guarantee through lower borrowing costs for the project company, and/or through a guarantee fee. If the guarantee is only implicit, the government will probably not reap the entire benefit, because investors will probably not be sure that the debt is guaranteed, and therefore will charge an interest rate higher than the rate for guaranteed debt, leaving government with the worst of both worlds.

5.2.6   Conclusions on minimum-equity requirements

Because governments have a tendency to bailout financially distressed private infrastructure providers, investors have an incentive to use excessive levels of debt in financing private infrastructure providers. Governments can counteract this tendency by requiring that the equity capital in the company exceed specified levels. Options include requiring that projects be undertaken on-balance sheet by established companies, or if project specific companies are allowed, requiring parent company guarantees, minimum equity levels in the project company, or third party guarantees or performance bonds.

By making risk-transfer to the private sector effective, these options will reduce the investor's expected cashflows increase the investor's cost of capital. To the extent that the higher cost of capital reflects an effective risk transfer, this is a price worth paying.

Unfortunately, these options involve other costs. The greater the restriction on an investor's ability to choose its capital structure, the greater is the likelihood that the cost of capital will be increased unnecessarily. Requiring on-balance sheet financing or parent company guarantees removes an investor's ability to limit their exposure to a project. Many companies would refuse to invest, rather than take on an unlimited liability for a new venture in a developing country. Specifying minimum equity levels reduces the investor's ability to use the tax advantages of debt finance. Finally, attempting to control a company's capital structure imposes a continuing monitoring burden on governments.

One response to these problems is to provide as much freedom as possible to investors, consistent with requiring a certain level of equity-like risk-taking. Rather than mandating any specific approach (for example, parent-company guarantees or minimum equity levels), government could allow any approach that provided the required level of at-risk capital. Companies could then choose which of the various mechanisms provided the required level of risk bearing at least cost.

Finally, in setting requirements for minimum equity levels, governments need to balance the benefits of effective risk transfer against the costs of interfering in market-determined capital structures.

5.3 Subjecting the operator to less risk

In some cases, the best approach may be to reduce the risk of bankruptcy by building explicit risk-sharing mechanisms into the transaction design. In other words, it may be better to recognize that it is not realistic to expect the investor to bear all risk, and explicitly provide for consumers or the government to share risk beyond a certain level.

When allocating risk between the public and private sectors in infrastructure provision, the usual recommendation is to allocate each risk to the party best able to manage it. So for example, risk of construction cost overruns and operating cost increases are allocated to the private operator, since the operator is responsible to managing construction and operations. On the other hand, risk of future discriminatory tax treatment of the private infrastructure provider may be allocated to the government—through a requirement to compensate if the discriminatory tax treatment occurs—since the government is best placed to control the future tax regime.

There are other broad risks that neither the public or private sector is fully able to control, but which are frequently allocated to the private sector. Demand risk is one of the most significant of these. The theory is that the private operator has at least some control over these risks (for example through marketing, pricing and service quality in the case of demand risk); may be better than the government at anticipating them (for example, by scaling the project according to forecasts of demand); and its equityholders may be in at least as good a position as taxpayer to cope with the risk by diversification.

This approach to contract design may well be optimal when governments are truly willing to let investors bear the full consequences of these risks. However, where the government is likely to intervene to protect debtholders, the transfer of many large risks is illusory. In fact, the government loses twice over, since:

- Bidders for the transaction initially will factor in some of the risk-transfer specified in the contract, so the government or customers at least partially compensate the private investor for bearing the risk.

- If the business goes unexpectedly well, the investors get all the benefits.

- If the business goes unexpectedly badly, customers or taxpayers bear the risk through an intervention to prevent bankruptcy.

If the government will not be able to make the risk transfer stick, it would be better to recognize this up front, and write the risk-sharing mechanism into the contract. Examples of risk sharing mechanisms include:

- Rate-of-return bands and profit-sharing

- Trigger-point resets

- Cost pass-throughs

- Shipwreck clauses.

The following sections discuss each of these mechanisms and their costs and benefits.

5.3.1 Rate-of-return bands and profit-sharing

A simple form of risk sharing provides that if a company's profitability falls below a specified level, tariffs will be increased to partially restore the company's financial health. This arrangement can be symmetrical, so that if profits exceed certain levels, consumers share in the benefits through lower tariffs.

This arrangement can be expressed in terms of a rate-of-return band. For example, assume that a company's cost of capital is estimated at 10 percent. A band of plus or minus 2 percent could be agreed in which the company takes all the risk. If returns moved outside this rate-of-return band—below 8 percent or above 12 percent—the tariff formula would allow prices to adjust so that the losses (or gains) are shared between the company and consumers.

For example, if the profit-sharing factor was set at 50 percent and profits fell to 6 percent one year, prices would be increased by enough to bring the profit level back to 7 percent. In this way, half the risk would be kept by the company, and half shared with the customers. Conversely, if profits increased above the band, the allowed tariff would reduce. This type of rate of return band has been was used in regulation of the telephone company serving New York. A similar profit-sharing arrangement applied to the water and gas industries in the United Kingdom before World War II.

The advantage of this approach is that it reduces risk to the investor, while preserving some incentives for efficiency. It also reduces the political problems that can result from high profits, since they lead to rebates for consumers. By providing an automatic mechanism for reducing a company's downside risk, it reduces the risk of bankruptcy and a government bailout.

5.3.2 Trigger-point resets

We use the phrase "trigger-point reset" to refer to a contractual provision that allows prices or subsidies to be reset if a specified variable moves past a specified limit. For example, tariffs may have been set on the basis of particular forecasts of demand growth. If demand deviates from the forecast amount by more than, say 20 percent, the contract calls for a tariff reset.

This approach is common in concession and lease contracts in the French tradition. Such contracts specify a number of key variables such as demand, energy prices, and other factors likely to have a major impact on costs and revenues. The contract recognizes that the tariff-setting regime in the contract is based on assumptions about the range into which these variables would fall. If there are significant deviations from the expected value of these variables, it indicates that the cost and revenue conditions have changed, and the contract needs to be adjusted.

Rather than allow the operator to make losses (or excessive profits) as a result of the changes, the contract provides for a readjustment. The exact rules of the readjustment vary from contract to contract, but the intent is usually to restore the financial balance of the contract in some sense—for example, to bring the operator back to similar position to that which would have prevailed if the variable in question had remained within the expected range.

5.3.3 Cost pass through

Allowing the private infrastructure provider to pass on to consumers changes in costs that are largely beyond its control is another way of reducing risk. For example, electricity utilities and independent power projects typically have the ability to pass on fuel price increases directly to their customers.

5.3.4 Shipwreck clauses

Shipwreck clauses are designed to rescue the company in the event that it strikes disaster. A "shipwreck event" would generally trigger bankruptcy or financial restructuring of the private infrastructure provider concerned. Including a shipwreck clause in the contract provides an orderly way to address the problem. It makes clear at the start how the government or regulator will intervene in such cases. This has the advantage of allowing the private sector to price in the risk reduction in the form of a lower cost of capital. And if governments are likely to intervene to assist a distressed company anyway, spelling out the process provides a framework in which to operate, reducing the debate about how to proceed if and when a crisis does occur.

5.3.5 Conclusions on risk-sharing

Deciding whether to include risk-sharing arrangements in a contract involves balancing incentives on the operator against keeping risk to the private sector at manageable levels. Risk sharing protects the operator from unmanageable risks, but reduces its incentive to manage efficiently.

Often in the past, the focus has been on providing efficiency incentives by transferring as much risk as possible to the private sector. However, if we believe that governments will continue to intervene to stop private infrastructure providers going bankrupt, then the amount of risk that can be effectively transferred is limited. It would be better to recognize this by designing risk-allocation arrangements that limit risk transfer to realistic levels. By realistic levels, we mean that the probability that losses would exceed the total equity value of the company should be low. This reduction in risk transfer to private companies might need to be combined with controls on the company's capital structure. Otherwise, companies could respond to reductions in risk transfer by increasing leverage.

This approach would see the transaction structure reflect the reality of how governments behave. It would have the advantage of lowering the cost of capital by allowing the

private sector to price in the risk-sharing arrangements with certainty. It would also reduce the number of crises governments have to deal with, and could provide an orderly framework for resolving those crises that do occur.

6 Conclusions

Governments and regulators should be concerned about combinations of high leverage and high-powered regulation. The combination implies a significant chance of bankruptcy and experience suggests that, when push comes to shove, the government and the regulator will find it very difficult to allow the firm to fail. As a result, customers and taxpayers are probably bearing more of the project's risks than the project documents suggest. Indeed, they may effectively be providing a guarantee of the project's debt, without receiving any explicit compensation.

The best solution to the problem is for the government to make bankruptcy politically acceptable by ensuring that mechanisms are in place to allow it to occur without risk of service disruption. But, if governments cannot commit to allowing bankruptcy, they have to consider restricting leverage, reducing the power of regulation, or both. Neither of these options is costless. Depending on the tax regime and other circumstances, reducing leverage may increase the cost of capital and therefore raise required tariffs. Restrictions on leverage may also be difficult to enforce in practice. On the other hand, by reducing the company's exposure to risks, the government sacrifices some of the benefits of privatization: one of the rationales for privatization is that private firms respond better to the incentives created by exposure to risk than the government does.

The appropriate policy thus depends on the tax system, the feasibility of enforcement, and the benefits of risk transfer, which will differ from case to case. But combining high leverage, high risk-transfer, and a bankruptcy-shy government and regulator is unlikely to be the right answer.

Annex 1: Selected papers on capital structure of regulated firms

Paper	Approach	Conclusion
Besley and Bolton 1990	Survey of opinions	"Besley and Bolton (1990) in a survey of 27 regulatory agencies and 65 utilities, find that approximately 60% of the regulators and utilities surveyed believe that an increase in debt relative to equity increases regulated prices (Spiegel and Spulber 1994: 425)"
Bradley and others 1984	Empirical	"Regulated firms such as telephone, electric and gas utilities, and airlines are consistently among the most highly levered firms (page 870)".
Dasgupta and Nanda 1993	Empirical	"Regulated firms can improve their bargaining positions and induce the regulator to set higher prices for firm output by choosing more debt." Harsher regulatory environments lead to higher debt–equity ratios in the US.
Spiegel 1996	Theoretical	"Debt financing is shown to alleviate this distortion [firms' choosing high variable-cost technology to reduce regulatory opportunism] because it induces regulators to increase the regulated price to prevent the firm from financial distress, thereby reducing the cost to the firm of adopting technologies with low marginal costs. When regulators restrict the firm's ability to issue debt, the firm may have an incentive to goldplate (i.e. waste resources). This incentive disappears when the firm can use its most preferred mode of financing"
Spiegel and Spulber 1994	Theoretical	"Our main finding is that lack of regulatory commitment to rates provides the firm with an incentive to issue debt because debt mitigates the regulator's incentive to act opportunistically. Thus, debt reduces the regulator's incentive to lower rates as a response to the firm's investment in cost reduction (page 425)".
Taggart 1981	Theoretical	"Rate-of-return regulation may create incentives for regulated firms to alter their capital structures (page 392)".
Taggart 1985	Empirical	"Taggart (1985) studies state electricity and natural gas regulation in the period 1912–1922, and concludes that the establishment of regulation increases the utility's debt–equity ratio. Taggart attributes this in part to the reduction in the firm's risk due to regulation, but cannot reject a "price influence" effect of debt on regulatory decisions (Spiegel and Spulber 1994: 425).

Annex 2: The model underlying the example

In this Annex, we set out the model underlying the numerical example set out in Section 4. We start by considering the value of the firm and then turn to the question of how its value is shared by debtholders and equityholders.

The evolution of the value of the firm

We assume we know the initial value of the firm, which we denote V_0; this value can be thought of as the market value of the firm's assets and opportunities. We suppose that the firm's value is expected to grow over time, but that its actual value at any time in the future is unknown. Specifically, we assume that the value of the firm evolves according to a geometric Brownian motion, so that

$$\frac{dV}{V} = \mu dt + \sigma \sqrt{dt}\, \widetilde{Z} ,$$ 1.

where

μ is the expected growth rate of the value of the firm

dt is an increment of time

σ is the volatility of the value of the firm (the standard deviation of the annualized rate of appreciation)

$\widetilde{Z}$ is a normally distributed random variable with a mean of zero and a variance of one.

The volatility of firm's value σ is similar to the more familiar measure of a share's volatility, but relates to the value of the firm's assets, not just its equity. Volatility will be influenced by factors such as the volatility of demand for the firm's services and the way the firm is regulated. Under an extreme version of rate-of-return regulation, in which prices are continuously adjusted to compensate for all variation in demand and input prices, σ would be zero. Under an extreme version of fixed-price regulation, in which prices are never varied in response to changes in demand or the price of inputs, σ might be very high.

Value of the firm at *T*

It follows from equation 1. that the value of the firm at *T* is given by[29]

$$V_T = V_0 \exp\left[\left(\mu - \frac{\sigma^2}{2}\right)T + \sigma\sqrt{T}\,\widetilde{Z}\right].$$ 2.

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[29] See, for example, Baxter and Rennie 1996.

The expectation at time 0 of the value of the firm at T is given by

$$E_0[V_T] = V_0 \exp(\mu T). \qquad 3.$$

And the variance of the change of value of the firm between 0 at T is given by

$$\mathrm{var}\left(\frac{V_T - V_0}{V_0}\right) = \sigma^2 T .$$

Debt and bankruptcy

We suppose the firm's assets are financed by a combination of equity and debt and that the debt must be repaid at time T; there are no interest payments required before then. Let P_T denote the firm's debt-repayment obligation at T (P_T can thus be considered the face value of a zero-coupon bond). P shouldn't be confused with the value of the debt, which depends on the timing of the repayment and the probability of default, and which we will denote D.

The probability that the firm will be bankrupt at time T is the probability that the value of the firm will be less than the required debt payment:

$$pr(V_T < P_T).$$

Or, substituting in equation 1 for V_T above,

$$pr\left(V_0 \exp\left[\left(\mu - \sigma^2/2 \right) T + \sigma\sqrt{T}\tilde{Z} \right] < P_T \right).$$

Rearranging terms, the probability can be expressed in terms of a random normal variable as follows:

$$pr\left(\tilde{Z} < \frac{\ln\left(\dfrac{P_T}{V_0}\right) - \left(\mu - \sigma^2/2 \right) T}{\sigma\sqrt{T}} \right).$$

Expected value of the equity and debt at T

One might at first try to estimate the expected value of the equity at T ($E_0[S_T]$) as the expected value of the firm at T less the debt obligation, P_T. But equityholders' limited liability means it is higher than this. At time T, equityholders receive $\max\{V_T - P_T, 0\}$, the expected value of which, is given by

$$E_0(S_T) = V_0 e^{\mu T} N(d_1') - P_T N(d_2'), \qquad 4.$$

where

$$d_1' = \frac{\log\left(V_0/P_T\right) + \left(\mu + \sigma^2/2\right)T}{\sigma\sqrt{T}} \qquad \text{and} \qquad d_2' = d_1' - \sigma\sqrt{T}$$

The expected value of the debt at T is equal to $\min\{P_T, V_T\}$. It can be inferred from the fact that the expected value of the firm is the sum of the expected values of the debt and equity:

$$E_0[V_T] = E_0[S_T] + E_0[D_T].$$

So we can calculate the expected value of the debt at T from equations 3. and 4. above.

Promised and expected interest rates

We can also calculate expected interest rates and compare them with the promised rates. Continuously compounded interest rates can be derived from the expression, $X_T = X_0 \exp(iT)$, where X is the value of the asset and i is the interest rate. If we denote the amount of funds provided by debtholders at time 0 by F, the promised interest rate, i^p, is thus

$$i^p = \frac{\ln \dfrac{P_T}{F}}{T},$$

while the expected interest rate, i^e, is

$$i^e = \frac{\ln \dfrac{E[D_T]}{F}}{T}.$$

Present value of the equity and debt

Equation 4 makes use of the fact that equity can be analyzed as a call option on the assets of the firm, the required debt payment being the exercise price. We can also use this fact to value the equity. Specifically, we can value the equity as a European call using the Black–Scholes equation (see, Hull 2003, for example):

$$S_0 = V_0 N(d_1) - P_T e^{-rT} N(d_2)$$

where

$$d_1 = \frac{\log\left(V_0/P_T\right) + \left(r + \sigma^2/2\right)T}{\sigma\sqrt{T}},$$

and

$$d_2 = d_1 - \sigma\sqrt{T}$$

where r is the continuously compounded risk-free rate.[30]

Present value of the debt and debt guarantees

We can apply the same approach to valuing the debt and a debt guarantee.

Taking into account the possibility of default, the present value of the debt at time 0, D_0, can be inferred from the values of the firm and equity at time 0:

$$D_0 = V_0 - S_0.$$

We assume that the government will allow equityholders to lose their investment in the firm, but will step in to protect the debt holders. We analyze this as the government's giving the debtholders a put option on the value of the firm, with a strike price equal to the required debt repayment (P_T). In other words, the government gives the debtholders the option to sell the firm to the government for an amount equal to the required debt repayment. If the debtholders exercise the option, they receive $P_T - V_T$ in net terms. Their payoff function from the guarantee is thus $\max\{0, P_T - V_T\}$. This payoff function is the same as that received by the owner of a European put with exercise price P_T on the asset V. We can therefore estimate the value of the guarantee at time 0 (G_0) using the Black–Scholes formula for valuing a European put:

$$G_0 = P_T e^{-rT} N(-d_2) - V_0 N(-d_1).$$

Because the debt guarantee makes the debt riskless from the perspective of the debtholders, it can also be valued by subtracting the value of the risky debt, estimated above, from the value of riskless debt of an equal amount:

$$G_0 = e^{-rT} P_T - D_0.$$

Note that the combined value of the guaranteed debt and the equity is higher than the initial value of the firm—the increase in value being a subsidy from the government.

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[30] In doing so, we reverse the usual order of things, which is to observe a market value of the equity and then to derive an estimate of the value of the assets. One of the assumptions of the Black–Scholes theorem is that the underlying asset (the firm in this case) is traded. This does not hold in our case, but see Copeland and Antikarov 2001, pages 94–95, on why it might be reasonable to act as if the assumption held. We also assume the firm makes no dividend payments.

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