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INFRASTRUCTURE FRANCHISING AND GOVERNMENT GUARANTEES*

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Abstract

Government guarantees for private infrastructure projects reduce the incentives of firms to perform efficiently, weaken the incentives to screen projects for white elephants, and shift government obligations to future periods. Thus the use of guarantees needs to be limited, and they need to be carefully designed.
Franchising schemes should in principle assign risks to the parties best able to manage and control them. The mechanisms by which contracts are awarded should be simple, so that possibilities for evaluator subjectivity are reduced, the award process remains as transparent as possible, and the likelihood of having to renegotiate is minimized.
Infrastructure franchises have usually been awarded on a fixed-term basis. Such contracts expose franchise holders to considerable demand risk, which investors are often unwilling to assume without government

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guarantees. These contracts are also inflexible, since it is difficult to determine a fair level of compensation to the franchise holder if the contract is terminated early or modified.
Under an alternative mechanism, the franchise is awarded to the firm that asks for the least present value of user fee revenue for a given tariff structure, and the franchise ends when the present value of user fee revenues is equal to the franchise holder's bid. Such contracts reduce the demand risk borne by the franchise holder (and the concomitant demand for government guarantees). They also make fair compensation of franchise holders in the event of early termination straightforward, since the level of fair compensation is equal to the revenue remaining to be collected.

I. Introduction

Most developing countries urgently need to make massive investments in infrastructure. Until recently most types of infrastructure were viewed as services that had to be publicly provided. In recent years, however, a wave of privatizations has swept the world, driven largely by chronic budgetary problems and widespread disappointment with the performance of state-owned enterprises.

Privatization has several advantages. First, the public sector often lacks the financial and human resources necessary to undertake needed projects. Second, private firms are usually better run and more efficient than state-owned firms. Third, private participation helps screen projects for "white elephants" (projects with negative net present value). Fourth, cost-based user fees are easier to justify politically when infrastructure providers are private.

Despite these advantages, the experience with private participation in infrastructure provision has been mixed. Privatization of infrastructure often awards a monopoly to a private firm, and it is difficult to regulate the exercise of the firm's market power. Moreover, the sudden creation of large private enterprises may alter a country's political economy. Finally, many infrastructure projects face large commercial and policy risks, which have led their sponsors to press for generous up-front government guarantees or the implicit assurance that they will be bailed out should they face financial distress (implicit guarantees).

Government guarantees have undesirable consequences that may offset the benefits of privatization. First, they reduce the incentives of firms to perform efficiently. Second, they weaken the incentives to screen projects for white elephants (Example 1). Third, although they reduce current government expenditures, they shift obligations to future periods and administrations.

Example 1: ***Poor Project Screening in Chile***
In the mid-1940s, Chile and Argentina decided to integrate their economies. As part of this process, a railway link between Concepción and a port in Argentina was conceived. The Chileans built the line up to the border, constructing the Lonquimay tunnel, the (still) longest tunnel in Latin America, and rail stations along the way. The Argentine line was never built, and the project was never put to its intended use. A private firm would not have begun the Chilean part of the project before it was assured that the Argentine project was under way.

These contingents liabilities are seldom valued, and they are typically not included in the year-to-year budget or counted as government debt. As a result, they are not subject to scrutiny. Moreover, since many of these guarantees may become effective during recessions, they may trigger a new type of debt crisis.

When private infrastructure franchises run into financial trouble, the terms of the contract are usually renegotiated, almost always to the detriment of tax-payers and users of the project.[1]

These implicit government guarantees are undesirable for several reasons: they are not accounted for in the budget, they encourage firms with experience in lobbying to underbid in the expectation of future renegotiations, and they have an adverse effect on the public's perception of private participation in the provision of infrastructure.

Firms demand guarantees for various reasons. They may be unwilling to bear the policy risk created by the lack of adequate regulatory reform, or the risk allocation between the regulator and the firm may be inefficient. Neither shortcoming needs to be addressed with guarantees. Once necessary regulatory reform has been undertaken, appropriate contract design can enhance social welfare by distributing risks efficiently, reducing the need for guarantees. Where regulatory reform is not undertaken, guarantees are a poor substitute. To the extent that guarantees accompany privatization and therefore blunt the incentives for efficiency, there is little reason to expect that privatization will improve service or relieve government budgets (Example 2).

Example 2: ***The regulation of telecoms in the Philippines***
Regulation of the Philippines telecoms system was ineffective because the regulator could exercise discretion and was strongly influenced by the executive. Entry into telecoms was allowed after a politicized and discretionary process, and it proved difficult to enforce interconnections. The system was liberalized in 1995 and since then has shown major gains.

Competition should regulate the provision of infrastructure whenever feasible. If competition can be made to work - because a well-developed market exists or can be designed (as in the case of electricity generation) - private contracts should be left to deal with risk sharing and renegotiation, and no government guarantees are needed (Example 3).[2] When competition cannot work, regulators should use mechanisms that mimic competition and use direct regulation only as a last resort. This implies that the temporary franchising of infrastructure through competitive bidding should be preferred in principle to the creation of regulated utilities. To date, however, few infrastructure projects have been periodically reauctioned. In some cases the reason is fundamental: when the quality and state of conservation

of the assets cannot be verified by third parties (as is the case, for example, with underground pipes for water distribution and sewage), periodic reauctioning of the franchise is inadvisable and a utility is preferable as a means of providing the correct incentives for investment and maintenance.[3] In the case of utilities, no guarantees are necessary provided that regulatory reform credibly commits the government not to act opportunistically.[4] In other cases, however, franchises have not been granted because they appear to be so risky that private firms have refused to participate without generous guarantees by the government against commercial risks.

Example 3: ***The benefits of deregulation and competition***
The annual benefits from deregulation in the airline, trucking, railroad, and telecommunication sectors in the United States have been estimated at $35-$45 billion (Winston, 1993). In Chile the long-distance monopoly operator was perceived as having been regulated efficiently. After competition was introduced in late 1994, however, prices of international calls fell more than 60 percent, while demand more than doubled.

The creation of competitive markets, such as those in electricity generation and long-distance telephone services, has been widely discussed in the literature. There is also vast literature dealing with the regulation of natural monopolies. In contrast, little research has been done on the use of limited time concessions to provide infrastructure, a case that lies between the extremes of competitive provision of infrastructure and natural monopoly. This article focuses on franchises in which initial investments are large relative to both the size of the market and to operating costs, assets are tied to a particular location, and service at a distance is not feasible. Examples of these types of projects include highways, bridges, airport runways, seaport defenses, and water reservoirs. Renegotiation, flexibility, and risk sharing, and their close connection to explicit and implicit governments guarantees are particularly important in these types of projects.

Fixed-term franchises are risky because they assign risks inefficiently. This inefficiency arises because the term of the franchise is fixed and independent of the actual realization of demand. Franchise holders assume a major proportion of demand risk; if demand is hard to estimate, they will press the government for guarantees. The new competitive mechanism presented here allocates franchises so that the risk borne by the franchise holder is substantially reduced. Under this mechanism the regulator fixes prices, and the winner of the auction is the firm that bids for the least present value of revenues (LPVR). The franchise ends when the present value of user-fee revenue equals the winning bid. Year-to-year revenues are discounted at a rate known to all bidders before the auction.

In contrast to mechanisms in common use, in LPVR auctions the term of the lease is not set at the time the franchise is awarded. The franchise lasts longer when demand grows slower than expected, and it expires earlier when demand exceeds expectations. This characteristic reduces the importance of making accurate

demand forecasts and reduces the risk borne by the franchise holder and hence the need for guarantees.

A second advantage of LPVR auctions stems from the fact that the winner's bid reveals the income required in order to earn a normal profit. This reduces the scope for post-contract opportunistic renegotiations for two reasons. First, from a political perspective it is more difficult for the government to exploit the franchise holder by changing the original contract, because the winning bid is a clear and observable benchmark that makes it easy to compute any wealth loss borne by the franchise holder. In contrast, with fixed-term franchises it is very difficult to estimate how changes in the term of the contract affect the venture's profitability. Second, it is also more difficult for the franchise holder to renegotiate the contract, since any giveaway by the government can be compared with the winning bid. As a consequence, LPVR auctions discourage artificially low bids by opportunistic firms (lowballing), because the regulator can credibly threaten to pay whatever sum remains to be collected and terminate the franchise in the event that the franchise holder attempts to renegotiate.

The fact that the franchise holder reveals the income it requires to earn a normal profit makes LPVR auctions more flexible than their fixed-term counterparts. If the project needs to be reauctioned before the sum is collected, the franchise holder can be compensated simply and fairly by paying the difference between the bid and the revenue accumulated by the time the franchise is canceled.

The only case in which arguments for government guarantees may be valid is in the early stages of private franchising, since initial franchise holders may reveal information about the business and any regulatory dangers that benefit later participants. If these externalities are important, it may be appropriate to combine an LPVR auction with a government guarantee that is a fixed fraction of the winning bid. Other things being equal, such guarantees imply smaller government liabilities and provide less scope for opportunistic behavior by the franchise holder than those currently in use.

A fundamental assumption underlying the analysis in this article is that franchise holders are unable to diversify a large fraction of the project-specific risk they face. If project-specific risks could be diversified there would be no demand for government guarantees. Yet private firms and financiers usually refuse to participate in franchise auctions for infrastructure projects unless governments pledge guarantees. The demand for guarantees is not restricted to countries where policy risks are large and regulatory frameworks weak, but appears also in countries where only commercial risks exist. Even though the empirical fact described above is well established, at this point we have no satisfactory theoretical explanation for this phenomenon. Presumably, agency problems in infrastructure projects require franchise-holders to be highly exposed, yet this topic is beyond the scope of this paper.

The remainder of the article is organized as follows. Section II reviews the usual arguments in favor of guarantees for private infrastructure projects and classifies the risks that generate the demand for guarantees. Section III develops a conceptual framework for the analysis of the design of franchise contracts. Section

IV uses this framework to analyze fixed-term contracts and argues that they create a demand for guarantees. Section V presents LPVR auctions and shows that they significantly reduce the risk borne by franchise holders and hence the need for guarantees. The last section summarizes the main conclusions.

II. Government Financing of Private Infrastructure

Governments provide financial support to infrastructure projects in various ways:

- Funding it completely, by providing lump-sum funding of construction projects, a practice common in many countries
- Providing guarantees against different types of risks, such as demand risk, convertibility and devaluation risk, commercial risk, and policy-induced risks
- Subsidizing the project up front
- Providing loans at subsidized rates
- Becoming a partner in the project.

Since most firms participating in infrastructure projects are cash constrained, equity financing is impossible and debt finance is needed. At least during the construction phase, financing is usually provided by banks, which are extremely risk averse, partly because they are penalized by regulators if they carry non-performing loans and partly because they do not share in the upside gain if the project is successful.[5] Regardless of the risk premium offered to them, they are unwilling to provide funds if the probability of repayment falls below a certain threshold (say, 80 percent). For this reason firms participating in infrastructure projects, which are inherently risky (at least under present franchise mechanisms), press for government demand guarantees in order to gain access to bank finance.[6]

Costs of guarantees

Guarantees defeat the purpose of private franchising for several reasons. First, they reduce the incentives to screen projects carefully (Example 4). Second, guarantees blunt incentives to operate efficiently. When the government guarantees against cost overruns, for example, costs tend to exceed the original estimates. Assuming some types of risks increases the incentives of the franchise holder to be efficient. Third, guarantees create contingent liabilities - either explicit or implicit - for the government (Example 5). These are seldom valued and are typically not included in the year-to-year budget or counted as government debt. Thus they are not subject to scrutiny. Finally, since guarantees often become effective during recessions, they may trigger a new type of debt crisis.

Example 4: ***Weakened incentives for project screening for the San José Lagoon Toll Bridge***
The San José Lagoon Toll Bridge was built to relieve congestion in the San Juan region in Puerto Rico. The government assumed most of the commercial risk by guaranteeing to buy back the project at the concessionaire's request if traffic fell short of 80 percent of projections during the first three years and 100 percent of projections after nine years. In the event of a buy back, the government would reimburse the concessionaire for all project costs and pay it a 13 percent return on its investments. Under such a badly designed guarantee scheme the concessionaire has few incentives to screen the quality of the project.

Example 5: ***The high cost of implicit guarantees in Mexico***
In the late 1980s and early 1990s Mexico franchised the construction and operation of about 5,000 kilometers of highways. Most franchise owners faced financial distress when demand forecasts turned out to be overly optimistic. This led to renegotiations of the original agreements between the government and the franchise owners that extended some of the leases to more than twice the original term and pumped in more than $ 6 billion of government funds to save the firms (and the banks that lent to them) from bankruptcy.

Arguments in support of guarantees

Government may legitimately offer subsidies, such as guarantees or budgetary support, to private infrastructure projects in which externalities exist or in which the government may be able to obtain financing at a lower cost than the private sector.

Positive externalities. There is a role for government intervention when the externalities associated with the infrastructure project lead to positive net social benefits but negative private benefits (Example 6). A subsidy just large enough to make the project attractive to private investors would allow the project to be franchised as usual. The incentives to screen the private profitability of the project would remain in place, although the firm's value at risk would be smaller than if it had to finance the project itself.[7] Subsidies have the additional advantage of running through the normal budgetary process, so that they face scrutiny and must compete with other items in the government's agenda. In comparison, demand guarantees normally face no such screening and lead to potential liabilities for future administrations.

Example 6: ***Subsidizing the Pan-American Highway in support of social goals***
The Chilean government has divided the Pan-American Highway, which runs through the country from north to south, into nine sections, which are being auctioned separately. Motivated by the externalities associated with decentralization (and possibly also by political considerations), the government plans to levy similar tolls at all nine sections, despite the differences in traffic flows. In low traffic volume sections, which are unattractive to the private sector, the government will subsidize the winning firms. These subsidies are expected to be financed by fixed payments to the government from the holders of the sections with high traffic volumes.

The process by which a subsidy is fixed is delicate. Political pressures may lead to subsidies that are more generous than is necessary to attract private investors. In a worst-case scenario, projects that are not welfare enhancing may be built.

Guarantees may be justified in the early stages of the private franchising process. Initial franchise holders generate learning externalities about the long-run viability of the system. In this case a contingent subsidy paid only if the franchise business is not viable provides adequate incentives and compensates initial franchise holders for the learning externalities they generate. These guarantees should be phased out as soon as learning externalities are exhausted. Moreover, before guarantees are provided their aggregate value at risk should be estimated and subject to standard budgetary approval procedures.[8]

Government's lower cost of capital. As Klein (1996) convincingly argues, there are many reasons to doubt that the true cost of sovereign debt is lower than the rates obtained by private firms. For the sake of argument, assume that this is indeed the case, and assume that the government is willing to incur sovereign debt for the private provision of infrastructure. What is the best way to use these funds to finance infrastructure?

As long as the advantages of private sector participation continue to hold, there is no reason why the government should build or operate infrastructure. Two schemes can be used to transfer the lower cost of capital to the private sector.

Under the first scheme, the government can invite the private sector to bid on construction of the projects. The winning firm is the firm that satisfies the minimal technical requirements and requests the lowest lump sum to build a project. If the government wants a private firm to operate the franchise, it can set up a second auction for this purpose. This type of scheme faces potentially serious problems, since it includes no market-based incentives to screen projects and political opposition may prevent the government from charging the efficient user fee. Since governments usually lack the backbone required to resist political pressure, this can be a serious danger.

An alternative approach is to develop a scheme for second-tier banking in which the government offers a credit line (at a rate reflecting the government's lower cost of funds) to banks, which in turn provide funding for BOT infrastructure projects. Firm negotiate loans with the banks in the knowledge that the banks have access to cheap, subsidized credit. The supposed advantage of this scheme is that banks will screen the quality of projects and bidders and that competition between banks will transfer the lower loan rate to bidders. The scheme is equivalent to the standard franchise scheme, except that the loan rate is lower. The choice between the two schemes depends on the percentage of the debt that must be covered by guarantees and on the supervisory ability of the government.

III. Principles Governing the Design of Franchising Schemes

Allocation mechanisms should maximize the sum of user and franchise holder surpluses.[9] It follows from this principle that the regulator should prevent the exploitation of any monopoly power and that the most efficient firm should be assigned the franchise in a competitive auction. In addition, most governments in developing countries want the private sector to finance the costs of building new infrastructure. This means that terms must be long enough for a normal profit to be earned on investments.

An auction mechanism is a set of rules that indicates how the winning bid is chosen. It determines the franchise holder's obligations, regulates the monopolistic exploitation of the franchise (by fixing a maximum price for the service or by sharing income with the government for example), and determines how risks, profits, and losses are shared among the franchise holder, users, and taxpayers. According to standard theory, any open and competitive auction guarantees social efficiency. In practice, uncertainty, incentive problems, and the possibility of renegotiation mean that different types of open and competitive auctions may differ substantially in their welfare implications.

Franchise contracts are difficult to design because in many cases demand forecasts are highly uncertain, sunk investments are large, and it is costly for the state to switch to another supplier after the contract is awarded. They are thus subject to what Williamson (1985) has termed "the fundamental transformation": before the auction the relationship between firms and the state is competitive; after the contract is awarded it becomes a bilateral monopoly. Because the venture's profitability depends on events that cannot be anticipated, franchise contracts are inherently incomplete and there is ample room for opportunistic behavior on both sides (Example 7).

Example 7: ***Opportunistic behavior by the French government***
After the first oil shock in 1973 the French government was reluctant to let highway tolls rise, because it wanted to control inflation. The government simply ignored provisions in the toll road franchise contracts that stipulated that private concessionaires could fix tolls at will. Concessionaires sued and lost after the court ruled that a 1945 law gave the government the power to fix any price (see Gómez-Ibañez and Meyer, 1993).

In designing and evaluating an auction mechanism and its associated franchise contract, several principles should be followed, as shown in the following sections.

Allocate risks efficiently

A franchise contract spreads the risks of an infrastructure project among the franchise holder, users, and taxpayers.[10] Since the ex post risk premium required by a franchise holder rises with the variability of returns, everything else equal the chosen mechanism should transfer risks to the party best able to diversify them and minimize the total level of demand risk.[11] This principle is subject to one major qualification: controllable risks should be borne, at least in part, by the party best equipped to control them, since parties have fewer incentives to be

efficient when they do not bear a risk they can partially control. If the regulator grants complete insurance against cost overruns, for example, the franchise holder has no incentive to control costs, and on average they will be too high. Thus, any risk that cannot be controlled or eliminated should be diversified.

In principle, transferring uncontrollable risk to taxpayers is efficient and largely eliminates its costs. The reason, as Arrow and Lind (1970) demonstrate, is that when large uncontrollable risk that is uncorrelated with taxpayer's wealth is spread among many taxpayers, the aggregate risk premium is negligible.[12] But as Klein (1996) argues, the government must have incentives to avoid white elephants for this argument to hold, which is often not the case. Severe agency problems that deter private investors from investing without guarantees are likely to be encountered by the government as well. In this case, shifting risk to taxpayers is inadvisable, since it will force them to pay for bad projects. An alternative is to shift risk to the users of the project. If there are many users and the conditions assumed by Arrow and Lind apply, risk allocation can be efficient. Since users pay only if they use the infrastructure, agency problems are less severe.

Demand risk. Demand risk arises when demand forecasts are unreliable. This risk is compounded when firms have little flexibility to adapt to unforeseen demand scenarios, as is the case in many types of infrastructure projects, in which investments are large relative to the size of the market, indivisible, tied to a particular location, and service at a distance is not feasible.

Demand forecasts are based on estimates of both macroeconomics risks, which are tied to the aggregate performance of the economy, and microeconomics risks, which reflect local demand fluctuations. Errors in either estimate will throw off forecasts of demand, which are usually inaccurate in the short term (three to five years) and all but useless in the long term (Example 8).

Construction and operating risk. Construction and operating risk exists because the costs of building and maintenance generally differ from projections. These risks should be borne by the franchise holder, because building costs and diligence in operating are known and controlled only by the franchise holder and cannot be observed by the state and users.[13]

Policy risk. Many private infrastructure projects are subject to policy-induced risk, which may take two forms. Actions by different government agencies may unintentionally affect the profits of the franchise. A tightening of policy by the central bank, for example, may cause a recession that significantly reduces demand growth, or a change in environmental standards may require additional investments. In these cases the government is not acting opportunistically, since these policies are not intended to affect the profitability of the franchise. These risks are not controlled by the franchise holder and should be diversified.

A second class of policy risks occurs when the government alters polices with the intent of affecting the profitability of the franchise holder. The government may build or expand infrastructure that competes with the franchise and charge subsidized user fees, for example, or it may reduce user fees in response to political pressures. These risks should be eliminated by adequate and credible regulatory reform that constrains government opportunism. Guarantees are a poor substitute for regulatory reform, not least because of the dubious value of a guarantee provided by a government that cannot commit not to act opportunistically (Example 9).

Example 8: ***Forecasting demand for toll roads in Chile***

The table below shows the rates of growth of the number of motor vehicles paying tolls during the last decade on three of the main toll roads in Chile. Macroeconomic risk is reflected in the fact, for example, that vehicle flows in the three roads grew much faster during 1987 than in 1990. Microeconomic risk is apparent in most years: the growth of vehicle flow fluctuates considerably from one road to another. It should be stressed that, macroeconomically speaking, the past ten years have been Chile's most stable during this century: there have been no recessions, and GDP has grown 6 percent a year. Despite this, traffic growth rates have fluctuated considerably.

Vehicles paying tolls: Growth rate (percentage)

Toll road	*1986*	*1987*	*1988*	*1989*	*1990*	*1991*	*1992*	*1993*	*1994*
Angostura	*8.8*	*15.0*	*11.7*	*4.5*	*8.7*	*12.4*	*6.7*	*7.8*	*9.4*
Zapata	*21.5*	*14.4*	*13.1*	*8.1*	*7.2*	*5.2*	*2.9*	*3.9*	*4.9*
Lampa	*3.8*	*13.4*	*15.9*	*8.9*	*6.8*	*18.0*	*8.8*	*16.2*	*12.5*

Note: Growth rates refer to the growth in the flow of vehicles from one year to the next.
Source: Ministry of Public Works, Chile.

Example 9: ***The impact of policy changes on the Dulles Highway franchise in the United States***

The $ 347 million Dulles Greeway is a four-lane, private access road from Dulles Airport near Washington D.C., to Leesburg, Virginia. The 14.5 mile long highway is the first private toll road developed in the United States in the twentieth century.

Revenues from the project have been far lower than projected. Two independent traffic consultant companies predicted a daily flow in 1996 of 35,000 vehicles paying an average toll of $ 1.75. By March of 1996 the average number of vehicles per day was only 8,500. Lack of traffic is mainly due to good competitive free highways and resistance to tolls. Once tolls were lowered to $ 1, traffic rose to 25,000, still below predictions . It may take five years to get to the break-even level. Worse yet, there are plans (fueled by political pressures) to expand competitive toll-free roads, breaking the oral agreement between the operating company and the state authorities. Such an expansion probably implies that the Dulles venture will never earn a profit (Di Marco, 1997).

In some circumstances the government may wish to retain flexibility to react to unforeseen events, which may require specifying that certain actions are

allowable under the contract. The franchise contract should be designed to reduce the impact of policy changes that cannot be anticipated.

Do not depend on information provided by the franchise holder

In order to determine whether the franchise holder complies with the terms of the contract, the regulator needs information. Since the franchise holder has an incentive to provide misleading data, all information obtained from the franchise holder should be independently verified. Independent confirmation that the terms of the contract are being met restricts the possibilities for opportunistic behavior by the franchise holder or the opportunistic exercise of discretion by the regulator and reduces the likelihood of disputes.

It follows from this principle that the regulator should not attempt to limit the franchise holder's profits, since doing so would require data on the cost of building and operating the franchise, which are likely to be difficult to verify independently. Quality standards in infrastructure projects should, however, be specified when they are easily verifiable (for example, an airport runway).

Design simple auction mechanisms

Auction mechanisms in many countries depend on many variables, which makes them difficult to analyze and can lead to complaints of evaluator bias. Complex mechanisms are typically not transparent, enlarging the scope for discretion by the regulator and for opportunistic behavior by the franchise holder.

In order to reduce the scope for evaluator subjectivity, factors used in multifactor point rating systems should be quantifiable. Even when they are quantifiable, however, the weights assigned to different factors are to some extent arbitrary, and they can lead to unanticipated outcomes, thereby increasing uncertainty. Furthermore, complex mechanisms are typically not transparent, enlarging the scope for discretion by the regulator and for opportunistic behavior on the part of the franchise holder.

Regulators usually accept complexity in an effort to satisfy the different parties with stakes in the franchise. For example, planners may link an auction with minimum demand guarantees to a profit sharing system between the state and the franchise holder under which the state would benefit if the returns exceed a predetermined limit. Such a system makes it difficult for potential bidders to estimate the value of the project and requires a sophisticated monitoring system.

Another problem with complex contracts is that supervision is more difficult and there may be a lack of coherence between different provisions of the contract, leading to the possibility of renegotiation (Example 10). The problem with renegotiation is that it substitutes an ex post bilateral monopoly for an ex ante competitive situation, and taxpayers or the public end up as losers. Moreover, the results of the renegotiation process can easily lead to charges of corruption and improper discretion, which may deter participants in future franchises. Finally, complex contracts hinder the public's ability to understand what has been awarded in the auction.

Example 10: ***Pressure to renegotiate the complex contract for the El Melón tunnel in Chile***

In 1992 the Chilean government announced a BOT auction for the El Melón tunnel, on the Pan-American highway. Project costs were estimated at $ 40 million. Only companies whose projects satisfied minimum technical standards could bid in the final stage of the auction. The scoring formula included seven variables with different weights: annual subsidy by or payment to the state by the franchise, toll level and structure (composed of six different tolls, with different weights for different classes of vehicles); length of the franchise; minimum income guarantee from the state, degree of construction risk borne by bidders; score on the basis of additional services; and CPI adjustment formula.

The outcome of the auction was unexpected. The top two bids offered the maximum toll, and the award was decided mainly on the basis of the payment to the state. The tunnel was built on time, but the franchise owner has been pressing for a renegotiation in which tolls are reduced in exchange for a lower payment to the state. This would lead to an efficiency gain but would establish the precedent that contracts can be renegotiated at the franchise holder's request. So far the Chilean government has resisted pressure to renegotiate.

Eliminate monopoly rents through competition

Where no substitutes exist for a franchise –as is often the case for seaports, airports, tunnels, bridges, and roads– an auction awards a monopoly. Where a monopoly is awarded, the regulator should prevent the exploitation of monopoly power, since a monopoly does not maximize social welfare (unless it can price discriminate perfectly) and monopoly rents redistribute wealth from users to the franchise holder. The auction mechanism should eliminate monopoly rents, so that users do not pay more than the minimum required to make the franchise attractive to private investors.

Where fixed-term franchises can be awarded (that is, where the state of the assets at the end of the franchise is observable), the social cost of a monopoly can be eliminated by awarding the franchise in an open and competitive auction, since competition to obtain the franchise will dissipate economic rents (Demsetz, 1968).[14]

Provide incentives for marketing and maintenance

The franchise holder can often undertake activities that increase the demand for the infrastructure or increase the efficiency of operation of the franchise. A train company can provide good and reliable service, a telephone company can develop and introduce new services, and an airport can invest a radar system that allows planes to land in low visibility.

The importance of this factor in different project settings will influence the choice of an auction mechanism. When demand is inelastic and unresponsive to the actions of the franchise holder, no purpose is served in forcing the franchise holder to bear demand risk. In this case demand risk should be diversified, and

the regulator should impose and enforce minimum quality standards of service. Projects falling into this category include roads, tunnels, and water distribution, which have no close substitutes. Where users have access to alternative sources for the services of the infrastructure project and demand may be highly sensitive to the quality of the service, the franchise holder must be given incentives to perform demand-enhancing activities, which implies the need to bear commercial risk.

The franchise holder should also be given incentives to maintain the infrastructure in good working condition. When there are no close substitutes for the services provided by the infrastructure project, the regulator must define and enforce objective standards of quality of service. The regulator should consider other options, such as indefinite concessions, when it is not feasible to verify the quality of assets. In addition, the regulator should demand guarantees to safeguard users' interests in case the franchise holder does not meet the required quality standards. Incentive problems are particularly severe toward the end of the franchise, because the franchise holder has little to gain by spending on maintenance. It may become necessary to have the franchise holder post guarantees that are redeemable if the state of the infrastructure does not meet previously established quality standards at the end of the franchise.

Avoid opportunistic renegotiation

Contracts are often renegotiated when the project turns out to be less successful than the franchise holder expected, and losses are eventually absorbed by the state or by users (Example 11).

Example 11: ***Renegotiation and government bailouts for unsuccessful toll road projects in France, Mexico, and Spain***

Renegotiation of contracts and government takeovers of bankrupt franchises have taken place in France, Mexico, and Spain. France awarded four private toll road concessions in the early 1970s. After the oil shocks three of the four went bankrupt and were taken over by the government.

In Mexico virtually all the highway concessions were renegotiated after costs exceeded expectations while revenues were lower than expected. The (declared) cost to taxpayers has reached $ 6 billion, not including the cost to users of term extensions, which more than doubled in several cases. Cost overruns were caused partly by the fact that the companies made the profits by inflating construction costs, siphoning funds through the building companies, and letting the operating companies go bankrupt.

In Spain twelve toll road concessions were awarded before 1973. Building costs ended up being four to five times higher than expected, and traffic was one-third of projections in several of the franchises. Three firms went bankrupt, two others were absorbed by stronger franchise holders, and all firms were granted toll increases and term extensions.

Renegotiation is undesirable not only because of the wealth transfers involved but because it creates incentives for firms with more lobbying power to underbid (lowball) more efficient firms in the expectation that terms will be renegotiated in their favor in the future (Williamson, 1985). A commitment by the state to let the franchise go bankrupt would prevent this problem. In most developing countries such a commitment would not be credible, however, since the state is generally unable to withstand pressures from interest groups. A wave of populism can also lead to regulatory opportunism and creeping expropriation.

To prevent lowballing, renegotiation should be discouraged, and constraints should be placed on the outcomes of renegotiations that do occur.

Design a flexible contract

While it is desirable to prevent opportunistic renegotiations, some circumstances warrant modification of the original contract. For example, it may be desirable to increase the service capacity of the infrastructure before the end of the franchise period.[15] Alternatively, user fees may turn out to have been set too high (concessions may last more than twenty years), or demand may increase and a higher user fee may be required to allocate existing capacity efficiently. Substantial inefficiencies can result if the contract specifications cannot be changed.

Planners face two options when a contract requires modification. The original contract can be renegotiated with all the problems associated with bargaining under a bilateral monopoly (Example 12), or the concession can be canceled and the franchise holder compensated for the profits foregone (Example 13). The problem with the second option is that the fair compensation due to the franchise holder (the expected present value of future profits had the concession continued on the original terms) is subjective and open to dispute.

Example 12: ***Inadequate provision for renegotiation of toll road contracts in Argentina***

An example of an incomplete contract that allows renegotiations to take place is toll road contracts in Argentina. They state that "... in case of a substantial and sustainable increase in traffic volume, larger than initially estimated, the concessionaire and the government may conceive a plan to improve the levels of service."

Example 13: ***Compensation disputes over terminations of airport concessions in Argentina***

The government of Argentina wants to end the present airport franchises in order to reauction them under new terms. To do so the government must compensate the present franchise holders. According to former Economics Minister Domingo Cavallo, government employees, swayed by the franchise holders, have written a decree that provides compensation of $ 400 million –ten times the estimated level of fair compensation (El Mercurio, February 6 1997).

IV. Fixed-Term Contracts

Infrastructure franchises have usually been awarded on a fixed-term basis.[16] The main defect of fixed-term mechanisms is that the franchise holder must assume a large fraction of the demand risk. A franchise may lose money because the franchise ends before user fees cover for investments costs. If the auction is competitive and no guarantees are pledged, firms will make bids that lead to normal profits on average. Since returns are uncertain, franchise holders will ask for a risk premium, so that profits made if outcomes are good more than compensate for losses in case of bad outcomes. This risk premium is paid by users. In theory, financiers should be able to diversify all project-specific demand risk, so that firms will not ask for a risk premium when they participate in the auction. In practice, however, financiers have refused to participate in auctions unless governments pledge guarantees.

The second shortcoming of fixed-term franchises is that they increase the demand for renegotiation or implicit government guarantees. First, they increase the likehood that the best bid will be made by the firm that is most optimistic in predicting future demand for the infrastructure (the "winner's curse"), since optimistic estimates lead to aggressive bids when the term of the franchise is fixed. Second, fixed-term mechanisms encourage underbidding (lowballing) by firms that are good renegotiatiors and lobbyists.

A third shortcoming of fixed-term franchises is that contracts are inflexible, because it is difficult to specify fair compensation for any modifications to the original terms. Since the fair compensation is the expected profit that the franchise holder would have earned over the remainder of the franchise had the original terms of the franchise contract remained in force, any estimate of these profits can be challenged. Where a challenge is made, compensation is usually decided in bilateral negotiation, in which political clout can be very important.

Finally, if franchises are allocated to the bidder offering the lowest user charge, the regulator loses a large part of its ability to fix user fees based on efficiency criteria so as to correct externalities.[17]

Fixed-term mechanisms have one important virtue: they provide powerful incentives to increase demand, since the franchise holder appropriates the marginal income generated by its effort. Where consumers have substitution possibilities and demand is very responsive to the actions of the operator, this feature is important.

V. Least Present Value of Revenues Auctions

A new mechanism for auctioning infrastructure franchises is proposed that reduces the need for government guarantees. Its distinctive feature is that the franchise term is variable, adjusting automatically to realized demand. In its pure form the mechanism includes the following features:

- The regulator fixes the user fee that the franchise holder can charge.
- The franchise is awarded to the firm that asks for the least present value of user fee revenue (LPVR).
- The franchise ends when the present value of user fee revenue is equal to the franchise-holder's bid.
- The rate used to discount user fee revenue is part of the franchise contract and is determined by the regulator before the auction takes place; it should be a good estimate of the rate faced by franchise holders and may be variable (such as LIBOR plus a fixed risk premium).

In addition, it is desirable to establish minimum quality standards, to have those standards enforced by an independent agency, and to impose appropriate fines on firms that do not comply.

To see how the mechanism works, consider an auction in which two firms take part. The first firm estimates its costs at $ 100 million and asks for a present value revenue of $ 112 million. The second estimates its costs at $ 99 million and asks for $ 110 million. The second firm wins the franchise and operates it until the present value of user fee revenue equals $ 110 million. Once this amount is collected the franchise ends.

LPVR auctions are often superior to fixed-term franchises, as shown in the following sections.

Demand risk

By making the length of the franchise responsive to demand, LPVR auctions significantly reduce the demand risk borne by the franchise holder relative to fixed-term franchises. Under a fixed-term contract a franchise holder can lose money if the franchise term is too short, even if the franchise would have been profitable in the long-run. In such a case extension of the term of the franchise would have enabled the franchise holder to earn a normal profit. An LPVR auction reduces the risk borne by the franchise holder by automatically lengthening the franchise term when demand grows more slowly than expected and shortening the term when it grows more rapidly than expected. Since ultimately franchise owners receive (and toll users pay) similar amounts whether demand outcomes are better or worse than estimated, with LPVR auctions the risk premium required by the franchise holder is smaller, and users pay less in expected value over the life of the franchise. These savings could be substantial. In Chile, for example, it has been estimated that user fee revenues on toll roads would fall 33 percent, saving users $ 800 million, if LPVR auctions were used instead of fixed-term franchises (Engel, Fischer, and Galetovic, 1996).[18] Transferring risk to users unambiguously enhances welfare as long as the project-specific component of risk is significant.[19]

An additional advantage of LPVR auctions is that they reduce the chance that the firm making the most optimistic demand estimate will fall victim to the winner's curse, because the impact of demand forecast errors is smaller. When the term of the franchise is fixed, an optimistic demand estimate translates into an aggressive bid (a low user fee or a short concession term). In contrast, under LPVR franchises

firms fix their revenues in present value when they choose their bids; winning the auction by being too optimistic means that the franchise will end later than expected, not that total revenue will be lower.[20] Reducing the likelihood of the winner's curse means that bidders will ask for a smaller expected present value equivalent over the life of the franchise. Because bids in LPVR auctions depend more on investment costs and less on demand estimates, such auctions are more likely to awards franchises to the most efficient construction firm.

LPVR auctions reduce the risk borne by the franchise holder, but they do not eliminate it completely.The franchise holder assumes construction, maintenance, and operating cost risks, all risks that are unverifiable and under the control of the franchise holder. Since the present value of operation and maintenance costs varies with the term of the franchise, the franchise holder has an incentive to perform activities that raise demand for the services provided by the project. These incentives are lower than under a fixed-term franchise, however. This is not a serious disadvantage in cases in which the franchise holder can do little to increase demand. Even an indefinite franchise may not be sufficient to pay for the cost of building the infrastructure; that is, the project may turn out to be a white elephant. Allowing franchise holders to bear the risk of investing in a white elephant is a desirable feature of the auction mechanism, since it forces them to screen potential investment projects carefully.

Renegotiation, discretion and modification of the contract

Another advantage of LVPR franchises is that as long as the auction is competitive, the firm's bid reveals the revenues required to earn a normal profit. Thus, a fair compensation for early termination of the lease is the revenue remaining to be collected.[21] This feature has important benefits. First, suppose that before the franchise ends the regulator decides that increased demand requires that the infrastructure be enlarged. Under a fixed-term auction there is no easy way to assign the costs of the expansion, since negotiations take place under conditions of bilateral monopoly - precisely the situation that competitive auctions try to avoid. If instead, the lease is terminated, the government faces the difficult problem of determining how much compensation it must pay the franchise holder. Under an LPVR franchise the regulator pays the fair compensation and no renegotiations are necessary.

In addition, the existence of an observable fair compensation makes it more difficult to expropriate the franchise (or even to use regulations to impose a creeping expropriation). When the term is fixed it is difficult to estimate the wealth loss incurred by the franchise holder if the franchise is expropriated, making it is easier for the government to argue that the compensation offered implies no loss or that the franchise holder has earned "excessive" profits. Under an LPVR auction the franchise holder's bid is a clear, observable benchmark that can be used to challenge any attempt at opportunistic expropriation. Moreover, in the event that the franchise holder wants to renegotiate, (say, because of cost overruns) the fair compensation serves as a standard of comparison that helps stiffen the backbone

of the regulator against pressures from the franchise holder. LPVR auctions also discourage underbidding (lowballing) by opportunistic firms.

Note also that common forms of renegotiation are ineffective in an LPVR auction. Raising user fees has the effect of shortening the lease but does not increase the franchise holder's revenues; lease extensions have no meaning in the context of LPVR auctions, since by definition the term is variable.

Optimality properties

LPVR franchises enable the regulator to separate the process of setting user fees from the process of allocating the franchise. LPVR auctions thus make it much easier to change user fees if they prove inadequate. If operation and maintenance costs are small relative to sunk initial investment, user fees can be adjusted optimally to reflect demand conditions, since the effect of changes in user fees is reflected in changes in the length of the franchise and the effect on profits is small.[22]

It is easy to show that an infrastructure project franchised under an LPVR auction that is operating at capacity and subject to congestion can achieve a first-best solution if user fees are set at the optimal level (see Engel, Fischer, and Galetovic, forthcoming, for a formal proof). To see why, suppose there are two possible demand states, high and low demand, and that in both states the present value of revenues is sufficient to recover the investment cost if user fees are set optimally and the franchise lasts long enough. If tolls are set optimally, the franchise holder will recoup its investment in both states and a first-best solution will be achieved.

Government guarantees

Guarantees may be justified in the early stages of a franchising program, when initial franchise holders generate learning externalities that benefit followers. Since even under an LPVR concession the franchise holder may lose money if demand is so low that the initial investment and operating costs cannot be recouped even over a very long period, a guarantee may be warranted. The value of the guarantee should be a fraction of the present value of revenue requested (say 70 percent), so that the absolute amount of the guarantee is chosen by the franchise holder and competed for in the auction.[23] These guarantees should be removed as soon as the information generated by early participants is revealed.

Financing

Some critics of LPVR franchises have suggested that since variable-term debt contracts are not common, financing could be more expensive. In fact, the opposite is true, since LPVR auctions reduce the risk borne by financiers substantially, as the following example shows.

Assume two identical infrastructure projects, costing $ 1.500 to build and nothing to operate, and assume that the high demand (200 units each year) and low demand (100 units each year) scenarios are equally likely. The regulator fixes user fees at $ 1 per unit and for simplicity assume that the discount rate is zero.

In the first project the term of the franchise is fixed and independent of demand realizations, and the franchise is allocated to the firm asking the shortest term. If firms are risk neutral, the winner would offer a term of ten years (1/2 ($200 x 10) + 1/2 ($100 x 10) = $ 1.500). If firms are risk averse, however, they will require a longer term, (say, twelve years). In that case, if demand is high, the franchise holder earns a profit of $ 900. If, however, demand is low, the franchise holder loses $ 300. The second project is awarded in an LPVR auction. Regardless of its degree of risk aversion, the winner will ask for $ 1.500 because it can cover its costs in both states of nature. Economic profits are zero, regardless of the state of demand.

Consider the problem from the perspective of lenders. For the sake of simplicity, assume that lenders are willing to lend only if the probability of default is zero. Under a fixed-term franchise, revenues will be at least $ 1.200 with certainty. Thus debt holders will lend more than $ 1.200 only if a guarantee is given. In contrast, under an LPVR auction, financiers would be willing to lend up to $ 1.500.

As long as debt finances less than $ 1.200 lenders can be sure that they will receive at least $100 a year under both mechanisms. In both cases early payment could be made if demand turns out to be high. Thus the safety of the loan does not depend on the mechanism chosen, since lenders are senior claimants and receive all cash flows even when demand is low, regardless of the auction mechanism used.

Guarantees are equally attractive to lenders under both mechanisms, but the LPVR auction is more attractive in terms of social welfare, since shareholders assume much less risk. If, for example, 80 percent of the project is financed with debt and 20 percent with equity and the government guarantees the debt, equity holders lose all their investment when demand is low. In contrast, equity holders experience no losses under an LVPR auction (although they face uncertainty as to when they will recoup their investment) (Example 14).

Example 14: ***Using an LVPR-like mechanism to finance construction and operation of bridges in the United Kingdom***

In 1987 the British government franchised the construction and operation of the Queen Elizabeth II Bridge that crosses the River Thames in Essex County. The winning consortium of Kleinwort Benson, Trafalgar House, Bank of America, and Prudential Assurance was chosen in part because of its innovative financing package (which would be suitable for financing projects concessioned under an LVPR auction). While the demand for bridge crossings was uncertain, there was little doubt that the project was financially sound provided that the franchise term was long enough. The concession was thus designed to end after twenty years or as soon as toll income is sufficient to repay principal and interest, whichever occurs first.

The project relied 100 percent on debt financing. The four members of the consortium formed the Dartford River Ltd., with nominal capital of just £1.000 and debt of £190 million provided by the members of the consortium. Dartford River Ltd., pays no dividends and allocates all its net cash flow to pay back debt and interest. The bridge was inaugurated in October 1991, and the franchise is expected to end after only eight years.

In 1992 construction work started on the Second Severn Crossing, the second bridge on the Severn estuary at the English Stones site (nominal capital of £25.000). The bridge was inaugurated in July 1996. The financial structure was similar to that of the Queen Elizabeth II bridge. The revenue that the franchise holder is allowed to collect is fixed, so that the concession ends as soon as the sum is collected, with a maximum franchise term of thirty years. "If the contingent concession length had not been allowed, extra risk would have been transferred to the project's cost of capital, and banks may have been less prepared to take on financing risks" (Jones, Zamani, and Reehal, 1996).

Three implication follow from this analysis. First, guarantees are less important when a franchise is allocated by an LPVR auction. Second, even if the government pledges the same guarantee under both mechanisms, its expected outlays will be smaller with an LPVR auction, because guarantees will be exercised less often. Third, equity holders assume much less risk with an LPVR auction, which implies that the risk premium they demand to participate is smaller, that opportunistic renegotiations will occur less often, and that users of the infrastructure will pay less on average.

Term extension

The value of term extensions in reducing risk has been questioned on the grounds that typical discount rates in project financing range from 10 to 15 percent, so that cash flows twenty to thirty years into the future are not very valuable. This argument has less force than might appear at first sight. First, discount rates increase with the risk of the project. The typical high discount rates observed in infrastructure projects correspond to fixed-term franchises, which are inherently risky for the franchise holder. Project discount rates should be lower in an LPVR auction. Second, in most infrastructure projects demand grows over time at rates similar to those of GDP, and risk-free rates tend to be similar to GDP growth rates. Thus an extension of the term of x percent should increase the present discounted value of a project by about x percent.

Incentives for efficient marketing

One limitation of LPVR franchises is that incentives to engage in marketing activities are reduced when the term is fixed, because any marketing effort that translates into higher demand shortens the term of the franchise, so that profits increase less that they would under a fixed- term franchise. Franchise holders

thus face fewer incentives to invest in demand-increasing features. For this reason LPVR auctions need to be complemented with institutions that determine and enforce minimum quality standards to be met by franchise holders (see Tirole, 1997). Pure LPVR auctions are not thus recommended for infrastructure projects in which demand is highly responsive to the activities of the franchise owners and in which minimum standards are not sufficient to ensure adequate service.

Additional means can be used to enhance marketing efforts. Lump-sum payments that are inversely proportional to the length to the effective franchise term may provide additional incentives for efficient management (Tirole, 1997). In some cases unbundling may be used to separate those parts of the business in which performance incentives are not needed from those parts in which they are important (see Engel, Fischer, and Galetovic, 1997b).[24]

VI. Conclusion

Franchises have not been widely used to privatize infrastructure, and experience with private infrastructure franchises has not always been positive. In some cases, franchises that purport to create infrastructure without the need for government financing have lead to nontransparent transfers of funds through renegotiation of the original contracts. Such has been the case in Mexico, where the government has spent vast sums on guarantees for and renegotiation of the contract for new roads.

Fixed-term contracts, which are commonly used to franchise private infrastructure projects, are at the root of the demand for guarantees. Such guarantees are an inappropriate mechanism for reducing the risks faced by franchise holders.

The LPVR mechanism is a competitive mechanism for auctioning infrastructure franchises that represents a significant improvement over other mechanisms in many instances. LPVR auctions reduce the need for government guarantees and thus promise to decrease the likelihood of future massive infusions of public funds into "private" infrastructure projects.

LPVR auctions eliminate much of the undesirable demand risk borne by the franchise holder, but they provide insufficient incentives to provide services of good quality and to invest in socially valuable marketing efforts. To mitigate this problem, LPVR franchises should be complemented with other regulatory innovations, such as independent third parties that verify quality of service standards and the introduction of appropriate fines for noncompliance (Tirole, 1997).

Notes

[1] A large number of cases in which road franchises were renegotiated are described in Gómez-Ibañez and Meyer (1993).

[2] For a list of previously regulated infrastructure services that are now provided in competitive markets, see Klein and Smith (1994).

[3] French municipal water franchises are an exception, since they are auctioned periodically in order to stimulate efficiency. They rarely change hands, however (see Klein and Smith, 1994).

[4] Behavior is opportunistic if it takes advantage of ambiguities in a contract (see Williamson, 1985).

[5] Banks could avoid the problem of nonperforming loans by forming syndicates, but these are subject to severe agency problems.

[6] All kinds of risks (demand risk, policy-induced risk) are considered equally as the franchise holder –and hence its bankers– must bear them.

[7] Value at risk refers to the largest loss with a given probability, usually 0.05 or 0.01. This criterion is one of many possible ways of capturing the fact that guarantees are exercised in bad and not normal times.

[8] Value at risk (see previous note) is more appropriate than the expected cost of the guarantee because guarantees present a problem under adverse economic conditions for the country as a whole, when guarantees on several projects may be called simultaneously.

[9] Where marginal costs are constant or decreasing, as they are in various kinds of infrastructure projects, this is equivalent to maximizing consumer surplus subject to the constraint that the franchise holder earns normal profits.

[10] "Risk" refers to the fact that returns are a random variable, not that returns may be negative with positive probability. An increase in risk indicates a mean-preserving spread of the distribution of returns.

[11] Firms are assumed to be risk-averse in the sense of decision theory under uncertainty.

[12] If the risk is partially correlated with the taxpayer's wealth, the result applies to the component of risk that is uncorrelated with it.

[13] There could still be cost sharing for adverse selection reasons, although in the case of auctions the argument for cost sharing is weaker (see chapter 7 in Laffont and Tirole, 1993).

[14] The idea is due to Chadwick (1859); see also Posner (1972). Chadwick was inspired by the French experience with competitive public works contracts dating back at least to fortress construction under Vaubon in the seventeenth century. For more on infrastructure privatization in an historical perspective see Klein and Roger (1995). For a critical assessment of Demsetz's work see Williamson (1985).

[15] These problems do not arise when there are close substitutes for the services of the project, since the franchise-holder will be interested in expanding capacity in order to avoid losing customers.

[16] Some mechanisms, such as those used for private highways in Mexico, give the franchise holder the option of extending the franchise for an additional fixed term at the end of the original franchise. The analysis in this section applies to these cases as well. The most common fixed-term mechanism is one in which the regulator fixes the term and the franchise is awarded to the firm that offers to charge the lowest user fee. In a variation used in some highway franchises in Mexico, the toll (user fee) is set by the regulator, and the franchise is awarded to the firm asking for the shortest term.

[17] Of course, the regulator may impose taxes or subsidies to compensate for externalities, but these have to be fixed after the winning bid is selected and may thus be open to regulator discretion.

[18] This figure underestimates the true advantages of the LPVR auctions, because it does not include gains stemming from the better renegotiation characteristics and the added flexibility in capacity and toll setting.

[19] A formal argument follows from the Arrow-Lind result.

[20] Being more optimistic leads to a somewhat more aggressive bid because estimated operating costs are lower. When operation costs are small relative to the investment cost this effect is substantially smaller than the effect of uncertain demand in the case of fixed-term auctions.

[21] In practice the amount should be reduced to account for the savings in operating and maintenance costs due to early termination of the franchise.

[22] Note, however, that tolls should not be set so low that the franchise never achieves the revenue demanded in the winning bid.

[23] Since there may be collusion among auction participants, the government should set an upper bound on the guarantee.

[24] Marketing can also be enhanced by lowering the discount rate, which makes shorter franchises more attractive. Lowering the discount rate may create other distortions, however.