

PUBLIC-PRIVATE PARTNERSHIPS: WHEN AND HOW

Eduardo Engel
Yale University

Ronald Fischer
Universidad de Chile

Alexander Galetovic
Universidad de los Andes

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Abstract

When are public-private partnerships (PPPs) better than conventional provision and regulated privatization? And should PPP contracts be structured and governed when this is the case?

We show that the defining features of a PPP are (i) bundling of construction and operation, (ii) private but temporary ownership of assets and (iii) intertemporal risk sharing with the public sector. Thus some characteristics of PPPs are akin to privatization while others are similar to conventional provision. Since incentives for efficient building and management are related to bundling, PPPs are closer to privatization in this regard. As the discounted government budget under a PPP is similar to that under conventional provision, PPPs are closer to conventional provision when it comes to budgetary accounting. We also show that avoiding distortionary taxation and relieving strained government budgets are weak arguments for PPPs.

We examine the institutional requirements for a successful PPP program and emphasize the need for an independent supervisor of PPPs (and in general of all public works) and a Committee of Experts to award when conflicts or the need for renegotiation arises. Lack of rule of law alters the choice between conventional provision and PPPs in favor of the former, as there is less risk of regulatory takings in a short term construction contract than in a long lived PPP.

In the case where quality service is contractible, the the PPP contract that optimally balances demand risk, user-fee distortions and the opportunity cost of public funds, features a minimum revenue guarantee and a revenue cap that differ from those observed in practice. This contract can be implemented via a competitive auction with realistic informational requirements.

¹First version: May 2008. Engel: Department of Economics, Yale University, 28 Hillhouse Ave., New Haven, CT 06511. Fischer: Center for Applied Economics (CEA), Department of Industrial Engineering, University of Chile, Av. República 701, Santiago, Chile. Galetovic: Facultad de Ciencias Económicas y Empresariales, Universidad de Los Andes, Av. San Carlos de Apoquindo 2200, Santiago, Chile. E-mails: eduardo.engel@yale.edu, rfischer@dii.uchile.cl, agaletovic@uandes.cl. We thank Eduardo Bitrán, José Luis Guasch, Pablo Sanguinetti, Mario Weissbluth and participants at the “Infrastructure and Development” Seminar organized by the Corporación Andina de Fomento (CAF) in Lima, Perú, on May 5th and 6th, 2008, for insightful conversations, useful comments and suggestions. Financial support from CAF is gratefully acknowledged. R. Fischer and A. Galetovic received support from the Instituto Milenio de Sistemas Complejos de Ingeniería. A. Galetovic also acknowledges the generosity of the Tinker Foundation and the hospitality of the Stanford Center for International Development.

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1 Introduction

The use of Public-Private Partnerships (PPPs) in the provision of infrastructure services has increased substantially since the early 1990s, as illustrated by Figure 1 that shows the evolution of investment commitments in infrastructure projects with private participation in developing countries, by sector and in total, during the 1990-2006 period (Source: World Bank and PPIAF, PPI Project Database).^{2,3,4,5,6} As privatization became increasingly unpopular (see Table 1 with the evolution of the fraction of the population, in 17 countries in Latin America, that agrees or strongly agrees with the statement that privatization has been beneficial), PPPs emerged as a “third way,” promising the advantages of privatization while avoiding its pitfalls.

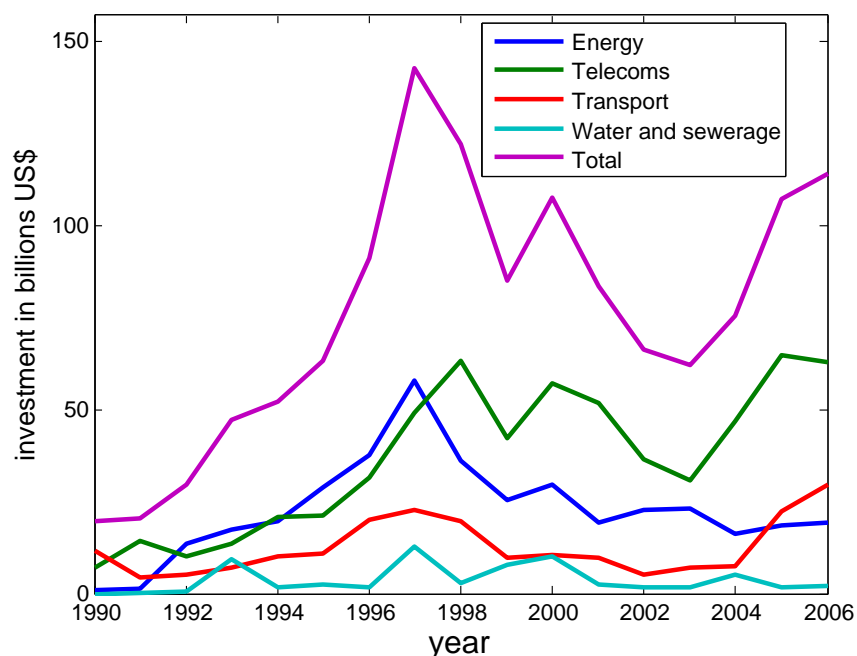


Figure 1: Investment in projects with significant private participation

²This does not correspond to the exact concept of public-private partnerships but constitutes a reasonable (and the best available) proxy.

³The surge in PPPs is also reflected in the financial press. For example, articles in the Financial Times mentioning this concept increased twenty-fold over the last decade, from 50 in 1995 to 1,153 in 2004.

⁴With 14% of public investment done under the so-called Private Finance Initiative, Britain is the country where PPPs account for the largest fraction of public investments (Hemming, 2006).

⁵We adopt a broad concept of infrastructure that includes social, economic, hard, soft, institutional, personal, material, and public infrastructure. In light of this broad approach, infrastructure that has been provided via PPPs include roads, bridges, tunnels, railways, ports, airports, air traffic control systems, water and sanitation plants, hospitals, schools, prisons, and social housing.

⁶There also exists a rich set of acronyms to describe specific PPP arrangements, including BLT, BLTM, BOT, DBOT, DBFO, DBFO/M, JV and ROT. The B usually stands for build, the L for lease, the R for rehabilitate, the T for transfer, the O for operate, the D for design, the F for finance, and the M for manage. JV stands for “joint venture”.

Table 1: SUPPORT FOR PRIVATIZATION IN LATIN AMERICA

	ARG	BOL	BRA	COL	CRI	CHI	ECU	SLV	GUA
1998	39	52	49	40	59	50	52	53	61
2001	17	24	49	13	31	43	33	25	22
2004	25	25	35	26	n.a.	30	26	22	2
2007	19	43	45	33	29	33	45	38	26
	HON	MEX	NIC	PAN	PAR	PER	URU	VEN	<i>Ave.</i>
1998	46	50	46	20	46	43	43	51	46.3
2001	21	28	31	37	34	22	23	49	29.4
2004	20	37	21	12	n.a.	29	n.a.	41	25.7
2007	33	40	29	27	22	32	n.a.	47	33.8

Source: Latinobarometro

There exists no single definition of a PPP, yet most definitions mention participation by the public and private sector coupled to a contract that influences risk sharing among parties.⁷ A defining characteristic of a PPP, compared with the conventional approach to the provision of infrastructure, is that it bundles investment and service provision into a single long term contract.⁸ By contrast, under conventional provision, which is also referred to as “public provision” or the “traditional approach,” the firm that builds the infrastructure takes no responsibility for its long term performance after the relatively short term construction warranty has expired.⁹

⁷For example, Grimsey and Lewis (2004) define PPPs as “...arrangements whereby private parties participate in, or provide support for, the provision of infrastructure, and [...] a project results in a contract for a private entity to deliver public infrastructure-based services.” The U.S. National Council for Public-Private Partnerships defines a PPP as “a contractual agreement between a public agency (federal, state or local) and a private sector entity [whereby] the skills and assets of each [...] are shared in delivering a service or facility for the use of the general public. In addition [...], each party shares in the risks and rewards potential in the delivery of the service and/or facility.” According to the Canadian Council for Public-Private Partnerships, a PPP is “a cooperative venture between the public and private sectors, built on the expertise of each partner, that best meets clearly defined public needs through the appropriate allocation of resources, risks and rewards.” Finally, according to the BBC, “any collaboration between public bodies, such as local authorities or central government, and private companies tends to be referred to a public-private partnership (PPP).”

⁸It follows that our definition of PPP involves an upfront investment by the firm either building new infrastructure or rehabilitating existing infrastructure. A maintenance and operations contract does not qualify as a PPP according to this definition.

⁹This paper focuses on three broad organizational forms: conventional provision, PPPs and privatization. Each one of these forms include a number of contractual arrangements. For example, Figure 2.1 in Guasch (2004) includes outsourcing, performance agreements and management contracts under conventional provision; leasing (also known as *affermage*), franchises, concessions and build-operate-transfer (BOT) under PPPs; and build-own-operate (BOO), divestiture by license, divestiture by sale and private supply and operation under privatization. Note that the 11 organizational forms mentioned by Guasch are ordered in terms of increasing degree of private participation.

For the duration of a PPP contract, which can be thirty years or more, the concessionaire will build, manage, maintain and control the assets, in exchange for some combination of user fees and government transfers, which are its compensation for the investment and other costs. Even though, in principle, the firm is the residual claimant during the contract, while the government is the residual claimant after the contract, these claims are often ambiguous due to contract incompleteness. On the other hand, the main characteristics that distinguish PPPs from privatization is that public planning is an important aspect of PPPs, plus the fact that contracts are periodically reassigned.

For the three organizational forms we consider —the conventional approach, PPPs, and privatization— we assume that private firms build, maintain and operate the infrastructure project. The difference between these organizational forms derives from asset ownership (or control), whether the firm builds and operates the project, and which is the entity in charge of planning. Under both a PPP and privatization the same firm builds, operates and maintains the infrastructure, while under conventional provision the firm building the infrastructure has no role in maintenance and operations.¹⁰ Also, only a PPP and privatization involve asset ownership by the private firm involved, in the case of PPP ownership is temporary and partial while under privatization it is indefinite and complete, restricted only by general legislation. The advantage of partial control and reversion to government ownership (of PPPs and conventional provision) is that the government can use this power to solve coordination and planning problems, in contrast to the case of privatization.

As mentioned above, our definition of PPP assumes that the firm is remunerated via a combination of user fees and government transfers. Government transfers are a combination of subsidies, guarantees, shadow fees and availability payments.¹¹ Some authors reserve the PPP term for projects that cannot be financed without government transfers, referring to projects that can be financed via user fees as *concessions*. We do not make this distinction and use the terms PPP and concession interchangeably.

Many arguments have been given for why PPPs may help governments provide infrastructure in a more efficient manner. Some practitioners and governments claim that PPPs relieve strained budgets and release public funds;¹² others argue that PPPs are appealing because finance is delegated to private firms subject to the discipline of financial markets; still others argue, perhaps cynically, that it is a reasonable compromise for outright privatization, often made difficult by political considerations. PPPs have also been heralded for bringing infrastructure provision closer to the advantages of competition, since they are often adjudicated in competitive auctions — competition *for* the field when a natural monopoly infrastructure rules out competition *in* the field. Further-

¹⁰Under conventional provision building, maintenance and operation are “contracted out” to different firms.

¹¹Shadow fees are paid directly by the government to the firm based on usage of the service; users face no fees in this case. Availability payments are regular payments made by the government to the firm conditional on the contracted service being available.

¹²“The boom is good news for governments with overstretched public finances: many local and national authorities have found themselves sitting on toll roads, ports and airports that they can sell for billions of dollars to fund other public services.” *Financial Times*, July 5, 2007.

more, it was hoped that PPPs would help filter ‘white elephants’, defined as projects with negative social value, in the case where firms are financed mainly with user fees, since in this case projects that are not profitable will fail to attract a concessionaire.

Despite these seemingly reasonable arguments, however, the experience with PPPs has been mixed. Whereas in some cases expectations were met, in many other cases contracts were renegotiated in favor of the concessionaire, or conversely, subject to regulatory takings (Guasch, 2004). PPPs were also routinely used to circumvent budgetary oversight and anticipate government spending, while generous government guarantees often canceled the potential of PPPs to filter white elephants. Frequently deadlines were not met, or projects required substantial subsidies to be completed and operated, and these subsidies were added to the original contract in opaque manner and without the benefit of competition.¹³

The purpose of this paper is to answer the questions of (i) *when* are PPPs to be preferred over conventional provision or outright privatization, and (ii) if the government decides to undertake a project using a PPP, what are the appropriate rules to use to structure, allocate and enforce the contract (*how*)?

Question (i) is to a large extent a matter of organizational form and productive efficiency. Different organizational forms imply different assignments of control rights on how to invest and manage the assets. Why should we add PPPs to the possible organizational forms in which resources are allocated? Which are the fundamental reasons why bundling might enhance efficiency? When answering the *when* question, we also address the extent to which PPPs are justified on the grounds that they help governments relieve strained budgets, and conclude that this argument is incorrect in many cases. We also compare alternative organizational forms according to the extent to which they mitigate or exacerbate various sources of government failure in the overall provision of infrastructure (mainly via the conventional approach).

In answering the question of *how* PPPs should be provided, we stress the importance of risk allocation, specifically in the form of the large demand uncertainty present in many PPP projects. We emphasize the fact that the temporary nature of PPPs contracts can sometimes be used to improve welfare substantially, since it allows for state-contingent contract terms and therefore makes feasible risk allocations that are not available under privatization. We also extract some important lessons from the experience with PPPs during the last two decades when discussing the institutional design and governance for PPPs.

The remainder of the paper is organized as follows. Section 2 covers the *when PPPs* question, while section 3 answers *how*. Various case studies are considered in Section 4; the main conclusions obtained throughout the paper are summarized in Section 5.

¹³This does not mean that the conventional approach to infrastructure provision, with the government contracting a private firm to build the project, would have done better. For an early evaluation of infrastructure PPPs, see Economic Planning Advisory Commission (EPAC) (1995), *Final Report of the Private Infrastructure Task Force*, Australian Government Publishing Service, Canberra. For more recent evaluations, see Engel et al. (2003) and Grimsey and Lewis (2007).

2 When

In this section we study the conditions that determine when PPPs yield higher social welfare than the alternatives. We assume throughout that private firms build, operate and maintain the infrastructure under all organizational forms—conventional provision, PPPs, or privatization. Thus, by assumption, the advantages of a PPP do not arise from private participation but from its incentive structure. In Section 2.1 we informally discuss conditions under which a PPP is the best alternative; in Appendices A and B we provide a formal model. Section 2.2 adopts a public finance perspective and studies to what extent the case for PPPs stands on the premise that they relieve public budgets. Finally, as discussed in the introduction, pervasive renegotiations and poor fiscal accounting are associated to PPPs. This motivates Section 2.3.

2.1 Bundling, ownership and efficiency

Assume a benevolent and efficient government that does not suffer any of the normal failures of real governments. While extreme, this assumption is a benchmark that we use in this and the next section, leaving the final section for an examination of the effects of departing from the benchmark.

The literature has identified two main characteristics of PPPs. One is that it bundles financing, building and operation, which are delivered by the same firm. Second, while the PPP contract lasts, the private firm has a degree of control (ownership rights) and autonomy in managing the assets, for instance, in the choice of quantity and quality of the inputs. Thus, as pointed out by Hart (2003) and Bennet and Iossa (2006), the case of PPPs stands and falls on the incentives induced by these characteristics.¹⁴

Table 2: ORGANIZATIONAL FORMS

	Characteristic		
	Bundling	Ownership	Regulated prices
Liberalization	yes	private, permanent	no
Conventional	no	public	yes
PPP	yes	private, temporary	yes
Regulated privatization	yes	private, permanent	yes

It is obvious that, other things equal, bundling stimulates investments that cut life-cycle costs. Since a firm with a PPP contract enjoys partial or total ownership rights and keeps most of the gains from cost cutting, these are strong incentives, and even stronger under privatization, because the firm owns the assets completely and indefinitely. This is important, because many infrastructure

¹⁴A second strand of the literature studies how PPPs alters incentives and contracting under moral hazard. See Bentz et al. (2001), Martimort and Puyet (2007) and Iossa and Martimort (2008).

projects, operation and maintenance costs depend on investments made during the initial construction stage. A potential problem is that there are investments that reduce life-cycle costs while lowering service quality and consumer welfare, which makes them undesirable. For example, investing in more durable but less reflective paint for road surfaces marking might lower operational costs but increases the risks of night driving. The fact that cost saving investments can be detrimental in some cases is a major problem in bundling infrastructure, which we analyze below.

To compare PPPs with alternatives forms of infrastructure provision, we begin by analyzing a service that is produced under constant or decreasing returns to scale, and for which user fees can be charged. Elementary economics shows that the optimal organizational form is privatization plus price deregulation, i.e. market liberalization. First, because competition forces firms to internalize consumer surplus and to provide the socially optimal level of service quality—there is no need to impose service standards. Second, because private ownership and competition induce the optimal amount of life-cycle cost savings. Of course, careful market design might be required, as is the case of the wholesale electricity market, but there are well known solutions to this problem.

Market liberalization is unfeasible when users cannot be charged, either because the infrastructure is not excludable or because society prefers not to charge users (as, for example, in the case of countries with universal healthcare). Market liberalization is also inappropriate under increasing returns, because the infrastructure is a natural monopoly. In these cases the relative standing of a PPP relative to, on the one hand, conventional provision and, on the other hand, regulated privatization, depends on the specific characteristics of the project. In particular, it matters whether quality and quantity can be contracted and enforced and whether planning is required to solve future coordination problems.

If quality is contractible, the government can specify the desired service standards, letting the firm choose the optimal combination of inputs to achieve the standards. For example, service standards, such as the wait before obtaining a berth or transshipment rates, can be specified and enforced when seaports are privatized or contracted as a PPP. They include the time ships need to wait before obtaining a berth and the speed with which cargo is unloaded. This implies that cost cutting investments that lower service quality can be excluded. Thus ownership, which implies bundling, increases welfare in the absence of planning and coordination issues. If coordination and planning issues override other considerations, PPPs are preferred because they provide more control to the planning unit.

Things are less clear cut when quality is not contractible, since the firm can make cost-saving investments that lower service quality. If the quality of inputs is positively related to the quality of outputs and input quality can be enforced, the government can limit welfare reducing cost/cutting by specifying inputs. There is a cost, since the rigidity introduced by specifying inputs may inhibit the firm from adopting new and better technologies (see Box ?? for an example). Given the input requirements, under bundling the firm will choose the profit maximizing combination of cost-saving and quality-reducing investment, subject to the constraints imposed by the government. If quality reduction is the main result of bundling, conventional provision is the best option. By contrast,

if the benefits of cost-cutting outweigh the costs of quality reduction, regulated privatization is preferred if fees can be charged, while a PPP should be chosen otherwise.

BOX 2.1 (Education and input specification) *Education and input specification*

It can be argued that in the case of primary and secondary education important aspects of educational quality sought by parents and society are not contractible.¹⁵ A variety of inputs (measured as students per teacher, the experience and education of teachers, equipment) can be specified that are partially related to the quality of education. Specifying these inputs may help attain reasonable levels of educational quality, yet it may also limit the extent to which the school can implement innovative options that increase efficiency. For example, requiring a small number of students per teacher may limit expenditures on innovative software that partly substitutes for in classroom teaching. ■

Table 3 summarizes the conclusions. PPPs emerge as the preferred alternative when quality is contractible and user fees are ruled out. When quality is not contractible, PPPs still dominate conventional provision when life-cycle cost cutting dominates over service quality considerations. Last, conventional provision is the preferred organizational form when quality is not contractible and the main concern.

Table 3: COST-CUTTING INCENTIVES AND OPTIMAL ORGANIZATIONAL FORMS

Increasing returns	Environment		Organizational form
	User fees possible	Quality contractible	
no	yes	—	Liberalization
—	no	yes	PPP
—	no	no	PPP or conventional provision
yes	yes	yes	Regulated privatization (*)
yes	yes	no	Privatization or conventional provision

(*): If planning issues are important, PPPs or conventional provision may dominate privatization.

2.2 Public finance perspective

The most common argument in favor of PPPs among practitioners and politicians is that they relieve strained government budgets. According to this line of thought, this frees up government resources that can be spent on other projects with high social return. Even though *prima facie* this

¹⁵This reflects the fact that standardized tests represent only a partial measure of quality.

argument seems unobjectionable, we argue that the reasoning is unconvincing. We show that the resources saved by the government upfront when choosing a PPP over alternatives such as conventional provision are offset by the loss of future revenues.

We compare the public finance implications of conventional provision and provision under a PPP, assuming no rents for the firm (by competition for the concession or for the contract in the case of conventional provision) and that user fee revenue does not depend on the organizational form under which the infrastructure is provided.¹⁶ We show that the government's present discounted revenue is the same in both cases.

Denote the upfront investment in the project by I . For simplicity we ignore operational and maintenance costs, even though what follows can be easily extended to incorporate these costs. We then have that under conventional provision the expected present value of government revenues is given by:

$$EPV(\text{Gov Income}) = EPV_0^\infty(\text{Fees}) - I, \quad (1)$$

where $EPV_0^\infty(\text{Fees})$ denotes discounted user fee revenues during the lifetime of the infrastructure, which we assume does not depreciate or become outdated, so that it lasts forever.

We denote by T the contract length under a PPP. The government is the residual claimant of revenues in this case, and therefore collects user fees after the concession ends.¹⁷ It follows that net government revenues are equal to the difference between the user fees it collects and the transfers it makes to the firm:

$$EPV(\text{Gov Income}) = EPV_T^\infty(\text{Fees}) - EPV(\text{Gov Transf}). \quad (2)$$

The expressions for government income in (1) and (2) look quite different, suggesting that the present discounted government budget will vary across organizational forms. We show next that this is not the case, that both expressions are identical.

Under a PPP, the firm's discounted profits are equal to the difference between its income (either from user fees or government transfers) and its investment:

$$EPV(\text{Firm Profits}) = EPV_0^T(\text{Fees}) + EPV(\text{Gov Transf}) - I.$$

By assumption, the above expression equals zero, which implies that

$$EPV(\text{Gov Transf}) = I - EPV_0^T(\text{Fees}),$$

¹⁶This is a strong assumption, as one of the advantages of PPPs is that user fees are less prone to being manipulated by populist governments (see Section 2.3).

¹⁷Alternatively, the government could re-auction the project, in which case we assume that by competition for the new concession, it collects an amount equal to the present value of user fees from that point onward.

and substituting this expression for EPV(Gov Transf) in (2) yields

$$\text{EPV(Gov Income)} = \text{EPV}_0^\infty(\text{Fees}) - I \quad (3)$$

which corresponds to the same expression we obtained in (1) for the case of conventional provision. Thus, we have shown that the future user revenue lost to the government by ceding income flows to the private sector is an exact offset of the initial investment savings made by the government by not having to finance the project.

A variant of the budget relief argument in favor of PPPs is that PPPs allow governments to invest in socially desirable projects during periods of severe credit constraints. In this case the choice is not between PPP and conventional provision, but between a PPP and not providing the service at all. In order to evaluate the validity of this argument, we need additional information on the cause of the credit constraints.

If the government cannot borrow because there is a high probability that it will default on its debt, is it realistic to assume that firms will be willing to invest in a project where they need to collect user fees over a long period of time to make a profit? If the firm can be given credible assurances that it will collect the income stream generated by the project, the answer may be positive. However, in many cases we cannot provide such a neat division between the revenue stream derived from the project and other potential sources of government revenue. In such cases, the viability of the PPP approach is affected by the weakness of the government's balance sheet.¹⁸ The case in which this line of reasoning is most attractive is when there is good reason to believe that liquidity constraints will be short-lived, since in this case a firm with access to financing at a reasonable price can build the project now and have the expectation of not being expropriated of its contractual rights to user fees (or *future* subsidies, availability payments or shadow tolls). In this case, users stand to benefit from the earlier implementation of the project at only a minor additional cost due to risk, when compared with the option of waiting until the government's liquidity constraints have disappeared and it can build the project.¹⁹

An alternative argument in favor of PPPs, which is also related to public finance, is the "cost of public funds argument." According to this doctrine, the government collects distortionary taxes to finance infrastructure projects, while the private sector can finance projects without these distortions. It follows that PPPs (or privatization) is to be preferred to conventional provision.

The previous argument is incorrect. Intuitively, assume that there is a cost of raising public funds, so that a dollar collected by the government has a cost that is more than a dollar to society, say $1 + \lambda$, with $\lambda > 0$. We also assume that the project can be financed either by user fees or with

¹⁸Consider Argentina's regulatory takings of PPPs after the 2001 crisis.

¹⁹Liquidity constraints correspond to the case where the government's cost of funds is infinite. A less extreme version is when the government has access to financing, but at a considerably higher cost than private firms. The same caveats discussed above apply in this case: whether this justifies choosing a PPP will depend on the reason why lenders are prepared to finance the same project at a lower cost when it is carried out as a PPP.

subsidies. The difference between the two approaches is that only subsidies involve distortionary taxation.

The government will save λ dollars per dollar invested by the firm in the infrastructure project. However, these savings are offset by the lower user fees collected by government, since under a PPP it collects user fees only once the concession has ended. while under conventional provision it can start collecting user fees once the project is available to users. Thus, for every dollar of user fees given up to the concessionaire, the government forgoes the opportunity of reducing distortionary taxation elsewhere in the economy. As long as the cost-of-public-funds parameter λ does not vary over time, these effects cancel out. Thus user-fee and subsidy financing are perfect substitutes at the margin and the distortionary cost of taxation does not provide a rationale for the use of PPPs.

Summing up, once we consider the intertemporal government budget, the case in favor of PPPs based on the relaxation of the governments budget constraints is weak. The initial savings of government under a PPP are equal, in present value, to the amounts it surrenders in user fees it could have collected under conventional provision.

2.3 Government failure

In the previous section we assumed that government is efficient, but there are various ways in which the government falls short of this standard. There is corruption, excess bureaucracy and general incompetence. This implies that some of the choices in Table 3, which gives the optimal organizational form considering an efficient government, should be modified when we include the possibility of government inefficiency.

We first review the problems encountered by governments in general when providing infrastructure (Section 2.3.1). Then problems that can be mitigated under PPPs (Section 2.3.2) and problems that are exacerbated by PPPs (Section 2.3.3).

2.3.1 Challenges for public provision of infrastructure²⁰

There are three main challenges governments face when providing infrastructure services, independently of the mechanism used to provide these services. First, which type of infrastructure to build, that is, adequate planning. Second, ensuring that the projects that are built provide adequate service. Third, ensuring that government is not overcharged for the construction, operation and maintenance of infrastructure.

Strategic planning in infrastructure is typically weak or even absent in developing countries. Social project evaluation is usually toothless, which means that projects are often chosen to satisfy short term political objectives, resulting in white elephants and over-engineering. Even when

²⁰This section benefited from conversations with Eduardo Bitrán and Mario Waissbluth. The bills to reform the PPP legislation and the Ministry of Public Works are another source for what follows.

procedures to filter poor projects are in place, costs are routinely underestimated while demand is typically overestimated (see, for example, Tables 4.1 and 4.2 in Flyvbjerg et al., 2002).

Most developing countries have little institutional separation between the agencies in charge of strategic planning and policy design, and those involved in execution of projects, and enforcement of contracts. This inadequate institutional design results in an array of problems. First, there are obvious conflicts of interest between these tasks, leading to the emphasis of some responsibilities at the expense of others. For example, new infrastructure projects are politically more attractive than enforcing contracts. Since contract enforcement makes it harder to find firms willing to participate in new projects, enforcement becomes even less attractive.²¹ It is therefore not surprising that public works in developing countries suffer delays and cost overruns, and that the bonds posted to ensure deadlines and quality standards are seldom collected, even when deadlines and standards are not satisfied.

Another problem caused by poor institutional design is the lack of supervision of maintenance of existing projects. Since building new projects is more attractive politically, governments typically spend too little on maintenance, until the project deteriorates sufficiently that the public complains and the government reacts. The cost of stop-and-go approach to maintenance is much higher (some estimates suggest cost multiples of 3 to 1) than what would have been the cost of continuous maintenance, without including the social cost of lower service quality.

Finally, poor institutional design weakens the public agency against pressures from the construction industry and politicians, and makes it difficult to hire high level professionals. Moreover, there is high risk of corruption in public work agencies with poor check-and-balances, since poorly paid government employees must oversee projects involving large investments, in the absence of institutional back up.

The capture of the public agency, either by the construction lobby and by politicians, leads to construction of the wrong projects at an excessive cost. When the government is in urgent need infrastructure projects before an election, private firms have more bargaining power and can overcharge. When construction lobby influences the projects that are built, it is also likely that there is little competition for the projects, resulting in higher prices.

Summing up, the poor institutional design of the public works authority in most developing countries exacerbates a host of agency problems, resulting in the wrong projects being built, poor maintenance of existing infrastructure, and high prices paid for infrastructure services.

2.3.2 Potential advantages of PPPs

Next we consider some of the problems with conventional provision of infrastructure described above that can be mitigated with PPPs.

²¹The claim that strict enforcement dissuades participants may be spurious, as we show in the next section, but the threat may be effective against nervous politicians.

White elephants and over-engineered projects

White elephants, defined as projects with negative social value (i.e., whose social costs exceed their social benefits), are pervasive throughout the world, reflecting the fact that the political process may lead governments to build projects that would not have been accepted had the project been subjected to a rigorous process of social project evaluation. The obvious solution is to implement a program of social project evaluation, so as to protect society against white elephants.²² This option fails in many developing (and some industrialized) countries. Below we consider alternative options that become available when a *market test* is combined with private participation.

White elephants can be filtered by selecting an organizational form where the firm that builds and maintains the infrastructure is financed mainly via user fees. In this case private firms will participate in the project only if it is privately profitable to do so, a good proxy for social desirability.²³ In this context, infrastructure privatization helps countries with weak systems for social project evaluation.²⁴

Privatizations have the advantage that firms will not be interested in the project if it is a white elephant. PPPs also can be structured to avoid white elephants, if the firm's main source of income is derived from user fees. If shadow tolls or availability payments are used to pay for the project, PPPs do not filter white elephants and social evaluation of the project is required.

Government guarantees, a topic we cover in detail when considering risk related issues in Section 3, are another factor that reduces the filtering ability (for white elephants) of PPPs, since the lowered risk in bad states of the world can raise the profitability of socially wasteful projects.

Improving maintenance

Incentives to maintain infrastructure provided under a PPP are larger than under conventional provision. By lowering maintenance expenditure, the government frees resources that can be used for political advantage. On the other hand, the concessionaire of a PPP is subject to monitoring by

²²One difficulty of social program evaluation is interference by the executive power, specially when convinced that a statesman's vision is superior to the pedestrian technicality of social evaluation. An escape valve for these pressures would be to assign the President a fraction of public works investment (say 5-10%), without undergoing social project evaluation for his or her pet projects, in exchange for lack of interference with the rest of the public works budget.

²³This is an old and powerful idea, going back to Adam Smith "The greater part of public works may easily be so managed, as to afford a particular revenue sufficient for defraying their own expense, without bringing any burden upon the general revenue of society [...] When high roads [...] are in this manner made and supported by the commerce that is carried on by means of them, they can be made only where that commerce requires them. Their expence too, their grandeur and magnificence, must be suited to what that commerce can afford to pay. [...] A magnificent road cannot be made [...] merely because it happens to lead to the country villa of the intendant of the province, or to that of some great lord to whom the intendant finds it convenient to make his court.", *The Wealth of Nations*. V.1.III.1.

²⁴A common problem is that projects are over-engineered, and therefore investment is larger than the social optimum. Standard social evaluation does not filter these projects, so long as their social profitability exceeds the hurdle rate. Linking the firm's revenue to demand realization, as is the case under privatization and PPPs, won't filter these projects either.

the fee-paying public, or by the treasury in the case of annual availability contracts. This implies that government does not benefit when the firm underspends on maintenance.

Regulating user fees, Demsetz auctions and renegotiations

Another type of government failure occurs when the service is provided under conditions of market power. In this case, user fees must be regulated, but this is often difficult. Under conventional provision, the main concern is that user fees might be set at a low level in response to political considerations (see Box 2.2). Similarly, under conventional provision some powerful users are often charged below the marginal cost they impose on maintenance and operation.²⁵ Since PPPs are more insulated from political pressure, the hope is this contractual form (and privatization) will make possible charging fees closer to marginal costs.

BOX 2.2 (Indiana Toll Road and toll indexation) *Tolls at the Indiana Toll Road in the United States remained unchanged in nominal terms for more than 20 years, falling substantially in real terms, under state ownership and management. When the road was contracted as a PPP in January of 2006, tolls doubled and were indexed to inflation. Other U.S. states have since adopted toll indexation, among them Florida, Pennsylvania and Texas. ■*

In developing countries, the rates charged by public providers are often so low that they lead to overconsumption and under-investment. After privatization of the utilities, rates are increased (in some cases leading to protests and re-nationalization) but investment also goes up, improving the quality of service while reducing wasteful consumption. The risk of setting user fees too low has been at the heart of macroeconomic instability in many developing countries in the (not so distant) past.

In the case of privatization, user fees may be set at a level that generates excess rents, reflecting regulatory capture, or they may be set at a low level, due to regulatory takings in response to political pressures. There exists a vast literature to address these problems.

An alternative to the regulator setting prices is that prices be set via a competitive process. Chadwick argued, long ago, that PPPs avoid regulatory shortcomings when the firm is chosen via a competitive auction, since this dissipates *ex-ante* rents (see Chadwick, 1859 and Demsetz, 1967). Competition *for* the field can be a close substitute for competition *in* the field. For example, if the bidding variable is the user fee that will be charged during the concession term, a competitive auction achieves second best pricing in the absence of congestion effects.

A prerequisite to reap the potential benefits from auctioning PPPs is that there is real competition for the contract. This is often not the case. In some countries (e.g., Brazil) the PPP legislation

²⁵For example, road deterioration is proportional to more than the third power (by some accounts, the fourth power) of axle weight. This implies that tolls paid by trucks are much lower than the maintenance cost that they cause.

excludes foreign participants. In other cases (e.g., Colombia and Argentina in recent years), the government's overt or implicit objective is that concession projects be spread evenly among the main domestic construction firms. In both cases incentives to compete are diluted and as a result, the cost of infrastructure rises and the quality may be lower.

As pointed out by Oliver Williamson (1976, 1985), the problem with Demsetz auctions is that the competitive process at the time of the auction turns into a bilateral monopoly relationship over the life of the contract. Since the investment is sunk, there is ample opportunity for opportunistic behavior by the government, as the firm cannot take its investment elsewhere. Similarly, for many types of infrastructure it is difficult for the government (for legal, technical, political or other reasons) to take over the infrastructure service without major service disruptions. This implies that it is difficult to punish noncompliance by the firm and thus it has incentives to behave opportunistically. Opportunities for hold up, by the firm or the the government, are plentiful adding to risk.

It is not surprising, therefore, that Guasch (2004) found pervasive evidence of renegotiations when he analyzed more than 1,000 infrastructure concessions granted in Latin America between 1985 and 2000. More than half of the original contracts suffered substantial changes in sectors with finite term contracts (54.7% in the transport sector; 74.4% in the water sector) — the average time between adjudication and the first renegotiation of the contract was slightly over 3 years, and most renegotiations were initiated by firms.

When opportunistic renegotiations by firms are pervasive, selecting the concessionaire in a competitive auction will be less beneficial than suggested by the literature on Demsetz auctions. The selected firms will be biased towards lobbying and renegotiation rather than towards technical expertise.²⁶

Summing up, PPP contracts are long-lived, incomplete contracts. Unforeseen circumstances will emerge that require welfare improving *ex-post* renegotiations. The challenge, of course, is to distinguish between “good faith” and “bad faith” renegotiations. Ideally, we would like a concession contract that allows for the former while avoiding the latter. We return to this topic in Section 3 and discuss institutional changes and specific PPP contract characteristics that avoid “bad faith” renegotiations and therefore help reap the benefits from competitive auctions.

²⁶See Engel et al (2008) for a formal analysis. Intuitively, the argument is that under competition, firms that survive cannot be relatively worse in both dimensions (renegotiation and technical ability), because they would be outperformed by firms that are better in the two dimensions. Hence, there will be a frontier of surviving firms, in which better lobbying and renegotiating ability is associated to poorer technical ability and viceversa. This also means that firms that better in the technical dimension will be at a disadvantage in countries with a higher propensity to renegotiate contracts (which will attract lobbying biased firms), and will gravitate to other countries.

2.3.3 Potential disadvantages of PPPs²⁷

Periodic recontracting under PPPs is more costly than the single auction necessary to privatize an infrastructure service. This makes privatization more attractive than a PPP.²⁸

An important type of government failure is caused by the tendency of governments, prompted by the election cycle, to discount the future. As we have mentioned before, governments would like to anticipate infrastructure spending, in the expectation of increasing their chances of being reelected. Anticipating infrastructure expenditures under conventional provision is complicated by budgetary controls (e.g., congressional approval) that limit the government's ability to impose liabilities on future administrations. By contrast, privatization by selling state-owned companies can provide resources for the current administration to spend with little oversight. PPPs can also be used to anticipate government spending, since they are often subject to laxer supervision than the budget.

The policy recommendation is straightforward. To make sure that the contractual form used to provide infrastructure is driven by social welfare considerations, the choice of organizational form should be independent of the possibility of anticipating spending. This can be achieved by an effective program of social project evaluation, as well as by including in the budget the future liabilities contracted during the current period via PPPs. In the case of the revenue from privatizations, fiscal rules that smooth spending of resources received on a one-time basis may help. Likewise, some countries have defined appropriate calculations for the value at risk associated with liabilities on future administrations imposed by PPP investments.

3 How

This section deals with *how* PPPs once the analysis of the preceding section suggests that a PPP is the best option. In this section we describe summarily the practical considerations on governance and the political economy of PPPs that are required before proceeding with a successful policy of developing infrastructure based on this mechanism. We also consider some issues of institutional design, in particular, the design of the PPP unit within the government and the legal environment necessary for a reasonably successful program of PPPs. Finally, we analyze in some detail efficient PPP contracts under different demand and contractual conditions.

²⁷As discussed above, renegotiations are one of the main consequences of government failure under PPP. We studied renegotiations in the section on potential advantages of PPPs, since it is the downside to the potential advantages of assigning PPPs via competitive auctions, but it could have been included just as well in this section.

²⁸Note, however, that the longer horizon under privatization means that the premium due to demand risk could be higher.

3.1 Two basic contractual principles

Renegotiations of PPP contracts have been pervasive and many are inefficient. There are many motivations, but two contractual premises seem to make them the normal state of affairs. One is the so-called “principle of financial equilibrium”. As Guasch (2004, p. 35) points out, in regulated markets firms expect revenue streams that ensure reasonable profits. If unable to earn these profits, they expect a change in contract terms. Second, the firm is responsible for all investment and has the exclusive right to use the assets and exploit the project. Thus any change in the project must be agreed with the firm. Both premises are reasonable and necessary—investors should earn a normal expected rate of return and ownership rights are a hallmark of PPPs. Nevertheless, they must be complemented and their scope narrowed to ensure proper incentives.

Recall that PPPs are useful when quality is contractible. Thus service standards should be a central part of the PPP contract and the firm should bear the costs of meeting them. Ex ante financial equilibrium should follow from a prudent bid, and not from ex post renegotiation justified by costs which are higher than expected.²⁹ Focusing on quality standards also provides incentives for appropriate maintenance.³⁰

Similarly, if the government decides to raise service standards and additional investments are needed to meet them, the firm should be compensated at market values. Thus, additional investments should be tendered in competitive auctions and revenues increased only to ensure a normal return on additional investments.³¹ Any renegotiation should be subject to independent review, a topic which we discuss next.

3.2 The governance of PPPs

As mentioned in Section 2, in many countries the same public works agency is in charge of planning the infrastructure, designing and awarding the PPP contract, monitoring compliance and renegotiating. This is bad governance. One reason is that public works agencies tend to be biased in favor of building as much as possible—project selection is inefficient and building is a goal in itself. Also, there is an inherent conflict of interest between promotion on the one hand and regulation and monitoring compliance on the other. Last, contracts are usually renegotiated behind close doors and bilateral agreements are not reviewed independently. This allows public works agencies to cover up their mistakes and stimulates their carelessness when designing and awarding PPP contracts.³² An appropriate governance fosters independent project selection and evaluation; separates contract design and award from contract monitoring; and subjects renegotiations to in-

²⁹Guasch (2004, p. 37) calls this “the sanctity of the bid”.

³⁰Additional incentives for maintaining the infrastructure toward the end of the contract term may be needed. When the state of assets can be verified by third parties, bonds posted by the firm constitute one possible mechanism.

³¹More precisely, to ensure zero change in the firm’s zero net present value of profits.

³²It also allows governments to anticipate spending—see Section 2.3.3 and below.

dependent review.

The recommendation is to relieve the unit that writes and awards PPP contracts from planning, project selection and contract enforcement. Before awarding contracts, a planning agency should design, evaluate and select projects. In turn, an external board should review the cost-benefit evaluations that support the chosen projects and the PPP contracts written to implement them. After contracts are awarded, a PPP superintendency should ensure compliance with the contract, monitor performance standards and service quality, and provide information to users and the public. At the same time, a panel of experts should review contract renegotiations and adjudicate conflicts. As mentioned above, when evaluating renegotiations the panel should ensure that the contractual modification neither increases nor decreases the project's profitability, thus eliminating the firm's incentives to behave opportunistically. The panel should also inform the public of the extent to which poor contract design motivated the renegotiation, thereby providing incentives for the unit that writes and awards PPP contracts to avoid careless project design.

The planning agency and the PPP unit must execute the incumbent government's policies, although they should probably be staffed by career civil servants. On the other hand, the external review board, the superintendency and the panel of experts should be financially and formally independent from the executive and their acts should be subject to strict transparency requirements.

3.3 Legal environment

PPPs are long lived contracts and their viability depends on the legal environment and the protection both of property rights of the private firm and of the rights of the public. In the absence of rule of law, honest investors in PPPs can expect to be fleeced, or suffer from regulatory takings, so that they will not participate in PPP projects in those countries. Instead, the firms that will be attracted are those with expertise in gaming the system. Alternatively, honest firms that participate will ask for such high rates of return to cover the risk of expropriation, that the country may be made better off by the conventional provision of infrastructure projects, since this approach may attract firms that would not dare participate in a long term PPP.

Poor countries sometimes have the option of resorting to international financial institutions (IFIs) such as the World Bank to provide insurance against expropriation for investors. Involvement by IFIs is justified by arguing that they have better information than conventional banks and that they can threaten to withdraw aid that is valuable to the government should it act opportunistically with the concessionaire. Nonetheless, this approach may be useful for a small number of projects that are expected to provide major externalities, it is unlikely that this approach can be the basis of a fully fledged PPP program.

The policy recommendation is to improve the legal environment and the protection of property rights prior to attempting to introduce PPPs, since they are more sensitive to deficiencies in this area than conventional provision of infrastructure.

3.4 Risk allocation

As mentioned in Section 2.3.2, PPP contracts serve as a market test to avoid white elephants. We also mentioned that this filtering ability is reduced in the presence of government guarantees. However, most PPP contracts include different forms of insurance against revenue risk, and this insurance is ultimately paid by taxpayers. The risks that are usually insured against are demand risk, construction and maintenance risk, as well as policy risk (see Box 3.1 for a description of risk factors).

Firms ask for guarantees so they can unload demand risk. This risk is large, since making accurate demand forecasts, even in a medium term horizon, is extremely difficult. Firms are unable to diversify these risks, possibly due to agency problems within the firm. As we argue in Section 3.5, the right way of dealing with this problem is by choosing the appropriate auction mechanism. A second source of the demand for guarantees is construction and maintenance risk. Here, firms often press for cost-sharing agreements with the government even though they control the sources of risk.

BOX 3.1 (A classification of risks faced by a concessionaire) ³³

With a typical concession contract, where the concession term is fixed in advance, and in the absence of government guarantees, the concessionaire faces the following risks:

Demand risk. *This risk arises when demand forecasts are unreliable, which happens most of the time. Demand forecasts are based on estimates of future growth of the overall economy, and deviations from this growth rate by the region in the country relevant for the project at stake. An increase or decrease by one or two percentage points of the demand growth rate over a long time period can have huge effects on the project's returns. Demand forecasts also depend on estimates of the macroeconomic cycle, which are tied to the aggregate performance of the economy, and on estimates of microeconomic conditions, which reflect local demand fluctuations. Box 3.2 shows that both sources of demand risk are important in Chile, even during the most stable decade in the country's history. Box 3.3 shows that, even in industrialized countries, where the quantity and quality of information available to make demand forecasts is considerably larger than in developing countries, demand forecasts can make huge mistakes, even in the short run.*

Demand risk may also be due to uncertainty on the changes in the income-elasticity of demand for motor vehicles and on uncertainty about the toll rate elasticity. Either of these sources of risk may throw off demand forecasts, which are usually inaccurate in the short term (three to five years) and all but useless in the long term.

Construction and operating risk. *Construction and operating risk exists because the costs of building and maintenance generally differ from projections. These risks can be large for specific infrastructures, such as tunnels.*

Policy risk. *Many private infrastructure projects are subject to policy-induced risk, which may take*

³³Based on EFG (1997e). An extensive analysis of risk allocation and valuation in PPPs appears in Irwin (2007).

two forms. Actions by different government agencies may unintentionally affect the profits of the concession. For example, a devaluation may lead to a major reduction in the concessionaire's return, especially if this firm is foreign owned and values its returns in foreign currency. Or a change in environmental standards may require additional investments. In these cases the government is not acting opportunistically, at least vis-a-vis the concessionaire, since these policies are not motivated by the desire to impinge on the profitability of the concession.

A second class of policy risks occurs when the government implements policies which affect the profitability of the concessionaire without increasing overall welfare (see Box 3.4 for an example). The government may build or expand infrastructure that competes with the concession and charge subsidized user fees, for example, or it may reduce user fees in response to political pressures.

Distinguishing between both kinds of policy risk may be difficult in practice. It is also sometimes difficult to distinguish between demand and policy risk, since many kind of policy decisions can affect demand. ■

BOX 3.2 (Demand uncertainty is very high in Chile) ³⁴

Table 4: DEMAND UNCERTAINTY IN CHILEAN TOLLROADS

	'86	'87	'88	'89	'90	'91	'92	'93	'94
Angost.:	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

Table 4 shows the increase in the number of motor vehicles paying tolls during the 1986–1995 period in three of the main tolled roads in Chile.³⁵ Since tolls remained approximately constant (in real terms) during this period, fluctuations in growth rates are due mainly to demand fluctuations. Macroeconomic risk is reflected, for example, in the fact that vehicle flows grew much faster during 1988 than during 1990. Microeconomic risk is apparent in most years: the growth of vehicle flow fluctuates considerably around the annual average from one tollbooth to another. ■

BOX 3.3 (Demand risk and the Dulles Greenway) ³⁶

³⁴Based on Engel, Fischer and Galetovic (1996).

³⁵The rates correspond to the growth in the flow of vehicles from one year to the next. For example, the vehicle flow through the Angostura tollbooth grew 8.8% between 1986 and 1987. These flows are representative, covering the three busiest highways near Santiago.

³⁶Based on Engel, Fischer and Galetovic (2006).

The Dulles Greenway is a 22 km. road joining Leesburg, Virginia, with the Western end of the Dulles toll road in the Washington DC area. When the concession was granted in the mid 1990s, two consulting companies independently forecasted a ridership of 35,000 daily vehicles if the toll was set at \$1.75. Actual traffic turned out to be 8,500 daily vehicles, partly because public pressure led the State of Virginia to widen an untolled alternative. ■

BOX 3.4 (Policy risk for Argentine utilities) *The contracts signed by the government of Argentina and foreign utility companies during the 1990s set user fees in dollars. After the crisis and devaluation of 2001, the Argentine government kept user fee values constant in local currency, which implied a reduction of two-thirds in foreign currency. ■*

A basic principle in optimal risk management is that the agent best positioned to manage a specific risk should bear this risk.³⁷ This suggests that firms should bear construction and operating risks. Regarding policy risk, it is unrealistic to have government bear the risk associated with unintended consequences of its actions. Furthermore, there is no reason why the government should bear specific policy risks. For example government often grant foreign concessionaires insurance against devaluations. Not only does this discriminate against local investors, it also discriminates against foreign firms in other sectors of the economy that must bear exchange rate risk. By contrast, the risk of “intentional” government actions can be mitigated by an appropriate contract, that explicitly rules out the most likely risk factors of this type, and by an effective conflict resolution mechanism, as described in Section 3.2. Finally, to the extent that demand risk is largely beyond the firm’s control, there is no reason why the firm should bear this risk, an idea we develop further in the following section.

3.5 The optimal contract

We have argued in favor of PPPs based on efficiency gains they promise and on their ability to provide second best solutions to various shortcomings of traditional provision. In this section we argue that the advantages of PPPs are further enhanced if they are implemented via a flexible term contract, with the property that in low demand scenarios, the contract length is longer.

What follows is an informal presentation, based on the formal results derived in Engel et al. [1997a, 2001, 2008]. The following assumptions are central to our analysis. First, the main source of uncertainty is demand uncertainty, which is assumed to be beyond the control of the concessionaire. This is a reasonable assumption for roads, but less so in other cases, such as port operations. Second, firms (or their managers) face limitations in diversifying across projects, and therefore charge a premium for the demand risk they bear. Third, all firms have identical technologies

³⁷Irwin (2007, p. 14) is more precise: each risk should be allocated to maximize project value, taking account of moral hazard, adverse selection and risk-bearing preferences.

(this simplifies our analysis but is not essential). Finally, the concession is assigned in a competitive auction.

Under the above assumptions we describe the optimal contract in various scenarios, and discuss how this contract can be implemented via a competitive auction.

3.5.1 No user fees

There are scenarios in which it is impossible to charge fees that will pay a significant fraction of the costs of the project. In that case, there are three alternatives to provide for the infrastructure. First, the government can use conventional provision. Second, it is possible to use shadow fees, where the government pays the private operator a fixed fee for each user of the infrastructure. Finally, the government can pay a fixed periodic fee, contingent on a service quality standard being met, under an availability contract. These three options have advantages and disadvantages in different environments, so the choice of contract on the characteristics of the project.

Shadow fees introduce demand risk, and this increases the risk premium included in the winning bid. Since having the firm bear this risk brings no countervailing benefit, this approach should be deprecated. The purported benefit of shadow fees is that, as they are demand dependent, they avoid white elephants. Consider, however, that a project in which all payments are made by the government is a project that should be subjected to cost benefit (social) evaluation, so the benefits of filtering white elephants are limited. For example, these benefits disappear if shadow fees are set at too high a level.

3.5.2 User fees and high demand infrastructure projects

Despite the high demand uncertainty faced by many infrastructure projects, it is often the case that eventually user fee revenue can repay the cost of the project plus a normal rate of return. The problem is that the required term of the project depends on the demand scenario. For these projects, which we refer to as ‘high demand’ projects, we argue in favor of using a present-value-of-revenue (PVR) auction to assign the PPP contract. Under this mechanism, the planner sets the discount rate and a user fee schedule, and firms bid the present value of user fee revenue they desire. The firm that makes the lowest bid wins and the contract term lasts until the winning firm collects the user fee revenue it requested.

The United Kingdom was probably the first country to use a contract that has the basic characteristics of a PVR contract. Both the Queen Elizabeth II Bridge on the Thames River and the Second Severn bridges on the Severn estuary were franchised for a variable term. Chile was the first country to use a PVR auction. In February of 1998, a franchise to improve the Santiago-Valparaíso-Viña del Mar highway was assigned in a PVR auction (see Box 4.2 for details).³⁸

³⁸On June 2008, the second PVR auction for the route 160, Tramo Tres Pinos–Coronel, was awarded for a bid of UF 7,950,000, equivalent to US\$ 272 million at January 2009 exchange rates.

A PVR contract reduces risk: When demand is lower than expected, the franchise period is longer, while the period is shorter if demand is unexpectedly high. Under the assumption that the project is profitable in the long run so that repayment eventually does occur, all demand-side risks have been eliminated. The reduction in the risk premium demanded by firms is significant compared to the case of fixed term concessions (e.g., by one third in the case considered by Engel et al. (2001)).

BOX 3.5 (First PVR Auction) *The Route 68 concession, joining Santiago with Valparaíso and Viña del Mar, was auctioned in February of 1998. It was the first road franchised with a PVR auction. The Route 68 concession contemplated major improvements and extensions of the 130 kilometer highway and the construction of three new tunnels. Five firms presented bids, one of which was disqualified on technical grounds. For the first time in the Chilean concessions program, minimum traffic guarantees were not included, but were optional and costly. The pricing of guarantees by the government was not off the mark, as can be inferred from the fact that two of the bidders chose to buy a guarantee, while the winner declined. Bidders could choose between two rates at which to discount their annual incomes: either a fixed (real) rate of 6.5% or a variable (real) rate given by the average rate of the Chilean financial system for operations between 90 and 365 days. A 4% risk premium was added to both discount rates. Three firms, including the winner, chose the option with a fixed discount rate. Somewhat surprisingly, the present value of revenue demanded by the winner turned out to be below construction and maintenance costs estimated by MOP.³⁹ One possible explanation for this outcome is that the regulator set a risk premium (and hence the discount rate) that was too high, neglecting the fact that PVR auctions substantially reduce the risk faced by the franchise holder. A return on capital in the 10–20% range is obtained if a more reasonable risk premium (in the 1–2% range) is considered.*

It is also interesting to mention that, apart from the pressure exerted by the Ministry of Finance, the main reason why MOP decided to use the PVR mechanism is that it facilitates defining a fair compensation should the ministry decide to terminate the franchise early. This feature of PVR is relevant in this case since MOP estimates that at some moment before the franchise ends, demand will have increased sufficiently to justify a substantial expansion of an alternative highway (La Dormida) that competes with some sections of Route 68. Thus, the contract of the Route 68 concession allows MOP to buy back the franchise at any moment after the twelfth year of the franchise, compensating the franchise holder with the difference between the winning bid and the revenue already cashed, minus a simple estimate of savings in maintenance and operational costs due to early termination. No such simple compensation is available if the franchise term is fixed.

PVR franchises should attract investors at lower interest rates than traditional Demsetz franchises with fixed terms.⁴⁰ Annual user fee revenues are the same under both franchises, but the

³⁹The winner bid US\$374 million while the MOP estimated costs to be US\$379 million.

⁴⁰Traditionally firms bid on the lowest toll, the shortest contract term or the lowest payment to the government. In all these cases the contract length is set before knowing demand for the road.

franchise term is variable under PVR. If demand is low, the franchise holder of a Demsetz-awarded contract may default; in contrast, a PVR concession is extended until user fee revenue equals the bid, which rules out default. Of course, under PVR, the bondholders do not know when they will be repaid, but that is less costly than not being paid at all.

PVR schemes also reduce the need for guarantees because the risk to investors is much smaller (see Box 4.2 for an example). Thus PPPs are more likely to filter white elephants under PVR contracts.

The PVR approach also reduces the likelihood of opportunistic behavior. Traditional fixed term infrastructure contracts are usually renegotiated by either extending the length of the concession, increasing user fees, providing a government transfer or combinations of these approaches. Extending the concession term with a PVR contract is not possible because, by definition, the term is variable. Increasing user fees is ineffective because it shortens the concession term without increasing overall income. Government transfers are not logically impossible under PVR but, because the PPP partner cannot claim that it will receive less user fee revenue than it expected, a government transfer would be difficult to explain to the public. Furthermore, to the extent that firms are more likely to act opportunistically under financial duress, PVR contracts reduce the incentives firms have to engage in “bad faith” renegotiations, since scenarios with losses for the firm are less likely under PVR.

PVR concessions allow franchises to be adapted to changing circumstances, which is usually difficult to achieve under standard fixed term contracts (see Boxes 3.7 and 3.8 for illustrative examples). They also allow for more flexibility in setting user fees (see Box 3.6).

BOX 3.6 (PVR, urban highways and toll flexibility) *Setting the appropriate toll for an urban highway project is a difficult problem. Unless traffic forecasters are unusually fortunate in their estimates as to the sensitivity of traffic to prices, the resulting tolls are likely to be incorrect – either so low that they create congestion or so high that the highway is underutilized. One possibility is to allow fees to respond directly to congestion, so they are never too low. The result can be monopoly pricing as in the case of the Orange County 91 Express Lanes (see Box 3.8).*

Under PVR, transit authorities can include toll flexibility in the concession contract. The guiding principle of the PVR franchise is to allow the winning bidder to collect its required present value. In order to induce the franchise holder to accept toll flexibility, however, the contract has to recognize that lower tolls not only increase the time required to earn the desired revenue, but also increase traffic and therefore increase maintenance costs. Under fixed term contracts, by contrast, no simple approach to incorporate toll flexibility exists, since the concessionaire's profits are very sensitive to variations in tolls.

Because maintenance costs are roughly proportional to road usage, the original PVR contract could be specified so that the revenue target is net of maintenance costs. With that adjustment, the only effect of a change in tolls is a change in the total operational costs over the length of the contract – costs that are predictable and represent a minor fraction of total costs. PVR franchises then allow

the transit authority to change tolls to the efficient level without harming the franchise holder. Of course, a lower limit must be set for tolls because, otherwise, the franchise holder might never obtain the revenue stipulated in the winning bid. ■

BOX 3.7 (Airport concessions in Argentina) *In 1997 the Argentine government decided to end the fixed term airport concessions in order to reactivate them under new terms. In order to do this, the government had to compensate the present franchise-holders. The former Economics minister, Domingo Cavallo, claimed publicly that some government employees, swayed by the concessionaires, had written a decree that provided a compensation of US\$400 million, while the fair compensation, in his opinion, was of the order of US\$40 million.⁴¹ No such ambiguity would be possible under a PVR contract. ■*

BOX 3.8 (The Orange County SR91 Holdup) *The California Orange County 91 express lanes concession in California is a ten-mile privately-owned toll section of the congested State Route 91, the Riverside Freeway, running from Anaheim to Riverside in California.⁴² Motorists use the express lanes to get relief from congestion, but may have to pay almost \$11 for a round trip. The concessionaire was allowed to raise tolls freely in order to relieve congestion. By early 2000, there were 33,000 daily trips on the express lanes, which were on the brink of congestion at peak time and the franchise was a financial success. Yet users were suffering enormous congestion in the freeway, and an expansion became urgent. The problem was that when the contract was signed, cash-strapped Orange County accepted a “non-compete clause” that prevented any expansion in capacity until the year 2035.*

A protracted negotiation followed. The situation became increasingly troublesome for the Orange County Transportation Authority (OCTA), which was empowered to negotiate the purchase of the tollway. Unfortunately, the value of the tollway was controversial since, strictly speaking, it should be the present value of profits from the 91 Express Lanes if the franchise continued as originally planned. Even though the lanes cost \$130MM to build, initially the company's value was set at \$274MM in a controversial (and ultimately unsuccessful) attempt at a buyout by a non-profit associated to Orange County. Years of negotiations followed, with frustrated commuters of the 91 Freeway stuck in traffic in the meantime. Finally the express lanes were bought by a government agency for \$207 million in 2003.

If the 91 Express Lanes had been a PVR franchise, finding a fair price at which to buy back the project would have been straightforward, since there is an obvious candidate for a fair buyout value

⁴¹ *El Mercurio*, February 6th, 1997, page B5.

⁴² The tolled section, which is known as the 91 Express Lanes, was built in the median of the freeway. It is separated from other traffic by a buffer zone. The 91 Express Lanes project was developed under a program authorized by the California legislature in 1989. The partnership raised \$126 million in financing from several sources, including \$65 million in variable-rate loans from Citibank and two French banks and \$35 million in a 24-year loan from Cigna.

under PVR: take whatever income (in present value) the project has generated so far, compare it to the present value of toll revenue the franchise holder asked for initially and pay the difference (minus expected maintenance and operation costs) to the owner of the franchise. Since this is what the franchise holder would have obtained if the franchise had run its course, she has no reason to complain.

■

While PVR schemes have a big advantage in terms of reduced risk, the downside is that the PPP franchise holder has few incentives to increase demand for the infrastructure project because any action that increases demand will shorten the term of the franchise. Projects earn their income regardless of efforts of the concessionaire. By contrast, demand increasing investments are more attractive under fixed term franchise. That suggests that the PVR method is applicable only in cases in which quality of service is contractible. Also, an important assumption underlying our analysis is that major investments are not needed frequently. Thus roads and port infrastructure (not operations) are natural candidates for PVR, while mobile telephony is not.

3.5.3 User fees and intermediate/low demand roads

When there exist many demand scenarios where a infrastructure project does not generate enough revenue to pay for itself, PPPs can be financed by a combination of user fees and government subsidies (where the latter refers to a variety of means by which governments transfer resources to concessionaires, including shadow user fees and guarantees). In Engel et al. (2008a) we derive the optimal contract for these projects, under the additional assumption that user fees are a more efficient way of paying the franchise holder than subsidies. Thus, we not only assume that governments raise revenues via distortionary taxes, but also that they are inefficient in transferring tax revenues to the concessionaire, either because the private sector pays a smaller overhead or because it is less corrupt and less bureaucratic.

Even when subsidies are costly, it is still feasible to provide full insurance, as in the case of the PVR contract for high demand infrastructure projects. This option, however, may not be optimal, since the savings that come from not having the firm bear any demand risk are offset by the cost of financing the firm via subsidies. The challenge is to find a contract that balances optimally demand risk, user-fee distortions and the opportunity cost of public funds. In Engel et al. (2008a) we show that such a contract combines a minimum revenue guarantee and a revenue cap. When demand realizations are low, the contract lasts indefinitely (or as long as allowed by the law) and the minimum income guarantee is binding, so that the government complements the concessionaire's income to attain the guaranteed level. By contrast, when demand is high, the revenue cap sets in and the contract ends when discounted revenue equals the cap. As in the case of a PVR contract, for high demand scenarios the franchise term is shorter when demand is higher.

The contract described above can be implemented via a competitive auction, where firms bid both on the user fee revenue cap and on the minimum income guarantee and both numbers are

combined in a simple scoring function. In the case where demand for the infrastructure project is so low that it cannot finance itself via user fees any scenario ('low demand' projects), the optimal contract provides full insurance, as in the PVR case. PPPs do not filter white elephants in this case, since the concessionaire's revenue is unrelated to demand realizations. This is not surprising, since low demand projects, by definition, are not profitable without subsidies. Thus social cost-benefit project evaluation is particularly important for these projects.

When the project can be financed via tolls in some scenarios but not in others ('intermediate demand' project), both the revenue guarantee and the revenue cap are relevant and it is optimal to have the concessionaire bear demand risk. If expected user fee revenue is large enough to pay for the upfront investment and for the risk borne by the PPP franchise holder, a PPP may help filter white elephants.

The two thresholds that characterize the optimal contract differ from the income guarantees and the revenue-sharing agreements observed in practice. Minimum income guarantees are routine in many PPPs that charge user fees. However, most real world contracts have a fixed term and therefore do not follow the prescriptions laid out above. These contracts would be closer to the optimal contract if their durations were longer in low demand states, when guarantees are paid out. Thus, real world contracts pay excessive guarantees in low demand states.

Real world revenue sharing agreements also do not coincide with the revenue cap that characterizes the optimal contract.⁴³ When governments impose revenue sharing arrangements, they split revenues in excess of a given threshold with the concessionaire in fixed proportions. By contrast, the optimal contract described above suggests terminating the contract once the cap is reached—the windfall profits tax rate should be 100%.

More generally, the rationale behind real-world guarantees and revenue sharing schemes is to reduce the risk borne by the concessionaire. By contrast, the rationale behind the optimal contract is to optimally trade off insurance on one hand, and the use of user fees and subsidies on the other. This is why the concession lasts indefinitely when subsidies (i.e., guarantees) are granted; the term is variable in high demand states; and the concessionaire's revenue in high demand states is higher than in low demand states.

3.5.4 Availability contracts

Availability contracts have become increasingly popular in many countries (e.g., France, the United Kingdom and the United States). Under these contracts, the government provides incentives to the firm to provide the service standards specified in the concession contract by making regular payments conditional on the contracted service being available.⁴⁴ These contracts are often auctioned

⁴³Profit sharing agreements should normally be avoided, since firms can (and do) use transfer pricing to inflate costs and avoid sharing profits.

⁴⁴When operational costs are significant and vary with demand, the government makes an additional payment to the concessionaire that reflects operation costs.

to the firm that demands the lowest annual availability payment. The resulting contract is equivalent to the optimal contract described above for a low demand project. Availability payments pay for the upfront investment and the concessionaire makes a normal profit on this investment regardless of demand realizations. This contract is optimal if no user fees can be charged or if user fees are insufficient to pay for the infrastructure in all demand scenarios. As mentioned above, this scheme is unable to filter white elephants, but on the other hand, the government does not need to compensate the firm for bearing risk.

3.6 Budgetary accounting

The results in the preceding section can be used to argue that, as far as the risk profile of the government's budget is concerned, PPPs are much closer to public provision than to privatization. Our starting point to derive this insight is that when thinking about the risk allocation implied by PPPs, what matters is the *intertemporal* risk profile of cash flows, not the year-to-year risk profile. This has interesting implications: for low and high demand projects, an optimal PPP contract replicates the net cash flow streams of conventional provision, state by state (see Table 5, which assumes an additive risk premium and denotes present discounted tolls by PVT and the corresponding average by $E[PVT]$). Essentially, all residual risk is transferred to the government, and the concessionaire recovers the upfront investment I in all states, as in the case of conventional provision.

Table 5: Average discounted budget: public provision vs. PPPs

	Public provision	PPP	Privatization
Upfront surplus:	$-I$	0	$E[PVT] - I - \text{Risk Premium}$
Discounted user fees:	PVT	$PVT - I$	
Total:	$PVT - I$	$PVT - I$	$E[PVT] - I - \text{Risk Premium}$

Under privatization, the project is sold for a one-time payment and all risk is transferred to the firm. Moreover, the link between the project and the public budget is permanently severed. This is not the case with a PPP, where at the margin cash flows from the project always substitute for either taxes or subsidies. The conclusion, then, is that from a public finance perspective there is a strong presumption that PPPs are analogous to conventional provision—in essence, they remain public projects, and should be treated as such.

4 PPPs in Latin America

In this section we examine the experience of highway PPPs in Argentina, Mexico, Colombia and Chile. As these country studies suggest, there are many pitfalls that weaken the arguments for PPPs

in this sector. In Colombia, investment targets have not been met, some projects were awarded but never started, and the government has paid large sums in cost overruns and traffic guarantees. In Argentina, the main problem has been that concessions were expensive for the government and for highway users. There were repeated contract renegotiations, which usually seem to favor concessionaires. It is conceivable that in some specific cases, most users ended up worse off. Chile seems to have been somewhat more successful at avoiding the major pitfalls of highway concessions, having completely renovated its road system in time at a reasonable cost. Nevertheless, contract renegotiations have been common, leading to an increase of 30% in the budget of the projects when compared with their original estimates. The regulation of concessions contracts has been lax and there are signs of future renegotiations, to the detriment of users and taxpayers.

4.1 Argentina⁴⁵

The Argentine franchise program began in 1990 and was the second major franchise program in Latin America, after Mexico's.⁴⁶ In 1989-90, the first stage of franchises, the government auctioned twelve 12-year intercity concessions (see table 6 for the main characteristics of the concessions). Traffic levels on these roads were sufficiently high (2,000 to 2,500 vehicles/day) for the private viability of maintenance, rehabilitation and capacity improvements, but were not high enough to build totally new roads (see Estache, 1999).⁴⁷ There was no toll revenue guarantee nor a profit sharing mechanism. Tolls were indexed to inflation to protect franchise holders. Service quality was measured by a quality index which was supposed to improve over the life of the concession. It was estimated that the service quality requirements would demand large investments in paving during the first few years of the franchise. Among other things, concessionaires were required to make the improvements before collecting tolls. This first round of auctions was very successful in attracting bidders, with more than a hundred bids for the simultaneous auction of the twelve franchises.⁴⁸ The most important bidding variable in this first round of auctions was the rent (or *canon*) that would be paid to the government.⁴⁹ The total amount bid in canons was US\$890 million a year in

⁴⁵The sources used for this case study are Estache, A., "Argentina's Transport: Privatization and Re-Regulation," Policy Research Working Paper 2249, Washington, DC: World Bank, 1999; Jose Luis Nicolini, "Toll Road Concessions in Argentina," Instituto de Investigaciones Económicas, Universidad de Buenos Aires, June 2001; Georgina Cipoletta Tomassian and Ricardo J. Sánchez, "Análisis del régimen de concesiones viales en Argentina", CEPAL February 2008; World Bank, Annex 1 to the World Bank Seminar on Asian Toll Development in an Era of Financial Crisis, "Financing the Road Sector in Argentina: Lessons from the Past,"

⁴⁶At this time, there are two classes of concessions. First, two remaining highway systems franchised in the 1990's, the Corredores Viales N°18 (Caminos del Uruguay) and N°29 (Caminos del Valle), with expiration dates in 2018 and 2013, respectively. Second, 6 Corredores Viales franchised in 2003 for a period of 5 years, these last consisting of almost 8,000 km of roads.

⁴⁷Tolls were set uniformly across all concessions on the basis of distance and type of vehicle. Tolls were set as multiples of the basic toll for cars of US\$1.50/100km.

⁴⁸Note however, that participation was restricted to domestic firms, and that the award process was marred by criticisms of lack of transparency, see Cipoletta and Sanchez (2008).

⁴⁹Other variables like lowest toll, highest quality or investment were also used, but only occasionally.

1990 dollars.

However, in the first instance of a pattern that was to repeat itself regularly, after only five months the government decided to renegotiate the contracts.⁵⁰ The main reason was the new policy of *convertibilidad*, which declared illegal all indexing provisions in contracts. Two further reasons to renegotiate the contracts were, first, that several concessionaires were collecting tolls before performing the investments required in their contracts, and second, the pressures by users unsatisfied with paying tolls. During a period lasting from January to April 1991, tolls were suspended until contracts were renegotiated. After the renegotiation, tolls were reduced by 50% and in exchange, the canon was eliminated. In fact, the government granted subsidies totalling US\$57 million per year to the firms.⁵¹ The program of road improvements changed. Though the road franchises became less attractive as business propositions, firms were receiving money rather than making payments. The resources for the compensations came from a trust fund created by a fuel tax.

Another round of renegotiations began in 1995, because higher than expected traffic led to congestion and the need for new investments. The government threatened to auction the expansion projects in order to force the franchise holders to accept extensions of the franchise term in exchange for the required investment.⁵² The negotiations were direct and dragged on until November 2000, except in the case of CV N°18, which signed an agreement in 1996, extending the concession until 2018. Nevertheless, at least US\$900 million in improvements agreed to in the 1995 renegotiations were not be built before the franchises ended, in 2003.⁵³

The negotiations were completed by December 2000. These specified additional government grants for the franchise holder, mainly because previous grants had not been paid. In exchange, the franchise holders agreed to some additional investment, and to a freeze in tolls until the end of the concessions. It is noteworthy that the ratio of normal expenditures (routine maintenance, exploitation, administration, and user services) to total revenues of the concessionaires averaged over the length of the franchises was 46%, with the remaining paying for the 20% of the franchised network that was reconstructed, the 35% that was repaved and profits.⁵⁴

In 1994 there was a second round of franchises for the four freeway accesses to Buenos Aires, which run down to 2018. These contracts were better designed than the interurban contracts, and franchises were awarded solely on the basis of the smallest toll, with franchise lengths of 22 years and no subsidies. The number of bidders was small, with at most two per franchise. The contracts These franchises have involved investments of around US\$ 1.7 billion, and represent 2,291

⁵⁰See World Bank (1999) or, for all the details, Cipoletta and Sanchez (2008).

⁵¹In 1992, a further renegotiation increased the government payments to US\$63 million, both extended the contracts and postponed the date of enforcement of quality standards by one year, and erased all complaints, sanctions and penalties against the concessionaires.

⁵²According to Estache (1999), who quotes the Public Works Secretary, the franchises were extremely profitable, at least until 1998, with rates of return between 26 and 38%.

⁵³One of the reasons being that not all the government payments agreed upon were not made in full, because the resources in the trust funds were directed towards other projects.

⁵⁴Nicolini 2001, using data from the Secretaría de Obras P'ublicas de Argentina.

Table 6: Characteristics of the 1990 interurban franchises, Argentina

Corridor	Road	Length in equivalent Km. (6)	Toll Tariff \$/100Km (1)	AADT (Average per Toll Station) in 2000 (4)	Provincial Location	Concessionaire	Main Firms
1 2	3 and 252 205	690 305	1,84 1,84	2649 3302	Buenos Aires Buenos Aires	SEMACAR S.A SEMACAR S.A.	Dycasa; Perales Aguiar
3	7	524	1,93	3590	Cordoba-S. Luis-Mendoza	CAMINOS DEL OESTE	Techint; Santa Maria
4	8 and 193	729	1,67	3217	Buenos Aires- Santa Fé- Cordoba-San Luis	CAMINOS DEL OESTE	
5	7	503	1,84	2770	Buenos Aires- Cordoba	NUEVAS RUTAS S.A.	Necon; Chediack
6	188	487	2,10	1409	Buenos Aires- La Pampa	COVICO U.T.E.	(2)
7	9, A012	489	3,05	10974	Buenos Aires- Santa Fe	SERVICIOS VIALES	Sideco Americana (Macri);
8	11, A009	743	1,27	1888	Santa Fe-Chaco	SERVICIOS VIALES	Lippstad SA
9	33	241	1,82	3691	Santa Fe	SERVICIOS VIALES	
10	9	497	1,89	4516	Rosario (Sta. Fe)-Cordoba	COVICENTRO S.A	Caminos Australes (Roggio);
11	34	722	1,78	2640	Santa Fe-Sant. del Estero	COVINORTE S.A	CCI (Aragon); Supercemento; Dyopsa
12	9 and 34	490	1,86	282	Santiago del Estero, Tucuman y Salta y Jujuy	CONCANOR S.A.	
13	16 and 12	954	2,17	2541	Corrientes- Chaco- Misiones	VIRGEN DE ITATI UTE	Chacofi; EAC; Nazar; Supercemento; Dyopsa
14	19	288	1,90	2617	Santa Fe y Cordoba	RUTAS DEL VALLE	Geope; Sycic; Luciano
16	226	413	1,98	2466	Buenos Aires	CAMINO DEL ABRA	Coarco S.C.A; Equimac
17	5	548	1,93	3386	Buenos Aires- La Pampa	NUEVAS RUTAS S.A.	Necon; Chediack
18	12,14,193,15, 117,13	700	2,21	n.a.	Buenos Aires- Entre Rios- Corrientes	CAMINOS DEL RIO URUGUAY	Welbers; Conevial; Babic; Codi; Eaca; Parenti Mai
20	36,38,A5	358	2,41	2474	Cordoba	RED VIAL CENTRO	Roggio; Afema; Boeto; Romero Cammisa; Arvial
Total		9681					
Average			1.97	3298 (5)			

Notes:

(1)January 2001 Toll Tariff Including 21% Value Added Tax

(2)Nordeste, Glikstein; Estructuras; Delta; Asfalsud; ICF; Enretto Bonfanti; Coemic; Guerechet

(3)Toll Station Revenue divided by the Basic Toll Rate.

(4)Of the 8860 Km network, 821 Km have two lanes per direction

Source: Nicolini, 2001.

equivalent km, and had revenues of US\$ 290 million in 2000.⁵⁵ It is interesting to note that the Buenos Aires contracts contained a *trigger clause* that limited the profit rate. In the cases in which the target profit rate was reached, either tolls would have to fall or the franchisee would have to undertake additional investments. As in the first-round franchises, contracts were amended frequently, five times since 1996, due to the trigger clause. Since these investments are not auctioned competitively, franchisees—which are owned by construction firms—chose to make additional investments, so as to avoid sharing profits with the government, keeping the extra revenue within the firm. Note that these trigger clauses may lead to inefficiencies. On the one hand, if the road generates large revenues, it is probably close to congestion so lowering tolls may be inappropriate. On the other hand, unlimited expansion due to the trigger program may lead to overcapacity or congestion at the points at which the franchised highway interconnects with the rest of the road network, as there is no coordination with the rest of the highway network.

Clearly the quality of roads improved as a result of the franchise program (Nicolini (2001), also Cipoletta and Sanchez (2008)). Intercity traffic increased from 73 million to 106 million traffic equivalent units from 1991 to 1998 (see World Bank [1999]), though it remained approximately constant between 1996 and 1999 and declined after the economic crisis of 2001. Intercity toll revenues were approximately US\$275 million a year (pre-2001 crisis), plus an additional promised US\$68 million in grants from the central government, i.e., approximately US\$ 350 million per year until the crisis (See Table 7). This is a large sum, considering that the franchises only had 821 km of two lane intercity highways. As a comparison, the budget for public expenditures in roads was only around US\$500 million of which 35% went to pay interest. Note, however, after the crisis the peso was devalued to one third of its former value, so during the last two years of the franchises, the revenue of the interurban concessions ran to about US\$ 150 million.

The Argentine experience in this first period shows the social costs that may be caused by franchise contracts that overlook important issues. For instance, since the location of the toll booths was not specified, *in some cases* the franchise holder placed them strategically so as to maximize revenue, by charging relatively high tolls to users of small sections of the franchised highway. This led to a much higher average cost per traveled kilometer than the originally anticipated rate of approximately 1.5 US cents/km, because the average trip was short but paid the full toll. In fact, it has been shown that for the average 25 km car trip, users were worse off than before the franchises.⁵⁶

Another remarkable fact is that reported operating costs of the inter-urban franchises ranged between 40 and 60% of net-of-VAT toll revenues. What is most surprising is that a large fraction, which has been estimated at around 40% of expenditures, was spent on administration and collection, and that of this fraction, more than two-thirds was spent collecting tolls. In fact, 21% of gross toll revenues were spent on administration and collection, which is similar to expenditures on maintenance. A possible explanation for these costs is that many intercity roads had low traffic

⁵⁵An exception to this story is the La Plata-Buenos Aires access, which was awarded during the 1980's, and is well behind schedule, but continues to collect tolls.

⁵⁶See World Bank (1999).

Table 7: Total revenue of Argentina interurban concessions 1990-2003, current A\$

Period	Toll revenue	Gov. Compensation	Total revenue
1(11/90-10/91)	61.915.532	17.841.259	79.756.791
2(11/91-10/92)	168.579.592	55.069.267	223.648.859
3(11/92-10/93)	207.937.218	69.998.802	277.936.020
4(11/93-10/94)	253.501.989	57.664.699	311.166.688
5(11/94-10/95)	258.125.574	74.203.689	332.329.263
6(11/95-10/96)	282.388.326	29.139.259	311.527.585
7(11/96-10/97)	316.812.644	81.467.654	398.280.298
8(11/97-10/98)	354.137.219	80.484.808	434.622.027
9(11/98-10/99)	343.811.007	86.248.220	430.059.227
10(11/99-10/00)	286.671.542	85.871.227	372.542.769
11(11/00-10/01)	246.484.285	514.145.100	760.629.385
12(11/01-10/02)	166.712.305	280.490.496	447.202.801
13(11/02-10/03)	186.633.478	278.159.155	464.792.633
TOTAL	3.133.710.711	1.710.783.635	4.844.494.346

Source: Cipoletta and Sanchez, 2008.

densities, which means that collecting tolls can be expensive. In fact, according to Nicolini (2001), routine maintenance costs, which are equivalent to US\$ 5,960/km, are also fairly high by international standards. An alternative explanation is that profits were being diverted in order to delay the application of the trigger clause that would have franchise holders share revenues with the government. This is consistent with the large gap that existed between profit rates estimated by the association of concessionaires (12.4%) and independent estimates (26–38%, see footnote 52). Note that in addition to toll revenue, we must add the annual compensations agreed to in 1997 after the tolls were reduced, which amount to 26% of total toll revenues. Recall that these franchises did not require new construction, but rather rehabilitation, maintenance and capacity improvements.

We can try to obtain rough estimates of the gross margins of the interurban concessionaires. There are estimations that investment levels for the years 1-9 of the intercity franchises were US\$1,448 million for the 9,681 km of the twelve initial concessions, or approximately US\$ 15 thousand/km/year.⁵⁷ Adding the US\$ 12.5 thousand/km/year in routine maintenance, exploitation, administration and user services, we obtain average expenditures on 27.5 thousand/km/year. We can compare these annual expenditures with average yearly revenue of US\$ 41.3 thousand/km (toll revenue of US\$ 30,5 thousand/km/year plus compensation subsidies amounting to US\$ 10,8 thousand/km/year).⁵⁸ The profitability of the franchises depends crucially, therefore, on the timing of the initial investments.

⁵⁷ Cited in “Financing the Road Sector in Argentina: Lessons from the Past”.

⁵⁸ Data from Nicolini 2001.

In October of 2003 the National Comptroller (*Auditoría General de la Nación*) published a lengthy report reviewing the main conclusions of its audits of franchised highways during the 1993-2003 period. The report provides further evidence on weak enforcement of franchise contracts. For example, the equipment needed to measure a highway's friction coefficient had been out-of-service since 1994, so that this index had not been measured for any franchised highways since then (p. 34 of the report). The rugosity index, however, has been collected by the Dirección Nacional de Vialidad (1990) and the Órgano de Control de los Corredores Viales Nacionales (later years), and it shows an improvement, going from 3.52 (1990) to 3.03 (1997 and 1998), reflecting the public perception of an improvement in road quality during the period.

More generally, highway quality immediately after construction had typically been considerably below specifications, and had often deteriorated faster than allowed by the contract specifications. Building delays had also been recurrent, while fines to which the government was entitled had seldom been collected and were eventually canceled in the 2003 auctions.

When the 1990 concessions ended in 2003 (excluding the aforementioned CVN°18 and 29), the government proceeded to reauction 17 franchises, grouping them into 6 new "Corredores Viales", representing 7,951 km of highways. Under the new scheme, concessions would last only 5 years and the firms' responsibility for the highway was limited to maintenance and operations, with all new investment financed by the government, under the aegis of the Sistema de Transporte Integrado (SIT), funded by the fuel tax. Toll were set by the government and toll revenues were pooled and then distributed according to a predetermined scheme, which was the basis for the adjudication of the franchises. Less than 1,350 km of the 7,951 km of franchised roads were assigned to previous concessionaires (Cipoletta and Sanchez, 2008). During this period road quality worsened, because lack of supervision meant that not all the necessary maintenance work was performed. The revenue of the firms was substantially lower than under the previous regime, reflecting the less ambitious character of the new scheme. Moreover, the SIT, which was supposed to use its resources (from the fuel tax fund) to finance additional investment in roads, began to use the resources to provide additional compensation to concessionaires (because of toll reductions decreed by the government), but specially to subsidize transport by buses, trains and trucks. Government inefficiency and led to delays in realized investment, which impacted the quality of the roads. Thus, for the period from the award of the franchises to October 2007, the total amount invested in the 6 Corredores Viales amounted to only A\$421 million.

Summing up, the original Argentine concessions program succeeded in providing a significant upgrade to the country's highway network. Yet this upgrade appears to have been expensive, in particular because of the incentives to pad costs in maintenance, administration and collection, and the continuous process of renegotiations that seem to have benefited concessionaires at the expense of toll users and tax payers. The failures of the original program led the Kirchner administration to move toward a hybrid system, where new projects and significant additions to capacity are financed directly by the government, with results that appear to be much worse than the original approach. Perhaps the main conclusion of this country study is the importance of stable rules

in the successful development of a franchise program.

4.2 Mexico⁵⁹

Mexico was the first country in Latin America to experiment with highway privatization. In the late 1980's, the country was successful with three demonstration projects, and this led to a program to build more than 4,000 km of toll highways in 1989, under the recently inaugurated Salinas' government. Under the scheme, the Transportation Secretariat selected roads to be offered, and specified the *maximum tolls* in real terms (**Check discrepancy between Ortiz, Bain and Carniado and WB (2003)**). The projects were to be privately financed (in contrast to the three demonstration projects), with approximately 70% of financing being provided by banks or other external sources of finance. The government provided a partial guarantee of costs and traffic projections by providing the option of concession extensions. Concessions were awarded competitively (but only to domestic firms) on the basis of the shortest concession period, which legally could not exceed 15 years.

The program appeared to be successful at first, with 52 privatized toll roads and 5,500 km of highway. The required investment amounted to approximately US\$ 13 billion, of which approximately 50% corresponded to bank credit, 29% to various public sector grants or other contributions and the remaining 30% was contributed by firms. A few years later, the program collapsed, and 20 concessions were taken over by government and incorporated into a public trust fund, the FARAC. According to Ortiz, Bain and Carniado (2008), equity holders lost perhaps US\$ 3 billion. The remaining concessions were extended by terms of, on average, 20 years, and in some cases, for much longer periods. For example, the Mexico-Toluca concession was extended from its original two years and four months to its current 42 years (Rogozinsky and Tovar (xxxx)).

The reasons for the collapse, which appears to have cost the government US\$13 billion, are multiple. First, the concession were awarded on the basis of the shortest term of the franchise, which meant that tariffs were set at the highest possible level (**See discrepancy above.**). The terms were on average shorter than ten years, which put enormous financial pressure on the projects. Second, inadequate preparatory design work and technical studies, which led to late changes in design and specifications, leading to delays and cost overruns. This was compounded by short deadlines for submissions, which led to inadequate evaluations by the private firms. Moreover, in many cases the rights of way, environmental permits and other approvals had not been obtained, creating conflicts

⁵⁹The sources of information used for this case study are: Fabiola Ortiz, Robert Bain and Santiago Carniado (2008), "A Credit Review Of Mexico's Toll Road Sector: Stable And Strong", *Standard & Poors, Infrastructure Finance*, September 2006; World Bank (2003), "Private Solutions for Infrastructure In Mexico", *A Country Framework Report*; Jaques Rogozinski and Ramiro Tovar, "Private Infrastructure Concessions: The 1989-1994 National Highway Program in Mexico", <http://ssrn.com/abstract=138273>; Amado Athie, "Public-Private Partnerships for Highways in Mexico: Federal Perspectives", Presentation of the Secretaría de Comunicaciones y Transporte, May 2007.

with communities and leading to changes in the routes.⁶⁰ Third, many of the projects were privately unfeasible due to low traffic flows and because of inadequate account of the price elasticity of demand for tolled roads, which combined with the very high tolls resulting from the bidding process, led to overestimates in traffic forecasts (on average, usage was 30% below expectations, see Ortiz, Bain and Carniado (2008)). In this context, it is important to recall that a constitutional requirement of a free alternative road increased the price elasticity for the tolled road. Fourth, the financial health of many projects was predicated on macro stability, and was devastated by the financial crisis of 1994 that led to devaluation of the Mexican peso with respect to the dollar. Finally, lack of international competition, with most participants being construction firms focussed primarily on the profits from upfront construction, and which lacked experience in the maintenance, operations and financial management (maintenance and operations was substantially more expensive than expected). Since these companies had lobbying capacity with the government, they assumed an implicit government guarantee for cost overruns and traffic prediction overestimates. In fact there was underbidding and overvaluation of costs, because when financial problems began, these led to franchise extensions. Moreover, nationalized banks were unable to monitor exaggerated construction bills (WB 2003).

The bailout that followed began by first extending the concession lengths, but this was insufficient in many cases, where traffic shortfalls or cost overruns made the projects unviable in all conditions. The peso devaluation of 1994 exacerbated these problems, and extended them to the bank system, which had extended loans to the projects. In 1997, the government assumed ownership and bank liabilities of 23 toll roads under a trust fund, the FARAC.⁶¹ FARAC operated the toll roads and lowered tolls to more realistic levels to enhance use and increase revenue, with reductions of 40% in the case of trucks. Around a quarter of the original franchises were earning reasonable rates of return, while the remainder appeared to be financially weak by 2003 (WB). In conclusion, even though the projects were built, the first wave of Mexican toll roads was a spectacular failure (Ortiz, Bain and Carniado (2008)).

The Mexican government has learnt from this painful experience, and now operates road infrastructure projects using PPPs under two modes: the New Concession Model and the PPS model. The New Concession Model is a traditional program with cost recovery based on user fees, but in which the many deficiencies of the first wave of toll roads have been corrected. The PPS model is used in the case of toll free roads or other projects in the health, education and transport sectors, and corresponds to availability contracts, in which the government pays partly on asset availability and partly on the basis of shadow tolls.

⁶⁰For example, the Cuernavaca-Acapulco toll road had cost overruns of 200% and was delayed 30 months, see Ortiz, Bain and Carniado (2008).

⁶¹According to Ortiz, Bain and Carniado (2008), there was no compensation to equity holders, who may have lost US\$ 3 Billion.

4.2.1 The New Concession Model

Under this approach, the projects are awarded to firms that meet technical, economic and legal conditions and which require the minimum subsidy for the project. The process of awarding projects is more transparent and bidders may propose changes that improve the project. The Transport Secretariat sets an average maximum toll, (AMT) but allows the firm to rebalance tolls for individual classes of vehicles. All bids must be accompanied by in-depth traffic and revenue studies, and in general the technical ability in the country for these studies has increased. There is now more competition for the projects and the bidders are usually combinations of domestic and international firms, which have knowledge and experience with managing and operating toll roads. The contracts assign the costs of overruns to the successful bidder, but changes required by the Transport Secretariat are reimbursed in full. There is a committee supervising the quality of construction work. In order to reduce uncertainty, rights of way are fully secured before awarding the project. Finally, the financial structures of the projects are designed to resist stress, and a large fraction of the financial resources are local, reducing the foreign exchange risk of the project. The new approach seems to be successful, with projects amounting to US\$1.5 billion under construction by May 2007 (Athie) and several other under progress, see table 8. There is strong competition for the projects: the Morelia-Salamanca toll road attracted 5 bidders.⁶²

4.2.2 The PPS model

Under the PPS model, the government promises to make periodic payments from the Transportation Secretariat budget, but there is some residual traffic risk in terms of shadow tolls. The Secretariat provides the conceptual design of the project and a list of requirements, and the decision criteria is the lowest net present value of annual payments. The duration of the contract is between 15 and 30 years. Table 9 summarizes the experience with highway PPS.

Mexico has developed another program, known as the Highway Asset Utilization program, under which the Secretariat assigns through a bidding process of an already existing tolled highway. The firm is responsible for maintenance and operation, and receives toll revenue in exchange. The bidding variable is the amount to be paid, and which is preassigned to build a new highway, normally (but not always) with some local affiliation to the auctioned highway. Examples of affiliation are the Reynosa Bypass and Rio Bravo Dona International Bridge, to be financed with the revenue from the auction of the Reynosa-Matamoros highway and the Reynosa-Phar International Bridge. The table 10 summarizes the state of the different approaches to PPPs in Mexico as of May 2007.

To conclude, the initial Mexican toll roads program was a case study of failure. The causes of the

⁶²Note however that all bidders were associations of Mexican firms. Interestingly, there was a tie since to firms asked for no contribution from the government. The resolution of the tie was based on the firm that offered the lowest cost of construction, according to the tender rules. This strange tie condition may be related to the memory of the implicit guarantees and cost overvaluation by contractors in the first generation of toll roads.

Table 8: Projects under construction and in progress under the New Concession Model

Project	Length (Km)	Amount (US\$ Mill)
Awarded Concessions		
Matehuala Bypass	14,2	39,6
Mexicali Bypass	41,0	73,3
Amozoc-Perote	103,0	171,6
Tepic-Villa Unión	152,0	281,1
Morelia-Salamanca	83,0	161,9
Northern Bypass of Mexico City	223,0	543,5
Tecpan Bypass	4,0	16,3
Monterrey-Salttillo and Saltillo Bypass	92,0	256,1
Bids In Progress		
Perote-Xalapa and Xalapa Bypass	60,0	247,3
Arriaga-Ocozocoautla	93,0	199,0
San Luis Río Colorado International Bridge	0,4	7,4
Reynosa-Anzaldúas International Bridge	10,0	60,1
Irapuato Bypass	29,5	57,4
Total	905,1	2114,6

Source: Athie (2007).

Table 9: Projects under PPS, under construction and bids in progress

Project	Length (Km)	Amount (US\$ mill)
Awarded Concessions		
Matehuala Bypass	14,2	39,6
Mexicali Bypass	41,0	73,3
Amozoc-Perote	103,0	171,6
Tepic-Villa Unión	152,0	281,1
Morelia-Salamanca	83,0	161,9
Northern Bypass of Mexico City	223,0	543,5
Tecpan Bypass	4,0	16,3
Monterrey-Saltillo and Saltillo Bypass	92,0	256,1
Bids In Progress		
Perote-Xalapa and Xalapa Bypass	60,0	247,3
Arriaga-Ocozocoautla	93,0	199,0
San Luis Río Colorado International Bridge	0,4	7,4
Reynosa-Anzaldúas International Bridge	10,0	60,1
Irapuato Bypass	29,5	57,4
Total	905,1	2114,6

Source Athie (2007).

Table 10: Summary of projects in progress and under preparation

Project	Concessions		PPS		Assets		Period
	Length (Km)	Amount (US\$ mill)	Length (Km)	Amount (US\$ mill)	Length (Km)	Amount (US\$ mill)	
Awarded	712,2	1543,4	213,0	269,3	–	–	Before 2007
Bids in progress	192,9	571,2	229,0	946,5	144,0	923,4	2007
Preparation	148,1	461,6	376,0	480,6	74,0	173,6	2007-2008
Others	717,5	2049,7	938,0	712,8	799,2	2156,0	2008-2011
Total	1.770,7	4.625,9	1.756,0	2.409,2	1.017,2	3.253,0	

Source: Athie (2007).

problems were the lack of serious technical and economic studies, lack of experience of successful bidders and the government, firms underbidding and assuming an implicit government guarantee, and finally, an inappropriate bidding variable. The cost to the country was very large and is not fully completed.⁶³ However, the country has learnt from the experience, and has designed a new approach to infrastructure PPPs that corrects the errors of the first generation. The new program seems to be more successful in avoiding the pitfalls of the previous experience, but time will test if this surmise holds true under more stressful conditions.

4.3 Colombia

The first generation of highway franchises, which involved investments of US\$1,076 million in 13 projects (**Check and compare with table below.**), was awarded during the mid-nineties, as seen in table 11. It is clear in retrospect that this first wave of highway PPPs had severe problems. Seven out of 13 projects were not awarded in an auction, but assigned in direct negotiations after no bidders showed up at the auction (and two projects adjudicated by auction had only one valid proposal).⁶⁴ A partial list of the additional problems detected in the first round of franchises is as follows:⁶⁵

Table 11: First generation concessions in Colombia

Project	Length	Investment (US\$ mill)
Santa Marta - Paraguachón	250 km	49
Cartagena - Barranquilla	109 km	14
Desarrollo Vial Oriente de Medellín	349 km	99
El Cortijo - La Punta - El Vino	31 km	32
Fontibón - Facatativá - Los Alpes	41 km	75
Desarrollo Vial Norte de Bogotá	48 km	87
Los Patios - La Calera - Guasca y El Salitre - Sopó - Briceño	50 km	9
Malla Vial del Meta	190 km	47
Bogotá - Cáqueza	49 km	94
Girardot - Espinal - Neiva	150 km	39
Armenia - Pereira - Manizales	219 km	131
Total	1,486km	676

⁶³See “Bumps ahead for a toll-road push”, *Los Angeles Times*, April 20, 2007, concerning the quality and cost of the Cuernavaca-Acapulco Autopista del Sol.

⁶⁴In addition, many projects started out late due to lack of financing. In fact, by 1999, one project awarded in 1995 and one awarded in 1996 had still not obtained financing.

⁶⁵From “Evaluación de las Concesiones Viales,” Contraloría General de la República de Colombia, 2001.

1. Invías did not define the definite route of the roads in detail.⁶⁶ This meant that Invías was unable to expropriate the required land in time and led to construction delays.
2. The auction process was short and Invías had no international “road shows” to attract international bidders. This meant that most auctions had no bidders and most projects were handed to Colombian firms directly.
3. Projects were franchised on the basis of feasibility studies, before the final project was defined. Moreover, traffic studies were preliminary.
4. Invías did not assess the financial health of bidders. Some winners (or firms that negotiated directly with Invías) could not obtain financing, which led to delays.⁶⁷
5. Contracts were incomplete: there were no conflict resolution mechanisms, nor rules for payment of guarantees, or *step-in* procedures for possession of the franchise by lenders.

Because of these shortcomings, the first round of franchises was plagued by contract renegotiations, delays, large payments for traffic and cost guarantees, and cost overruns in plot expropriations. On average, traffic was 40% lower than predicted by Invías, while costs were 40% above their contracted values. More than 40% of cost overruns were due to higher expropriation costs.⁶⁸ A further 58% of cost overruns were due to design changes and the inclusion of additional features to the project. In addition, there were compensations for toll revenue below guaranteed levels, adding in total to US\$ 133.8 million (2203 dollars), representing 25,3% of the initial investments of US\$ 529.7 million (M. C’ardenas 2003).

In the second generation of franchises, some of the errors of the first generation were avoided, since the projects were more fully developed before tendering, traffic demand was studied more carefully, and the rights of way and environmental permits were the responsibility of the government, and in some cases were obtained before tendering. The second round of franchises included only two projects, for a total of US\$ 504 million and 1041 km. Unfortunately, the first project was canceled due to breach of contract, while the second was late (in part because of problems with rights of way) and financially weak. It is interesting to note that, in contrast to the first round, variable franchise terms were used. The franchise ends when a predetermined level of accumulated revenue is collected. This is similar to the PVR mechanism discussed above, yet without discounting revenue flows, which means that some of the incentives to renegotiate remain, since the franchise owner bears more risk than under a standard PVR franchise.

⁶⁶Invías is the Spanish acronym for Instituto Nacional de Vías, the government agency responsible for highways of national importance.

⁶⁷Despite this difficulty, the average delay of the first round franchises was 17 months, against the average of 3.5 years for similar government projects. Hidalgo, Darío. “Los impactos en las concesiones viales en Colombia: Vamos por buen camino?”, *Estrategia*, June 30, 1997, cited in Pérez and Yovanovich, “Información Sectorial Sector Carreteras”, Corporación Financiera del Valle S.A., February 1999.

⁶⁸Note that there were construction cost guarantees offered by the government.

Currently, Colombia is in its third generation of highway concessions. The differences between the second and third generations are fairly small, at least given the focus of this paper. First, there is the introduction of the concept of *graduality*, which implies that projects are adapted and expanded –within the scope of the contract– as demand for the road increases. Clearly, the lack of competition for these required additional investments can be very profitable to the concessionaire. Second, the adjudication system is simpler, since the main bidding variable is the level of accumulated toll revenues.⁶⁹ As of June 2008, there were 10 concessions awarded under the new scheme. The characteristics of the Colombian concessions are given in table 12.

Table 12: Characteristics of Colombian concessions as of 2004

Project	Km		
	Construction	Rehabilitation	Maintenance
Armenia - Pereira - Manizales	66,4	110	219
Bogotá - Villavicencio	9,2	16,3	86
Bogotá(Puente El Cortijo) - Siberia - La Punta - El Vino	15	31	31
Carreteras Nacionales del Meta	2,8	180,9	190
Cartagena - Barranquilla	0	63	109
Desarrollo Vial del Norte de Bogotá	46	48	48
Desarrollo Vial Oriente de Medellín y Valle de Rionegro	45,7	168,4	349,1
Fontibón - Facatativa - Los Alpes	20	41	41
Los Patios - La Calera - Guasca y El Salitre - Sopo - Briceño	0	50	50
Neiva - Espinal - Girardot	11,2	138,8	150
Santa Marta - Riohacha - Paraguachón	0	170	250
Malla Vial del Valle del Cauca y Cauca	110,3	293,5	403,8
Briceño - Tunja - Sogamoso	31,2	189	203,8
Zipaquirá - Palenque	7	370	377
Bogotá - Girardot	121	87,75	121
TOTAL	485,8	1957,65	2628,7

Source: INCO June 2004.

Any fair evaluation of Colombian highway franchises, however, must consider that the benchmark should not be perfection but rather the experience with government-mandated construction. Even though concession contracts were renegotiated, and in many cases projects were delayed, the average delay was about two years less than before the program. Similarly, most concession contracts had cost overruns, yet the amount of the cost overruns were only about one third of the amounts under government mandated construction.

Summing up, the main shortcomings of the Colombian approach to highway PPPs have two origins. First, lack of experience with auctions and undue haste in preparing the first round of auctions. Haste led to constant changes in the projects, which increased costs. The lack of experience shows in not having promoted competitive auctions via “road shows”, which led to auctions with few bidders. Another facet of inexperience is the lack of concern for financial guarantees, with no penalties for firms that could not finance the project.

⁶⁹This is similar to PVR for the case of an infinitely patient firm.

A second source of problems has been the inattention to incentives, which coupled with traffic and construction guarantees, meant large contingent claims on the Colombian government.⁷⁰ The current generation of franchises seem to have improved on some of the more obvious mistakes of the past, but we believe that the use of total revenue instead of discounted total revenue as a bidding variable is a mistake, and that the concept of graduality provides the wrong incentives to concession owners.

4.4 Chile

Chile has, by now, a mature and successful highway concession system, specially when compared to the countries described above. Nevertheless, there have been problems, the major one being the magnitude and generality of renegotiations of the original contracts (see table 13).

4.4.1 History of the Chilean franchise system

In 1991 the Chilean congress passed a law that allows the government to concession most public works, including roads, seaports, airports, reservoirs, hospitals and jails.⁷¹ By the end of 2007, all main highways, most airports and several other projects had been concessioned. The total cumulative investment in 50 concessions awarded by the Ministry of Public Works (MOP), which is summarized in Table 13, is about US\$11,3 billion, about 10% of current Chilean GDP.⁷² Around 88% of that amount has been invested in highways.

Concessions must be awarded in competitive auctions open to any firm, national or foreign. The law is quite flexible, leaving ample room to adapt the contract to each project. For example, the tendering variables can include user fees, a subsidy from the state, the term of the concession, income guaranteed by the state, revenue paid by the franchise holder to the state for preexisting infrastructure, risk assumed by the bidder during the construction or operation stages, quality of the technical offer, fraction of revenue (beyond a certain threshold) shared with the state (or users), and total income from the concession.

The usual procedure to finance a concession involves several stages. To begin, bidders must offer bonds (*bonos de garantía*) that can be called in by the government if the bidder cannot finance the project. Moreover, similar bonds are callable if construction targets are not achieved by predetermined dates or quality maintenance standards are not met. Once the concession is awarded, banks lend money for construction of the road. The law stipulates that banks are the only financial institutions that may lend to finance construction. Last, a construction is completed, the concessionaire can issue bonds backed by toll revenues (securitization). These coupon bonds are usually

⁷⁰The Colombian government has put a lot of conceptual effort into valuing the contingent guarantees it offered in the franchises, but less effort has been spent improving incentives, and avoiding renegotiation of contracts and financial arrangements.

⁷¹DFL 164 and DS 240, 1991.

⁷²This figure does not include seaports, which are concessioned in a separate program.

Table 13: Main characteristics of the Chilean PPP system(UF)

	Budgeted cost	Total renegotiated value	Total Investment	Fraction of total	Number of works	Fraction of total	Average length of franchise
Ruta 5	71.885.711	20.544.456	92.430.167	0,33	8	0,16	23,8
Interurban highways	52.951.424	10.453.407	63.404.831	0,22	13	0,26	27,7
Urban highways	60.613.607	33.288.928	93.902.535	0,33	5	0,1	31,6
Highways	185.450.742	64.286.791	249.737.533	0,88	26	0,52	27,3
Airports	8.798.114	1.202.048	10.000.162	0,04	10	0,2	13,1
Jails	7.414.824	2.661.785	10.076.609	0,04	3	0,06	22,5
Reservoirs	4.131.579	413.094	4.544.673	0,02	2	0,04	27,5
Transantiago	4.884.764	645.599	5.530.363	0,02	5	0,1	15,8
Public Infrastructure	4.243.082	24,153	4.267.235	0,02	4	0,08	23,2
Other concessions	29.472.363	4.946.679	34.419.042	0,12	24	0,48	18,8
Total or average	214.923.105	69.233.470	284.156.575	1	50	1	22,7

Source: EFGH 2008.

Note: Currently, 1UF=US\$ 40.

bought by private pension funds and insurance companies. The law stipulates that the franchise owner cannot securitize more than 70% of the debt in order to induce good behavior in the maintenance and operational phase of the franchise.

The law states that the concessionaire must build the project within the time limits established in the contract, providing thereafter an uninterrupted service of a quality consistent with the terms of his bid. MOP supervises the construction and operation of the project, and is allowed to fine, suspend or even terminate the concession should the franchise holder fail to meet his obligations. The law also establishes a dispute resolution mechanism to review conflicts between the state and the concessionaire.

Highway concessions 26 highways were concessioned between 1993 and 2007 (Table 13), involving investments of about US\$10 billion. Projects can be classified into three groups:

- The Pan-American Highway (Ruta 5), which runs from La Serena in the North to Puerto Montt in the South, which was divided into 8 double lane segments and extends over approximately 1,500 kilometers.
- 13 interurban highways. They include some that join Santiago with nearby cities (Los Andes, San Antonio, Valparaíso), and a number of local roads (e.g., Camino de la Madera, Nogales-Puchuncaví, Acceso Norte a Concepción);
- Five urban highways in Santiago

The program was launched in 1993 with the 23-year long El Melón tunnel concession. The auction was unnecessarily complex (see Box 4.1), but this can be forgiven as the initial test of a new

system.

BOX 4.1 (The First Chilean Concession) *The auction mechanism used for El Melón tunnel was unnecessarily complex. Firms bid on a weighted average of seven variables: annual subsidy by or payment to the state, toll level and structure (composed by six different tolls, with different weights for different classes of vehicles), term of the franchise, minimum income guarantee, degree of construction risk borne by the franchise holder, score on the basis of additional services, and CPI adjustment formula. While only two of these variables (toll rate structure and payment to the state) were given weights that would have an effect on the final outcome, the result of the tender was unexpected. Four firms presented bids for the franchise and they all demanded the maximum toll and franchise term allowed by the auction. The selection was decided solely based upon the annual payment to the state. This outcome was inefficient, since a lower toll and a smaller annual payment to the state would have been better. Apparently, the weights on the toll rate variable were set incorrectly. Another surprise was that the winner outbid the second-highest bid by almost a factor of three.*

Subsequently MOP experimented with other tendering mechanisms. For example, the Acceso Norte to Concepción, the Nogales-Puchuncaví Road, and the Santiago-San Antonio (Ruta 78) highways were awarded to the firm bidding the lowest toll. By contrast, most segments of the Pan American highway were auctioned using a mechanism that made firms compete first on tolls and then, when a lower bound was reached, on either the shortest franchise term or a yearly payment to the state (which was described as a “payment for preexisting infrastructure”) since the government wanted similar tolls per kilometer in all of the Pan-American highway. Moreover, some segments, which were thought to be privately unprofitable, were awarded subsidies, which were supposed to be similar to the amounts collected as payments for existing infrastructure. The highway that joins Santiago with Valparaíso and Viña del Mar in the coast was the first that awarded with a PVR auction (during 2008, several additional projects were awarded using a PVR auction). Most tenders were reasonably competitive, because with few exceptions, the number of bidders was between three and six.

BOX 4.2 (First PVR Auction) *The Route 68 concession, joining Santiago with Valparaíso and Viña del Mar, was auctioned in February of 1998. It was the first road franchised with a PVR auction.⁷³ Under this scheme, the regulator fixes user fees and announces a discount rate, and the franchise is awarded to the firm that bids the least present value of toll revenue.⁷⁴ The franchise ends when the*

⁷³Even though firms did not bid on the present value of revenue, the franchise contract underlying the building of the Queen Elizabeth II bridge, tendered in 1987 in the UK, is similar to the PVR franchise. In a series of papers, beginning with Engel et al. (1996), we highlighted the advantages of this approach and formally derived many of its properties, including scenarios where it is the best possible auction mechanism (see Engel et al. [2001]).

⁷⁴The discount rate should be a good estimate of the costs of funds faced by franchise holders and could be variable (such as LIBOR plus some fixed risk premium).

present value of toll revenue is equal to the winning bid. By letting the franchise length depend on demand realizations, PVR auctions reduce risk born by the franchise holder substantially.⁷⁵ This should lower the demand for traffic guarantees. The Route 68 concession contemplated major improvements and extensions of the 130 kilometer highway and the construction of three new tunnels. Five firms presented bids, one of which was disqualified on technical grounds. For the first time in the Chilean concessions program, minimum traffic guarantees were not included for free, but instead were optional and at a cost. That the pricing of guarantees by the government was not way off the mark can be inferred from the fact that two of the bidders chose to buy a guarantee, while the winner declined. Bidders could choose between two rates to discount their annual incomes: either a fixed (real) rate of 6.5% or a variable (real) rate given by the average rate of the Chilean financial system for operations between 90 and 365 days. A 4% risk premium was added to both discount rates. Three firms, including the winner, chose the option with a fixed discount rate. Somewhat surprisingly, the present value of revenue demanded by the winner turned out to be below construction and maintenance costs estimated by MOP.⁷⁶ One possible explanation for this outcome is that the regulator set a risk premium (and hence the discount rate) that was too high, neglecting the fact that PVR auctions substantially reduce the risk faced by the franchise holder. A return on capital in the 10–20% range is obtained if a more reasonable risk premium (in the 1–2% range) is considered.

It is also interesting to mention that, apart from the pressure exerted by the Ministry of Finance, the main reason why MOP decided to use the PVR mechanism is that it facilitates defining a fair compensation should the ministry decide to terminate the franchise early. This feature of PVR is relevant in this case since MOP estimates that at some moment before the franchise ends, demand will have increased sufficiently to justify a substantial expansion of an alternative highway (La Dormida) that competes with some sections of Route 68. Thus, the contract of the Route 68 concession allows MOP to buy back the franchise at any moment after the twelfth year of the franchise, compensating the franchise holder with the difference between the winning bid and the revenue already cashed, minus a simple estimate of savings in maintenance and operational costs due to early termination. No such simple compensation is available if the franchise term is fixed.

The particulars of concession contracts vary, but they also share common features. Fifteen out of the 26 highway concessions have been awarded with subsidies and all of them received minimum income guarantees. Thus, direct and contingent subsidies are almost a given when it comes to highways. At the same time, 22 highway contracts include revenue sharing between the state and the concessionaire.

One of the main virtues of the Chilean concessions program is that legislation has been effective at dispelling fears of expropriation. An important part of the credit rests with the reforms implemented in Chile since the mid-seventies which considerably strengthened property rights. Perhaps

⁷⁵Associated welfare gains can be considerable. Engel et al. (2001) show that with parameters typical for developing countries, welfare gains are of the order of 30% of the investment in the highway.

⁷⁶The winner bid US\$374 million while the MOP estimated costs to be US\$379 million.

the most evident indicator that there is little fear of expropriation is that concessionaires have been quite happy with the “build now, regulate later” approach followed by MOP—so far there is no independent regulator of concessions, an idea that the industry has vigorously opposed. Another merit of the Concessions Law is that it specifies that all concessions must be awarded in competitive auctions, open to foreign firms. This proviso limits the scope for regulatory capture and outright corruption.

One of the main shortcomings of the Chilean concessions program, however, is the lack of an external regulatory framework. MOP has been in charge of designing, implementing, supervising and renegotiating contracts. Each project has been designed independently and its rules are defined by the specific contract. The tension between the pressures for the success of a concessions program measured in terms of construction and the enforcement of contracts is evident. MOP, as most sectoral ministries under similar circumstances, has opted for development over regulation. Moreover, because MOP renegotiates the contracts it has awarded, it has incentives and the opportunity of covering up its mistakes. (For an example, see Box 4.3 which describes the case of Tribasa.)

BOX 4.3 (MOP as contract supervisor) *Tribasa, a large infrastructure company, had been an important participant in the first stage in Mexico’s franchise program. At the time, it was saved from bankruptcy by the Mexican government. Notwithstanding that experience, it became an important and aggressive participant in the initial stages of Chile’s infrastructure program and was awarded three major franchises: Acceso Norte a Concepción, Chillán-Collipulli and Santiago-Los Vilos (which had complementary contracts worth almost 50% of the original project).*

After completing the Acceso Norte a Concepción it ran into liquidity problems and sold Chillán-Collipulli in July 1999. Moreover, Acceso Norte a Concepción has been plagued by unconfirmed rumors of deficient construction and supervisors of the projects at MOP are under investigation. In the year 2000, Tribasa was late in completing the stages of the Santiago-Los Vilos section of the Pan American highway. Surprisingly, MOP was willing to allow the delays to accumulate without collecting the guarantees Tribasa had posted.⁷⁷ Eventually, public pressure forced MOP to acknowledge there was a breach of contract. The franchise was transferred from Tribasa to another concessionaire without a formal auction procedure.

There is also evidence that MOP has been lax in enforcing concession contracts. For example, a report issued by the National Comptroller (*Contraloría General de la República*) in October of 2002 concludes that the ministry relies solely on traffic data provided by franchise owners, having neglected to set up independent procedures to collect this information.⁷⁸ This is worrisome, since government guarantees are triggered by low traffic flows, so that firms have incentives to underreport traffic.⁷⁹

⁷⁷At the time Tribasa was filing for bankruptcy in Mexico, and later went bankrupt in Chile as well.

⁷⁸“Contraloría critica sistema de control de concesiones”, *La Tercera*, April 22, 2003.

⁷⁹Moreover, in the case of Route 68, the concession length is inversely related to traffic flows.

Finally, MOP has probably auctioned projects with low social returns. Chile has had a social evaluation program of government financed projects for more than three decades. This procedure, which is performed by the Ministry of Planning, ranks projects according to their social return and screens projects with low returns. On occasion, MOP seems to have subverted this procedure, by removing the least cost-effective parts of the projects submitted to the Planning Ministry. The omitted components were reincorporated after the approval and adjudication of the project, via so-called *complementary contracts* with the franchise holder, which are negotiated in private.⁸⁰ MOP has often mentioned that it has estimated the expected outlays generated by traffic guarantees, but these estimates have never been made public. In those cases in which subsidies have been provided, the social project evaluations that justify the subsidies have not been made public either.

It has been fortunate that MOP's objective of attracting bidders conflicted with those of the Ministry of Finance, which is responsible for the budgetary process. This has forced a more independent evaluation of the toll road program. Indeed, press reports suggest that on more than one occasion the Ministry of Finance successfully stopped MOP from offering particularly generous government guarantees to franchise holders. The Ministry of Finance worries that the budget will be affected if guarantees become effective. More generally, however, MOP can transfer rents to franchise owners via favorable regulations. These transfers are unlikely to worry the Ministry of Finance if the budget is not affected.

Table 14: Renegotiations and total investment in PPPs in Chile (UF)

	Budgeted investment (Technical offer)	Bilateral renegotiation	Conciliations and arbitration	Total renegoti- ated	Total invest- ment	Renegotiation as fraction of budgeted	Renegotiation as frac- tion of investment
Ruta 5	71.885.711	15.866.047	4.678.409	20.544.456	92.430.167	0,29	0,22
Interurban roads	52.951.424	6.972.069	3.481.338	10.453.407	63.404.831	0,2	0,16
Autopistas urbanas	60.613.607	33.288.928	0	33.288.928	93.902.535	0,55	0,35
Highways	185.450.742	56.127.044	8.159.747	64.286.791	249.737.533	0,35	0,26
Airports	8.798.114	1.139.836	62.212	1.202.048	10.000.162	0,14	0,12
Jails	7.414.824	0	2.661.785	2.661.785	10.076.609	0,36	0,26
Reservoirs	4.131.579	197.212	215.882	413.094	4.544.673	0,1	0,09
Transantiago	4.884.764	0	645.599	645.599	5.530.363	0,13	0,12
Public Infrastructure	4.243.082	24.153	0	24.153	4.267.235	0,01	0,01
Other concessions	29.472.363	1.361.201	3.585.478	4.946.679	34.419.042	0,17	0,14
Total or average	214.923.105	57.488.245	11.745.225	69.233.470	284.156.575	0,32	0,24

Source: EFGH 2008.

Note: Currently, 1UF=US\$ 40.

Renegotiation of concession contracts During the early years of the franchise program, the government avoided renegotiations even in those cases in which they would have increased welfare, as in the case of the El Melón Tunnel, perhaps to build a reputation for not renegotiating (see

⁸⁰See "Informe de la U. de Chile revela suerte de embaucamiento del MOP a Mideplan," *La Segunda*, May 13, 2003.

Box 4.4) Indeed, renegotiations were limited until 2001. Substantial amounts were renegotiated in 2001, 2003, 2005 and 2007. As of the end of 2007, the 50 concessions that MOP awarded between 1993 and 2007 had been renegotiated 144 times, averaging 2.9 per concession. Highways tend to be renegotiated more. The 26 concessions have been renegotiated 109 times, 4.2 per concession. Most renegotiations have led either to increase the payments received by the concessionaire for the original project or to upgrades to the original project.

Renegotiations can be either bilateral or under the supervision of a commission set up to adjudicate disputes. In a bilateral renegotiation MOP and the concessionaire reach an agreement which is not revised by an independent third party. If, on the other hand, the parties fail to agree, they can appeal to a commission which first tries to conciliate and then arbitrates. A little above half of all renegotiations (74 out of 144) have been bilateral. Nevertheless, as can be deduced from Table 14, about 83% of the additional amounts conceded to concessionaires have been granted after a bilateral renegotiation, hence without external scrutiny (see Box 4.4 for an example). Almost all bilateral renegotiations have been initiated by MOP and occurred before the project was completed. By contrast, most renegotiations with a commission have adjudicated conflicts that have occurred after the project was completed.

BOX 4.4 (Renegotiation without supervision by third parties) *After signing the concession contract for Route 78, MOP required additional works that were not included in the original contract. The franchise holder asked for a compensation for the additional construction and the ministry decided to increase tolls by 18.1% during a five year period. No further explanation was given (public opinion learned of the agreement only after it was signed), and the calculations that led to the compensation were not made public.⁸¹*

The amounts renegotiated are substantial. As can be deduced from Table 14, of the US\$11.3 billion invested in 50 concessions, US\$ 2.7 billion were added after a renegotiation. Of these, at least US\$ 1,4 billion were additional works. In other words, about one in every four dollars invested has been added after the contract was awarded. Alternatively, the total amount invested has been increased by about one-third after contract award.

There are several means to increase the concessionaire's revenues or compensate him for additional works, among them direct payments from the government, tariff increases and term extensions. Nevertheless, the most used form of compensation is a direct payment from the government—almost 70% of the total amount renegotiated. This does not mean an immediate impact on the public budget, however. Indeed, two thirds of these direct payments will be paid by future administrations.

⁸¹See “Estado compensará a privados por concesión”, *El Mercurio*, July 15, 1997, page C8.

5 Conclusion

This paper asks *when* and *how* a government should use PPPs to provide specific infrastructure projects. This conclusion we synthesize our answers.

The defining characteristics of a PPP are three: bundled provision of construction and operation; private but temporary ownership of assets; and substantial intertemporal risk bearing by the public sector. On the one hand, this organizational form is akin to privatization: ownership and control over operational decisions rests to a great extent in the private firm and the cash flow generated by the project accrues to the concessionaire. On the other hand, temporary and state contingent ownership implies that a PPP is akin to conventional provision. In fact, most of the project's intertemporal risk should be borne by the government and then the impact on the intertemporal public budget resembles conventional provision. Therefore a PPP will be the adequate organizational form when its three defining characteristics induce a more efficient resource allocation than permanent privatization or conventional unbundled conventional provision.

A straightforward but important implication is that infrastructure should be privatized and liberalized whenever competition is feasible. A PPP (or any other means of infrastructure provision) should be considered only when increasing returns or the inability to charge consumers prevent competition and its case rests almost exclusively on efficiency. Indeed, we have shown that the argument in favor of PPPs cannot rest on the usual claim that they relieve the public budget, even when all the revenue received by the concessionaire comes from user fees.

When is a PPP more efficient? In general, bundling induces the concessionaire to partially internalize life-cycle costs. Private ownership, however, stimulates cost-cutting investments to the full extent, because the concessionaire receives all the benefits of investments that reduce life-cycle costs. Thus, when the main concern is to provide strong incentives to reduce or control life-cycle costs, a PPP is superior to conventional unbundled provision. Nevertheless, even here the case for a PPP is not clear cut, because regulated privatization provides even stronger incentives. Additional characteristics of the infrastructure project will then determine which mechanism is better. For example, if demand risk is largely exogenous and there is a large upfront investment, a PPP provides for (i) an auction of the project, (ii) a better distribution of risk, and (iii) the government keeps the planning authority. This may be useful, for example, when managing a network of highways. On the other hand, if continuous reinvestment and expansion is a feature of the infrastructure, as in a water utility or an electricity distributor, privatization may be a better idea, for a PPP would require continuous bargaining and recontracting.

But investments may also affect the quality of service. When quality of service is the main concern and objective standards cannot be enforced, the case for a PPP weakens because a concessionaire ignores consumer surplus when investing. Even worse, some investments that reduce life cycle costs may also deteriorate quality of service. In that case, conventional provision allows some internalization of consumer surplus and generally beats a PPP.

Assuming that a PPP is the most efficient way for providing a given infrastructure, how should

the contract be structured? We provide conditions under which the optimal contract features a minimum revenue guarantee (a state contingent subsidy) and a revenue cap. Revenue caps and especially minimum revenue guarantees have been extensively used in PPPs, but the optimal contract is quite different from the contracts observed in the real world. In practice, most concessions are fixed term, e.g. 30 years. In the optimal PPP contract, the concession should last as long as possible in those states where the the firm receives guarantee payments, and the term should be finite and variable in states in which the revenue cap is binding.

The logic behind the optimal contract is as follows. Bundling implies that PPP contracts are intertemporal by definition. If the government can bear risk at a lower cost, then it pays to reduce the risk born by the concessionaire, through a minimum revenue guarantee in low-demand states and/or through a revenue cap and variable-term concession in high-demand states. Nevertheless, if subsidy finance is more expensive at the margin than user fees because the government spends inefficiently, then it pays to minimize subsidies and finance as much as possible with user fees. Hence, in low-demand states where subsidies are paid, the concession must last as long as possible, while in high-demand states the concession should last a finite and variable term, to balance the cost of risk against the cost of subsidies. Finally, if all states are high demand, the optimal concession term is variable and finite, and the concessionaire receives full insurance. If, on the other hand, all states have low demand, the concessionaire also receives full insurance, but this requires subsidies in all states. In both cases, as the concessionaire faces no risk, the impact of the project on the intertemporal budget is the same as with conventional provision.

Thus a PPP shares some characteristics of privatization and of public, conventional provision. Regarding ownership and incentives to invest, a PPP is similar to standard regulated privatization. But on the fiscal side and risk bearing, it is similar to public conventional provision.

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