

# Managing the Fiscal Risks Wrought by PPPs

## A Simple Framework and Some Lessons from Chile

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## Abstract

Public-private partnerships are used to procure public infrastructure. Despite involving private investors and concessionaires, they impact the public budget like traditional provision and create fiscal risks. This paper develops a conceptual framework to assess whether and how public-private partnerships shift risks to concessionaires and financiers. It uses this framework to describe and assess the Chilean public-private partnerships program. The paper identifies renegotiations as the major source of fiscal risk, which involved additional investments, increasing the cost by about one-third over the original project cost estimates. The 2010 law reform on public-private partnerships introduced changes to the renegotiations regime and began the

routine use of variable term contracts. Using contractual data, the analysis finds evidence suggesting that renegotiations fell dramatically. The paper also calculates the realized internal rates of return for 50 highway and airport public-private partnerships, using cash flow data for the entire public-private partnerships program, which started in 1991. The average internal rate of return is 6.8 percent, with averages of 9.1 and 3.1 percent for fixed and variable term public-private partnerships, respectively. The returns show a large dispersion, which suggests that infrastructure projects are intrinsically risky and private participation entails significant risk shifting from the budget to concessionaires and financiers.

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# Managing the Fiscal Risks Wrought by PPPs: A Simple Framework and Some Lessons from Chile<sup>1</sup>

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## 1. Introduction

One of the main tasks of governments is to procure public infrastructure ---e.g., roads, seaports, airports, hospitals, and jails. During the last decades, public-private partnerships (PPPs) have emerged as an alternative to traditional provision in the procurement of public infrastructure.<sup>2</sup>

Under a PPP, various activities are bundled into a single contract: in general, the private party finances, builds, operates, and maintains the project.<sup>3</sup> The contract term is long, usually between 20 and 40 years, and the facility reverts to the government when the contract ends. At that time, the government can take over the management of the infrastructure or it can initiate a new PPP, perhaps involving additional investments and the revamping of the existing infrastructure.

PPPs are funded by a combination of user fees and fiscal transfers, and the chosen method depends on public policies and priorities. For example, a road in high demand can be funded entirely with tolls, while budget transfers are usually the main funding source for schools and hospital PPPs. On the other hand, PPPs are financed by a combination of debt and concessionaire equity.<sup>4</sup>

PPPs are used to procure public infrastructure. Thus, even though private parties undertake and finance the projects, they impact public budgets and fiscal risks. The purpose of this paper is to explain how PPPs may create fiscal risks and how these risks should be allocated and accounted.

The term “fiscal risk” can be used to mean at least two different things. In one interpretation, it is a factor that affects the distribution of public revenues and expenditures. Another, rather different but complementary way of defining the term, is to call “fiscal risk” a liability that is not accounted for in the public budget. When these liabilities unexpectedly emerge, they usually stress government finances.

Our starting point is the observation that the effect of an infrastructure project on the risk borne by the economy as a whole does not depend on the way savings are mobilized. To a first approximation, the effects are the same whether the project is procured as a PPP or in the traditional way. Nevertheless, whereas in public projects savings are mobilized through public debt and the fiscal budget, with little direct involvement of financiers, PPPs directly involve private investors and financiers in the project. For this reason, PPPs in principle shift risks to private parties---the concessionaire and debt holders---and away from the public budget.

From a positive perspective, we develop a simple conceptual framework to assess whether and how PPPs shift risks to private parties. Thus, in section 2 we explain how fiscal risks emerge when public projects are financed by the private sector in exchange for a stream of future payments from either the public budget or from user fees. We develop a simple taxonomy that relates contract form with risks assumed by the three parties involved in a PPP, i.e., the private concessionaire and its financiers; the budget; and users of the infrastructure. A key result is that user fee funding impacts the budget in the same way as public funding because the government

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<sup>2</sup> Under traditional provision projects are procured and executed by an agency of the government, which is also in charge of managing and maintaining it.

<sup>3</sup> We call a PPP any arrangement in which a private firm provides public infrastructure. Sometimes, particularly in France, the term “PPP” is reserved for projects which are funded with government transfers, while projects funded with user fees are called “concessions”. We do not make the distinction and denote all projects with private participation “PPPs.” Moreover, we often denote the holder of the PPP contract as “the concessionaire”.

<sup>4</sup> A key distinction in a PPP, and a source of much confusion, is between financing and funding. Financing mobilizes savings, allows the concessionaire to pay for the infrastructure upfront and repay debt and equity holders over time. Funding is what generates revenue for the PPP and allows investors in the PPP---debt and equity holders--- to get repaid over time. See Fay et al (2021) for an insightful discussion of the distinction.

relinquishes the opportunity to collect the user fees. It follows that PPP investments should be treated in the budget just as public investment, and that the obligations with the concessionaire should be recorded as debt. Repayments of the debt with budget appropriations or relinquished user fees should also be accounted for in the yearly budget.

In practice, however, fiscal rules treat PPPs differently. The cost of the projects is not accounted as public investment in the budget, nor is the debt with the concessionaire recorded, even though often project revenues are guaranteed by the government. These guarantees may be explicit, in the form of direct payments under so called availability contracts, or by granting debt and minimum revenue guarantees. They may also be implicit, operating through renegotiations of the original contract if revenues turn out to be lower than expected or if costs escalate. In these last two cases, there is no real allocation of risk to the to the private party. Moreover, poor accounting practices compound the problem by hiding fiscal risks, which emerge when the explicit or implicit guarantee is called.

Our conceptual framework also provides some normative guidance. We show that private finance of public infrastructure neither enlarges the set of projects that the economy can undertake, nor does it free public funds. Consequently, any potential benefits to society from PPPs are related to improvements in efficiency, which in turn rely on the proper allocation of endogenous and exogenous risks. Basic principles from incentive theory, and some characteristics of PPPs, suggests that concessionaires and their financiers should bear performance and availability risks.

On the other hand, when PPPs are subject to large exogenous demand shocks, such as in the case of highways, most of the demand risk should be retained by the government. This should be done via PVR contracts, where the term of the PPP adjusts automatically to ensure that the concessionaire obtains revenues that equal, in present value, the winning bid at the auction. In this way, the extent of fiscal risk is limited to the realization of demand for the infrastructure, the same as under public provision.

We use our conceptual framework to describe and assess the Chilean PPP program. In the early 1990s, Chile launched a massive program of infrastructure investment via PPPs, which led to substantial additions and improvements of the existing infrastructure. In Chile, PPPs are not accounted for in the budget and obligations to the concessionaire are not considered part of public debt. Despite these limitations, tight supervision by the Ministry of Finance imposed some discipline on the Ministry of Public Works (MOP). Government revenue guarantees, while generous, were seldom paid, as projects were well selected and funded mostly with tolls. Nevertheless, until 2010, and during the first two decades of this program contracts were routinely renegotiated. The renegotiations usually involved additional infrastructure, increasing the cost by about one-third over the original project cost estimates. Thus, renegotiations turned out to be the major source of fiscal risk.

The law was reformed in 2010, making it harder to renegotiate contracts. Perhaps the most significant change from the point of view of fiscal risk was the elimination of the supervening cause or event as a cause for renegotiation.<sup>5</sup> By default, the reform required that any risk not expressly allocated by the PPP contract to the government remains with the concessionaire. This severely limited the scope for renegotiations and thus the space for the emergence of government liabilities not previously accounted for in the fiscal accounts or the budget. Moreover, it effectively transferred availability and performance risk to the concessionaire, as incentive theory would recommend.

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<sup>5</sup> A supervening event is one that occurs after the contract is signed and that materially affects its results.

The second change was that PVR contracts began to be routinely used in the late 2000s, before the change of the law by the Ministry of Public Works and since then have become the main means of procuring transport PPPs. This provided an efficient allocation of demand risk to the public.

The third relevant change required that any significant additional works must be procured in a competitive auction under the supervision of the Public Authority.<sup>6</sup> This means that the PPP no longer has an interest in pressuring for additional works through renegotiations.

We find evidence suggesting that renegotiations are significantly lower with the new law. Projects tendered under the new law are renegotiated less frequently and for smaller amounts at similar stages in their lifecycle. In addition, we find evidence suggesting that PVR contracts are renegotiated less, even under the pre-reform law. The lack of renegotiations suggests that risks are shifted to a larger extent to concessionaires, and off the public budget.

We also provide estimates of ex post internal rates of returns (IRRs) for highway and airport PPPs in Chile. Ex post IRRs can inform about the cost to society and profitability of PPP projects. We find that the average IRR of PPPs in Chile is 6.8 percent (median 7.5 percent). These values lie in the lower range of the 7 -10% returns on assets obtained in Chile by regulated industries such as electricity transmission and distribution, and water utilities. Interestingly, ex-post IRRs of PVR concessions are significantly lower than IRRs of fixed-term concessions. Also, a robustness check we performed suggests IRRs may be a couple of percentage points higher, in line with the average estimate from a survey of 24 experts we conducted.

We also find that there is a large dispersion in the IRRs of individual projects, ranging from –23 percent to 25 percent, with seven PPPs with negative IRRs. This suggests that public infrastructure projects are intrinsically risky, and that private participation entails significant risk shifting from the budget to concessionaires and their financiers.

The rest of the paper proceeds as follows. In section 2 we develop a conceptual framework to think about fiscal risks. In section 3 we present the history of Chilean PPPs, with an emphasis on the management of fiscal risks. In section 4 we present the estimation of the ex-post IRR of PPPs. Section 5 concludes.

## **2 PPPs and fiscal risks: A conceptual framework**

In this section we develop a simple framework that identifies the sources of fiscal risks in PPPs.

### 2.1 Risk and infrastructure

Though it might sound like a platitude, the origin of the fiscal risks brought about by PPPs lies in the fact that infrastructure projects are risky (see our analysis of Chilean PPP project returns in section 3). It is useful, therefore, to start by showing that the risk added to the economy by a public infrastructure project does not depend on the procurement mechanism. To a first approximation, a new infrastructure project creates a fixed amount of risk, distributed between the public budget and the parties that finance the PPP, i.e., debt and equity holders.<sup>7</sup>

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<sup>6</sup> The concessionaire or a related party can perform the additional works only if they offer a price that is lower than the lowest price obtained in the competitive auction. In addition, the concessionaire is entitled to an administration fee for supervising the construction of the additional works.

<sup>7</sup> That is, if we exclude the incentive effects of PPPs.

We use simple sectoral T accounts to make our point. Consider the effect of a new infrastructure project, be it a highway, school, or airport, among other types of infrastructure. The first T account shows that the new project increases the asset side of the PPP sector. The right hand of the T account shows that the PPP sector acquires liabilities to finance the project: private debt and equity.

The second T account shows the effects on households (assuming domestic sources of private finance for the project). The liabilities of the PPP sector are assets of the households, reflecting savings.

PPP sector		Households	
Assets	Liabilities	Assets	Liabilities
Infrastructure capital	PPP debt  PPP equity	PPP debt  PPP equity	Household net worth

These T accounts (or the underlying reasoning) have been used by practitioners to argue that the private finance of infrastructure expands the set of projects available to the economy by mobilizing private savings. But savings can also be mobilized for infrastructure projects through sales of government debt and by taxation. Under public provision, infrastructure capital is part of the public sector's assets, and households own public debt and equity claims on the public sector.

Public sector		Households	
Assets	Liabilities	Assets	Liabilities
Infrastructure capital	Public debt	Public debt	Household net worth
	Public equity (taxes)	Public equity (taxes)	

In both cases, we can consolidate the balance sheets, so that debt and equity disappear in both types of provision.

Assets	Liabilities
Infrastructure capital	Household net worth

Thus, infrastructure capital turns out to be part of the net worth of households. The reason for this is that the impact of infrastructure on the real economy arises from its services, and not from the sources of finance used to procure the project.

Thus, if PPPs do not enlarge the set of feasible projects, why should governments choose private finance in some infrastructure projects? The answer is that a PPP is preferable to traditional provision only if it is more efficient, i.e., when the incentives embedded in the PPP contract delivers less expensive infrastructure or better quality of service at a given cost. Private finance of infrastructure is useful only if it improves incentives. Consequently, the distribution of risks between the public budget and PPP debt and equity holders matters only insofar as it affects incentives.

## 2.2 A fiscal illusion

Consider now the effects of PPPs on the fiscal budget. The fact that PPPs are financed by the concessionaire has made PPPs attractive to policy makers and politicians, because fiscal accounting rules in most countries do not count PPP investments as contributing to the current debt or deficit. This allows policy makers to argue that using PPPs, instead of the conventional approach for providing infrastructure, relaxes current fiscal constraints. The government then appears to build infrastructure without increasing government debt or raising taxes. This is an illusion.

Table 1 shows the intertemporal budgetary effect under both traditional provision and a PPP in the case when the infrastructure is funded with government transfers, i.e., a standard availability contract.<sup>8</sup> The first line shows that a PPP saves 100 in current spending and debt (because of the way PPPs are included in fiscal accounts), even though taxpayers pay 100 to fund the infrastructure in both cases. The only difference is that with traditional provision future governments use taxes to pay bond holders, whereas under a PPP they use tax revenues to compensate the concessionaire. Assuming there is no difference in efficiency, the fiscal implications are identical.

Table 2 shows that the same reasoning applies to PPPs funded with user fees. Again, the government seemingly saves 100 in current spending and debt by not procuring the project itself. Moreover, it does not need to raise any taxes. Nevertheless, relative to conventional provision, it relinquishes 100 in user fee revenue, which is used to compensate for the investment of the concessionaire. Because in both cases the government pays for the highway with user fee revenue, the fiscal impact is identical.

The illusion stems from the fact that fiscal accounting rules seldom consider the financing of a PPP for what it is---an increase in net government borrowing, which the government will pay off during the life of the contract. Thus, governments can use PPPs to avoid fiscal constraints and indulge in politically attractive infrastructure spending. It follows that proper fiscal accounts should record investments in infrastructure via PPPs as if they were conventional public investments. Note that this prescription does not exclude the possibility of giving preferential treatment to fiscal outlays that fund infrastructure projects, if they apply both to PPPs and to projects provided under conventional provision. The point is that traditional provision and PPPs should be treated on equal grounds so that the choice between both options is based on efficiency considerations.

The lure of off-balance sheet financing seems to have been the main driver for the use of PPPs in Europe. For example, the UK's PPP program, known as the Private Finance Initiative (PFI), encouraged off-balance sheet finance and encumbered the UK with average annual payments of £7.7B, for the following 25 years, beginning in 2017-18, that is, about 0.5 percent of the national budget until the 2030s.<sup>9</sup>

Similarly, Portugal invested €20 billion in PPPs between 1995 and 2014, mainly roads and hospitals. Most of this amount (94 percent) was spent on highways that used shadow tolls, which is a scheme under which tolls are paid by the government in lieu of the highway users. The payments for these PPPs were equal to one percent of GDP annually between 2014 and 2020, falling to a projected 0.5 percent of GDP thereafter, until 2030.<sup>10</sup>

The Chicago Skyway, a 7.8-mile-long toll road linking downtown Chicago to the Indiana Toll Road, shows yet another way in which PPPs have been used to circumvent budgetary controls and increase current expenditure. The \$1.83 billion bid paid by Cintra, a Spanish firm, for a 99-year lease allowed the city government to retire the remaining Skyway bonds, save some funds for the future, and use almost all of the remaining \$475 million to increase current spending. The efficiency gains generated by the contract were minimal, being at most a reduction in operating costs of \$1 million a year.<sup>11</sup>

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<sup>8</sup> To isolate efficiency effects from the accounting issues we analyze here, the analysis assumes there are no efficiency gains from PPPs.

<sup>9</sup> PFI and PF2, National Account Office UK, January 2018, p 25.

<sup>10</sup> Ferreira Reis and Miranda Sarmiento, J. (2019).

<sup>11</sup> See Cheng (2010).

**Table 1: Fiscal accounting: Funding from government transfers**

	Conventional provision	PPP
Now:	Issue 100 in debt	“Save” 100 in debt
Now:	Spend 100 on infrastructure	Spend 100 on infrastructure
Future:	Collect 100 in taxes	Collect 100 in taxes
Future:	Pay 100 to bondholders	Pay 100 to concessionaire

**Table 2: Fiscal accounting: Funding from user fees**

	Conventional provision	PPP
Now:	Issue 100 in debt	“Save” 100 in debt
Now:	Spend 100 on infrastructure	Spend 100 on infrastructure
Future:	Collect 100 in user fees	Give up 100 in user fees
Future:	Pay 100 to bondholders	Concessionaire collects 100 in user fees

The gold standard in rules to prevent this type of fiscal trickery are the so-called Ryrie Rules, introduced in the 1980s in the U.K.<sup>12</sup> These allowed private finance of public infrastructure only if public expenditure was reduced by the same amount---i.e., pound for pound. Thus, the Ryrie Rules ensured that infrastructure spending remained constrained by the total infrastructure spending allowed by the budget. Furthermore, the Rules provided incentives to choose between public provision and PPP based on efficiency grounds alone. The Ryrie Rules were abandoned under the PFI program of the mid-1990s.

More generally, the approach we propose more or less replicates the prescriptions of the International Public Sector Accounting Standards (IPSAS) in standard IPSAS 32, Service-Concession Arrangements.<sup>13</sup> Governments are not required to follow IPSAS, however, and when they do use those standards, the resulting accounts are not often used to set fiscal rules and budget targets.<sup>14,15</sup>

### 2.3 PPP risks without renegotiations

As a rule, demand for a socially desirable infrastructure is uncertain and, in the case of projects such as highways, this uncertainty is largely exogenous and beyond the control of the concessionaire. This implies that both the benefits of a project, in terms of consumer surplus, and the user fee revenue that the project can generate, are random variables. In addition, the contract

<sup>12</sup> Engel et al. (2014), p 110.

<sup>13</sup> See for example, IPSASB (2018). We thank Tim Irwin for pointing this out to us.

<sup>14</sup> New Zealand follows IPSAS. It has treated PPPs in its budgets and accounts in the way recommended in the paper---though it does not have many PPPs and as far as we know it has no user-funded PPPs.

<sup>15</sup> The IMF’s manual on fiscal statistics (IMF, 2014) takes a similar, though perhaps less explicit, approach for PPPs deemed to meet certain criteria. Again, no government is required to follow these rules, but they are influential, especially with countries with IMF programs.

governs the assignment of exogenous demand risk to the PPP.<sup>16</sup> It is somewhat surprising that, as we will see, some contractual forms can create demand risk---that is, the sum of the risks borne by the government and the PPP exceeds the risk of the project.

To understand PPP risk, it is useful to use a framework developed in Engel, Fischer and Galetovic (2010). Assume that the consumer surplus generated by an infrastructure project at time  $t$ ,  $CS_t$ , and user fee revenues,  $R_t$ , are random variables determined by the state of demand,  $v$ , that is, by one possible trajectory of future demand realizations. Denote the upfront investment by  $I$  and, for simplicity, assume that operating and maintenance costs are zero. The PPP firm is selected in a competitive auction that dissipates rents. We assume, for simplicity, that there is neither construction nor availability risk.

The upper half of Table 3 depicts the distribution of the present value of cash flows and surpluses in a demand state  $v$ , for alternative funding sources and types of contracts. Rows distinguish between the funding sources (user fees versus taxes), columns between governance structures (traditional public provision versus PPPs). Two alternative PPP contractual forms are considered under PPPs, for each funding source, either fiscal payments or user fees.

Consider first PPPs funded by user fees. Under a PVR contract, firms bid on the present value of revenue that they will receive over the term of the project, and the concession ends when that present value is collected. Thus, the term of the PPP is variable---the PPP lasts longer for low-demand realizations. Under a fixed term concession, by contrast, the PPP collects user fees for a fixed number of years and revenues can be higher or lower depending on demand realizations.

**Table 3. Risk allocation, source of revenues, and contractual form (based on Engel et al (2014)).**

	<i>Contractual form</i>		
	<i>Traditional provision</i>	<i>PPP</i>	
<i>Funding source</i>	(1)	<i>PVR contract</i> (2)	<i>Fixed-term contract</i> (3)
<i>User fees</i>			
Users	$CS_0^\infty(v) - R_0^\infty(v)$	$CS_0^\infty(v) - R_0^\infty(v)$	$CS_0^\infty(v) - R_0^\infty(v)$
Taxpayers	$R_0^\infty(v) - I$	$R_0^\infty(v) - I$	$R_0^\infty(v) - R_0^T(v)$
Firms	$I - I$	$I - I$	$R_0^T(v) - I$
<i>Taxes</i>			
		<i>Availability payment</i>	<i>Fixed-term shadow toll</i>
Users	$CS_0^\infty(v)$	$CS_0^\infty(v)$	$CS_0^\infty(v)$
Taxpayers	$-I$	$-I$	$-R_0^T(v)$
Firms	$I - I$	$I - I$	$R_0^T(v) - I$

*Notation.*  $v$  = state of demand; CS = consumer surplus; R = user fee or shadow toll revenue;  $I$  = upfront investment;  $X_s^t$  = present discounted value of  $X$  between times  $s$  and  $t$ , as of time 0;  $T$  = length of fixed-term contract.

*Assumptions.* The table depicts cash flows and social surplus for a given demand state  $v$  (corresponding to present discounted value of user fee revenue in the state) for alternative sources of funds and contractual arrangements. Rows distinguish between sources of funds (user fees and taxes); columns between procurement forms (public provision and PPPs). Demand for the infrastructure is uncertain, so consumer surplus, CS, and user fee revenues, R, are random variables of the demand state,  $v$ . The upfront investment,  $I$ , is the same in all demand states, and operating and maintenance costs are zero. Firms are selected in competitive auctions that dissipate all rents.

<sup>16</sup> When we consider the possibility of renegotiations, the contractual risk assignment may be altered ex post.

Consider next PPPs funded by tax revenues. Under an availability contract the concessionaire is paid an annual fee, provided that the infrastructure is available and meets the contracted minimum quality standards. The PPP bears availability risk, but no demand risk. An alternative scheme is a fixed term, shadow toll PPP contract. The concessionaire is paid by the state a notional user fee for each user of the infrastructure over the fixed term of the project. The framework can be easily extended to include projects funded by a combination of user fees and tax-funded payments. It is possible to conceive other types of contract---e.g., a present value of revenue contract based on shadow tolls.

How can one assess the fiscal risks generated by PPPs? We use the risk generated by traditional provision on the government budget as a benchmark. Independently of the source of funds, there exist PPP contracts that replicate the surplus and cash flow distribution of traditional provision. It follows that these contracts have the same impact on the intertemporal fiscal budget, in all demand states. For example, traditional public provision and availability payments have the same fiscal impact when the project is funded with taxes (second row, columns 1 and 2). When the project is funded with user fees, PVR and public provision are identical in fiscal terms.

To see this, consider first the case in which funding comes from user fees. Under public provision, the project is built at cost  $I$ , and the firm receives  $I$  before the infrastructure becomes operational (recall that we assume competitive tendering that dissipates rents). Hence, the state pays  $I$  upfront and collects revenue  $R_0^\infty(v)$  in state of demand  $v$ , therefore receiving  $R_0^\infty(v) - I$  in net present value, where  $X_a^b$  denotes the present value of  $X_t$  between  $t = a$  and  $t = b$ , as of time  $t = 0$ . Users, on the other hand, receive a net surplus of  $CS_0^\infty(v) - R_0^\infty(v)$ . Under a PVR contract (first row, second column), the state saves  $I$  upfront, but relinquishes user fee revenue during the length of the concession. The foregone user fee revenue equals  $I$  in present value (the competitive assumption implies a winning bid equal to  $I$ ). Because the government collects user fees after the concession ends, net revenue for the state is  $R_0^\infty(v) - I$ . The net surplus of users in state  $v$  is  $CS_0^\infty(v) - R_0^\infty(v)$ , as under conventional provision. This shows that the fiscal risks due to demand risk are identical under traditional provision and under a PPP contract of the PVR type.

Consider next a fixed-term PPP contract that lasts  $T$  years (first row, column 3). The concessionaire collects  $R_0^T(v)$ , with a surplus of  $R_0^T(v) - I$ , which is now a random variable and entails risk, in contrast to the PVR contract. The state receives  $R_T^\infty(v)$ , and, in general, the associated risk is smaller.<sup>17</sup> We conclude that, compared with PVR (or with traditional provision), a fixed-term contract shifts risk from the budget to the concessionaire because there is uncertainty about demand for the project --and therefore uncertainty on user fee revenues-- during the fixed term  $T$ . This is inefficient (because the capacity to absorb exogenous risk is lower in the concessionaire; see Irwin (2007)), and potentially leads to contract renegotiations with the associated fiscal risk.

Next consider projects that are fully funded by taxes. With traditional provision the project is built at cost  $I$ , which the firm receives before the infrastructure becomes operational, that is the state pays  $I$  upfront. Under a PPP that is remunerated with availability payments (second row, column 2), the timing of disbursements is different, but the present value of the payments remains equal to  $I$ , since there is no risk. Hence, neither party bears risk and the impact of the project on the intertemporal public budget is identical under traditional provision and a PPP.

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<sup>17</sup> For any process with independent increments, as well as any stationary process, it is easy to show that the standard deviation of  $R_T^\infty$  as of time zero, is decreasing in  $T$ . It follows that with public provision or a PVR contract, the standard deviation of taxpayers' discounted revenue will be higher than under a fixed term PPP.

PPPs funded via taxes have sometimes resorted to shadow tolls.<sup>18</sup> That is, the state pays a fee to the concessionaire for every user of the infrastructure for a fixed number of years,  $T$ . This type of PPP contract shifts risk to the concessionaire and a PPP premium associated to risk appears (second row, column 3 of Table 3). Thus, a shadow toll contract adds a zero-sum lottery to an availability contract, with no discernible benefit.<sup>19</sup>

Two lessons follow from this analysis. First, with PVR and availability contracts the government bears essentially the same demand risk as under conventional provision. So long as PPPs are considered as public investment and are reflected as government's debt, no hidden liabilities emerge. The only liabilities under an availability contract would be the (accounted for) future payments owed by the government. Under a PVR contract, they correspond to relinquished toll revenue.

The second lesson is that fixed-term, user fee funded PPPs involve an inefficient transfer of exogenous demand risk to the concessionaire. Moreover, since in some states of demand the concessionaire will have losses, PPPs will lobby for contract renegotiations, and this creates fiscal risk. This is also true for shadow tolls. A PVR contract, by contrast, is less prone to renegotiation, because the term is automatically extended following negative demand shocks.

#### 2.4 Minimum revenue guarantees<sup>20</sup>

It is common for governments to include minimum revenue or demand guarantees in PPP contracts, especially when concessions last a fixed term. Guarantees act as contingent subsidies. As such, they impact the intertemporal fiscal budget, but their contingent nature makes it difficult to estimate their value.

Under current fiscal accounting standards, the contingent obligations created by these guarantees will probably remain hidden (Hemming, 2006, p. 40). Under cash accounting, guarantees emerge only when they are paid, and are recorded as current expenditure. Under accrual accounting and Eurostat guidelines, guarantees are recorded as a government liability only if the government considers that the probability of making a payment is higher than 50 percent and can make a reasonable estimate of the payment. Even then, unless the government makes a provision and sets aside the funds, guarantees are only recorded when they are called. To make matters worse, most countries keep poor records of contingent guarantees, and, when information exists, it is dispersed through agencies and ministries (Hemming, 2006, p. 42).

Some countries, such as Chile, Colombia, and New Zealand, have attempted to quantify the value of guarantees within an accrual framework, by estimating the expected outlays and correcting for the degree of risk involved (for example, via value-at-risk-type measures). However, rules based on probability assessments can be manipulated. It follows that government revenue or debt guarantees are a source of fiscal risk.

#### 2.5 Renegotiations and fiscal risks<sup>21</sup>

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<sup>18</sup> See Miranda Sarmiento and Renneborg (2015) for the case of Portugal.

<sup>19</sup> Of course, a lottery is a non-systematic risk, and should be fully diversifiable through perfect capital markets. Nevertheless, in the real world there are many reasons why risks are not fully diversifiable, including transaction costs. Moreover, non-diversifiable risk is required to provide incentives for efficient management.

<sup>20</sup> This is based on Engel et al. (2014, ch. 6).

<sup>21</sup> This is taken from Engel, Fischer and Galetovic (2021). See that paper for further details.

The fact that PPPs are routinely renegotiated has been known since Guasch (2004) examined nearly 1,000 Latin American concession contracts that had been awarded since the mid-1980s to 2000. Guasch showed that 54.4 percent of the contracts in the transportation sector (roads, ports, tunnels, and airports) had been renegotiated. The cost of renegotiations of Mexico's program of highway PPPs of the late 1980s has been estimated to have cost Mexican taxpayers more than US\$13 billion, in addition to the original investment cost of \$13 billion. In Chile, 47 out of the first 50 PPP concessions awarded by 2005 had been renegotiated by 2006, adding almost a third to the original planned investments (see Engel et al. 2009). A recent review of highways in Colombia, Peru, and Chile (Engel et al., 2019) analyzed 535 renegotiations of 59 highway PPPs. The average number of renegotiations per year was 9.5 percent of initial investment in Colombia, 3.6 percent in Peru, and 1.3 percent in Chile. More than 45 percent of renegotiations (by dollar amount) take place in the construction phase. In Chile (the only country for which the data was available), more than 60% of the renegotiated cost falls on future administrations.

PPP contracts are inherently long-lived incomplete contracts because unforeseen circumstances may arise over the life of a concession. Thus, renegotiations can be expected to occur over time, and they provide the flexibility necessary to adapt to changing conditions. While this is a reasonable argument for renegotiations it ignores two disturbing features of real-world renegotiations of PPP contracts.

First, they often occur in the early stages of the contract: Guasch (2004, p 14) showed that, on average, renegotiations started after only 2.2 years of the award of the contract. Moreover, when considering contracts that were renegotiated, in 60 percent of the cases contracts were first renegotiated in the first three years. Engel et al. (2009) showed that 78 percent of the renegotiated amounts were awarded during construction. One possible explanation for early renegotiations is that projects are procured and awarded with early-stage designs, which do not include detailed specifications. This leads to increases in costs as details are specified and negotiated during construction. Awarding a project with final specifications may lead to fewer renegotiations, but this is slower and more expensive, so inefficient from a political point of view.

Second, renegotiations tend to favor the concessionaire. Guasch (2004) has shown that two-thirds of contract renegotiations led to tariff increases, 38 percent to extensions of the concession term, and two-thirds to a reduction in investment obligations. Engel et al., (2009) showed that most renegotiations of Chilean PPPs, led to higher costs for the original project. Though in principle renegotiations may allow governments to expropriate concessionaires after they have sunk their investment, in practice it seems that in most of Latin America, renegotiations favor the private partner.

The high frequency of renegotiations is the result of poor governance and rules. When contingencies such as a fall in demand or a cost overrun occur, the PPP expects to be made whole again by changes in the contract, so the "economic equilibrium" is recovered. On the other hand, good results are not renegotiated, so that the PPP obtains a positive return in all events.<sup>22</sup> The combination of competition and the expectation of renegotiations encourages lowballing in the PPP auction. Any losses will be recouped by future bilateral bargaining.<sup>23</sup>

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<sup>22</sup> General laws in many countries in Latin America and Spain support this expectation. Legal reforms (see, for example, the reform of the Chilean Concession Law of 2010) are required to avoid this source of renegotiations.

<sup>23</sup> This gives an unfair advantage to firms that specialize in lobbying activities. See Engel, Fischer and Galetovic (2021, p20). Campos et al (2021) showed that Odebrecht underbid in PPP and traditional projects if there was competition for the project and the expectation of renegotiations.

A contractual framework for PPP that allows easy renegotiations is an important source of fiscal risks because the renegotiations create government liabilities not previously accounted for in the budget or in fiscal accounts.

## 2.6 Conclusion of this section

A PPP uses private financing of the project to substitute for public financing with taxes or debt. In exchange, future cash flows from user fees or appropriations from the budget are tied as remuneration to the PPP for the investment and O&M expenses. A PPP alters the timing of cash outlays, and this intertemporal trade creates fiscal risks through accounting rules and renegotiations.

First, PPP investments tend to be kept off the fiscal balance sheet and off the budget. Moreover, governments usually offer minimum revenue or demand guarantees. These are contingent liabilities that are also not usually included in fiscal accounts.

Second, PPPs are routinely renegotiated both during and after construction. PPPs are often renegotiated when “unforeseen” contingencies emerge, and governments are expected to compensate the PPP for the impending losses. Renegotiations also occur because projects are procured with insufficient details in their design. Both sources of renegotiations are often anticipated by firms, which leads to lowballing as the auction in the expectation of renegotiations and further compounds fiscal liabilities that are not accounted for.

Third, when fixed term user funded PPP contracts are auctioned competitively, there will be demand trajectories in which the PPP makes losses. This creates pressures for a renegotiation, to recover the “economic equilibrium” of the PPP contract, i.e. a contingent liability.

## **3. Fiscal risks and the Chilean PPP program: a brief history**

In many countries (e.g., Portugal, UK, Mexico, Colombia), PPP programs have led to large fiscal expenditures, in many cases unforeseen. The case of Chile is interesting in that even while there have been some unexpected expenditures, the levels have been contained, and more recently have been decreasing. In this section we address the question of how Chile was able to maintain some fiscal discipline. We observe that the initial PPP legislation was puritanical in its desire to limit the fiscal risks involved in PPPs. However, there were no PPPs during that era. Successive reforms introduced to the PPP Law in the 1990s relaxed these constraints and led to large number of infrastructure PPPs. We describe the conditions that limited risks as well as those that increased the likelihood of large fiscal costs. Finally, we describe the fiscal aspects of the reform of 2010, which introduced several changes that led to a substantial reduction in contract renegotiations and fiscal risks.

### 3.1 1980s: The first PPP law

From its inception in Decree N°591 of 1982, the Chilean infrastructure PPP system has always been uneasy about the fiscal risks of PPPs, and this is reflected in this early piece of legislation. The 1982 law did not include any provisions mandating proper budget or debt accounting of PPPs, but included several of the basic ideas required to limit fiscal risks. For example, the PPP could only ask for what was expressly stated in the contract, which included, for example escalator clauses (tolls in real terms plus an additional growth factor). Once the project started operating, the PPP had to

hand over guarantees of performance, such as surety bonds.<sup>24</sup> The law did not allow for the adjustment of the contract in case of force majeure (for example, the effect of earthquakes, which are common in Chile) or any other circumstance, except those cases in which the Public Authority required a modification of the project, in which case the state would compensate the private party for the costs.

PPPs were awarded for a fixed term and the only allowed bidding variable was the user fee in the case of projects that could be fully funded with user fees. If not privately profitable, then the project would be awarded to the firm asking the lowest subsidy, given a predefined toll, but only if they passed a social cost-benefit assessment by a strict specialized office. There was no possibility of a scoring function including aspects such as term length, experience of the bidder or other variables. This was a positive characteristic, because scoring functions are easy to corrupt or can lead to unexpected results which are a source of fiscal risks by themselves (see the case of the El Melón Tunnel, below).<sup>25</sup> A further measure that was meant to ensure only serious bidders with strong financial backing was the requirement that the concessionaire should establish a domestic Single Purpose Vehicle (SPV) with equity of at least 20% of the value of the project.<sup>26</sup> Many other risks were transferred to the private party. There was no provision for adaptation of the contract due to force majeure or exceptional circumstances, which limited the fiscal risk. Only if the contract was modified by requirement of the government was there a possibility of compensations. Importantly, any renegotiation requested by the private party would be at its own expense and could never lower the standards of the project.

However, the law was primitive in many respects, and naive in others. Some of the risks were assigned incorrectly. For example, the expropriation of land required for the project was based on eminent domain, but all the expenses incurred in the expropriations process –including the value of the land used in the project– fell on the private party. These costs can be much higher than expected, as seen in the case of some Spanish concessions.<sup>27</sup> Hence the law shifted to the PPP risks that are difficult to manage for a private firm.

The law was also naive in believing that the private parties would not be able to manipulate the system once they obtained a PPP. For example, since there were no surety bonds required of the firm during the construction stage, a private firm could potentially pressure the government to change the conditions of the contract in its favor. The only option of the government would be the politically costly cancellation of the contract, delaying the provision of the required services. Requiring surety bonds at the operational stage is an efficient mechanism for discouraging strategic behavior by the private party.

The also law created a conciliation commission for conflict resolution, but without arbitration powers. The existence of a conflict resolution mechanism was an important innovation, but it was a primitive design. First, it lacked independence because two members were public officials appointed by the government and the third was a lawyer associated to the judicial appellate system. Second, because it could only act to reach agreements among the parties. Otherwise, the conflict ended in the very inefficient civil justice system.

Perhaps for these reasons or because of the political conditions of the time, there were no PPPs under this Law.

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<sup>24</sup> In contrast to later legislation, the guarantees were handed over only in the operational stage, after construction.

<sup>25</sup> See Campos et al. (2021) for examples of the use of scoring rules for corruption.

<sup>26</sup> This was not directly in the Law, but in Decree 217 of 14 September 1983, which regulated the detailed working of the PPP Law.

<sup>27</sup> See Engel, Fischer, Galetovic and de Rus (2015).

### 3.2 1990s and early 2000s: The high investment era of PPPs

During the second half of the 1980s, in the aftermath of a major economic crisis and recession between 1982 and 1984, Chile experienced a period of remarkably high economic growth. However, the government was reluctant, in part due to the difficulties in obtaining access to international finance, to increase spending and incur debt to improve the national infrastructure. The rate of investment was only about 1% of GDP, in the context of high economic growth, leading to increased congestion costs for producers, and especially for exporters. This changed after the end of the Pinochet dictatorship, with a notable increase in infrastructure spending. This is the period of greatest expansion of the PPP system, when the main interurban and urban highways were built to improved standards and capacities.

#### *3.2.1 The 1991 and 1996 laws*

After the return of democracy in 1990, the Ministry of Public Works (MOP) decided to develop its PPP policy, and adjusted the Law in 1991, 1993, and 1996. Perhaps the most important modification from the point of view of the management of fiscal risk is that the 1991 law introduced the concept of force majeure or hardship (supervening cause) as a reason for renegotiation of the contract. This opened the way for bilateral contract renegotiations between the PPP and the MOP, which could potentially be expensive and became a major source of fiscal risk.<sup>28</sup> The one saving circumstance was that the Finance Ministry had to agree to the contractual modification through a decree. The Finance Ministry interacted with the MOP through a senior technical official dedicated to the task of monitoring and controlling the risk of increased fiscal expenditure.

Several other changes were also added in the 1991 Law. First, it allowed projects proposed by private parties (the so-called private initiatives), which had to be evaluated within a year and if approved, had to be put to tender the following year. The proposer would get a prize in the bidding stage (for instance allowing it to win the bid even when making a slightly worse offer). Second, it allowed for additional bidding variables (level of minimum traffic guarantees, payment to the state, shorter concession term, degree of risk assignment in case of force majeure) and scoring functions weighing the different variables. Third, the law allowed more flexibility in transferring the project to other private parties and the possibility of assigning the revenues of the PPP as a guarantee for loans. Fourth, it added a clause that facilitated the transfer of the PPP to a new private party in the case of bankruptcy of the original concessionaire, reducing the risk to lenders. Finally, the Conciliation Commissions (one per PPP contract) for conflict resolution took a different form, with one member of the Commission selected by each party and the third by mutual agreement. These were not arbitration commissions and could not enforce a decision that was not agreed to among the parties. Recourse to the commission was not mandatory if the PPP and the Ministry of Public Works reached a bilateral agreement.

While the new Law improved several aspects that were deficient in the original PPP Law, many of the improvements had potentially negative long term fiscal impacts. First, there was a problem with private initiatives because they involved intellectual property rights and had to be processed quickly. Since some of the projects could require subsidies, this could put the Finance Ministry in a

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<sup>28</sup> According to David Duarte (personal communication), who headed the unit in charge of monitoring contingent risk (the PPP unit) at the Ministry of Finance for 12 years, renegotiations were the largest fiscal risk in Chilean PPP.

bind, facing pressures to subsidize projects at a rate determined by the arrival of new proposals, which was unpredictable. Moreover, the private initiative projects could interfere with similar projects planned by the Public Works Ministry, because the proposer could potentially claim that the Ministry did not respect its intellectual property rights.

Second, the use of a scoring function was an error that quickly became evident in the first concession. In the El Melón Tunnel, the scoring function was badly designed, and it ended up transferring annual sums to the government while overcharging users. This led to a low demand for the tunnel because users preferred other travel options.<sup>29</sup>

The following PPP under that law was the Camino de la Madera, the first PPP road in Chile. This was also unsuccessful, with a road design that led to many accidents, and eventually the contract was cancelled by mutual agreement and compensation in 2012, five years before the end of the original contract.<sup>30</sup>

It is important to observe that the law led to only four small projects, so that the risks were limited, and the MOP learnt from the experience.<sup>31</sup> This also kept fiscal risks at the minimum while learning about the management of PPPs.<sup>32</sup> The law was modified again in 1993, adding small changes, with perhaps the most important –from a fiscal point of view– being that the government could be made responsible for the total or partial cost of land expropriations. While this had important fiscal implications, it seems to be a reasonable assignment of risks because of the potential open-ended nature of these costs and the fact that there is little the PPP can do to manage this risk.

An important institutional change was the creation of a separate PPP unit within the MOP. This unit initially employed a small group of highly qualified personnel that led the development of the Chilean PPP industry. Using the experience of the early projects, this group planned a third reform to the PPP Law to make it more attractive to the private sector. They also scaled up the effort in PPPs, so three larger projects were awarded in 1995, all of them to the participant that bid the lowest toll. These were the small Nogales-Puchuncaví project, and the much larger investments in the Acceso Norte a Concepción and the Santiago-San Antonio highway, adding to slightly more than USD 500MM.<sup>33</sup>

In 1996 the reformed law was approved by Congress. It added to the potential bidding variables the present value of revenues. However, lobbying by the PPP industry ensured, as explicitly mentioned in the law, that it could only be used in exceptional circumstances (see Engel, Fischer and Galetovic, 2001).

The law also created a special lien on the revenues of the PPP, making it easier to finance the projects. These liens were added to an official registry, which allowed banks and institutional investors to participate in financing infrastructure. The private pensions system and the life insurance industry were searching for new long-term investments and thus financing of PPPs could use domestic funds. Such a lien does not affect fiscal risks directly, but by involving sophisticated

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<sup>29</sup> When the quality of these alternatives was improved, the El Melón PPP sued, and eventually received compensation.

<sup>30</sup> In the aftermath of the 1998 recession, the contract was modified to make it a variable term (Mecanismo de Distribución de Ingresos or MDI) contract. This contract is similar to PVR, but without the auction. However, the revenues were so slow in accruing, due to the low standards of the road, that the Public Authority thought it best to buy back the contract. Thus, it would be able to redesign and perhaps auction a redesigned project.

<sup>31</sup> MOP (2016): Concesiones de Obras Públicas de Chile: 20 años.

<sup>32</sup> The total cost of the of the early projects Camino de la Madera and Túnel El Melon was less than USD 100 million of the time.

<sup>33</sup> Two small airport PPPs were also auctioned at the time.

financial intermediaries in the financing of PPPs, it adds an additional layer of monitoring and independent evaluation of the projects. Between 1998 and 2015, close to USD 6 billion in PPP related domestic bonds were issued.

Previously, in case of a serious contractual breach by the private party (inability to finish the construction to the predefined standards or non-maintenance of the project, for instance), the PPP could be cancelled, after an appeal to the Conciliation Commission and the Justice system. However, there was no explicit compensation to the lenders in case of contract cancellation. The reformed Law provided for a compensation for the lenders with registered liens, from the revenues of the auction of the project after the contract was cancelled. The concept was that lenders should face limited risks, while the SPV had equity at risk.

However, the new Statute eliminated the capital requirement for an SPV, which was left for regulatory interpretation.<sup>34</sup> The SPV was also required to post surety bonds before the bidding and construction stage (as well as during the operational stage, continuing with the legal tradition of the previous law). This condition, if the bonds are of appropriate size, is probably more efficient at limiting reckless offers than a having a minimal capital requirement. It allows for an independent review of the project by the bank that provides the surety bond, given that it will have to pay if there are problems in the bid or during the construction phase (see below).

The reformed Law now allowed for contract renegotiations as soon as the contract became official, i.e., even before construction, as well as during the construction and operation phase. The modifications still required the Finance Ministry's approval. Early contract renegotiations became routine, as we have shown (Engel et al, 2009). Submissions to the Conciliation Commission could only be made by the private party. In case of failure of the conciliation process, the Commission metamorphosed into an Arbitration Commission, issuing judgments that could not be appealed.

As can be seen in Figure 1, under the reformed Law, PPP investment grew fast.<sup>35</sup> Most of the Chilean portion of the Pan American Highway, known as Ruta 5, from La Serena to Puerto Montt (<1,400?> km of double carriage highway) was auctioned in the next two years, as well as the Santiago-Valparaiso-Viña del Mar highway (the first PPP to be tendered with the PVR method) and the Santiago airport. These were sorely needed projects.<sup>36</sup> The Ruta 5 was divided into 8 segments, which faced different demands. A system was devised so that expected tolls from the auctions would be approximately equal, with a fraction of the revenue from the high demand segments diverted to cross subsidize those segments that were not self-financing at that toll rate.

From Figure 1, the total amount awarded in PPPs in 1996-1998 was USD 3.55 Bn. This led to a major improvement in infrastructure in Chile, lowering costs of the productive processes as well as improving welfare. There were no large projects awarded in the following few years, for which there are three potential and complementary explanations. First, Chile underwent a recession in 1999, which lowered the appetite and need for new investments in infrastructure. Second, the PPP unit at MOP might have been overwhelmed with work managing these projects and third, there were fiscal constraints on the value of PPPs that could be awarded. The third reason is explained below.

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<sup>34</sup> The Regulation associated to the Statue (which was not approved by the General Comptroller until 2010) did require a minimum of 20% of the capital cost of the project.

<sup>35</sup> Some of these projects were assigned before the Law was published. However, transitory articles allowed existing projects to choose to be ruled by the reformed Law, so all projects during 1996 (and perhaps even during 1995, while it was discussed), while the Law was close to being approved, can be considered a product of the reform.

<sup>36</sup> See Engel et al (2006).

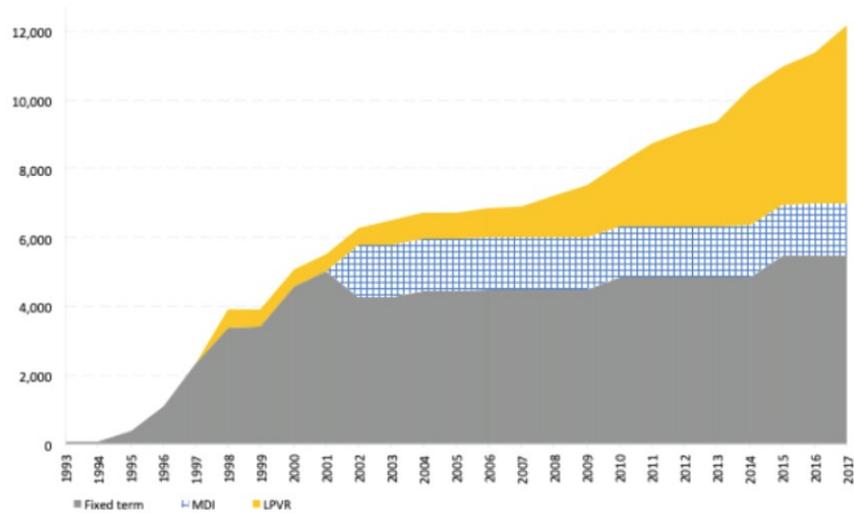


Figure 1: Cumulative value of transport PPP Contracts in Chile. Source: Engel et al (2021).

### 3.2.2 Controlling PPP spending through budgetary mechanisms.

During the early 1990s the annual inflation rate was slowly being brought down from more than 20% in 1990-1991 to less than 10% per year in 1995. The Finance Ministry worried that with the high growth rates of the period, there would be excessive pressure on spending, and therefore on inflation, if PPPs could grow unchecked. Even though the powerful Budget Directorate at the Finance Ministry could contain government spending, the potential growth in private infrastructure spending might overheat the economy. With this object, they devised various mechanisms to keep PPP spending in check.

The first mechanism used Chile's Value Added Tax (VAT). Chile charges a VAT on all goods and services except those related to health, education and, crucially, transportation. That meant that tolls could not include VAT, so the expenditure in building a road incurred the VAT tax without the possibility of transferring it onto consumers. The budget office devised the argument that since PPPs eventually would revert to the State, for consistency, the State had to pay the VAT on the projects. This meant that the MOP would return the VAT paid by the private party on its expenditures during construction and operations. This implied that a large part of the budget of the Ministry—in fact by far the main component of the budget of the PPP division—was the budget line associated with VAT repayments. Since the Ministry's budget has multiyear planning, the budget could not jump in response to an increase in the number of PPPs. Thus, the MOP could not increase PPP spending beyond the funds assigned in its budget to pay VAT. However, this did not work as intended, because in an era of high growth and infrastructure deficits, it turned out to be impossible to resist the political pressure to develop projects once the required preliminary studies had shown that it was socially profitable.

A related problem that appeared as the new PPPs began construction, was that many contracts were renegotiated, often involving an increased expenditure from the budget. Thus, a new method was devised by the Budget Office to limit the growth of PPPs: limiting the resources available for the study of new PPPs.<sup>37</sup> If projects were not fully developed, they could not be auctioned. This succeeded, at least initially, in controlling the expansion of the PPP system. However, this approach created severe problems.

<sup>37</sup> Personal communication from David Duarte.

The lack of resources for studies led to an informal and illegal arrangement by which the private sector would pay for the studies as well as for additional compensation to the professional cadres within the PPP office.<sup>38</sup> Of course this sort of arrangement, even if initially innocent, can easily lead to corruption. The scandal that ensued was known as the MOP-GATE scandal because the firm that made the illegal payments, Gestión Ambiental y Territorial, went under the acronym GATE. During this period, the PPP program had grown quickly first with the development of additional interurban highways and then urban highways (approximately USD 2.8Bn in projects in 2000-2002).<sup>39</sup> After this period, there were few PPP projects, in part because of the scandal, but also because the ousted Minister had spent several years of future VAT budgets (personal communication, E. Bitrán, former Minister of Public Works, see below on the timing of expenditures).

Since the mid-2000s, the Ministry of Public Works has used private initiatives to develop new projects. Rather than its intended use in the Law as a means of adding creative and socially beneficial projects, the prizes associated to accepted private projects were used to compensate the private party for preparing a project that the Ministry wanted to develop. This meant that MOP had little oversight over the details of project design and that auctions were less competitive because the firm that did the study ran with an advantage. Also, often many years went by between the study and the beginning of construction. This led to projects being auctioned with dated studies which then required costly contract renegotiations.

All of this shows that the Finance Ministry was unable to design a system to control the growth of PPPs. By skimping on studies, this contributed to poorly designed projects that would later be renegotiated. In the end, the measure designed to control renegotiations itself led to renegotiations.

### 3.2.3 Traffic guarantees

To be bankable, PPP projects with a fixed term required minimum revenue guarantees, that took the form of minimum traffic guarantees.<sup>40</sup> The strategy used by the Finance Ministry was to guarantee 70%-80% of expected traffic demand, corresponding to the desired leverage in PPPs. Thus, long term institutional lenders faced less risk, while the remaining risk was left to the PPP equity holder, who therefore was supposed to have skin in the game. These guarantees led to some contingent risks, and the Finance Ministry created an office to keep track of these and other contingent payments. However, due to strong economic growth in the period, the value of the contingent risks associated to PPPs never became large, not surpassing 0.25% of annual GDP, and the annual outlays were much smaller.<sup>41</sup>

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<sup>38</sup> To stop the drain of these highly qualified professionals to the private sector.

<sup>39</sup> From Engel, Fischer, Galetovic and Hermsilla (2009).

<sup>40</sup> These are not usually needed in the case of PVR contracts. For more information about the financial arrangements in PPPs, see Engel et al (2020). In principle, projects could be bankable without insurance if they used more equity. However, equity is expensive, so the required return on projects would need to be much higher.

<sup>41</sup> See the annual *Reporte de Contingencias*, Ministerio de Hacienda. Only in two PPPs were guarantees ever paid: Santiago-Los Vilos and Red Litoral Central, and then only for a few years. Since the guarantee also limits the upside, in many concessions the State may eventually receive payments from some PPPs (D. Duarte, personal communication).

Table 4 shows the value of the traffic guarantees and the disbursements in terms of the UF, a constant value unit of account whose value ranged from USD 38-44 during the period.<sup>42</sup> We also show the values as a percentage of GDP.

The first two columns show the actual payments to PPPs from contingent debt. On average they add to 0.01% of GDP, with a standard deviation of 0.0044%; the value corresponding to 2019 was USD 63MM. The third and fourth columns are derived from a model developed by the Ministry of Finance and the World Bank and represent the expected value of guarantees.<sup>43</sup> These values are small, with a maximum value of about USD 600MM, or 0.21% of PGB, with an average of 0.18% of PGB and a standard deviation of 0.04%. The last two columns of the table represent the cost of the guarantees if there were no revenue at all from PPPs: no traffic in highways and no demand for airport services. This is the maximum possible exposure of the guarantees, and the payments would be spread over the term of the PPPs.

As we can see from Table 4, traffic guarantees in PPPs were not an important source of fiscal risk in Chile. There were several reasons for this. First, it was a period of high economic growth, so traffic volumes grew fast in most projects. Second, from around 2007 onwards, most projects were of the PVR type and did not require guarantees. Third, as the projects age, the number of remaining years in which guarantees might be paid gets smaller.

The risk and outlays associated to renegotiations were much larger, but these were never included in the Contingency report, presumably due to the difficulties in estimation. According to David Duarte (personal communication), the Budget Office used the rule of thumb that it would have to pay 20% of the value of the project in renegotiations, at least until the 2010 reform of the statute. Indeed, in some years renegotiated amounts equal the stock of contingent guarantees and until 2012 were often 10 times the size of annual outflows from guarantees. Since the proceedings in renegotiation agreements are very bureaucratic, there is a lag of 2-3 years between the initial renegotiation and the time when the final amount is determined. As we will see in what follows, three years after the law was changed in 2010, the amounts renegotiated decreased substantially.

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<sup>42</sup> We use the UF because it does not suffer from currency gyrations and is constant in terms of buying value in Chile.

<sup>43</sup> The model makes predictions of future traffic flows given growth expectations, growth volatility and the correlation between GDP and traffic flows. It then uses Montecarlo simulations to estimate the probability distribution of payments. The associated predictions of revenues are adjusted by risk, leading to guarantee payments adjusted by risk. These are then discounted at the risk-free rate to obtain the value for the guarantees. The calculations include the fact that if revenues grew beyond predetermined bounds, the state would receive a payment from the private party.

**Table 4: Payment of minimum revenue guarantees, 2003-2021**

Year	Payment Flows		Net contingent debt		Maximum possible value	
	Amount (UF)	GDP %	Amount (UF)	GDP %	Amount (UF)	GDP %
2003			7,610,372	0.25%		
2004			7,189,035	0.22%		
2005			5,603,497	0.16%		
2006			7,791,593	0.22%		
2007			9,652,143	0.21%	159,293,178	3.50%
2008			6,449,236	0.14%	167,362,390	3.72%
2009	403,914	0.01%	8,635,767	0.23%	156,617,577	4.16%
2010	467,603	0.01%	8,629,404	0.21%	167,703,662	4.11%
2011	608,797	0.01%	8,528,232	0.20%	176,679,755	4.08%
2012	551,356	0.01%	9,161,175	0.16%	169,282,523	3.00%
2013	657,329	0.01%	8,338,316	0.14%	158,830,123	2.67%
2014	717,094	0.01%	8,612,847	0.14%	148,956,861	2.49%
2015	983,734	0.02%	9,106,707	0.15%	153,173,869	2.53%
2016	945,906	0.02%	9,389,196	0.15%	144,710,605	2.29%
2017	1,252,638	0.02%	13,316,272	0.20%	109,796,369	1.64%
2018	1,445,460	0.02%	15,168,661	0.21%	100,432,433	1.40%
2019	1,758,179	0.02%	10,904,887	0.15%	86,030,778	1.19%
2020	2,420,254	0,04%	10,148,538	0,15%	97,208,601	1,43%
2021	821,362	0,01%	11,821,489	0,15%	88,751,039	1,12%

Source: Informe de Pasivos Contingentes, Ministerio de Hacienda, years 2007 onwards. For previous years, from the yearly Informe de Finanzas Públicas, Ministerio de Hacienda. Amounts are in UF, an inflation indexed unit of account that usually fluctuates in the range USD38-44.

### 3.2.4. *The timing of fiscal expenditures*

PPPs affect not only the level of fiscal expenditures, but also their timing.<sup>44</sup> There are at least five items that affect the timing of disbursements:

1. Expropriations. Since the expropriation expenditures by the private party are capped, any underestimate of these costs becomes an expenditure for the public purse. In a period of intense PPP activity (1998-2001), this was the main source of expenditures by the concession unit.
2. VAT outlays depend on the timing of construction expenditures. Efficient construction can accelerate VAT payments by the MOP. Similarly, since VAT is paid on maintenance and operating expenditures, a successful PPP can increase these expenses.
3. Subsidies (in case the project requires them) are paid when the project begins operations, so efficient construction can alter the timing of these expenditures.
4. There are expenditures associated to inspections, which are performed by specialized companies hired by the MOP. However, PPP contracts include a payment from the PPP to MOP for these estimated costs.
5. Any payments to the PPP due to contract renegotiations.

These items meant not only that the Concessions unit became an important source of expenditure for MOP, reaching 33% of all expenditures in 2005, but also that there is a lot of inertia in spending. The expenditure in subsidies and compensations, and specially renegotiations, represented the largest fraction of the concessions unit's expenditure in 2005-2010. The disbursements for the period 1998-2008 exceeded the budget assignments by amounts that ranged from 14%-34% (except for 2003). This was one of the reasons for a dearth of important projects in 2003-2009.

### 3.2.5 *Renegotiations before the 2010 reform*

The period between 1990 and 2010 of Chilean concessions program was characterized by frequent contract renegotiations, as we have mentioned. By 2006, there had been 3 renegotiations per PPP contract on average, adding up to USD 2.810 MM in renegotiated contracts (Engel et al., 2009). This means that the initially contracted amounts of approximately USD 8.460 MM had increased by one-third.

Some of these renegotiations were bilateral agreements, while others were the result of appeals to the Conciliation Commission by the private party. Contract renegotiations usually took the form of i) payments by the Ministry of Public Works (56% of renegotiated amounts, 47 of 78 bilateral renegotiations and 21 out of 30 conciliations or arbitrations),<sup>45</sup> ii) reduction in some investments in exchange for other additional investments agreed upon in bilateral renegotiations, and iii) the sacrifice by MOP of revenues. This took place by allowing early participation of the private party in toll revenues from public projects, by contract extensions (which delayed the time at which the State became the recipient of toll revenues) and by reductions in contracted payments to the MOP. After the 1997 Asian financial crisis, 7 concessions asked for and obtained relief by transforming the original fixed term contract to a variable term contract where they would be assured of the total (discounted) revenues from the contract, eliminating most of the

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<sup>44</sup> This section is adapted from MOP (2016): *Concesiones de Obras Públicas de Chile: 20 años*.

<sup>45</sup> This explains why the Budget Office started including a 20% surcharge in their cost estimates of PPP projects. This reduced the number of PPPs that could be awarded as a result (D. Duarte, personal communication).

demand risk. In exchange, they were asked to make additional investments for about USD 300MM. Given that this was a bilateral negotiation, the real value (at the time) of the contract modification to the concessionaires must have been higher than this amount.

The extent of renegotiations was an important issue in the 2010 Reform (more on this below). Renegotiations not only affected the fiscal balance, but also generated perverse incentives among bidders and authorities in the MOP. For instance, it was especially worrying at the time that, as shown in Table 5, 63% of the amounts renegotiated occurred within the first three years of contract, with 78% of the renegotiated amounts occurring before the project became operational.<sup>46</sup>

### *3.2.6 The PVR method*

The first PVR auction in Chile took place in 1998: the Santiago-Valparaíso-Viña del Mar Route 68 highway. This was the second largest project at that time, with an estimated value of slightly less than USD 500MM. The MOP used PVR because it believed that demand would grow so much that alternative routes would have to be developed in the future. Due to the supervening event clause, the State might have had to compensate the PPP for the reduction in demand if it used a fixed term contract. Using the PVR approach, MOP was able to include a clause that allowed the Ministry to buy back the concession at any point after the twelfth year of the franchise, paying the difference between the winning bid and the revenue already collected, minus a simple estimate of savings in maintenance and operational costs due to early termination. There is no equivalently simple way of estimating a fair compensation in the case of early termination in the case of fixed term concessions.<sup>47</sup>

Despite the opposition of the industry to the PVR method, there were five bidders who passed the technical qualification. The winning bidder asked for a present value of revenue (for construction and O&M expenses) which was smaller than the Ministry's estimate, probably because the rate at which revenues were discounted was not adjusted for the risk reduction associated with PVR concessions. The winning bid did not request a minimum traffic (or revenue) guarantee, though it was available, at a cost. This showed that the PVR approach not only provides more flexibility to the Public Authority, but it does not require traffic guarantees, with their potential contingent costs. Even though PVR began to be used routinely when Eduardo Bitrán became Minister of Public Works in 2006, making PVR a standard and not exceptional bidding variable was another motive for the 2010 Reform.

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<sup>46</sup> The percentage is skewed by the fact that many big projects had been auctioned in the previous few years (to the making of the table), so the table does not include a representative sample of operational periods, with the corresponding renegotiations. However, it remains true that the magnitude of early renegotiations was a serious problem.

<sup>47</sup> Under fixed term contracts, fair compensation depends on the forecast of future revenues. These estimates will differ between the concessionaire and the Public Authority, so the outcome will be the result of bargaining among the two parties, or the result of arbitration. This procedure increases fiscal risk, is more complex and can lead to unequitable results, in contrast to the much simpler compensation under PVR.

**Table 5: Timing of contract renegotiations (up to 2021)**

	Before the 1st year	Years 1-3	Before the PSD	After the PSD
Ruta 5	1,530,561	5,415,022	14,980,586	34,323,659
Interurban highways	825,050	3,687,631	8,900,077	11,751,385
Urban highways	4,744,666	19,381,086	33,288,918	22,636,337
<b>All highways</b>	<b>7,100,276</b>	<b>28,483,738</b>	<b>57,169,581</b>	<b>68,711,381</b>
Airports	-	510,640	510,640	2,810,282
Jails	-	-	-	207,661
Reservoirs	-	395,360	395,360	-
Transantiago	-	98,500	-	104,742
Public Infrastructure	-	24,153	-	827,350
Hospitals	-	-	438,510	-
Other PPPs	-	1,028,653	1,344,510	3,950,035
<b>Total or average</b>	<b>7,100,276</b>	<b>29,512,391</b>	<b>58,514,092</b>	<b>72,661,416</b>
Share in total	0.05	0.22	0.44	0.54

Notes: The first column corresponds to renegotiations during the first year after signing the contract. The third column corresponds to total renegotiations before the start of operations (PSD, for its Spanish acronym), after construction. The last column to renegotiations after PSD. Amounts are in UF, an inflation indexed unit of account that usually fluctuates in the range USD38-44.

### 3.2.7: Details and fiscal risks

*Insurance against earthquakes* Details can be important in PPPs. Chile, which is subject to strong earthquakes, has required PPPs to take insurance against natural disasters since the first El Melón PPP. The requirement is that insurance should be for the total construction value and that MOP be the beneficiary. This ensures that in the case of an earthquake, the firm has the resources to pay for the reconstruction of the project, at a time of increased expenditure for reconstruction in general. Over time, the terms of this part of the PPP contracts have been finessed to make them more effective by eliminating loopholes.

*Surety bonds* Another detail with important consequences is the intelligent use of surety bonds. At all stages of the PPP process, from bidding to construction to the handing back of the franchise to the state, surety bonds are held by the Ministry in case of serious non-compliance by the private party. The use of surety bonds increases the cost of PPPs but has direct and indirect positive effects that more than compensate for these costs. First, bidders must post surety bonds of around 5% of the estimated value of the project, which ensure the seriousness of their bids. This discourages strategic bids or bids designed to renegotiate the contract after adjudication. The MOP will only return the surety bond to the winning bidder if it achieves the financial close of the project, i.e., finds willing lenders by a predetermined date.<sup>48</sup>

In exchange for the return of the first surety bond, the firm provides a second surety bond to ensure satisfactory completion of the construction phase. This bond is made for an amount similar to the first surety bond, but it can be exchanged for smaller bonds as the construction process advances. Once the project is completed and approved, the construction surety bond is returned, but only after the firm hands a third surety bond for the duration of the operational phase (around 3% of estimated project value). Moreover, close to the end of the franchise, the PPP owner must exchange that bond for a final surety bond for a similar amount, to ensure that the project has been maintained to the end of the contract. Thus, in all stages, the project is covered by a surety bond.

Using surety bonds has many advantages. First there is the direct effect of the state receiving a compensation in case of non-compliance by the private party. Second, in the bidding stage, the bank that provides the surety bond will ensure that the offer is reasonable, thus providing a second check on the bid and discouraging reckless offers. Moreover, it provides political cover for the government when a reckless offer fails to attract financing and the process fails. This happened in 2011, when the consortium AZVI-Copasa (and its bank) made a mistake in the assessment of the costs of the PPP for the northern La Serena-Vallenar segment of the Ruta 5. When the bank realized its mistake, it refused to fund the project and the consortium was unable to obtain the financial close. The surety bond was cashed into the Ministry's account and the project was re-auctioned six months later. While there were criticisms for the failed auction, the Minister was able to point out the cost to the bidder and to the fact that the delay would only be for a few months.<sup>49</sup> Finally, MOP can cash in the surety bond easily when the clauses of the bond are breached. This provides stronger incentives to the concessionaire to abide with the contract

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<sup>48</sup> The losing bidders receive their surety bonds back automatically.

<sup>49</sup> A similar case was the Ruta del Loa project. The winning bidder in the 2013 auction was unable to obtain financing. In 2015 the CHP 4,250 MM peso (USD 6.45 MM) surety bond for the initial bid was cashed to the Ministry's account. After dilatory judicial measures by the original winner, the project was auctioned successfully in 2017.

than a potential fine, which would be challenged in court by the concessionaire in a process that could take many years before any payments by the firm were due.

*Bankruptcy* From the first law of 1983, the bankruptcy of the private party was considered as a possibility. The 1983 Law only mentions that in case of bankruptcy the PPP is automatically extinguished. This makes it impossible to lend against the flows of revenue of the PPP. The reform of 1993 allowed for the continuation of the concession, either under the control of the lenders or by auction of the PPP under the same conditions as those of the original auction, with the proceeds going to the lenders.<sup>50</sup> This was a marked improvement, making it easier to lend to the SPV. The 1996 law added the possibility that a serious violation of the terms of the PPP contract would lead to the cancellation of the contract, but then the previous procedure applied to the lenders.

This change turned out to be especially important when in the year 2000 the Mexican construction company Tribasa went bankrupt in Mexico and was unable to obtain the funds required to complete the upgrade of the Ruta 5 segment Santiago-Los Vilos. After several months of delays, and political pressure on the MOP, eventually the Minister had the concession declared in serious violation of the terms of the contract. The concession devolved on the lender, Mexican bank Bancomex, which contracted with the Spanish company OHL to finish the project and eventually sold it. The transition worked out smoothly. If that rule had not been in place, Tribasa could have continued to keep the contract, with the possibility that the pressure to improve the Ruta 5 would lead to a contractual change in its favor.

*Payments to the Public Authority* Contracts for the most profitable projects specify payments to the MOP. The argument is that these payments correspond to the value of preexisting infrastructure, and to repay the value of assets and rights. The economic logic for their existence is not clear, since higher payments only mean that the projects become more expensive. These payments can be substantial, adding to almost USD 2 billion by 2016 (MOP, 2016).<sup>51</sup> Two reasons may explain their existence: first, as a way to cross-subsidize the less demanded PPP sections of the Ruta 5, so the tolls could be made similar even though revenues differed.<sup>52</sup> Second, a specious argument that PPPs are not getting the contracts for free, and perhaps a means of countering arguments by the Finance Ministry against excessive expenditure by the concession unit.

The payments for technical inspection can be justified as a way of ensuring that fiscal constraints do not interfere with this task. Observe also that fixed term contracts (with minimum traffic guarantees) specify payments from the SPV to the MOP when a PPP contract exceeds a revenues threshold, but apparently these payments have not taken place yet.

*Subsidies* Some projects are not self-sufficient, either because they correspond to public services such as hospitals and jails, or because a socially desirable route would never generate sufficient revenues to repay for the investment. In those cases, subsidies are used. For the case of public services, Chile uses availability contracts. Since these PPPs add up to a relatively small fraction of PPPs, their effect on the intertemporal budget is small. Upfront subsidies for socially beneficial non-profitable projects are included in the budgets and usually disbursed only when the project begins to operate. Potential delays in the start of operations lead to some fiscal timing

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<sup>50</sup> A special agent (Interventor) would manage the PPP during this intermediate period.

<sup>51</sup> \$5.5 UF MM, see page 140, MOP (2016).

<sup>52</sup> Note that these transfers are unnecessary under PVR, as tolls can be set equal, and the length of the contracts will adjust endogenously.

uncertainty, as mentioned before, but beginning payment only when operations begin provides incentives for early completion of the project.

*Expropriations* The PPP contract includes an upper limit to the expenses of the concessionaire in expropriations, which means that the residual expropriation risk is absorbed by the state. When the urban PPPs were being built, this was a relevant source of fiscal risk, and these expenditures represented a large fraction of the PPP unit's expenditures in the years when it overspent.

### 3.3 The 2010 Reform of the Law

#### *3.3.1 Fiscal risks and the 2010 law*

While the 1990s reforms were successful in creating a PPP industry in Chile, by the mid-2000s it was apparent that renegotiations were pervasive and a source of fiscal risks. The levels of contract renegotiation were high, and it was worrying that many contracts were renegotiated almost as soon as they were awarded. Experience showed that frequently the PPP and the MOP would reach a bilateral agreement, under terms that the Ministry of Finance struggled to restrain. These renegotiations would often add works which were initially not in the project, sometimes in exchange for term extensions or, even worse from the Finance Ministry point of view, in exchange for current or future disbursements of State funds. Three additional issues were related to renegotiations.

First, except for the Santiago-Valparaíso highway, all other PPPs were tendered using a fixed term which, as we have seen, transfers exogenous risk to the PPP. To see the magnitude of demand risks, and thus the potential strength of lobbying for contract renegotiations, consider the 2001 renegotiation of projects affected by the Asian crisis of the late 90s. The result of renegotiation was to substitute a variable term for the original fixed contract term. In exchange, the PPPs agreed to additional works worth USD 300MM (note that the additional works were the result of a bilateral negotiation, so the private party must have valued the change in conditions by more than the USD 300MM).

A second issue is that renegotiations to add works were welcomed by concessionaires, who could negotiate prices bilaterally, without competition. This was compounded by the fact that projects were tendered without advanced and updated designs (as mentioned above, partly due to the practice of the Ministry of Finance of limiting the resources available for studies by the PPP unit of the Ministry of Public Works), which opened further opportunities for renegotiations.

Finally, the mandate of the Arbitration Commissions was seen to need reform after the arbitration of prison PPPs. In that case, the Arbitration Commission arrived at a decision that awarded the concessionaire more than could be allowed under the PPP contract. There was no effective redress, because of the final nature of the Arbitration Commission rulings (see Bitrán and Villena, 2010, for details).

It is in this context that the 2010 reform of the Law must be understood. Perhaps the most significant change from the point of view of fiscal risk was the elimination of the supervening cause or event as a motive for renegotiation. By default, the reform required that any risk not expressly allocated by the PPP contract to the government remained with the concessionaire. The only exception was an act of the government, but only if it satisfied several restrictive conditions. The act of government had to occur after the adjudication of the contract, it had to be impossible to foresee, it had to be specific to the PPP sector and not of a general nature, and it had to significantly alter the economic profitability of the project. This severely limited the scope for renegotiations and thus the space for the emergence of government liabilities not previously

accounted for in the fiscal accounts or the budget. Arguing that the PPP was entitled to a compensation that restored its “economic equilibrium”, every time a government decision affected it adversely, became much harder under the new law.

The second change was the elimination of the “exceptionality” of PVR contracts. Indeed, PVR contracts began to be routinely used in the late 2000s, before the change of the law by the Ministry of Public Works and since then have become the main means of procuring transport PPPs (see Figure 1). The Minister at the time, Eduardo Bitrán, believed that PVR contracts should become the standard rather than an exceptional method of awarding PPPs, given its success in the Santiago-Valparaíso highway. Moreover, it had become clear that the opposition to PVR was self-interested when, after the 1999 crisis, several major PPPs ran into financial trouble and were converted to a variable term contract.

The third relevant change was that any additional works must be procured in a competitive auction under the supervision of the Public Works Ministry. The value of the additions would be estimated (for social project evaluation purposes and for use as an upper limit to bids) using unit prices included in the original contract. After the opening of the bids, the SPV can make a lower offer for the additional works. This bid in turn can be contested by a lower offer from the lowest bidder in the auction. The procedure implies that there are scant rents from renegotiations, and the PPPs became less interested in pressuring for additional works through renegotiations.<sup>53</sup>

Finally, the new law modified the governance of PPP renegotiations by creating an independent and specialized Experts Panel. The Panel is the first step in the resolution of any conflict between the parties and issues a recommendation after a public hearing. The parties can accept the recommendation or appeal to the Arbitration Commission of the PPP. Moreover, the Arbitration Commissions are no longer allowed to judge in equity but must issue a verdict based on the Law and the contract. The Experts Panel also reviews renegotiations that exceed 25% of the original value of the contract.

### *3.3.2 The effect of the new law*

The new law applied only to PPPs tendered after 2010.<sup>54</sup> Thus we compare PPPs tendered under the old law with those tendered under the new law. Of course, our comparison is only suggestive, because PPPs were not randomly assigned to the old and new laws.

Table 6 summarizes renegotiations under the new and the old law overall, distinguishing also between fixed and variable term PPPs. We have data from 98 PPPs, of which 57 were projects awarded before the 2010 Reform. Of all projects, 55 were fixed-term PPPs and 36 were variable-term concessions.<sup>55</sup> As column 1 shows, as of 2021, 55 of the 98 PPPs had been renegotiated 189 times. On average 20 percent of the total investment was a result of renegotiations. The average hides important differences, however.

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<sup>53</sup> The concessionaire does receive a contract management fee of 8% of the bid value for the additional works.

<sup>54</sup> More precisely, the older PPPs could decide whether to abide by the reformed Law. None chose that option.

<sup>55</sup> Recall that seven PPPs were tendered as fixed term, but then their term was made flexible post the 1999 Asian crisis. Thus, we excluded them from the comparison between fixed and variable term PPPs.

**Table 6: Renegotiations of Chilean PPPs up to 2021**

	(1) All PPPs	(2) Old Law	(3) New Law	(4) Variable Term PPPs	(5) Fixed Term PPPs	(6) Variable Term PPPs with Old Law	(7) Fixed Term PPPs with Old Law	(8) Variable Term PPPs with New Law	(9) Fixed Term PPPs with New Law
<b>Number of Projects</b>	98	63	35	36	55	13	43	23	12
<b>Initial Investments (UF)</b>	432,721,408	221,560,816	211,160,608	205,242,128	185,661,760	44,765,524	134,977,760	160,476,608	50,684,000
<b>Total Renegotiated Amounts</b>	134,082,784	130,966,144	3,116,637	11,195,966	89,607,784	8,636,347	89,050,760	2,559,619	557,018
<b>Amount renegotiated during construction</b>	58,514,092	57,369,424	1,144,668	4,895,964	43,259,912	4,195,805	42,815,404	700,159	444,508
<b>Average years after adjudication</b>	18.06	19.66	8.11	12.8	18.84	14.09	20.37	9.25	7.2
<b>Average construction duration</b>	4.31	4.3	4.33	4.33	4.14	4.18	4.16	4.75	4
<b>Average years of operation</b>	13.75	15.36	3.78	8.47	14.7	9.91	16.21	4.5	3.2
<b>Number of projects with renegotiations</b>	55	48	7	12	36	7	34	5	2
<b>Total number of renegotiations</b>	189	179	10	28	115	21	112	7	3
<b>Average number of renegotiations</b>	3.44	3.73	1.43	2.33	3.19	3.00	3.29	1.40	1.50
<b>Number of projects with renegotiations (during construction)</b>	32	29	3	6	21	5	19	1	2
<b>Number of renegotiations (during construction)</b>	70	66	4	11	41	9	39	2	2
<b>Average number of renegotiations (during construction)</b>	2.19	2.28	1.33	1.83	1.95	1.80	2.05	2.00	1.00
<b>Amount renegotiated/Total investment (%)</b>	30.99%	59.11%	1.48%	5.46%	48.26%	19.29%	65.97%	1.60%	1.10%
<b>Amount renegotiated/Total investment (%) (during construction)</b>	13.52%	25.89%	0.54%	2.39%	23.30%	9.37%	31.72%	0.44%	0.88%
<b>Total renegotiation/[Total investment x total number of years of concession]</b>	1.72%	3.01%	0.18%	0.43%	2.56%	1.37%	3.24%	0.17%	0.15%
<b>Total renegotiation/[Total investment x total number of years of concession] (during construction)</b>	10.13%	10.19%	8.48%	10.10%	11.66%	11.62%	11.56%	5.76%	19.95%
<b>Average time until the first renegotiation (conditional on at least one renegotiation)</b>	4.1	4.0	4.3	3.8	4.1	3.1	4.2	4.6	3.5
<b>Number of concession with term extensions</b>	23	21	2	5	15	3	15	2	0

Notes: Initial Investment is based on MOP estimated budget in the concession terms. Construction period is defined as the time between the start of the concession and the PSD. Investment and renegotiation amounts are in UF (USD 38-44).

Consider first PPPs before and after the Reform (columns 2 and 3). Under the old law one-third of the amounts invested were the results of contract renegotiation, almost half of it during construction. By contrast, under the new law less than 2 percent of the amount invested was the result of renegotiations with less than 1 percent during construction. While under the old law 47 of 55 PPPs were renegotiated, only 9 out of 41 concessions awarded under the new law had been renegotiated by 2021.

Of course, PPPs under the new law are more recent and thus have had less time to renegotiate (which is why the relevant difference lies in the amounts renegotiated during construction). Nevertheless, there are indications that the substantial fall in renegotiations is permanent and not only during the early years. For example, the average amount renegotiated per year is only 0.16 percent of total investment under the new law, an order of magnitude less than the 1.70 percent renegotiated on average every year under the old law.

Table 7 controls for the fact that PPPs awarded under the new law are still underway, by comparing the amounts renegotiated during construction, and 2, 4 and 6 years after the project began service. We also consider only highways, only transport PPPs and all PPPs. In all cases the amounts renegotiated are very small with the new law. By contrast, note that under the old law renegotiations were routine.

Columns 4 and 5 of Table 6 compare renegotiations under variable and fixed term PPPs. Variable-term PPPs are renegotiated less frequently, and the amounts are smaller. For example, 4.44 percent of the total amounts invested under a variable term PPP were renegotiated, which contrasts with 29.53 percent for PPPs tendered under fixed term. Another observation is that the amount renegotiated per year is only 0.35 percent under variable-term PPPs, about one-fifth of the 1.57 percent on average renegotiated every year by PPPs tendered under fixed a term.

As can be seen in the next four columns, under the new law both fixed and variable term PPPs have only been renegotiated by small amounts: 0.17 percent per year on average for variable term, and 0.11 percent on average for fixed term contracts.

It should be added that the lower frequency of renegotiations of PPPs tendered under the new law is not an artifact of the period. Indeed, there were two large renegotiations of PPPs tendered under the old law, one in 2013, and a smaller one in 2017.

### 3.4 Conclusions of this section

It is interesting that even though Chilean fiscal accounting did not follow the best practices in terms of including PPPs in the intertemporal budget, it managed to avoid the fiscal costs that have affected other countries with large PPP programs. Recall that by 2016 Chile had 3.300 km of interurban highway PPPs and close to 200km of urban highway PPPs. In addition, most airports were also PPPs.

**Table 7 Renegotiations (as fraction of investment) in Chile: Before and after the 2010 reform**

	No. of Renegotiations	Renegotiations as fraction of Investment		
		Construction	First 6 years	Construction + First 6 years
<b>Highways</b>				
Before 2010 Reform	31	31.5%	16.5%	47.9%
After 2010 Reform	17	0.5%	1.2%	1.7%
<b>Transport</b>				
Before 2010 Reform	50	28.9%	15.4%	44.2%
After 2010 Reform	28	0.4%	1.1%	1.5%
<b>All PPPs</b>				
Before 2010 Reform	62	26.0%	14.0%	40.0%
After 2010 Reform	35	0.5%	0.9%	1.5%

Note: Investment is defined as the estimated MOP budget (in UF) available in the bidding terms.

There are several institutional reasons for these comparatively good results. First, since the mid-1980s and until recently, the finance minister (seconded by strict fiscal budget directors) has been extremely powerful, both by institutional design and by empowerment. For example, all renegotiations had to be approved by the finance minister. Second, projects—even in the case of self-financing PPPs—had to be vetted by the social cost-benefit analysis unit, which ensured that approved projects had passed a hurdle rate of social profitability using a standard methodology. Third, the strategy of starting with a test run of only a few small projects and then improving the procedures and legislation was successful. Fourth, the notion was always that some projects could lose money, and that debts were not guaranteed, though they had liens on the flows of the project or on the results of a new auction of a failed PPP. More recently, the reform of the PPP Law improved the balance between the interests of the state and the private parties (Technical Panel, no supervening clauses) and the increased use of PVR contracts have reduced the extent of contract renegotiations.<sup>56</sup>

#### **4. The ex post internal rate of return on PPP projects**

##### 4.1 Overview

In this section we estimate ex post internal rates of return (IRR) for Chile’s PPPs.<sup>57</sup> The estimates we obtain can be interpreted as representing the cost to society of PPP provision of infrastructure. They also provide some indication on the profitability of individual projects and of the entire PPP program. We relate the estimated IRRs to key elements of Chilean PPPs discussed above.

<sup>56</sup> Other important features that increased the confidence of international investors and thus decreased the costs and increased competition were agreements for investment protection, national treatment principles, free capital transfers and the possibility of appeals to international arbitration panels.

<sup>57</sup> We also refer to these rates as “realized” or “actual” rates.

Our numbers were obtained directly from cash flow data and projections, in contrast to indirect estimates based on the cost of private versus public funds, for instance. Thus, the IRRs we report can be used to evaluate whether the advantages or disadvantages of PPPs compensated for the higher or lower cost of funds when compared with public provision.

Our estimates for the rates of return have a large dispersion, implying a large variance in the results of PPP projects. This explains the pressure for contract renegotiation and underlies the fiscal risks discussed earlier in this paper. The large variance in actual returns indicates that infrastructure investment is intrinsically risky, independent of whether the project is financed by the public purse or as a PPP.

#### 4.2 Methodology

One of the challenges we faced when calculating the IRRs was the switch from traditional Chilean accounting standards to IFRS standards that took place in the mid-2000s. This meant that the income statements could not be used directly, because several of its components are marked to market under IFRS. This change also implied that fluctuations in interest rates can affect the operational results, which would bias our IRR estimates. For this reason and taking advantage of the fact that PPPs are Single Purpose Vehicles (SPVs), we used cash inflows and outflows –which are not marked to market– to determine the profitability of projects. These cash flows are somewhat erratic in individual years, with inflows and outflows that are large in magnitude and whose nature is sometimes unspecified. Over longer periods however, this problem tends to cancel out and should not have a large impact on our estimates. Also, some items were excluded for reasons we explain below.

To estimate the IRR of a given PPP, we began by constructing a cash-flow series for years with information on cash flows. We classified inflows and outflows reported in the SPV's financial statements into three categories: operations, investment, and financing. Next, we used this information to determine net investment cash flows and net operational cash flow, excluding interest payments for the latter. The difference between these flows, the net cash flows, was used to estimate the realized (ex post, actual) IRR. The details may be found in the Appendix, as well as the judgement calls we made and how they varied with whether the SPV chose the direct or indirect method to present cash flows.<sup>58</sup>

We considered all highway and airport PPPs with at least 5 complete operational years up to 2019 (see the Appendix for a detailed definition), resulting in a sample of 50 projects, where 31 are highways and 19 are airports. For the 14 (out of 50) concessions that had concluded by 2019, the last year for which we have data, we obtained the IRR directly. For the remaining 36 concessions, we used regression-based simulations to forecast future net cash flows and then calculate the IRR. The regression we used estimates a linear relation between annual cash flows (normalized by MOP's estimate of total investment reported in the bidding documents) and year of operation. The regression also includes concession and calendar year fixed effects.

Our estimates show that cash flows increase with the year of operation, albeit at a decreasing rate (see Figure 2). We used these estimates together with the regression residuals to simulate 1000 cash-flow series for every ongoing concession and calculated the IRR for every simulated series. The estimated IRR is the median of the 1,000 IRRs obtained this way. In the case of PVR contracts we used an auxiliary regression model to determine the concession length for a given

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<sup>58</sup> These methods differ in how they record operative cash flows: the direct method reports cash inflows and outflows from operating activities, while the indirect method adjusts the period's net income by adding changes in short-term assets and liabilities to determine the implied cash flow.

cash flow series. This model relates toll revenues –the series that determines the duration of the contract under PVR– to cash flows (see the Appendix for details on both regression models).<sup>59</sup>

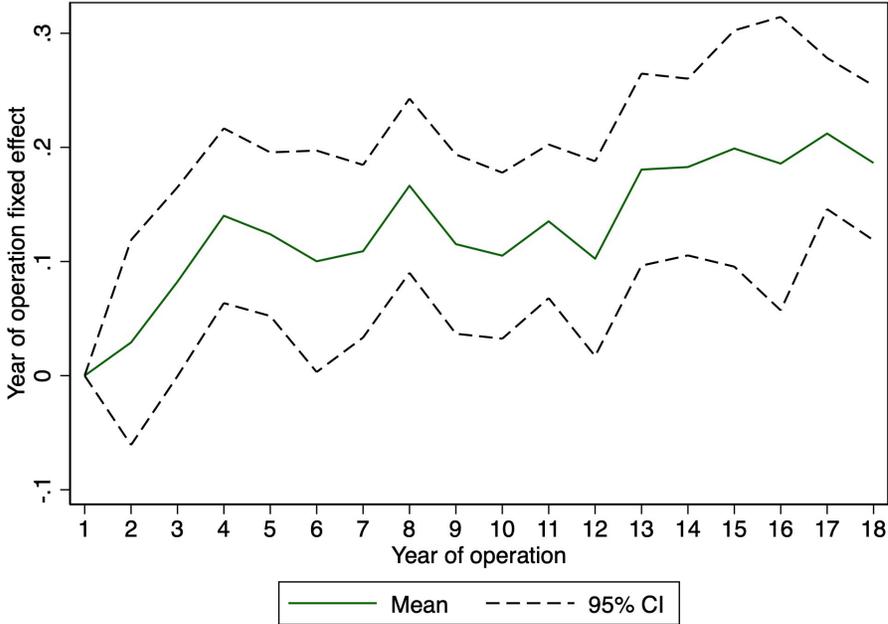


Figure 2: Year of operation fixed effects. *Note:* Estimates consider projects with at least 5 observed operational years. Our specification includes an additive constant.

**4.3 Results**

The first column in Table 8 presents summary statistics for our estimates of realized IRRs for the 50 PPPs in Chile. We considered all highway and airport PPPs with at least five years of operations. The first row reports the average IRR across the projects considered. The second row reports the median of the 50 estimated IRRs. The rows that follow report measures of dispersion of estimated IRRs: the standard deviation and the 25th and 75th percentile (the difference of the latter two is the interquartile range).

It follows from the first column in Table 8 that the mean and median of the estimated IRRs are 6.8% and 7.5%. Reports for our estimates of realized IRRs for every concession are available upon request. For seven concessions the estimated IRR is negative while for four it is larger than 20%. The largest IRRs are 25.2% (Acceso Norte Concepción) and 25.0% (second Acceso Vial Aeropuerto Arturo Merino Benítez concession) while the smallest IRRs are -23.0% (second El Loa Airport concession) and -17.9% (second Punta Arenas Airport concession).

The second and third columns in Table 8 report the summary statistics for the subset of 29 fixed term projects and for the 21 PVR projects, respectively. They show that the IRRs for fixed term contracts (mean: 9.8%, median: 9.4%) are significantly higher than for PVR contracts (mean:

<sup>59</sup> We thank MOP for providing the revenue series for PVR contracts.

2.6%, median: 4.7%).<sup>60</sup> One possible explanation is that with less demand risk, the required rate of return on projects is lower. Another possible explanation is that fewer renegotiations under PVR provide incentives for concessionaires to be more efficient, thereby reducing the threshold returns required to procure a project as a PPP.

The fourth and fifth column in Table 8 report the summary statistics for the subsets of 31 highway PPPs and the 19 airport PPPs. The returns for highway PPPs (mean: 9.1%, median: 7.9%) are considerably higher than for airport PPPs (mean: 2.9%, median: 5.8%). The seven PPPs with negative estimated IRRs are all flexible term airport PPPs, providing yet another possible explanation for lower returns under PVR.

**Table 8: Summary Statistics for Estimated IRRs.**

	All	Fixed Term	Variable Term	Highway PPPs	Airport PPPs
Mean	6.8%	9.8%	2.6%	9.1%	2.9%
Median	7.5%	9.4%	4.7%	7.9%	5.8%
SD	9.4%	7.2%	10.5%	5.8%	12.5%
25% Quantile	3.7%	6.8%	-3.8%	5.5%	-4.5%
75% Quantile	11.1%	13.2%	8.3%	10.7%	12.7%
<b>No. of projects</b>	50	29	21	31	19

Figure 3 plots the IRR against the year when construction of the project began. A downward trend is evident. Estimates from a linear regression of the IRR on the year where construction began suggests a negative slope significant at the 10 percent level and an (imprecisely) estimated decrease of the IRR of approximately 12 percent between 1998 and 2013.

This downward trend in IRRs can be attributed to the firm’s learning curve, the use of PVR beginning in the mid-2000s and the legal reform of 2010. Another possible explanation is provided by Figure 4. This figure presents some very simple estimates for the cost of debt of every project (see the Appendix for how we calculated the estimates), plotted against the year of procurement. A downward trend is evident. If the decision to undertake a PPP project depends on its ex-ante IRR being above a threshold that reflects the cost of debt, a downward trend in the cost of debt would lead to the observed trend in realized IRRs. The downward trend in IRRs should not be attributed to the initial projects being the “low-hanging fruits”, because there was competition for the projects, which should reduce those rents. There is however the possibility of initial political risk (requiring higher returns), which dissipates over time, and this could also explain the downward trend.

<sup>60</sup> Formal statistical tests reject that the mean (or median) of returns are the same for both subsets of projects, at conventional significance levels.

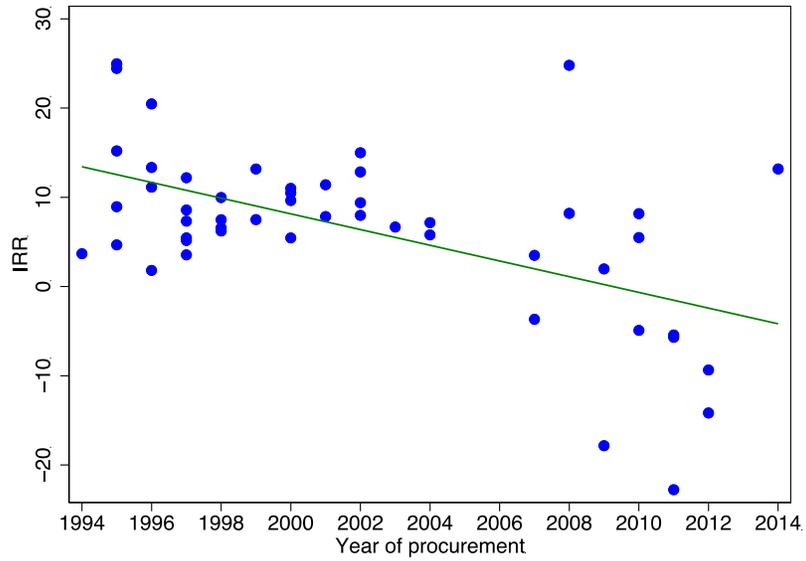


Figure 3: Estimated IRR vs Year of procurement

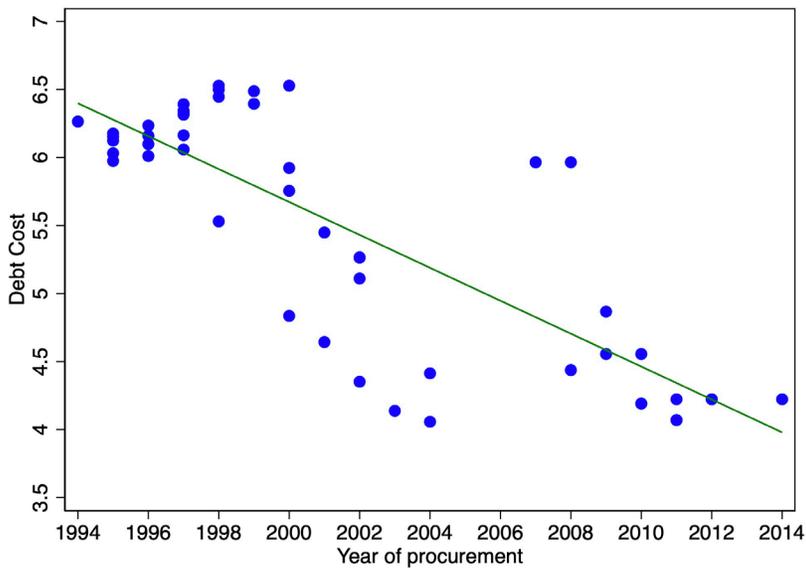


Figure 4: Debt Cost vs Year of procurement

#### 4.4 Robustness checks

We present robustness checks for the two main findings obtained above, that is, an average IRR of approximately 7 percent and higher IRRs for fixed term projects than for PVR projects.

Consider first the 14 concessions that have concluded. No simulations were needed to estimate the IRR for these projects. These estimates, therefore, are likely to be more precise. Their average and median are 7.9% and 7.5%. These returns are similar to those reported in Table 8, especially

once we note that the fraction of fixed term projects in this subsample (79%) is larger than this fraction in the entire sample of projects (62%).

Our second robustness check focuses on the possibility that SPVs are inflating their investment costs, which would bias the estimated IRRs downwards. This could happen, for example, if the concessionaire hires a company related to the owners of the SPV to build the road at an inflated price. To allow for this possibility, we replaced net investment costs with the MOP’s estimate of construction costs for construction years’ cash flow. We excluded all airport PPPs because they typically have small initial investments, making them closer to an Operations and Maintenance (O&M) contract than a PPP. We also excluded a highway PPP where the contract specifies significant investments after the project becomes operational, one highway where the investment was done in two stages, which results in an insufficient number of observations for this exercise, and one highway where MOP’s estimated budget does not correspond to the entire project.

Table 9 summarizes our findings. The left panel replicates the first three columns of Table 8 for the subset of projects considered. The right panel reports summary statistics when MOP estimates are used to proxy investments during construction. This time the difference is substantial. The mean and median of the IRRs increase by approximately 3 percent. This increase is larger for fixed term concessions (approximately 5%) than for PVR contracts (approximately 2%). This difference could be overestimating the actual bias in Table 8, since renegotiations during construction may lead to larger outlays than the value estimated by MOP. For this reason these estimates should be considered, informally, as an “upper bound” for the actual IRRs.

**Table 9 Estimated IRR: Replacing reported investment during construction by MOP estimates.**

	Median Returns (Reported Investment Costs)			Median Returns (MOP’s Investment Estimates)		
	All	Fixed Term	PVRs	All	Fixed Term	PVRs
Mean	7.4%	8.1%	6.5%	10.2%	11.8%	7.8%
Median	6.8%	7.1%	6.4%	9.9%	12.9%	8.5%
SD	4.1%	4.8%	2.7%	5.5%	5.7%	4.3%
25% Quantile	4.4%	4.6%	4.3%	7.1%	8.8%	4.3%
75% Quantile	9.5%	10.2%	7.9%	14.3%	16.0%	10.3%
<b>No. of Projects</b>	<b>28</b>	<b>17</b>	<b>11</b>	<b>28</b>	<b>17</b>	<b>11</b>

#### 4.5 Assessing the magnitude of IRRs

Is an average IRR of around 7 percent for a typical concession project in Chile a reasonable return or is it low or high? The answer is not obvious since, to the best of our knowledge, there is no equivalent previous study estimating internal rates of return for a countrywide PPP program.<sup>61</sup>

One possibility is to compare with the IRR of regulated companies in Chile, even though these sectors are not part of the Chilean concession program. For example, in electricity and water

<sup>61</sup> Vergara-Novoa et al (2020) estimate the revenues, costs and average costs for highway concessions in Chile directly from financial statements. This study does not consider the change in accounting standards mentioned above.

distribution, tariffs are set aiming for an IRR between 7 and 10 percent for an efficient company. These returns suggest the IRRs we estimate are in the right ballpark.

Another possibility is to contrast our estimates with the opinion of experts. To this effect we conducted a survey with 24 experts, which included former authorities at the Ministry of Public Works and related ministries, private sector executives involved in investment decisions in the PPP sector and academics specialized in project evaluation.<sup>62</sup> The average IRR was 11.0% (median: 10.3%) with a relatively large dispersion (standard deviation: 2.8%).<sup>63</sup> These estimates are 3%-4% higher than the estimates from our benchmark model and very close to the estimates from our second robustness exercise (Table 9).

## 5. Conclusion

There are several dimensions in which Chile's PPP program has been successful, many of which have implications for the management of fiscal risk. First, most projects have suffered only relatively short delays, if any.<sup>64</sup> Second, the direct fiscal cost of guarantees has been small. Third, Chile innovated by introducing flexible term (PVR) contracts which have better risk allocation properties: They allow for contract flexibility with less risk of opportunistic renegotiation and the fiscal risks associated with these renegotiations. Fourth, the extent of contract renegotiations was significant before the 2010 reform but fell dramatically following the reform, mainly for two reasons: acts of government that justify a compensation were severely limited and additional works contracted during the concession term had to be procured in a competitive auction. Fifth, despite a major reform in 2010 that reduced the bias in favor of the private party in the original PPP legislation, interest in the PPP program by local and international investors has continued to be strong. Sixth, it emerged unscathed from the 1999 and 2008 recessions, without having an impact on the fiscal balance. Seventh, the infrastructure built under the PPP program had a positive impact on productivity.<sup>65</sup> Eighth, the PPP program was able to mobilize resources from domestic institutional investors to finance the projects. Ninth, the annual cost to society of having PPPs lies somewhere between 7% and 10% of total investment value and can be lowered by using PVR as the contract mechanism. Finally, we observe that there is a large variation in the return of projects, independently of the type of contract.

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<sup>62</sup> The experts we contacted are: Marcela Allue, Eduardo Bitrán, Fernando Britos, Eduardo Contreras, Leonardo Daneri, Álvaro Fuentes, Andrés Gómez-Lobo, Aldo González, Luz Granier, Ignacio Guerrero, Cristina Holigue, Cristián López, Rodrigo Manzur, Edgardo Mimica, Ricardo Mogrovejo, Juan Carlos Muñoz, Raúl O'Ryan, Cristián Palacios, José Antonio Sanhueza, Jennifer Soto, Daniel Ulloa, Juan Vargas, Thomas Verbeken, Leonel Vivallos. The response rate was 20 out of 24.

<sup>63</sup> We asked for separate estimates of the average IRR for concessions adjudicated between 1994 and 2004 and between 2004 and 2014. The average IRRs for the former and latter periods were 11.7% and 8.4%. The IRRs we report in the main text consider the weighted average of both estimates with weight proportional to the number of PPPs in each period.

<sup>64</sup> This may be because the concession term begins immediately after adjudication and that in many cases, toll revenues can only be received after the project is in operation. This creates strong incentives for building the projects as fast as possible. These incentives also apply under PVR contracts, since for these projects revenues are discounted to the date the project completes construction.

<sup>65</sup> Chile, ranked 34 worldwide, has the highest Logistic Productivity Index (LPI) in Latin America (World Bank, 2018). And it outranks other countries in Latin America in the Infrastructure subindex, which is explained in part by the PPP program.

## Appendix: Estimating the Internal Rate of Return and Return to Capital for Chilean Concessions

### A. Data

We obtained the Financial Statements for the concession companies, from 2001 onwards, from the website of the Financial Market Commission (CMF, by its acronym in Spanish). For years prior to 2000, we requested the information from the CMF by the Chilean equivalent of the Freedom of Information Act.

Financial Statements include information on firms' Balance Sheets, Income Statements and Cash Flow Statements. Cash Flow Statements present all cash inflows and outflows during the year, classifying them into three categories: Operative, Investment and Financing. Operative cash flows are the inflows and outflows associated with the activities necessary to produce net income, i.e. the operation of the project. Investment cash flows include transactions associated with the acquisition and sale of long-term assets related to the project. The financing flows contemplate the activities necessary to raise money, via debt or equity, and the payment of these liabilities. To calculate the IRR, we used the Net Operative cash flows, without considering interest payments, and Net Investment cash flows. These are cash flows associated with the concession's income, and therefore, its profitability. We define Net Cash Flow in year  $t$  as:

$$CF_t = (OP_t - INTP_t) + INV_t$$

where  $OP_t$  is the Net Operative cash flow,  $INTP_t$  is interest payments listed as operative flow and  $INV_t$  is the net investment cash flow. We emphasize that these are net cash flows, and thus include cash inflows and outflows.

Some judgement calls were needed to determine Net Cash Flows in our data. First, firms choose whether they present cash flows using the direct or the indirect method. These methods differ in how they record operative cash flows: the direct method reports cash inflows and outflows from operating activities, while the indirect method adjusts the period's net income by adding changes in short-term assets and liabilities to determine the implied cash flow.

While the direct method allows us to identify the cash flow from interest payments related to operating activities, the main challenge is to obtain interest payments when firms use the indirect method. In this case, interest payments cannot be identified because they are lumped together with other outflows under operational flows. We used financial costs as a *proxy* for interest payments reported under this method.

Second, the financial statements prior to 2000 do not include Cash Flow Statements. We describe next how we built flow statements from the information available for these years.

We constructed the cash flows under the indirect method from the variations in the balance sheet. We used a common criterion for all concessions to define cash and operating, investing and financing cash flows, based on the following accounting identity:

$$\Delta\text{Cash}_t = OP_t + INV_t + FIN_t - \Pi_t,$$

where the right hand terms are Net Operative, Investment and Financing Cash Flows respectively, and  $\Pi_t$  is an inflation-correction factor.

We assigned the available information to the different kinds of flows as follows:

- Cash: Current Assets on Hand, Short-term Deposits, Negotiable Securities and non-categorized current assets (listed as "Other Current Assets").

- Operative Cash Flow: Changes in current assets not considered as cash, depreciation of fixed assets, amortization, current (or short-term) liabilities and the period's results (profits).
- Investment Cash Flow: Variation in the position of fixed assets and other non-current assets.
- Financing Cash Flow: Changes in the long-term liability position and changes in equity.
- Inflation-correcting factor: Obtained by applying the period's inflation,  $\pi_t$ , to the three cash flow variables, i.e.  $\Pi_t = \pi_t(OP_t + INV_t + FIN_t)$ .

These adjustments allowed us to determine net cash flows for all the years in the sample.

## B. Internal Rate of Return (IRR) Estimation

### B.1 Definitions and notation

- Operating Years: Years during which the concession is operational and operating revenues are obtained. This period begins in the first full year after provisional entry into service.<sup>66</sup> The number of Operating Years is denoted as  $T^{OP}$ .
- Construction Years: All years prior to the first year in operation. The number of Construction Years is denoted as  $T^C$ .
- From the definitions above, we denote the Number of Observed Years (i.e. years for which cash flow data that will be used to calculate the IRR are available) by  $T^{obs} = T^C + T^{OP}$ .
- The duration of the concession is denoted by  $T$ . Obviously,  $T \geq T^{obs}$ . The value of  $T$  is known for concessions that have concluded. For fixed term concessions that have not yet concluded, we infer  $T$  from the latest version of the contract. For PVR concessions, we determine a value of  $T$  for every simulation used to obtain the distribution of IRRs as described below.
- $CF_t$ : Cash Flow in year  $t$ . All Cash Flows are in UF (*Unidad de Fomento*), a unit of account indexed to inflation that is broadly used in Chile.
- $IRR$ : Internal Rate of Return.
- $Y_t$ : Toll Revenue in year  $t$ , used to calculate the Present Value of Revenue (PVR) that determines the contract's length. It may also include government transfers if specified in the contract. These revenues are discounted at the rate defined in the concession contract.
- $PVR_t$ : Present Value of Revenues up to period  $t$ , discounted according to the rate stipulated in the original contract.
- $PTR$ : Present Total Revenues. This is the discounted amount offered by the company in the bidding process. The contract will end in the first period when  $PVR_t \geq PTR$ ; we denote this period as  $T_{PVR_t \geq PTR}$ .
  - For some specific concessions, there are variations to the PTR rule to determine when the concession ends. For example, in a couple of cases the project ends  $M$  months (e.g., 36 months) after a fraction  $\delta$  (e.g., 75%) of PTR is collected. Our simulations take into account these special cases.

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<sup>66</sup> For example, if a project starts operations in February 2010 or later that year, we consider 2011 as the first operating year.

- The Total Number of years for a PVR contract will be  $T = \min\{T^{max}, T_{PVR_t \geq PTR}\}$ , where  $T^{max}$  is the maximum number of years stipulated in the contract. The contract lasts this number of years if the condition  $PVR_t \geq PTR$  is not met for  $t = T^{max}$
- For both Fixed Term and PVR contracts, we made a correction to the last year's simulated Cash Flow that accounts for the fact that the contract ends before December 31<sup>st</sup> of that year. Simulated income for year T is multiplied by  $m/12$ , where  $m$  is the month where the projects ends.

## B.2. Estimating the Internal Rates of Return (IRR)

1. For completed projects (i.e.,  $T = T^{obs}$ ), the IRR is calculated by solving the equation

$$\sum_{t=0}^T \frac{CF_t}{(1 + IRR)^t} = 0.$$

If there is more than one solution we choose (in order):

- i. The smallest positive root.
  - ii. If there are no positive root, the largest (closest to zero) negative root.
2. For each ongoing projects (i.e.  $T > T^{obs}$ ), we obtained 1000 simulated values for the IRR and reported the median of these values as the estimated IRR. We chose the median over the mean, because for some projects a small number of IRRs obtained via simulation were clearly outliers.

## B.3. Model to generate simulated cash flow series

For concessions that had concluded, we obtained the IRR directly from the cash flows. To obtain an estimate for the realized IRR for an ongoing concession, we followed the following steps.

### *B.3.1. Estimating a cash flow equation*

First, we estimated a linear relation between operational cash-flows (normalized by MOP's estimate of total investment)<sup>67</sup> and year-of-operation, controlling for calendar-year and concession fixed effects:

$$\frac{CF_{it}}{I_0^i} = \alpha + \theta_{j(i,t)} + \phi_t + \delta_i + u_{it} \quad (1)$$

where  $CF_{it}$  is cash flow of concession  $i$  in calendar year  $t$  and  $I_0^i$  is MOP's investment estimate for concession  $i$  (as reported in the bidding documents). The  $\theta_j$  denote year-of-operation fixed effects: for every concession  $i$  there exists an integer  $n_i$  such that  $j(i, t) = t - n_i$ . Our data have at least five observations for the each of the first 18 years of operation. We therefore include  $\theta_1, \theta_2, \dots, \theta_{18}$  in the above specification. The  $\phi_t$  denote calendar-year fixed effects and the  $\delta_i$

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<sup>67</sup> We cannot use  $\log CF_{it}$  because there are many observations with negative cash-flow.

denote concession fixed effects.<sup>68</sup> Errors were clustered at the concession's level. From the estimation, we obtain parameters  $\hat{\alpha}$ ,  $\hat{\theta}_j$ ,  $\hat{\phi}_t$  and  $\hat{\delta}_i$  and residuals  $\hat{u}_{it}$ .

As mentioned in the main text, estimated year-of-operation fixed effects showed an increasing trend that tended to flatten out, we therefore set  $\hat{\theta}_j = (\hat{\theta}_{16} + \hat{\theta}_{17} + \hat{\theta}_{18})/3$  for  $j \geq 19$ . Estimated values of calendar-year fixed effects showed no discernible trend, we therefore set  $\hat{\phi}_t = \frac{1}{23} \sum_{t=1997}^{2019} \hat{\phi}_t$  for  $t \geq 2020$ .

### B.3.2. Simulating cash flow series: Fixed term concessions

We simulated 1,000 cash flow trajectories for each ongoing concession as follows. We used observed values of cash-flow for all years of construction and for the years of operation (at least five) when they were available. For unobserved observations we used the fitted values in eq. (1) and added an error term sampled with replacement from the residuals,  $u_{it}^k$ :<sup>69</sup>

$$\frac{CF_{it}^k}{I_0^i} = \hat{\alpha} + \hat{\theta}_j + \hat{\phi}_t + \hat{\delta}_i + u_{it}^k \quad (2)$$

For each simulated cash flow trajectory, we calculated the realized IRR. The estimated IRR is the median of the 1000 IRRs obtained this way.<sup>70</sup>

### B.3.3. Simulating cash flow series: Flexible term concessions

For ongoing PVR contracts, we simulated 1,000 cash flow series in the same way as for fixed term concessions. The only difference is that the number of observations for each simulated series was the maximum duration of the concession stipulated in the contract.

To determine the actual length of the (simulated) cash flow trajectory and the number of observations that should be considered when calculating the IRR, we used an auxiliary model that relates toll revenue with cash flow and the regression for cash flow in (1) as follows

$$\frac{Y_{it}}{I_0^i} = \beta_0 + \beta_1 \frac{CF_{it}}{I_0^i} + \beta_2 \hat{\theta}_j + \beta_3 \hat{\phi}_t + \beta_4 \hat{\delta}_i + e_{it} \quad (3)$$

where  $Y_{it}$  is toll revenue (in real terms) in year  $t$  for concession  $i$  and the  $\hat{\theta}_j$ ,  $\hat{\phi}_t$  and  $\hat{\delta}_i$  are the coefficients estimated for (1). We obtain the estimated parameters and residuals  $\hat{e}_{it}$ . Table A1 reports the results from this regression when estimated for all the PVR projects and only for highway PVR projects. The latter model is the one we use for the robustness check that involves replacing declared investment with MOP estimate.

<sup>68</sup> For identification, we set  $\theta_1 = \phi_1 = 0$ , so that the  $\theta_j$  are in deviation from  $\theta_1$  and the  $\phi_j$  in deviation from  $\phi_1$ .

<sup>69</sup> The reason for sampling from estimated residuals is that the IRR may be a highly non-linear function of realized cash flows, ignoring this source of variation may lead to a biased estimate of the IRR and certainly would lead to overestimating the precision of the estimate.

<sup>70</sup> We use the median because, for some concessions, there was a small number of cash flow trajectories with implied IRRs that took extreme (and implausible) values.

**Table A1: Toll Revenue regression**

	(1)	(2)
	Toll Revenue (as % of $I_0^i$ )	Toll Revenue (as % of $I_0^i$ ), only highways
$CF_{it}$ (as % of $I_0^i$ )	0.0686** (0.0300)	0.0487* (0.0261)
Concession's fixed effect	0.662** (0.245)	1.293*** (0.276)
Year fixed effect	0.201 (0.206)	0.429** (0.150)
Year of operation fixed effect	0.607*** (0.144)	0.632*** (0.105)
Constant	0.0998*** (0.0221)	0.0781*** (0.0174)
Observations	181	142
R-squared	0.542	0.728

Robust standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

To obtain simulated trajectory  $k$  for concession  $i$ , we first obtained the  $\widehat{CF}_{it}^k$  as described above. Next, we calculated the corresponding series of toll revenues using (3) together with estimated residuals from this regression as follows:

$$\frac{\widehat{Y}_{it}^k}{I_0^i} = \widehat{\beta}_0 + \widehat{\beta}_1 \frac{\widehat{CF}_{it}^k}{I_0^i} + \beta_2 \widehat{\theta}_j + \beta_3 \widehat{\phi}_t + \beta_4 \widehat{\delta}_i + \widehat{e}_{it}^k \quad (4)$$

where the  $\widehat{e}_{it}^k$  are obtained sampling with replacement from the residuals from (3). Next, we added the discounted values of  $\widehat{Y}_{it}^k$  over  $t$  until the sum was larger than the winning bid or the number of periods reached the maximum specified in the contract, whichever happened first. This determined the number of observations in the  $\widehat{CF}_{it}^k$  series used when calculating the  $k$ -th simulated IRR for concession  $i$ .

**Table 8b: Summary Statistics for Estimated IRRs for road PPPs**

	All	Fixed Term	PVRs+MDI	PVR	MDI
Mean	8.6%	9.0%	8.1%	8.7%	7.5%
Median	7.0%	8.0%	6.7%	6.4%	7.5%
SD	5.9%	6.1%	5.7%	7.6%	3.0%
25% Quantile	4.7%	4.7%	4.5%	4.6%	4.7%
75% Quantile	10.4%	10.7%	9.5%	8.6%	10.5%
<b>No. of projects</b>	<b>31</b>	<b>18</b>	<b>13</b>	<b>7</b>	<b>6</b>

#### B.4. Estimating the Cost of Debt

To estimate the cost of debt for a PPP project, we proceed as follows: First, we assume that cost of debt is a risk-free rate plus a corporate spread. Second, we obtain the minimum required equity share,  $\alpha$ , from the concession contract and we assume that the firm finances with debt the remaining fraction  $(1 - \alpha)$  of the project. Third, we assume that firms acquire debt in the construction period, financing the first fraction  $\alpha$  with equity and the remainder with debt. Thus, the effective rate is approximated by the average rate of the last  $(1 - \alpha)m$  months of construction.<sup>71</sup> For simplicity, we impose that a month's rate is the average rate of the corresponding year. Fourth, we assume that firms finance the entire project at this rate.<sup>72</sup>

Additional assumptions are the following:

- For 2003 and prior years, the cost of debt is approximated by the rate of a 20-year treasury bonds discounted by effective inflation<sup>73</sup> plus an average Moody's BAA bond spread.
- For years 2004 to 2011, the cost of debt is the rate of a 20-year inflation-indexed treasury bonds plus an average Moody's BAA bond spread.
- For years 2012 to 2019, the cost of debt was obtained from information provided by Chile's financial regulator (CMF) on the rates for several syndicated corporate loans, including many concession projects. For companies included in this data set, we use their cost of debt. For those not included but which started the concession in this period, we use the average cost over the 2012-2019 period.

The above assumptions ignore the fact that prior to the financial crisis of 2007, many concessions were financed with monolines (see Engel et al., 2010) which presumably led to a lower cost of financing. Unfortunately there is no data on the premia paid by the SPVs to have the monolines insure AAA ratings.

**Table A2: Average Debt Cost**

	All	Fixed Term	PVRs
Mean	5.4%	5.6%	5.2%
SD	0.9%	0.8%	1.0%
Median	5.9%	6.0%	4.9%
25% Quantile	4.4%	4.9%	4.2%
75% Quantile	6.2%	6.2%	6.2%
<b>No. of projects</b>	<b>50</b>	<b>31</b>	<b>19</b>

<sup>71</sup> For example, for a project with  $\alpha = 0.25$  and 48 months of total construction time, the debt cost rate will be the average rate of the last 36 months.

<sup>72</sup> Incorporating the fact that the SPV often issues bond when construction ends does not change our estimates significantly, since this amounts to giving more weight to the final months of the construction period in our estimates.

<sup>73</sup> Since these securities are not indexed to inflation.

## References

- Bitran, E., and Villena, M. (2010). El nuevo desafío de las concesiones de obras públicas en Chile. Hacia una mayor eficiencia y desarrollo institucional. *Estudios Públicos*, **117**.
- Bitrán, E., S. Nieto-Parra and J.S. Robledo (2013). "Opening the black box of contract renegotiations: an analysis of road concessions in Chile, Colombia and Peru." Working Paper 317. OECD.
- Campos, N., Engel, E., Fischer, R. D., and Galetovic, A. (2021). "The Ways of Corruption in Infrastructure: Lessons from the Odebrecht Case," *Journal of Economic Perspectives* **35**, 171-90.
- Cheng, J. 2010 (Fall). "The Chicago Skyway concession." Unpublished senior essay. Yale University, New Haven, CT.
- Engel, E., Fischer R., and Galetovic A. (2001), "Least Present Value of Revenue Auctions and Highway Franchising," *Journal of Political Economy* **109**,993–1020
- Engel, E., Fischer, R., & Galetovic, A. (2010). "Finance and public-private partnerships," in *Financial flows and infrastructure financing*, 193-223.
- Engel E, Fischer R, Galetovic A., (2013). "The Basic Public finance of Public-Private Partnerships," *Journal of the European Economic Association* **11**, 83–111
- Engel, E., Fischer R., and Galetovic A. (2014), *The Economics of Public-Private Partnerships: A Basic Guide*. Cambridge University Press.
- Engel, E., R. Fischer R., and A. Galetovic (2019). Soft budgets and renegotiations in transport PPPs: An equilibrium analysis, *Economics of Transportation*, **17**, 40–50.
- Engel, E., R. Fischer R., and A. Galetovic (2021): "When and How to Use Public-Private Partnerships in Infrastructure: Lessons from the International Experience", to appear in Poterba, J. and Glaezer, E. (eds) *The Economics of Infrastructure Investment*, University of Chicago Pre
- Engel, E., Fischer R., Galetovic A., and de Rus, G. (2015), "Colaboración Público-Privada en infraestructuras: reforma del sistema concesional español de autopistas de peaje," Fedea Policy Papers, 2015/11.
- Engel, E., Galetovic, A., Fischer, R., & Hermosilla, M. (2009), "Renegociación de concesiones en Chile," *Estudios Públicos* **113**.
- Engel, E., Fischer R., and Galetovic A. and Soto, J. (2020): "Financing PPP projects with PVR contracts: Theory and evidence from the UK and Chile", unpublished manuscript.
- Fay M, Martimort D, Straub S. 2021. Funding and financing infrastructure: The joint-use of public and private finance. *Journal of Development Economics* **150**:102629

Ferreira Reis, R. and Miranda Sarmiento, J. (2019): ““Cutting costs to the bone”: the Portuguese experience in renegotiating public private partnerships highways during the financial crisis”, *Transportation* 46: 285-302.

Guasch, J. L. (2004). *Granting and Renegotiating Infrastructure Concessions: Doing it Right*. Washington: The World Bank.

Hemmings, R., *Public-Private Partnerships, Government Guarantees and Fiscal Risk*. Washington: International Monetary Fund, 2006.

International Monetary Fund. 2014. *Government Finance Statistics Manual, 2014*. Washington, DC: IMF.

Irwin T. 2007. *Government guarantees: Allocating and valuing risk in privately financed infrastructure projects*. The World Bank

International Public Sector Accounting Standards Board (2018), *Handbook of International Public Sector Accounting Pronouncements*. New York: International Federation of Accountants.

Miranda-Sarmiento J., Renneboog L. 2015. Portugal’s experience with public-private partnerships. In *Public Private Partnership s: A Global Review*, eds. A Akintoye, M Beck, M Kumaraswamy. Routledge, UK.

Vergara-Novoa C, Sepúlveda-Rojas JP, Alfaro MD, Soto P, Benitez-Fuentes PA. (2020): “Analysis of revenues, costs and average costs of highway concessions in Chile.” *Transport Policy* 95:114–123