When and How to Use Public-Private Partnerships in Infrastructure
Lessons from the International Experience

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6.1   Introduction

Public-private partnerships, also known as PPPs, P3s, and concessions, emerged in recent decades as a new organizational form to provide public infrastructure.[1] Even though public provision continues to be the dominant procurement option, investment in transport PPPs over the past 25 years has been considerable, adding investments of €203 billion in Europe and $535 billion in developing countries.[2] In some countries, investment via PPPs in other types of infrastructure, such as hospitals and schools, has also been significant. By comparison, PPP investments in the US have been relatively small.

PPPs are funded with a combination of user fees and government transfers. For example, a road in high demand can be funded entirely with tolls, while government transfers are usually the main funding source for schools and hospitals. In general, under a PPP the firm finances, builds, operates,

1. See Engel, Fischer, and Galetovic (2014a), Grimsey and Lewis (2004), and OECD (2008) for general introductions to PPPs.

2. Sources are the European Investment Bank (1990–2018) and Public-Private Infrastructure Advisory Facility (1990–2018).

and maintains the project. The contract term is long, usually between 20 and 40 years, and the facility reverts to the government when the concession ends. At that point the government can initiate a new concession, involving additional investments and revamping of the existing infrastructure, or manage the infrastructure itself.

6.1.1   Why Do Governments Choose PPPs? Political Economy Reasons

Governments choose PPPs mainly to spend more on infrastructure. First, and in contrast to public provision, most of the investment via PPPs is not counted as public debt, nor does it contribute to the fiscal deficit, at least in the short run. This is attractive for governments constrained by fiscal rules or international agreements, like the Maastricht Treaty, that limit their levels of debt and deficits.[3] The second reason PPPs allow governments to spend more is that these investments are usually not subject to congressional oversight and other budgetary controls. Therefore, PPPs allow incumbents more leeway for spending.

Nevertheless, the fiscal impact of a project in present value is the same, whether it is procured as a PPP or as a public work.[4] For example, by choosing a PPP to procure a toll road, the government does not pay for the up-front investment. However, these savings are equal, in present value, to the toll revenues that the government forgoes during the duration of the concession. This equivalence result also debunks the claim that PPPs free up government funds, an argument that ignores the fiscal impact of PPPs after the project is built.[5] It follows that investments in infrastructure via PPPs should be recorded in fiscal accounts in the same way as public investments (see Engel, Fischer, and Galetovic [2013] for a formal treatment).[6]

The preferential treatment of PPPs has led to higher deficits and to projects being provided as PPPs when traditional provision is more efficient.[7] Sometimes governments choose PPPs for ideological reasons: PPPs are a second-best option to replace an incompetent public sector with an efficient private

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3. "Cynics suspect that the government remains keen on PFI not because of the efficiency it allegedly offers, but because it allows ministers to perform a useful accounting trick." *Economist*, July 2, 2009. PFI is the acronym for the UK's PPP program.

4. This argument omits any efficiency differences between these two procurement mechanisms.

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

6. This recommendation does not rule out having a dollar of investment in public infrastructure count less than a dollar of other types of government expenditure as argued by Blanchard and Giavazzi (2004). It means that such a differential treatment should apply both to public provision and to PPPs.

7. "Some have argued that the structuring of Network Rail and the pursuit of PFI deals were influenced by the fiscal rules in place at the time. It is not for us to comment on the motivation behind these decisions, but it is possible to see why people might believe that their statistical treatment may have played a part." *Fiscal Risks Report*, UK Office of Budget Responsibility, 2017.

sector when privatization is not possible. This argument is incorrect. It overlooks that the private sector is already routinely involved in public provision of infrastructure as designers, builders, operators, and maintainers of public infrastructure. Moreover, stronger government capabilities are required to provide infrastructure services efficiently with PPPs. Finally, the financing of PPPs is more complex and there is more scope for opportunistic behavior because the contractual relationship between the firm and the government lasts for decades. These issues are at the core of PPP governance challenges.

6.1.2   Economic Reasons for Governments to Use PPPs

An economic argument for PPPs is that governments should use PPPs instead of public provision when they provide sufficient efficiency gains. Since private firms are already involved in building infrastructure projects under public provision, efficiency gains do not stem from private participation per se but from the different incentives.

Narrow focus and dedicated management: A PPP is a private specialized firm whose contracting relations with employees, other firms, and financiers are governed by private law. This improves incentives, because during the term of the PPP, the private firm can manage the infrastructure as a private entity. Moreover, by creating a specialized firm (called a special purpose vehicle, or SPV) to build and manage the infrastructure project, the scope of the firm is clearly defined and bounded, and the project gets a dedicated management team, which answers to the firm's board.

Bundling: PPPs provide incentives to make noncontractible investments during construction that may reduce maintenance and operations costs over the life cycle of the concession (Grout and Stevens 2003; Hart 2003). No such incentives are present under public provision, since different firms are in charge of construction and operations. This "bundling argument" in favor of PPPs requires that quality of service be contractible; otherwise, the concessionaire may lower costs by degrading the quality of service. Singh (2018) provides evidence that PPPs encourage investments that reduce life-cycle maintenance costs.

Fewer and shorter construction delays: Incentives to avoid delays are large if a PPP can begin charging user fees or receiving government transfers only after the project is operational.

The two efficiency arguments in favor of PPPs that follow apply when the project is funded mainly with user fees.

Filtering white elephants: PPPs filter white elephants since, in the absence of government transfers, no firm will be interested in a project in which user fees cannot pay for capital and operational expenditures. This insight goes back to Adam Smith.[8]

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8. "When high roads are made and supported by the commerce that is carried on by means of them, they can be made only where that commerce requires them. . . . A magnificent road

Avoiding the cost of bureaucracies: PPPs allow users to pay the firm that builds and operates the infrastructure asset directly, avoiding the efficiency costs associated with spending money via government bureaucracies (see Engel, Fischer, and Galetovic [2013] for a formal model). These efficiency losses are caused by justifiable rigidities in public spending and by corruption.

Advantages of private financing: PPPs developed hand in hand with project finance, a technique based on lending against the cash flow of a project that is legally and economically self-contained. Banks, which are usually the main financiers during construction, mitigate moral hazard by exercising tight control over changes in the project's design and disbursing funds only gradually as project stages are completed. The oversight under public provision is weaker as a result of moral hazard.

Better and less expensive maintenance: In most countries, there is a bias to spend on new infrastructure and against maintaining the existing infrastructure. New infrastructure is more visible and can be used to increase an incumbent's reelection probability.[9] Also, the annual logic of public budgets makes it difficult to guarantee funding for future maintenance at the time the project is built.

Intermittent maintenance is very costly. Not only is the average quality of service much lower than with continuous maintenance, but the overall cost of intermittent maintenance is also higher. For example, in the case of highways, the cost of intermittent maintenance, which often involves costly rehabilitations, has been estimated to be between 1.5 and more than 3 times the cost of continuous maintenance.[10] Recent studies (see Leslie [2019] and references therein) suggest that PPPs may involve important efficiency gains from better maintenance for other types of infrastructure services, prominent among them hospitals.

PPPs solve the maintenance problem of public provision if the quality of the services provided by the infrastructure asset is contractible. It then suffices to set service quality specifications in the contract and enforce them on a regular basis. In the case of highways, which account for the largest fraction of investment in PPPs, the efficiency gains associated with better and cheaper maintenance are substantial. On the cost side, these savings are somewhere between 10 and 32 percent of initial investments.[11]

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cannot be made merely because it happens to lead to the country villa of the intendant of the province." Adam Smith, *Wealth of Nations*, 1776.

9. Rioja (2003) estimates, based on social welfare criteria, that one-third of expenditures on new infrastructure should be allocated to maintaining existing projects.

10. See TRIP (2013) for the lower bound, which applies to the US. For the upper bound, see World Bank (1994, 4): "Timely maintenance expenditures of $12 billion would have saved road reconstruction costs of $45 billion in Africa in the past decade." The difference grows with the extent to which the road is allowed to deteriorate before it is rehabilitated.

11. We arrive at this range as follows: Annual maintenance costs of a typical highway are typically 2–3 percent of the initial investment. Over a 30-year period, discounted at 5 percent,

6.1.3   Governance and Renegotiations

Under a PPP there is more scope for opportunistic behavior than with traditional provision, because the contractual relationship between the firm and the government lasts for several decades. Therefore, efficient infrastructure provision under a PPP requires governance that prevents opportunistic renegotiations.

Contract renegotiations that modify the initial contract have been pervasive under PPPs, however. Even though incompleteness is to be expected in a complex contract that lasts several decades, the evidence suggests that renegotiations are often the result of poor project and contract design, opportunistic behavior by concessionaires, the desire of incumbents to increase spending in infrastructure, and outright corruption.

Renegotiations cancel the efficiency gains promised by PPPs. For example, if concessionaires expect to be bailed out when demand for the project turns out to be low, PPPs do not filter white elephants. Similarly, incentives for careful project and contract design are weak if lack of diligence at the design stage can be corrected by altering the project during construction. Even more worrisome, when contract renegotiations become central to the PPP business model, firms that are good at renegotiating and lobbying have an advantage, as they can bid more aggressively when the project is tendered, in the expectation of recovering profitability in renegotiations.

Renegotiations also allow incumbents to bring forward investment spending, to increase their probabilities of reelection. Because PPPs are kept off the balance sheet, additional spending does not go through the usual budgetary oversight process. Therefore, the incumbent can ask for additions to the initial project and pay for them with an extension of the concession term or payments that will be made by future administrations. Moreover, the new works are likely to be more expensive because they are usually not contracted in competitive tenders.

Recent evidence from Latin America shows a connection between renegotiations and corruption. Campos et al. (2019) consider all projects undertaken by the Brazilian conglomerate Odebrecht in eight countries over a 10-year period and find that the average renegotiation, as a fraction of the initial investment, was 71 percent for projects in which bribes were paid, compared with 6 percent for projects with no bribes. These percentages do not differ substantially between PPPs and public provision, suggesting that renegotiations are always problematic when providing public infrastructure.

The frequency and magnitude of costly renegotiations can be reduced by making them less attractive for concessionaires and public authorities.

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this adds as much as 32–48 percent to the cost of the highway. Using the 3:1 ratio of maintenance costs under continuous and intermittent maintenance then leads to the 10–32 percent range for savings.

For example, the contract can include the requirement that any significant addition to the project must be assigned in a competitive auction, in which concessionaires cannot bid. Another helpful measure is to create an independent, specialized board that reviews and approves renegotiations to ensure that the SPV and its owners do not increase their profits in renegotiations.

Costly renegotiations can also be avoided by using contracts with better risk allocation. In the standard fixed-term highway PPP contract with tolls, the concessionaire bears all the exogenous demand risk. This risk is in general beyond the concessionaire's control, and low realizations of demand often trigger renegotiations. In contrast, a flexible-term contract, with the winning firm collecting a fixed amount in user fees (in present value), eliminates demand risk. By extending the contract term when the demand realization is low, these present-value-of-revenue (PVR) contracts have a built-in renegotiation, which is triggered automatically when demand falls. Therefore, it is unnecessary to modify the contract, avoiding this source of opportunistic behavior.

Chile began using PVR contracts for most transportation PPPs in 2007. The country reformed its PPP legislation in 2010 and created an independent technical panel that reviews and authorizes large renegotiations. Under the reformed law, the owners of the SPV are required to auction the works in all major additions to the initial project. The combination of both policy innovations was followed by a reduction in renegotiations of more than 90 percent, as a fraction of initial investment.

The remainder of this chapter is organized as follows. In section 6.2 we briefly review some data about global and regional PPP spending and show that PPPs represent a modest share of total infrastructure spending. Section 6.3 explains how current fiscal accounting practices stimulate the use of PPPs for the wrong reasons. Section 6.4 discusses the efficiency gains potentially brought about by PPPs. Section 6.5 deals with renegotiations, perhaps the main threat to the PPP model of procurement. Section 6.6 describes the PVR contract, which corrects many of the defects of fixed-term contracts. Section 6.7 concludes the chapter.

6.2   PPPs around the World

6.2.1   World Infrastructure and PPPs

Governments use PPPs to procure infrastructure.[12] Comprehensive figures of world infrastructure spending are notoriously difficult to obtain.

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12. What is classified as infrastructure varies. Ports, airports, railroads, and roads are almost universally included in any list and are called "transport infrastructure." "Social infrastructure" includes government buildings and facilities, schools, jails, and hospitals. "Energy" includes electricity (generation, transmission, and distribution) and pipelines (oil and gas). "Sanitary infrastructure" includes waste management and water (production, distribution, sewerage, and

Table 6.1   **World infrastructure spending and PPPs, 2008–2010, annual, billions of dollars**

	Total	Private		
	Public + private	PPP (project finance)	Non-PPP (project finance)	Corporate finance
Transport	1,040	[45–75]	—	n/a
Airports	80			
Ports	110			
Railroads	400			
Roads	450			
Social infrastructure	490	[12–20]	—	n/a
Water and waste	160		—	n/a
Oil, gas (transmission)	200		n/a	n/a
Electricity	810	[3–5]	[140–160]	n/a
Telecoms	300		[42–48]	n/a
Total	3,000			
Total private	1,000	[60–100]	[180–220]	[680–760]
World GDP 2010	63,000			

Available estimates of global infrastructure and PPP spending come from a few studies by global consultancy firms and must be parsed from several studies. We now will see that available data suggests that PPP spending accounts for about 3 percent of global infrastructure spending and 8 percent of private infrastructure spending.[13]

According to Airoldi et al. (2013, exhibit 1), world public and private infrastructure spending, excluding telecoms, averaged about $2.7 trillion in 2008–2010.[14] As can be seen in the row labels of table 6.1, spending can be broken down into transportation ($1,040 billion), social infrastructure ($490 billion), water and waste ($160 billion), oil and gas transmission ($190 billion), and electricity ($810 billion). Transportation, in turn, can be broken down into ports ($110 billion), airports ($80 billion), rail ($400 billion), and roads ($450 billion). Moreover, according to the consultancy Infonetics, global capital expenditure spending in telecommunications was about $300 billion in 2011. Hence, yearly global infrastructure spending is about $3 trillion, around 5 percent of world GDP.

Also according to Airoldi et al. (2013, exhibit 1), private infrastructure spending is about one-third of total infrastructure spending. With some extrapolation to telecoms, this implies that private spending in infrastructure is about $1 trillion. Private infrastructure is funded through PPP project

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treatment). Finally, sometimes telecom investments (cable or fiber optic transmission, towers, base stations, fixed line, and satellites) are included.

13. What follows is based on Engel, Fischer, and Galetovic (2014b).

14. This estimate includes 69 countries that account for about 96 percentage of world GDP.

finance, other project finance, and standard corporate finance. We have not found a breakdown of private infrastructure investment by type of infrastructure.

Estimates of PPP investment are rather sparse. We built the following estimate, reported in the first column of table 6.1, with information from Inderst (2013) and Blanc-Brude and Ismail (2013). Note that most PPPs are financed with project finance. According to Inderst (2013), who cites Dealogic (2012), total project finance around the world in 2012 was $382 billion—total project finance for infrastructure projects varies between $280 billion and $320 billion. According to Inderst (2013, 24), PPPs represent between $60 billion and $110 billion per year of project finance.

It can also be seen in table 6.1 that around 75 percent of PPP spending is in the transport sector—that is, $45–$75 billion per year. Another 20 percent of PPP spending finances government services ($12–$20 billion per year), while the remainder ($3–$5 billion per year) is invested in the electricity, telecoms, and water and waste. It follows that PPP spending is only a small fraction of global infrastructure spending: around 3 percent of total world infrastructure spending and around 8 percent of private infrastructure spending.

6.2.2   PPPs in Europe and Developing Countries

PPP spending and the number of projects are relatively small. To gain some perspective about recent developments in PPP spending, we present some data from Europe and from developing countries.

6.2.2.1   Europe

In the European Union, infrastructure PPPs emerged in the 1990s and grew until the 2008 crisis, peaking at €26.8 billion in 2007 (see figure 6.1). There were 129 PPP projects in the EU that year, but since then their number and value has fallen, and in 2018 there were 39 projects worth €14.6 billion.

All in all, since the 1990s 1,841 PPP projects were undertaken in the European Union, valued at €383.2 billion, with an average project value equal to €480 million.[15] More than half of the investments (54.8 percent) were in roads (391 projects, €500 million on average), followed at a big distance by health care (393 projects, €129 million on average) and education (443 projects, €81 million on average).

However, these investments are a small fraction of EU investments in infrastructure. The European Economic Association (EEA) records investments in transport infrastructure.[16] Between 1995 and 2014, average annual EEA road infrastructure investment was €62.5 billion. Considering all transportation sectors (road, rail, inland water, sea, and air), this average increases

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15. Source of the data in the paragraph: https://data.eib.org/epec/sector/all.
16. The European Economic Association includes all member countries of the EU plus Switzerland, Norway, Iceland, Lichtenstein, and Croatia.
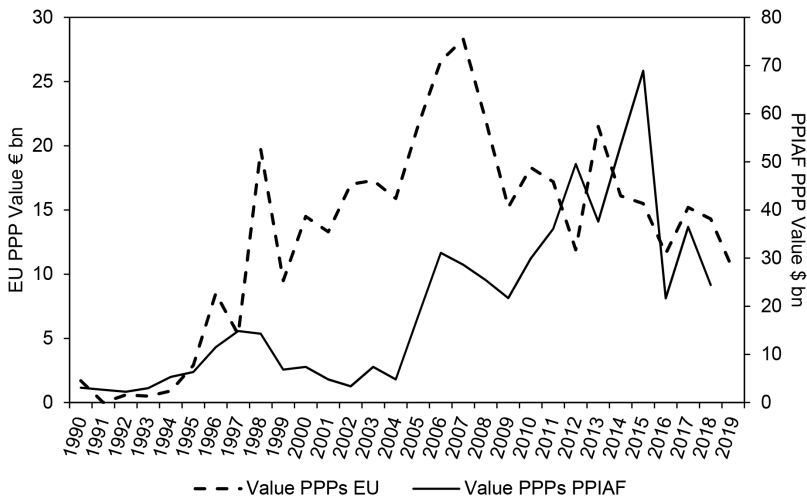
Fig. 6.1   Value of PPP projects in the European Union and in developing countries
Source: For the EU, https//data.eib.org/epec/sector/all. For developing countries, the PPIAF database 2019, processed by the authors.

to €111.5 billion. Therefore, transport PPPs represent 9 percent of transport investment in the EU. In Europe, PPPs are a complement and not the main source of transport investment.

Notwithstanding their small proportion of total expenditure in Europe, in some countries PPP projects represented substantial additions to the transport infrastructure. For instance, between 1999 and 2008 Portugal built 1,300 kilometers of highways using PPPs, which increased the stock of highway kilometers by two-thirds, from less than 2,000 kilometers before 1999.[17]

6.2.2.2   Developing Countries

The Private Infrastructure Advisory Facility (PPIAF) keeps a database of PPP projects in developing countries, classified by type of investment (transport, energy, telecom, and water and sanitation). Between 1990 and 2018 there were 1,762 transport projects (railroads, roads, ports, and airports) with a combined investment value of $535 billion. The average road cost $287 million, close to the project average of $304 million. Figure 6.1 shows the evolution of these PPPs in value.[18]

Table 6.2 shows the sectoral composition of transport PPPs. About half of all the projects and amounts invested are road concessions. About a quarter of the projects, but only 13 percent of the investments, went to ports.

17. "Major Highway Growth in Portugal," *Highways Routes du Monde*, March 2010, http://www.worldhighways.com/sections/eurofile/features/major-highway-growth-in-portugal/.
18. We include projects only when they reach financial closure. The PPPIAF database includes projects with private participation that are not PPPs. These amount to 310 projects worth $46 billion—that is, less than 10 percent by value.

Table 6.2   **Number and investment in PPPs by sector, developing countries**

Sector	Projects	Total investment ($ millions)	Average project size ($ millions)	% of PPP investment	% of projects
Airports	142	95.085	670	17,8	8,1
Roads	921	264.219	287	49,4	52,3
Ports	469	69.839	149	13,1	26,6
Railways	228	105.601	463	19,7	13,0
Total	1760	534.744	304	100,0	100,0

Note: We exclude two projects that combine sectors: a US$79.5 million railway and port project in India and a US$17.7 million port and railway project in Mozambique.
Source: Private Infrastructure Advisory Facility.

Ports represent the smallest investment on average, because in most cases the PPP consists of an operational franchise and investments are mainly in equipment, but do not include new port infrastructure. The average size of an airport project ($670 million) is raised by two outliers, the $35 billion IGA airport in Turkey and the combined $20 billion of the Guarulos (São Paulo) and Rio de Janeiro airports, both in Brazil.

6.3   Why Governments Use PPPs: Fiscal Accounting

In many, if not most cases, PPPs have been attractive to policy makers because they promise to ease the fiscal constraints that limit resources for infrastructure projects. A PPP program allows governments to build schools, hospitals, roads, and airports without increasing the fiscal deficit.

6.3.1   PPPs as a Means of Evading Fiscal Spending Constraints

As mentioned in the introduction, there is no agreement on whether or how to include PPPs in the public accounts and in the government's balance sheet (see Grimsey and Lewis 2002; Heald 1997, 2010; Heald and Georgiou 2009; Heald and McLeod 2002; and Schwartz, Carbacho, and Funke 2008, part 4). In practice, PPPs investment is not considered government spending and therefore does not affect the fiscal deficit, even when the PPP is funded with periodic payments to the concessionaire. Governments use PPPs to circumvent fiscal constraints. In fact, this seems to have been the main incentive for the use of PPPs in Europe. For example, in the UK, the Private Finance Initiative (PFI) led to increases in public investment that were not recorded in the standard measures of public debt.[19] According to the National Audit Office (NAO) 2018 report on PFI and PF2:

19. As a signatory to the Maastricht Accord, the UK was required to keep its fiscal deficit below a maximum deficit.
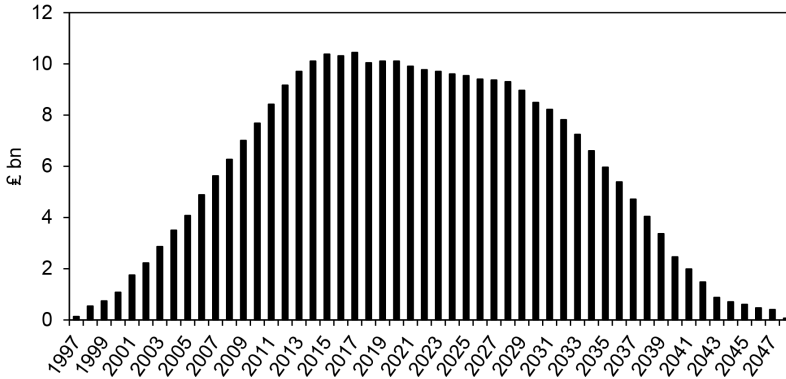
Fig. 6.2   Private Finance Initiative past and forecast unitary charge payments
Source: National Audit Office (2018).

The Office for Budget Responsibility's (OBR's) July 2017 fiscal risks report cited the use of off-balance sheet vehicles like PFI as an example of a "fiscal illusion." . . . The debt is recorded as a financial liability but as noted by the OBR "most public and political attention, and the government's fiscal rules, still concentrate on the National Accounts measures of PSND (Public Sector Net Debt) and PSNB (Public Sector Net Borrowing)," which does not reflect fully PFI liabilities. PFI can be attractive to government as recorded levels of debt will be lower over the short to medium term (five years ahead) even if it costs significantly more over the full term of a 25–30 year contract.

These policies encumbered the UK with average annual payments of £7.7 billion for the 25 years beginning in 2017–2018, according to the NAO 2018 report. This represents 0.5 percent of the national budget until the 2030s (see figure 6.2).

Similarly, between 1995 and 2014, Portugal received €20 billion in PPP investments in roads, hospitals, and other projects. Ninety-four percent of the investment was in highways that used shadow tolls, and the annual minimum guaranteed payments were equal to 1 percent of GDP between 2014 and 2020, falling to 0.5 percent of GDP after 2020 and until 2030. In a study of Portuguese PPPs, Sarmento and Renneboog (2014) argue that the incentive to resort to PPPs was mainly to avoid budget constraints.

Another way in which PPPs can be used to increase current spending is by exchanging the future cash flows of existing infrastructure for an up-front payment. For example, the city of Chicago auctioned the operation of the Chicago Skyway, a 7.8-mile toll road linking downtown Chicago and the Indiana state line. The $1.83 billion bid 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

Table 6.3   **Fiscal accounting: Funding from government transfers**

	Public 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 bondholders 100	Pay concessionaire 100

Table 6.4   **Fiscal accounting: Funding from user fees**

	Public 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 bondholders 100	Concession collects 100 in user fees

spending. The efficiency gains of the contract were minimal, being at most a reduction in operating costs of $1 million per year (see Cheng 2010; Engel, Fischer, and Galetovic 2014a).

We have shown (Engel, Fischer, and Galetovic 2013) that the effects of PPPs on the intertemporal balance sheet are no different from those of public provision. Table 6.3 provides the intuition when the PPP is funded with government transfers. The first column shows the dynamics of debt and spending under public provision, the second column under a PPP. In both cases, the infrastructure is funded by a commitment to collect taxes in the future. Therefore the initial investment should count as public debt in both cases.

Table 6.4 considers the case in which user fees fund the project. Now, for both organizational forms, building the infrastructure entails a commitment to collect user fees in the future, in the same amount, to pay for the debt. It follows that the up-front investments should be counted as debt for a PPP as well.

6.3.2   Distorted Policy Choices

The choice between PPPs and public provision of infrastructure becomes distorted when PPPs are excluded from the fiscal accounts, because incumbents can then shift spending to future administrations. This distortion disappears if PPPs are included in toto in the balance sheet at the inception of the contract. As revenues accrue and the time at which the PPP contract ends comes nearer, the balance sheet incorporates these revenues on the revenue side. In that case, the choice between PPPs and traditional provision of infrastructure would depend only on which is more efficient to procure the infrastructure.

6.3.3   Eurostat and Fiscal Accounting of PPPs

In order to limit the use of PPPs to elude fiscal constraints, Eurostat introduced accounting rules for PPPs (Eurostat 2016). As a general rule, Eurostat considers that toll-funded PPPs are off the balance sheet, unless there exist significant government guarantees. In contrast, the treatment of government-funded PPPs seems to have been a compromise between the forces pushing for the exclusion of PPPs altogether from the government balance sheet and those finding that exclusion is unsound fiscal policy. Thus the classification of a particular government-funded PPP project as on or off the balance sheet depends on the answer to 84 yes-or-no questions divided into 11 sections.[20] Necessary conditions for the PPP to remain off the balance sheet are that there should be no government guarantee or early termination provisions that transfer risks back to the government.

Summing up, Eurostat guidelines are ineffectual in limiting the use of PPPs to circumvent budgetary controls, as the guidelines' main focus is on risk sharing, not on budgetary implications. There have been more effective rules in use in the past. In the 1980s the UK used the so-called Ryrie Rules for PPP projects.[21] These rules allowed private finance of public infrastructure only if public expenditure was reduced by the same amount. These rules were abandoned under the PFI program of the mid-1990s.

6.4   Economic Arguments for PPPs: Incentives, Risk, and Efficiency

6.4.1   Efficiency

PPPs are a response to the inefficiencies of traditional provision of government infrastructure. This implies that PPPs should be understood as an alternative way of procuring infrastructure and not as a mechanism for privatizing government assets and functions.

With traditional provision, incentives for efficiency tend to be weak. First, public agencies have multiple objectives and principals, exacerbating agency problems. Second, fiscal accounting practices are designed for budgetary purposes and not for monitoring performance. Third, in the public sector there are usually no bonuses associated with specific projects, and there are only career incentives for better performance. Fourth, the public sector is inflexible, because laws constrain hiring and firing, purchasing, and

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20. For example, question 70 asks, "Does the [private] partner bear the construction risk and at least one of either the availability or the demand risks?" If the answer is no, the asset is classified on the government's balance sheet. If the answer is yes, additional conditions must be met for the asset to be kept off the government's balance sheet.

21. See Heald and McLeod (2002) for a discussion of the Ryrie rules. Maskin and Tirole (2008) provide a model for how PPPs are used to elude budgetary constraints.

contracting practices. Finally, the scale and scope of the organization that manages projects is constrained by the administrative structure of the state.

This lack of incentives has serious consequences. First, infrastructure assets are poorly maintained, because budgets are yearly appropriations and maintenance expenditures are a less visible use of resources than new or refurbished infrastructure. Often poor design and construction increase the cost of maintenance. The end result is often low service quality and higher costs. Second, the projects that are built are not always a good use of resources, because demand is systematically overstated, and costs and building times are underestimated (Flyvbjerg, Bruzelius, and Rothengatter 2003). In some cases, building pork barrel projects or poor planning leads to white elephants.

Historically one way of increasing efficiency has been to subcontract various building and design tasks to private firms, but the subdivision of activities between different firms leads to agency and coordination problems. PPPs represent an alternative organizational form that aligns the incentives of the various private parties in order to build, maintain, and operate a project. Under the PPP approach a single private entity—a so-called special purpose vehicle or SPV—is responsible for the finance, delivery, operations, and maintenance of the infrastructure project. The relation between the state and the SPV is governed by public law, but the SPV follows private law in its contractual relations with employees, other firms, and financiers. Finally, the scope of the SPV and its management team is clearly defined and limited to the project at hand, which focuses attention and incentives for efficiency.

Hart (2003) has shown that the theoretical benefits of PPPs arise in part from bundling design, building, operations, and maintenance into one contract. Since the concessionaire will operate and maintain the project, the concessionaire will design and build to minimize life-cycle costs. Provided that the quality of conservation can be measured and required by the contract, it is in the interest of the concessionaire to maintain the infrastructure continuously. Bundling, however, entails the risk that cost cutting may occur at the expense of service quality and user welfare. Thus, it is fair to say that PPPs work well when maintenance, quality, and performance standards can be defined and enforced. Roads are an example that satisfies these conditions.

The theoretical advantages of bundling have proved difficult to test, but the benefits in terms of improved maintenance are clear. As we have already mentioned, governments often do not perform regular, continuous maintenance. By contrast, a PPP owner benefits from routine maintenance if quality standards are enforced. The firm knows that reactive maintenance is more expensive and that there is the added cost of penalties for low service quality. As mentioned in the introduction, continuous maintenance of a highway not only provides better quality of service but is also less expensive.

There is some evidence that PPP projects tend to be delivered on time. For example, Raisbeck, Duffield, and Xu (2010, 352) found that, in a sample of

21 PPP projects and 31 traditional projects in Australia, the time "between the signing of the final contract and project completion, PPPs were found to be completed 3.4% ahead of time on average, while traditional projects were completed 23.5% behind time." The incentives for timely completion exist if the firm begins to receive revenues only when the project starts to operate. In the particular case of fixed-term contracts financed with user fees, this incentive is even stronger, because delays in construction cut into the revenue-generating period. Moreover, on-time delivery also requires good planning, project design, and execution—conditions that reduce cost overruns.[22]

As mentioned in the introduction, strong government capabilities are required for the success of a PPP program. The government is responsible for planning what to build (network planning and coordination), whether a particular project should be built (cost-benefit appraisal), and when it should be built. In addition, there are arguments for and against delegating project design to the SPV. The advantages lie in the creativity of the private sector and in the transfer of design risk to the concessionaire. The danger is that governments that delegate project design do not to have a full understanding of the projects they procure, nor of the risks involved. Thus there is no presumption that delegating project design to the concessionaire will lead to a better result.

When PPPs are financed with tolls, two additional sources of efficiency gains appear. First, the transfer of resources to the private firm is direct. In contrast, in a publicly funded project, the resources for construction, maintenance, and operations are collected through taxes and wend their way through the government bureaucracy until eventually they reach the SPV. The direct approach eliminates the costs associated with this bureaucracy. The second benefit is that tolling can reduce congestion and increase allocative efficiency, since the total marginal cost includes the congestion externality. Given that the taxes used to provide a free public highway create distortions, it might well be that a toll-funded PPP highway is more efficient than a congested toll-free public road.[23] A final advantage of PPPs is that the private firm will have stronger incentives to resist petitions for lower tolls than a publicly elected official.

6.4.2   Incentives and Risk Allocation

One of the challenges of a PPP contract is efficient risk allocation. Following Irwin (2007) we identify eight sources of risk: (1) construction, including design flaws, cost overruns, and delays; (2) operation and maintenance; (3)

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22. A rule of thumb in construction states that if the project is delayed, overheads continue to be incurred. A second rule of thumb states that overhead is roughly one-third of the yearly as well as of the total cost of a project. Source: Klaus Grewe, personal communication.

23. In fact, a globally optimal fiscal policy would set tolls slightly higher than the optimal congestion toll, because by so doing the government can reduce distortionary taxation (see Engel, Fischer, and Galetovic 2013).

availability under the terms agreed in the contract; (4) residual value at the end of the PPP contract; (5) policy, ranging from macroeconomic uncertainty to government actions that affect the project; (6) demand; (7) financial factors (for example, interest rate and exchange rate fluctuations); and (7) political factors (for example, regulatory takings or expropriation).

Irwin (2007, 65) states the rule for efficient risk allocation:

Each risk should be allocated, along with rights to make related decisions, so as to maximize total project value, taking account of each party's ability to: 1. Influence the corresponding risk factor. 2. Influence the sensitivity of total project value to the corresponding risk factor—for example, by anticipating or responding to the risk factor. 3. Absorb the risk.

Consider construction risk. The builder controls the time to complete and the cost of building the project. The concessionaire should thus bear these risks, perhaps with the exception of delays caused by disputes about the application of eminent domain and environmental certification. Similarly, because diligence during construction influences the availability of the facility during operation, it is efficient for the concessionaire to bear operation, maintenance, and service quality risks.

Bundling, control, and service standards are all required to ensure that these risks are effectively borne by the concessionaire. For example, it may be easier to hold the concessionaire who built the facility responsible for service quality—hence the importance of bundling. Likewise, without objective and measurable service standards, it is difficult to transfer service quality risk to the concessionaire.

Some risks are created by government policies and therefore should be borne by the government. For example, because the residual value of PPP assets depends on government planning decisions and the willingness to charge tolls in future concessions, it is reasonable to transfer the residual value risk to the government. This happens when the concessionaire recovers its initial investment over the term of the contract and then transfers the infrastructure value to the government.

Broadly speaking, policy risks fall into two categories. First, the government may implement policies that directly affect the project. For example, the government may change the rules to expropriate the concessionaire. Irwin's principle indicates that these risks should be borne by the government, to prevent opportunism. Second, actions by the government or the legislature may unintentionally affect the PPP. For example, currency devaluation may reduce a foreign firm's return, or a change in environmental standards may require additional investments. In these cases, the concessionaire is in the same position as any other private firm in the economy. Therefore, these are standard business risks. This principle is routinely overlooked.[24] For

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24. García-Kilroy and Rudolph (2017) argue that governments should offer currency risk-sharing arrangements when financial markets fail to do so. García-Kilroy and Rudolph describe cases where this has been done, at a price close to what would have been a market price.

example, governments often grant foreign concessionaires insurance against devaluations. This practice discriminates not only against local investors but also against foreign firms in other sectors of the economy that have to bear this risk. More generally, policy risks that do not target the project specifically and that affect most firms in the economy (for example, those caused by monetary policy) should be treated as exogenous and allocated according to general principles of risk diversification.

Perhaps the main exogenous risk in a PPP funded with user fees is uncertainty about demand. As mentioned earlier, the general principle is that exogenous demand risk should be borne by the party best able to bear it. If the private firm assumes demand risk, taxpayers are in fact purchasing insurance against an exogenous risk (see Engel, Fischer, and Galetovic 2014a, chap. 5). As Hall (1998) notes, this is not cost effective. Demand forecasts are notoriously imprecise and future changes in policy may radically affect the usage of the facility, yet there is little that the firm can do. In those cases, either a present-value-of-revenue contract (see section 6.6) or an availability contract is appropriate, depending on whether the project is funded by user fees or government transfers.

The principle of transferring exogenous demand risk to the government admits of one important exception. When user fees are a PPP's only source of remuneration, the willingness of private firms to bid for the contract is a market signal that demand is sufficient (at least in expectation). This introduces a market test that is usually absent in infrastructure services. If there are no bidders at an auction, this suggests that the project is not privately profitable. Unless it has large positive externalities, there is a risk that the project is a white elephant.

As in the case of demand risk, financial risk is largely outside the firm's control. This does not mean, however, that the government should bear interest rate or exchange rate risk. Other firms in the economy do not receive this favored treatment, and firms can choose among alternative capital structures. More generally, governments are not particularly efficient at providing and selling financial insurance.

6.5   Governance and Renegotiations

Given the often unsatisfactory results of PPP programs in infrastructure, it is worthwhile to study whether these results are caused by defects in the governance of PPPs. At a minimum, a PPP-capable country requires institutions that allow private firms to receive a return after sinking a large investment. Furthermore, it must be possible to pledge the revenue stream generated by project to financiers and put them first in line if the PPP fails. These preconditions may preclude PPP investment in some countries.[25]

25. Or if it exists, it must be supported by multilateral financial institutions; see Engel, Fischer, and Galetovic (2014a).

However, even in countries that satisfy these minimal requirements, there is no guarantee that an infrastructure PPP will be successful. We deal with some of these problems in this section.

6.5.1   Renegotiations Are Pervasive

PPPs are routinely renegotiated. This has been well known since Guasch (2004) examined nearly 1,000 Latin American concession contracts awarded between the mid-1980s and 2000 and found that 54.4 percent of those in transportation (including roads, ports, tunnels, and airports) had been renegotiated. When Mexico privatized highways in the late 1980s, Mexican taxpayers had to pay more than US$13 billion after renegotiation of the initial contracts, on an estimated almost $13 billion in PPP investments. In Chile, 47 out of the 50 Chilean PPP concessions awarded by the Ministry of Public Works between 1992 and 2005 had been renegotiated by 2006, and one of every four dollars invested had been obtained through renegotiation (see Engel et al. 2009). More recently Engel, Fischer, and Galetovic (2019) analyzed 535 renegotiations of 59 highway PPPs in Colombia, Peru, and Chile. Renegotiations per concession/year average 9.5 percent of the initial investment in Colombia, 3.6 percent in Peru, and 1.3 percent in Chile. More than 45 percent of renegotiations (by dollar amount) occur during construction. Furthermore, in the case of Chile, at least 60 percent of the renegotiated spending increase falls on future administrations.[26]

One might think that renegotiations occur mainly in emerging economies, where governance is weak. Renegotiations are also pervasive in developed countries, however, as documented long ago by Gómez-Ibáñez and Meyer (1993). For example, three of the four highway concessions awarded in France in the early 1970s went bankrupt after the 1973 oil shock and were bailed out by the government. Similarly, several of the 12 highway conces-

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26. Renegotiations are not only common in transportation infrastructure. An example from the sanitation sector is the two concessions for water utilities in Manila, Philippines, in 1997. As noted in Wu and Malaluan (2007), the state-owned utility was divided geographically into two companies serving the city, and auctioned as 25-year concessions. The two winning consortia offered tariffs that were 26 percent and 56 percent of the previous rates, respectively. However, by 2002 the consortia had managed to renegotiate their contracts and double the prices using the Asian crisis as an argument; the consortia then almost doubled prices again in 2005. Moreover, the companies invested less than specified in their contracts, at least until 2003, when Manila Water began to expand investment rapidly, perhaps because after the change in tariffs the implied rate of return on assets rose to 9 percent. Nevertheless, as a result of bad management, the other company, Manilad, went bankrupt (in 2003) after its petition for even larger tariff increases was denied. Regardless of the adverse effects of raising rates, there were compensating benefits from privatization: a massive expansion in connections, by 30 percent in the first five years of operation; and in Manila Water, nonrevenue water (lost to theft or because of leaking pipes) decreased from almost 58 percent to 35 percent, while the response to service complaints and the time to repair leaks improved substantially. We can conclude from this case that unless precautions are taken, companies' bids can be renegotiated to the advantage of the winners at the expense of the public—but even then the public may benefit. For a more critical evaluation, see Esguerra (2003).

sions awarded in Spain in the 1970s had higher costs than anticipated, while traffic was lower than expected, causing three highways to go bankrupt and the remaining contracts to be renegotiated. Spain seems to be a serial subsidizer of PPPs at the expense of the public: in November 2010, all political parties agreed that it was necessary to bail out, among others, the seven PPP highways running into Madrid, at a cost that could reach €4 billion (see Engel et al. 2018).

Industry participants often claim that circumstances change over the life of a concession. Because most PPP contracts last for several decades, renegotiations of inherently incomplete contracts are to be expected. Renegotiations thus provide the flexibility necessary to adapt to changing conditions. While there is some truth to this argument, it ignores two disturbing features of most renegotiations. First, they often occur shortly after contracts are awarded. For example, Guasch (2004, 14) finds that the average time to renegotiation was only 2.2 years after the concession was awarded, and 60 percent of all renegotiated contracts had been renegotiated within the first three years after the concession award. Engel et al. (2009) show that 78 percent of the amounts awarded in renegotiations of PPPs in Chile were brokered during construction, shortly after awarding the concession.[27]

Second, renegotiations tend to favor the concessionaire. For example, Guasch (2004) finds that two-thirds led to tariff increases, 38 percent to extensions of the concession term, and two-thirds to reductions in investment obligations. In the case of Chilean PPPs, we find that most renegotiations imply paying more for the works originally contracted. Thus, while in principle renegotiations may allow governments to expropriate concessionaires after they have sunk their investment, in practice it seems that the private partner benefits the most, at least in Latin America.[28]

6.5.2   The Origin and Consequence of Renegotiations

The prevalence of renegotiations suggests that they are not accidents, but an equilibrium outcome of the incentive structure in place. There are at least four economic mechanisms that produce systematic renegotiations.

First, in Engel et al. (2019) we show that the possibility of being ousted from office increases the effective discount rate of the incumbent, who values the future less than the social planner and wants to bring forward spending to increase the probability of winning an election. Because fiscal accounting rules keep PPPs off balance sheet, the incumbent can renegotiate the PPP contract to increase current infrastructure spending. The concessionaire, in turn, is willing to renegotiate the contract because he is backed by a long-term legal agreement that is binding on future administrations. This

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27. For more on renegotiation of PPP contracts, see Guasch, Laffont, and Straub (2007, 2008).

28. For evidence on renegotiations of US PPPs that benefited private firms at the expense of taxpayers and users, see Engel, Fischer, and Galetovic (2011).

mechanism works independently of how the PPP is funded. With availability payments (as is the case, for example, with many highways in Europe), renegotiated payments will be borne by future administrations and constrain their ability to spend. If, on the other hand, the infrastructure is funded with tolls, future governments will forego revenues (see Engel, Fischer, and Galetovic 2013). Whatever the funding source, the incumbent can tie up resources that would have been available to future administrations, in exchange for current infrastructure spending by the concessionaire. In essence, therefore, in a renegotiation the concessionaire lends to the incumbent in exchange for payments by future administrations.

Even though there is no systematic evidence on the frequency of renegotiation of infrastructure provided under the traditional approach, this argument suggests that renegotiations should be less frequent in this case. Since the relation between government and the firm exists only during the construction period, there is less time for the firm to find arguments to renegotiate the contract. It is also more difficult to add additional works because they would lead to additional expenditures that must be approved by the legislature.

Renegotiations also generate adverse selection, by attracting firms skilled at lobbying but technically less proficient. Since renegotiations between the concessionaire and the government are bilateral, surpluses are split according to the relative bargaining abilities of each party. A better lobbyist should get a larger fraction of the pie in any renegotiation. Hence, if two firms are equally efficient, the firm with a better lobbyist can bid less at the competitive auction and win the concession, in the expectation of recovering up-front losses in later renegotiations.

The third mechanism at work is moral hazard. As we have seen, PPPs are appropriate when objective quality standards can be set, measured, and enforced. In that case, the concessionaire can be left to choose the production technology. Concessionaires foster the belief that PPP contracts should be adjusted to ensure the ex post financial equilibrium of the PPP, an argument that firms often produce to justify renegotiations (among many examples, this was the case for the bailout of Spanish PPPs mentioned earlier). This is not an acceptable argument for renegotiating the contract. If the firms' bids were prudent, the company should expect to receive the normal return on investment after adjusting for risk, as in all other sectors of the economy. Hence, the conditions of the bid should be preserved, and no renegotiation that results in a higher cost of providing the contracted service quality should be accepted. Renegotiations are not only unnecessary but also inefficient, because they weaken the incentives to control and reduce costs, thereby dampening the efficiency gains that PPPs can yield. Renegotiations meant to restore the concessionaire's financial equilibrium transform a fixed-price contract into a type of cost-plus contract. Even worse, since firms with strong renegotiation skills can extract more from the government,

they can afford to exert even less effort to control costs. Thus, moral hazard increases the advantage held by good renegotiators even further and worsens the adverse selection problem.

Similarly, when the PPP agency has discretion to renegotiate, it feels less pressure to plan and design projects carefully, because it can renegotiate away its own mistakes. The problem is compounded when the costs of renegotiating can be shifted to future administrations and when the PPP agency is not accountable. Thus, when coupled with inadequate accounting or governance, the expectation of renegotiations generates moral hazard in the PPP agency.

Last, recent evidence from Latin America shows a connection between renegotiations and corruption. Campos et al. (2019) consider all projects undertaken by the Brazilian conglomerate Odebrecht in eight countries over a 10-year period and find that the average renegotiation, as a fraction of the initial investment, was 71 percent for projects where bribes were paid, compared with 6 percent for projects where bribes were not paid. The projects considered include both PPPs and traditional provision, suggesting that the connection between corruption and renegotiations is relevant when providing public infrastructure in general. Campos et al. (2019) also show that firms pay bribes to benefit from renegotiations.

6.5.3   Pervasive Renegotiations and Remedies

Pervasive renegotiations are caused by inadequate rules and governance. They encourage lowballing in the auction, in the expectation of recouping any losses by future bilateral bargaining. The remedies combine proper accounting rules, competitive tendering for additional works, and independent review of renegotiations.

As shown by Engel, Fischer, and Galetovic (2019), treating PPPs as regular government expenditure and debt eliminates the incentive to use renegotiations to increase current infrastructure spending and burden future administrations.

The remedy to adverse selection and moral hazard is to eliminate the possibility of increasing profits through bilateral renegotiations. This may be achieved by preventing the concessionaire from participating in the tenders for additions to the original works. In addition, renegotiations should be subject to review by an expert panel, ensuring that the concessionaire's net rents are not altered. Box 6.1 describes the role of expert panels in the UK and Chile. Finally, transparency suggests that all contract modifications be published in a web page, so that the public is informed about the changes and can question the reasons and the amounts. Active transparency, such as publishing project modifications and their cost, fosters accountability and hardens the negotiating position of the public authority.

Chile reformed its PPP law in 2010 and established a Technical Experts Panel (see box 6.1 for details). The panel helps in conflict resolution and

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Box 6.1   Dispute Resolution in the UK and Chile

In the UK, the framework for dispute resolution is set up in the HM Treasury "Draft Standardization of PF2 Contracts" of December 2012. The document sets up a tiered structure of procedures that starts with a consultation between the parties for a fixed period in an attempt to reach a mutually satisfactory agreement. If this consultation approach fails, the parties can put their case before an expert adjudicator selected from a panel or, alternatively, to mediation or conciliation. If either party believes the decision is not acceptable, they can appeal to an arbitration procedure or, eventually, the courts. Akinbode and Vickers (2017) show that these procedures can escalate and that badly defined contracts can close out reasonable options of solving the conflict.

In Chile, the 2010 reform to the PPP law established the Technical Experts Panel (TEP), a permanent, independent board of legal and engineering experts that reviews technical disputes between the Ministry of Public Works and a private party (usually an SPV). The TEP hears the parties in public audience and issues a recommendation within 30 days. Even though the recommendations are not binding, in approximately 40 percent of the cases the parties have agreed to the recommendation. The remaining cases proceed to mandatory arbitration, and the panel recommendation is considered in the decision.

Table 6.5   **Renegotiations in Chile: Before and after the 2010 reform**

	Highways		Transport	
	Number	Renegotiation (fraction of investment)	Number	Renegotiation (fraction of investment)
Before 2010 reform	29	26.1%	44	27.6%
After 2010 reform	15	0.7%	25	0.9%

provides an opinion assessing the fairness of contract renegotiations above a threshold. In addition, the reform also makes it mandatory to put to tender additional works agreed on in a renegotiation and excludes the concessionaire or related parties from the ensuing contract.

Table 6.5 shows renegotiations as a fraction of initial investment for Chilean PPPs both before and after the 2010 reform of the PPP law. Since the time elapsed since the reform is relatively short, we present only renegotia-

tions during the construction phase, both for highway PPPs and for all PPPs in the transport sector. The table shows that renegotiations during construction decreased by more than 90 percent following the reform.

6.6   PVR Contracts

The standard user fee PPP is a fixed-term contract that is awarded to the firm that bids the lowest fee, shortest term, or lowest subsidy. At the end of the fixed term, the infrastructure reverts to the state, which can award a new concession or provide the service either free or with user fees.

A fixed-term contract allocates most of the demand risk to the concessionaire. This makes sense when the infrastructure is a container terminal, where demand responds to service standards that are difficult to specify and monitor. But demand forecasts for roads are unreliable and depend mostly on exogenous factors such as macroeconomic activity. Moreover, quality of service for a highway is easy to specify and enforce. Thus, in a fixed-term contract the winning bid internalizes exogenous risk by asking for a higher return—that is, a user fee that generates enough expected income to compensate for demand risk. In order to make projects bankable, governments must pledge revenue guarantees. Also, as discussed in the previous section, fixed-term contracts tend to be renegotiated in times of severe economic stress.

In this section we argue that exogenous demand risk can be mitigated with present-value-of-revenue (PVR) contracts (see Engel, Fischer, and Galetovic 1996, 2001). This applies to infrastructure such as highways and airports, where quality of service is contractible and demand uncertainty is exogenous. Under a PVR contract, the regulator sets the discount rate and the tariff schedule. Firms bid the present value of the user fee revenue they require for financing, building, operating, and maintaining the infrastructure.[29] The firm that bids the lowest PVR gets the concession. The contract ends when the present value of user fees collected equals the winning bid. The term of the concession automatically adjusts to demand shocks, resulting in a substantial reduction of demand risk borne by the concessionaire. Since user fees are the main revenue source for the PPP, the contract attains the efficiency gains associated with PPPs discussed in section 6.4.

6.6.1   Advantages of PVR Contracts

PVR contracts reduce demand risk, because demand fluctuations and their associated revenue variations are reflected in a longer or shorter con-

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29. User fees considered in the firms' bid are tolls in the case of highways. In the case of airports, only aeronautical revenues (passenger and airport fees) are considered; see Engel, Fischer, and Galetovic (2018) for details.

Box 6.2 PVR and the Two Major Highway PPPs in the US during the 1990s

The Dulles Greenway and Orange County's State Route 91 are the two main highway PPPs built in the US during the 1990s (see Engel, Fischer, and Galetovic 2011).[1] They both ran into problems that would have been avoided with a PVR contract.

Dulles Greenway

The Dulles Greenway is a 14-mile expressway that joins Dulles International Airport and Leesburg, Virginia. Investors put up $40 million in cash and secured $310 million in privately placed, taxable debt to finance the expressway. Loans were to be repaid with toll revenues. Tendered as a fixed-term, 42.5-year concession, the expressway was inaugurated in 1995. Demand turned out to be much lower than expected, with actual traffic equal to only one-fourth of projections. When the PPP defaulted in 1996, lenders restructured its debt and investors wrote off part of their equity. In addition, in 2001 the contract term was extended by 20 years, until 2056.

Despite a major forecast demand error, it was clear that even in low-demand scenarios the Dulles Greenway would eventually collect enough tolls to pay for capital and operational expenditures. Therefore, had the PPP been tendered using PVR, the contract term would have been extended automatically when demand turned out to be lower than expected, thereby avoiding losses for investors and bondholders. The contract renegotiation and debt restructuring that followed essentially turned the original fixed term contract into a PVR contract, yet this happened at a high cost.

Orange County's State Route 91

In 1995, the California Department of Transportation (Caltrans) awarded a 35-year concession of a 10-mile segment of the four-lane Riverside Freeway (also called State Route 91) between the Orange-Riverside County line and the Costa Mesa Freeway (State Route 55) to a private firm, California Private Transportation Corporation (CPTC). Motorists used the express lanes to avoid congestion in the nontolled lanes, paying tolls that could reach almost $11 for a round trip.

By the late 1990s, 33,000 daily trips brought the express lanes to the brink of congestion at peak time, turning the concession

into a financial success. At the same time and for the same reasons, users in the nontolled public lanes were suffering congestion, and an expansion was urgently needed. Nevertheless, the contract included a noncompete clause that prevented Caltrans from increasing the capacity of the Riverside Freeway without CPTC's consent. Caltrans tried to elude the clause, arguing that expansions were necessary to prevent accidents, but CPTC filed a lawsuit. The verdict stated that noncompete clauses were meant to ensure the financial viability of CPTC and that they restricted Caltrans's right to adversely affect the project's traffic or revenues. Consequently, no new lanes could be built.

Protracted negotiations ensued, and eventually the Orange County Transportation Authority (OCTA) was empowered to negotiate the purchase of the tolled lanes. The value of the concession was not easy to determine, because it should have been the present value of profits from the State Route 91 express lanes, had the franchise continued as originally planned. Although the lanes cost $130 million to build, initially the concession's value was set at $274 million in a controversial (and ultimately unsuccessful) buyout attempt by a nonprofit associated with Orange County. After several years of negotiations, with frustrated commuters stuck in traffic in the meantime, OCTA bought the express lanes in January 2003 for $207.5 million. Press reports suggest that CPTC received additional compensation.

Because this was a fixed-term PPP, demand risk was borne by the concessionaire. Therefore, this dispute was about the value of lost revenues and was unrelated to the cost of the infrastructure. Moreover, because the term was fixed, the value of lost revenues was inherently subjective. Not surprisingly, the concessionaire and OCTA disagreed. The disagreement had real economic cost: it delayed capacity expansion and prolonged costly congestion, In contrast, had this been a PVR contract with a clause allowing government to buy back the concession at any point in time, paying the difference between the winning bid and the amount collected (adjusting for savings in maintenance costs), no protracted renegotiation and dispute would have taken place.

Note

1. This section is based on Gifford, Bolaños, and Daito (2014) and Engel, Fischer, and Galetovic (2014a). The State Route 91 project is also analyzed, from a financial valuation perspective, in Lucas and Montesinos (2021).

tract term. Since revenue is in present value, the duration of the PPP does not affect its profitability.[30] For the same reason, minimum traffic guarantees are no longer required to make the project bankable.[31]

The efficient assignment of demand risk lowers the overall cost of the project. On the one hand, Engel, Fischer, and Galetovic (2001) estimated that, relative to a fixed-term contract, the reduction in risk wrought by a PVR contract was equivalent to 30 percent of the cost of a highway. On the other hand, and as pointed out by Tirole (1997), bids are cost based, creating incentives to reduce costs.

In addition, PVR allow for more contractual flexibility, correcting a serious problem of fixed-term PPPs. In general, PPP contracts are designed to be inflexible, to limit the risk of creeping expropriation by the government. For this reason, fixed-term PPP contracts have a hard time incorporating early termination clauses in a way that avoids opportunistic behavior by the government. The reason is that the fair compensation is equal to the revenue that would have accrued had the original contract run until termination. Because future demand is random, that quantity cannot be calculated with verifiable information. In contrast, in the case of PVR, the government has the option to unilaterally buy back the concession, paying a "fair" price for the contract. This fair price is equal to the difference between the concessionaire's bid and the present value of toll revenue already collected (with a sum subtracted for savings in maintenance and operational costs). Because the concessionaire's winning bid determines the total amount of present value revenues it requests, the PVR contract is closer to a complete contract than a fixed-term contract, and a fair value for the early buyback option can be calculated at any moment with verifiable accounting information.

For the same reason, a PVR contract allows flexibility in setting user fees. This can be valuable, for instance by allowing adjustments of user fees to better manage the entire public transportation network of a city or to adjust congestion tolls in a highway. In contrast, flexibility to change user fees in a fixed-term PPP comes at the cost of a large increase in revenue risk for the concessionaire.

6.6.2   PVR in Practice

6.6.2.1   *United Kingdom*

The first present-value-of-revenue contract that we know of was awarded to Trafalgar House on September 29, 1986, to build the Queen

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30. Given that damage to the road is driven mainly by usage (especially by heavy vehicles), maintenance cost is also related to demand. Hence a longer term is not reflected in higher maintenance costs. The contract does create some operation cost risk, but this is a small fraction of total costs.

31. Availability contracts also shield the concessionaire from demand risk. The government pays for both capital and operation costs. These contracts are useful when user fees cannot be charged.

Elizabeth II Bridge, crossing the Thames River at Dartford.[32] The proposal by Trafalgar was deemed the best among eight proposals.

The contract stipulated that Trafalgar would buy the two existing tunnels for £43 million, build a new 450-meter bridge, and operate all three for 20 years or until toll fees paid off the debt, whichever happened first. The project had four shareholders: Trafalgar House (50 percent), Kleinwort Benson (16.5 percent), Prudential (16.5 percent), and Bank of America (17 percent). The consortium financed the bridge with subordinated debt issued by insurance companies and term loans by banks. Project finance was used, and the shareholders invested only nominal equity. Interest on the syndicated loan was a floating rate, at a margin between 0.75 and 1.25 percentage points above the prime rate.

The bridge opened in 1991 and, after accruing the contracted toll revenue, the contract ended in March of 2002, almost 10 years before the maximum concession term of 20 years. The SPV in charge of the PPP was liquidated, the bridge reverted to public ownership and management, and the government began collecting tolls, now referred to as charges.

The Second Severn Crossing PPP on the Severn Estuary, which was tendered in 1990 and opened in 1996, also used a PVR contract. The contract stipulated a term of 30 years or until the concessionaire collected £995.8 million (in July 1989 prices), whichever occurred first. As with the Queen Elizabeth II Bridge, the PPP was financed fully with debt. Control of the crossing and the original Severn Bridge reverted to the UK government on January 8, 2018, after the required revenue had been collected. At that point responsibility for operating the bridge passed to Highways England, a public entity.

6.6.2.2   Chile

Figure 6.3 shows the cumulative investment in transport PPPs in Chile since the PPP program was launched in 1993 with the El Melón Tunnel.[33] As can be seen in the figure, initially all PPPs were fixed term. The first PVR contract was auctioned in 1998, and after 2006 PVR contracts became the norm. Note that a third type of contract—the so-called revenue distribution mechanism or MDI—appeared in 2002. These were five fixed-term PPPs that were renegotiated and turned into variable-term contracts in 2002, when their revenue plummeted following the Asian crisis of the late 1990s. By 2017, 29 of the 66 PPPs awarded were variable-term contracts. As figure 6.3 shows, by 2017 the cumulative investment in transport PPPs in Chile exceeded US$12 billion. Fifty-five percent of all investment had been made with (or turned into) variable-term contracts.

32. This section is based on Engel, Fischer, and Galetovic (2014a) and Levy (1996).
33. This section is based on Engel et al. (2019).
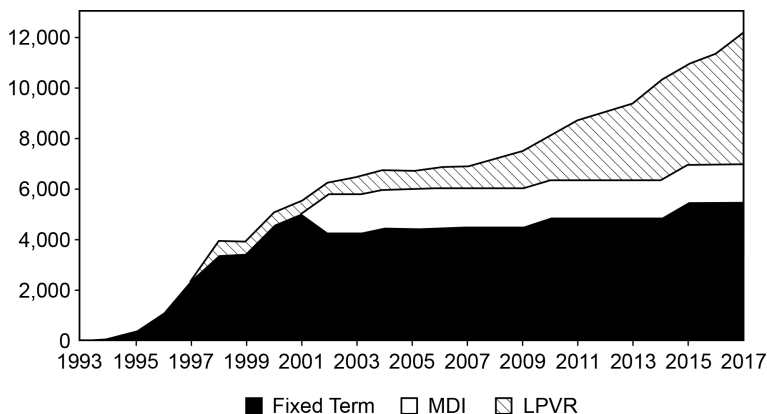
Fig. 6.3   Value of PVR contracts in Chile
Source: Authors with data from the Ministry of Public Works.

6.6.3   Financing and Renegotiations: Theory and Evidence

Flexible-term contracts have been used only in the UK, Chile, Colombia, and Portugal. Given all the advantages we described, this begs the question why they have not been used more. We can think of two reasons. First, there exists a belief that financing a PVR PPP is more difficult (see Klein [1997] for an early example).[34] We argue here that this belief is incorrect. Second, it is harder to renegotiate a PVR contract, which may explain why concessionaires sometimes oppose them.[35]

One reason why financing PVR contracts may be harder is that the contract term is not known in advance. This would seem to impose additional challenges on fixed maturity debt, and make financing more costly. Another concern is that the risk of debt prepayment by bondholders is higher under PVR contracts, since the PPP will pay its debt early when demand turns out to be high.

Many of the misunderstandings about PVR and debt contracts stem from ignoring that the per-period cash flows generated by a project depend only on demand realizations, not on the type of PPP contract. It follows that the main difference between a fixed-term contract and a PVR contract is that the latter lasts longer in low-demand scenarios and ends earlier in high-demand scenarios. When demand turns out to be low, the term is extended automatically, and the concessionaire receives revenues that are unavailable under a fixed-term contract. This implies that debt holders bear less risk with a PVR contract.

34. For financing of PPPs in general, and the important role of project finance, see, for example, Ehlers, Packer, and Remolona (2014), and Inderst (2010, 2013).
35. The PPP industry lobbied against PVR when it became the standard contract for highway and airport PPPs in Chile in 2007.

Table 6.6   **Renegotiations in Chile: Fixed-term versus PVR contracts**

Period	Fixed-term		PVR	
	Number	Renegotiation (average)	Number	Renegotiation (average)
Construction	20	32.0%	15	3.6%
First eight years of operation	20	25.2%	15	2.5%
Total (construction + first eight years of operation)	20	57.2%	15	6.1%

At the same time, the fact that the contract ends earlier in high demand scenarios implies a higher prepayment risk under PVR. However, the timing of prepayments is not correlated with periods of low interest rates. On the contrary, prepayment is triggered by an exogenous event—an unexpectedly high demand for the project. Moreover, because exogenous prepayments occur when demand for the project is high, they are likely to happen when the economy is booming and interest rates are high. By contrast, prepayment risk is usually costly for lenders when borrowers strategically prepay when interest rates fall. Thus with PVR, prepayment risk is low or even nonexistent. The Chilean experience with financing PVR contracts confirms this (see Engel et al. 2019).

Summing up, PVR contracts may be viewed as having an automatic renegotiation clause triggered by low demand realizations. Then the contract term extends automatically and the present value of total revenues is unaffected—no costly contract renegotiation is needed.

Table 6.6 compares the amounts renegotiated under fixed-term and PVR contracts for highway PPPs in Chile (similar results are obtained if airport PPPs are included). The table reports renegotiations as a fraction of the initial investment, both during construction and during the first eight years of operation.[36] Note that the percentage renegotiated fell by 90 percent with PVR contracts, both during construction and the first years of operation.

6.7   Conclusion

PPPs can deliver major gains in efficiency. However, successful PPPs require careful project and contract design by the government and good governance, both during the procurement and operation stages. The experience of the past 30 years and the analysis of this chapter suggest a set of best practices.

First, PPPs would not be used to circumvent fiscal restrictions if their link

36. Considering longer periods of operation reduces significantly the number of projects with PVR, since these contracts began being used on a regular basis only in 2007.

to the intertemporal fiscal constraint is acknowledged. This occurs if investment in PPPs is included in public accounts as if it were public investment, since the effect on the intertemporal budget constraint is identical. Second, careful planning, project design, and project management help PPPs to fulfill their promise. Careful planning reduces the frequency of costly mistakes and events that require modifications to the contract and thus renegotiations. Third, if renegotiations are reviewed and possibly approved by an independent expert panel, the incentives for opportunistic renegotiations are reduced. Fourth, there are fewer incentives to modify the project if additional works are tendered competitively. Finally, if concessionaires are not required to bear exogenous demand risk, the cost of the project is lower.

In 2010 Chile modified its PPP law, introducing an independent panel to review contract renegotiations and excluding concessionaires from building additions agreed in renegotiations. In addition, since 2007 Chile has routinely used PVR contracts, which shield the concessionaire from demand risk it cannot control. While we cannot prove causality, these reforms were based on sound economic analysis and were followed by a substantial decrease in renegotiations. This illustrates that governance and careful contract design are vital to reap the benefits from PPPs.

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