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**Nº 349 WHEN AND HOW TO USE PUBLIC-PRIVATE PARTNERSHIPS IN
INFRASTRUCTURE: LESSONS FROM THE INTERNATIONAL EXPERIENCE**

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Abstract

In the last 30 years public-private partnerships (PPPs) have emerged as a new organizational form to provide public infrastructure. Governments find them attractive because PPPs can be used to avoid fiscal check-and-balances and increase spending. At the same time, PPPs can lead to important efficiency gains, especially for transportation infrastructure. These gains include better maintenance, reduced bureaucratic costs, and filtering white elephants. For these gains to materialize, it is necessary to set up a governance structure, that is more sophisticated than the governance of traditional infrastructure provision. The governance structure can be complemented by variable-term contracts that allocate demand risk efficiently, and by avoiding opportunistic renegotiations, which have been pervasive. The good news is that, based on the experience with PPPs over the last three decades, we have learnt how to cope with these challenges.

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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.² Even though public provision continues to be the dominant procurement option, investment in transport PPPs over the last 25 years has been considerable, adding investments for €203 billion in Europe and \$535 billion in developing countries.³ 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, when demand is sufficiently high, a toll road 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 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.

Why do governments choose PPPs? Political Economy reasons

The main reason why governments have chosen PPPs is that this organizational form allows them to spend more on infrastructure, for two related reasons. First and in contrast to public provision, most of the investment via PPPs is not included 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.⁴ The second reason why PPPs allow governments to spend more is that these investments are usually not subject to Congressional oversight and other budgetary controls. Therefore, they allow incumbents more discretion.

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. For example, by choosing a PPP to procure a toll road, the government does not pay for the upfront 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 et al., 2013, for a formal treatment)⁶

²See Grimsey and Lewis (2004) and OECD (2008) for general introductions to PPPs.

³Sources: EIB (1990-2018) and PPIAF (1990-2018).

⁴"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." *The Economist*, July 2nd, 2009. PFI is the acronym for the UK's PPP program.

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 5th, 2007.

⁶This 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.

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 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 a PPP. Last, the financing of a 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 the core of the governance challenges for PPPs.

When should governments use PPPs: Economic reasons

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 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 non-contractible investments during construction that may reduce maintenance and operations costs over the lifecycle of the concession (Grout, 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, for 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 only begin charging user fees, or receiving government transfers, once 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: In the absence of government transfers, PPPs will filter white elephants, since no firm will be interested in a project where user fees cannot pay for capital and operational expenditures.

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.

This insight goes back to Adam Smith.⁸

Avoiding the cost of bureaucracies: PPPs allow users to pay the firm building and operating the infrastructure asset directly, avoiding the efficiency costs associated with spending money via government bureaucracies (see Engel et al., 2013, for a formal model). These efficiency losses are caused by justifiable rigidities in public spending, but also by the costs of corruption that those rigidities are meant to reduce.

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, who 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 due to moral hazard.

Better and less expensive maintenance: In many countries there is a bias to spend 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 set aside resources 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 is much 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 3 times the cost of continuous maintenance.¹⁰ Recent studies (see Leslie, 2018, 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 likely to be large. On the cost side, these savings are somewhere between 10 and 16 percent of initial investments.¹¹

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 a governance that prevents opportunistic renegotiations.

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 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.

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

¹⁰See TRiP (2013) for the lower bound, which applies to the US, and Engel et al. (2014) for the upper bound, which is obtained for developing countries. The difference grows with the extent to which the road is allowed to deteriorate before it is rehabilitated.

¹¹We arrive at this range as follows: Annual maintenance costs of a typical highway are typically between 2 and 3 percent of the initial investment. Over a thirty year period, discounted at 5 percent, this adds up to between 32 and 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 to 16 percent range for savings.

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 due to 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 there is low demand for the project, 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 ten 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 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 ostly renegotiations can be reduced by making them less attractive for concessionaires and public authorities. For example, the contract can include the requirement that any significant addition to the project be assigned in a competitive auction, where 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 its control, and low realizations of demand often trigger renegotiations. In contrast, a flexible term contract, such that the winning firm collects 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 that source of opportunistic behavior.

Chile began using PVR contracts for most transportation PPPs in 2007 and reformed its PPP legislation in 2010 to make them the default option. The reform also created the independent technical panel that reviews and authorizes renegotiations, and requires the owners of the SPV to auction the works required

by all major additions to the initial project. The combination of both policy innovations was followed by a reduction in renegotiations, as a fraction of investment, of more than 90 percent.

The remainder of this chapter is organized as follows. In section 2 we briefly review some data about global and regional PPP spending, and show that PPPs are a modest share of total infrastructure spending. Section 3 explains how current fiscal accounting practices stimulate the use of PPPs for the wrong reasons. Section 4 discusses the efficiency gains potentially brought about by PPPs. Section 5 deals with renegotiations, perhaps the main threat to the PPP model of procurement. Section 6 describes the PVR contract, which corrects many of the defects of fixed-term contracts. Section 7 concludes.

2 PPPs around the world

2.1 World infrastructure and PPPs

Governments use PPPs to procure infrastructure.¹² Comprehensive figures of world infrastructure spending are notoriously difficult to obtain. 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 Airoidi et al. (2013, Exhibit 1), world public and private infrastructure spending, excluding telecoms, averaged about \$2.7 tn in 2008-2010.¹⁴ As can be seen in column 1 of Table 1, spending can be broken down in transportation (\$1,040 bn); social infrastructure (\$490 bn), water and waste (\$160 bn), oil and gas transmission (\$190 bn), and electricity (\$810 bn). Transportation, in turn, can be broken down in ports (\$110 bn), airports (\$80 bn), rail (\$400 bn) and roads (\$450 bn). Moreover, according to the consultancy Infonetics, global capex spending in telecomm was about \$300 bn in 2011. Hence, yearly global infrastructure spending is about \$3 tn, around 5 percentage of world GDP.

Also according to Airoidi 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 tn. Private infrastructure is funded through PPP project finance, through other project finance and by 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 column 2 of Table 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 (2013), total project finance around the world in 2012 was \$382 bn—total project finance for infrastructure projects varies between \$280

¹²There are variations about what classifies as infrastructure. Ports, airports, railroads and roads are almost universally included in any list and 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 treatment). Finally, sometimes telecom investments (cable or fiber optic transmission, towers, base stations, fixed line and satellites) are included.

¹³What follows is based on Engel et al. (2014b)

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

Table 1: World infrastructure spending and PPPs, 2008-2010, annual, \$ bn

| | <u>Total</u> | <u>Private</u> | | |
|-------------------------|---------------------|-----------------------------|---------------------------------|----------------------|
| | Public + Private | PPP (project finance) | Non-PPP (project finance) | Corporate finance |
| Transport | 1040 | [45 – 75] | – | n.a. |
| <i>Airports</i> | 80 | | | |
| <i>Ports</i> | 110 | | | |
| <i>Railroads</i> | 400 | | | |
| <i>Roads</i> | 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 | 3000 | | | |
| Total private | 1000 | [60 – 100] | [180 – 220] | [680 – 760] |
| World GDP 2010 | 63000 | | | |

bn and \$320 bn. According to Inderst (2013, p. 24), PPPs represent between \$60 bn and \$110 bn per year of project finance.

It can also be seen in Table 1 that around 75 percent of PPP spending is in the transport sector, that is, between \$45 and \$75 bn per year. Another 20 percent of PPP spending finances government services (between \$12 and \$20 bn per year), while the remainder (between \$3 and \$5 bn per year) is invested in the electricity, telecoms, and water and waste sectors. 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.

2.2 PPPs in Europe and developing countries

Both PPP spending and the number of projects are relatively small, and for that same reason, both the composition and size of PPP investment varies from year to year. To gain some perspective about recent developments in PPP spending, we present some data from Europe and from developing countries.

2.2.1 Europe

In the European Union, infrastructure PPPs emerged in the 1990's and grew until the 2008 crisis, peaking at €26.8 bn in 129 projects in 2007. Since then the number of projects fell, and in 2018 there were 39 projects worth €14.6 bn, see figure 1.

All in all, since the 1990s 1,841 PPP projects were undertaken in the European Union, valued at €383.2

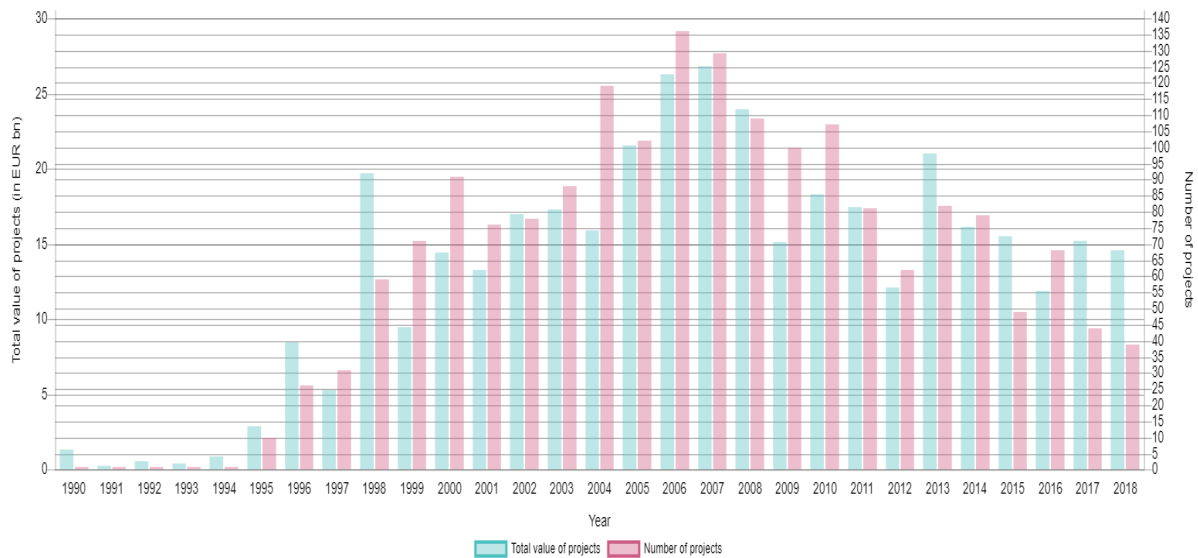


Figure 1: Number and Value of PPP projects in the European Union. Source: <https://data.eib.org/epec/sector/all>.

bn, with average project value equal to €480 MM.¹⁵ More than half of the investments (54.8 percent) were in roads (391 projects, €500 MM on average), followed at a big distance by healthcare (393 projects, €129 MM on average) and education (443 projects, €81 MM 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 bn. Considering all transportation sectors (road, rail, inland water sea and air) this average increases to €111.5 bn. 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 1,300km of highways using PPPs, which increased the stock of highway kilometers by two thirds, from less than 2000 km before 1999.¹⁷

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

¹⁵Source of the data in the paragraph: <https://data.eib.org/epec/sector/all>.

¹⁶The European Economic Association includes all member countries of the EU plus Switzerland, Norway, Iceland, Lichtenstein and Croatia

¹⁷Major highway growth in Portugal, March 2010, *Highways Routes du Monde*, <http://www.worldhighways.com/sections/eurofile/features/major-highway-growth-in-portugal/>.

investment value of \$535 billion. The average road cost \$287 MM, close to the project average of \$304 MM. Figure 2 shows the evolution of the PPPs in value as well as in number of projects.¹⁸

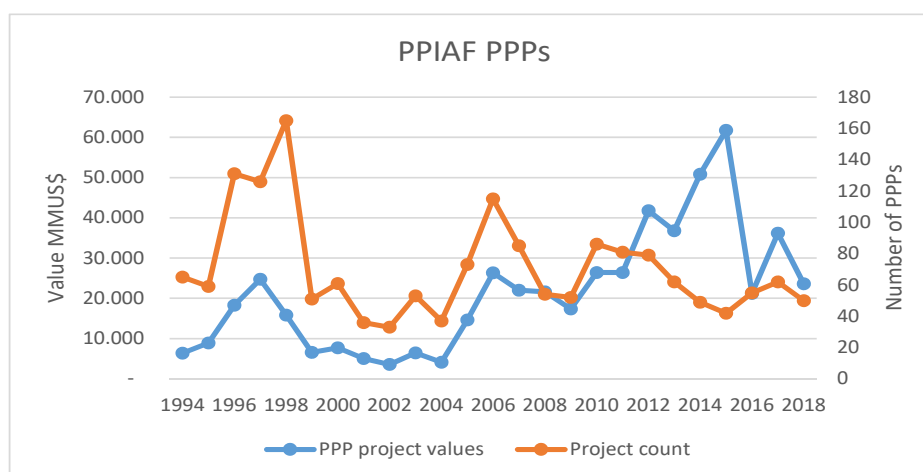


Figure 2: Evolution of the number of PPP projects and their value, developing countries

Table 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. 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 MM) is raised by two outliers, the \$35 bn IGA airport in Turkey and the combined \$20 bn of the Guarulos (Sao Paulo) and Rio de Janeiros' airports, both in Brazil.

Table 2: Number and investment in PPPs by sector, developing countries

| Sector | Projects | Total Investment (\$MM) | Avg. Project Size (\$MM) | % 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 |

Source:

PPIAF. Note: We exclude 2 projects that combine sectors: a US\$79.5M railways and Port ' project on India and a USD\$17.7M port and railway project in Mozambique.

¹⁸We 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 bn, i.e., less than 10 percent by value.

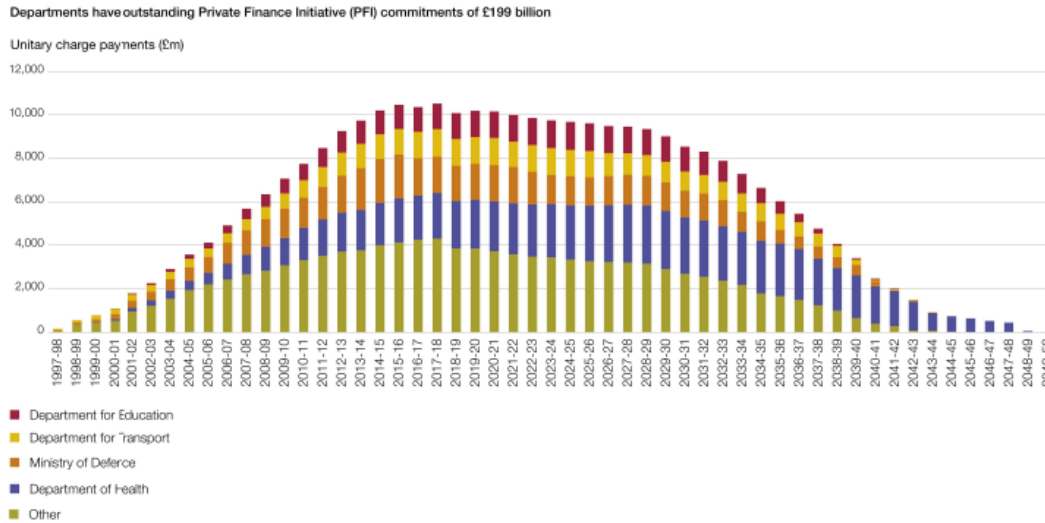


Figure 3: PFI Past and Forecast Unitary Charge Payments. Source: PFI and PF2 NAO 2018 Report

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. The government can build schools, hospitals, roads and airports without increasing the fiscal deficit. A second reason to adopt PPPs is to cater a political preference for private participation in infrastructure.

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.¹⁹ 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. Thus governments that are fiscally constrained may find it an attractive means to elude constraints. In fact, this seems to have been the main incentive for the use of PPPs in Europe. 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.²⁰ According to the PFI and PF2 National Accounting Office (NAO) 2018 Report:

“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

¹⁹See Heald (1997, 2002, 2010), Grimsey and Lewis (2002), Heald and Georgiou (2011) and Schwartz et al. (2008, part four).

²⁰As a signatory to the Maastricht Accord, the UK was required to keep its fiscal deficit below a maximum deficit.

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 bn, for the following 25 years, beginning in 2017-18, according to the NAO 2018 Report. This represents 0.5 percent of the national budget until the 2030’s, see figure 3.

Similarly, between 1995 and 2014 Portugal received €20 bn in PPP investments in roads, hospitals and other projects. 94 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, Sarmiento and Renneboog (2014). write that “[...] the incentive to resort to PPPs was mainly to avoid budget constraints, but not to use of public resources better by taking advantage of private sector [...]”.

Another way in which PPPs can be used to increase current spending is to concession the asset in exchange of an upfront 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 bn 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 MM to increase current spending. The efficiency gains of the contract were minimal, being at most a reduction in operating costs of \$1 MM a year (see Engel et al., 2014).

We have shown (Engel et al., 2013) that the effects of PPPs on the intertemporal balance sheet are no different from those of public provision. Table 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 PPP. In both cases, the infrastructure that is built today comes with a commitment to collect taxes in the future, in the same amount, and therefore the initial investment should count as public debt in both cases.

Table 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 4 considers the case where 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 upfront investments should be counted as debt for a PPP as well.

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 dis-

Table 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 |

tortion 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, choice between PPPs and traditional provision of infrastructure would depend only on which is more efficient to procure the infrastructure.

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 that found that exclusion is unsound fiscal policy. Thus the classification of a particular government funded PPP project as on- or off-balance sheet depends on the answer to 84 yes-no questions divided into 11 sections.²¹ Necessary conditions for the PPP to remain off the balance sheet is that there should be no government guarantee or early termination provisions, that transfers risks back to the government.

Summing up, Eurostat guidelines are ineffectual to limit the use of PPPs to circumvent budgetary controls, as their main focus is on risk sharing, not on their budgetary implications. This has not always been the case. In the 1980s the UK used the so called ‘Ryrie Rules’ for PPP projects.²² They allowed private finance of public infrastructure only be used if public expenditure was reduced by the same amount. These rules were abandoned under the PFI program of the mid 90s.

4 Economic arguments for PPPs: Incentives, risk and efficiency

4.1 Efficiency

PPPs are a response to the perceived shortcomings of traditional provision of government infrastructure. It is important to recognize this point of departure, for it confirms that PPPs are a different way of procuring infrastructure, not a form of privatizing government assets and functions.

²¹For 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.

²²See 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.

With traditional provision, incentives tend to be weak, because public agencies have multiple objectives and principals, fiscal accounting practices are not the right tools to monitor performance, and earnings do not reward employees and owners for better performance. Moreover, laws and the legislature constrain hiring, purchasing and contracting practices, and the organizational and management structure of the organization is determined by statute. Finally, the scale and scope of the organization that manages projects is set largely by the exogenously given administrative structure of the government, not by any efficiency consideration or regard for the optimal scope of the organization.

The consequences of poor incentives are also well known. The infrastructure assets are poorly maintained, because budgets are subject to yearly appropriations, maintenance expenditures are less visible than new works, and sometimes poor design and construction increases the cost of maintenance. Consequently, the quality of service in general tends to be low. In addition, project selection tends to be poor, both because demand is systematically overstated, and because costs and building times are underestimated (Flyvbjerg, 2003). Worse, pork barrel projects and poor planning often build white elephants.

Subcontracting tasks to private firms has been the main means whereby private incentives were brought into public provision. PPPs represent a different organizational form that goes beyond hiring contractors to build a project. Under a PPP, the private concern creates a private entity—a so called special purpose vehicle or SPV—in charge of financing, delivering and operating a public project. While the relation between the state and the SPV is still governed by public law, the SPV is a private firm and its contracting relations with employees, other firms, and financiers are governed by private law. This improves incentives, because during the term of the PPP, the SPV has discretion to manage the infrastructure as a private firm. Moreover, by creating an SPV, the scope of the firm is clearly defined and limited, and the project gets a dedicated management team, which answers to the SPV board.

The literature also notes that a PPP is an intertemporal contract between the government and a private firm. Hart (2003) has shown that the theoretical benefits brought about by PPPs arise in part from bundling design, building, operation, and maintenance. The reasoning is that since the concessionaire will operate and maintain the project, it will design and build it to minimize life cycle costs. Moreover, 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, introduces a basic trade off, identified by Hart (2003): other things equal, it stimulates investments and actions that cut life-cycle costs and other costs more generally. Nevertheless, this cost cutting may occur at the expense of service quality and user welfare; this is commonly known as “Hart’s tradeoff.” Thus, there is a strong presumption that PPPs will work well only if maintenance, quality and performance standards can be described clearly in the contract and can then be enforced. This is the case of roads, for example.

The theoretical advantages of bundling have proven difficult to test, but the benefits in terms of maintenance are clear. As we have already mentioned, governments often do not perform regular, continuous maintenance. There are more politically attractive uses for these resources: completely new infrastructure projects, or repairing severely deteriorated infrastructure. In both cases, the benefits are obvious and contrast with the lack of perceived benefits from routine maintenance. On the other hand, a PPP owner is

very interested in routine maintenance if quality standards are enforced. The firm is aware of the increased costs of reactive maintenance and of the penalties associated to insufficient maintenance. As mentioned in the introduction, continuous maintenance of a highway not only provides considerably better quality of service, but is much cheaper.

There is some anecdotal evidence that PPP projects tend to be delivered on time, which suggests stronger performance incentives. For example, Raisbeck et al. (2010) 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.” Indeed, if the firm begins to receive revenues only when the project starts to operate, there is a cost to delays, and an incentive to finish construction sooner. 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. On-time delivery also requires better planning, project design, and execution, all of which may lead to reduced cost overruns.²³

Even under PPPs, 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 concessionaire. The argument in favor is that it takes advantage of the creativity of the private sector and transfers design risk to the concessionaire. But the case can be made that governments who delegate project design tend not to have a full understanding of the projects they procure in the first place, nor of the risks they confront. The relevant point here is that it is unlikely that delegating project planning to the concessionaire will systematically increase productive or dynamic efficiency.

Two additional sources of efficiency gains appear when the PPP is financed with tolls. 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 their destination in the private firm that builds or operates the infrastructure. The direct approach eliminates the costs associated to this bureaucracy. The second benefit is that tolling can deal with congestion and increase allocative efficiency. In a congested highway, the marginal cost should include the congestion externality. Moreover, given that the taxes used to provide a free publicly provided highway create distortions, it might well be that a toll-funded PPP is more efficient globally than a free publicly provided road with a larger congestion externality. 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 et al. 2013).²⁴

²³A rule of thumb in construction says that if the project is delayed, outlays in materials and labor directly employed in construction are postponed as well, but overheads continue to be incurred. A second rule of thumb says that overhead is roughly one-third of the yearly and total cost of a project. Thus if T years is the estimated duration of the project and total project outlays are equal to 100, then an delay of t years creates an overrun of the order of $(100t/3T)$. Thus, delays create cost overruns. Source: Klaus Grewe, personal communication.

²⁴A final advantage of PPPs financed by tolls is that the private firm may be less responsive to petitions to lower tolls than a publicly elected official.

4.2 Incentives and risk allocation

Risk allocation is one of the main functions of the PPP contract. Following Irwin (2007) we can classify risks into eight categories: (a) construction risk, including design flaws, cost overruns, and delays; (b) operation and maintenance; (c) availability under the terms agreed in the contract; (d) residual value at the end of the PPP contract; (e) policy, ranging from macroeconomic uncertainty to government actions that affect the project; (f) demand; (g) financial (e.g. interest rate and exchange rate fluctuations); and (h) political (e.g. regulatory takings or expropriation).

Irwin (2007, p. 65) states the principles that should be used to assign each risk: allocate them to maximize project value, considering each party's ability to influence, anticipate, and absorb risk (and transaction costs). This implies risks should be borne, at least in part, by the party best equipped to control them. At the same time, an exogenous risk should be shifted to the party best endowed to bear or diversify it.

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

Bundling, control, and service standards are all required to ensure that these risks are effectively borne by the concessionaire. For example, it may be harder to make a concessionaire who did not build the facility bear responsibility for service quality –hence the importance of bundling. The same is the case if the concessionaire has no control over investment and operational decisions (hence the importance of control, or ownership, rights). Similarly, without objective and measurable service standards, it is difficult to transfer service quality risk to the concessionaire.

Some of the risks are created by government policies. Because the residual value of PPP assets depends on government planning decisions (not to mention that most assets are project specific), and the willingness to charge tolls in future concessions, it is sensible 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 residual value to the government. This principle suggests, as well, that an efficient policy would have some policy risks borne by the government, so as to reduce its own moral hazard.

Broadly speaking, policy risks fall into two categories. First, the government may implement policies that directly affect the project and have few other effects. For example, it may change the rules to expropriate the concessionaire. These principles indicate 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.²⁵ For example, governments often grant foreign concessionaires insurance against

²⁵García-Kilroy and Rudolph (2017) argue that governments should offer currency risk sharing arrangements, when financial markets fail to do so. They describe cases where this has been done, at a price close to what would have been a market price.

devaluations. Not only does this discriminate against local investors, but it also discriminates against foreign firms in other sectors of the economy that 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 project financed by user fees is uncertainty about demand. As mentioned above, 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 an insurance contract on an exogenous risk that they assume under public provision (see Engel et al. 2014a, chapter 5). As Hall (1998) notes, this is not cost effective. Demand forecasts are notoriously imprecise and changes in policy, which are unknown at the time of tendering, may radically affect the usage of the facility, yet there is little that the firm can do about it. Even the design of the project is usually determined by the government. In those cases, either a present-value-of-revenue contract (see section 6) or an availability contract are the appropriate compensation scheme, depending on whether the main source of funds are user fees or government transfers.

The principle of transferring exogenous demand risk to the government admits 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 and that helps to avoid white elephants. If there are no bidders at an auction, this is a signal that the project is not privately profitable and therefore there is a risk that the project is a white elephant unless it has large positive externalities.

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 favoured treatment, and firms can choose among alternative capital structures. More generally, governments are not particularly efficient at providing and selling financial insurance.

5 Governance and renegotiations

Given the often unsatisfactory results of PPP programs in infrastructure, it is worthwhile to study whether this is due to defects of the governance of PPPs. At a minimum, a PPP-capable country requires institutions that allow private firms to invest large amounts in sunk projects receive a return. 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. Furthermore, there has to be a reasonable expectation that the government cannot expropriate the investment without compensation. These preconditions may preclude PPP investment in some countries.²⁶

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.

²⁶Or if it exists, it must be supported by multilateral financial institutions, see Engel et al. (2014a).

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. 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., 2009b). More recently Engel et al. (2019a) 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. And at least 60 percent of the renegotiated spending increase falls on future administrations.²⁷

One might think that renegotiations occur mainly in emerging economies, where governance is weak. They 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 twelve highway concessions 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 (see Engel et al., 2018b).

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, p. 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

²⁷Renegotiations are not only common in transportation infrastructure. An example from the sanitation sector are 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 put up for auction of 25 year concessions. The two winning consortia offered tariffs that were 26 and 56% of the previous rates. However, by 2002 they had managed to renegotiate their contracts and double the prices (using the Asian crisis as an argument), and then almost doubled them 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%. Despite this, due to bad management, the other company, Manilad, went bankrupt (in 2003) after its petition for even larger tariff increases were denied. Regardless of the adverse effects of raising rates, there were compensating benefits from privatization: a massive expansion in connections by 30% in the first five years of operation, and in Manila Water, non revenue water (lost to theft or because of leaking pipes) decreased from almost 58% to 35%, 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, the bids of companies can be renegotiated to the advantage of the winners at the expense of the public, but in some cases even then the public can benefit. For a more critical evaluation see Esguerra (2003).

during construction, shortly after the concession was awarded.²⁸

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 than 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.²⁹

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.

One is related to the political cycle. In Engel et al. (2019c) 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 anticipate spending and 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 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 et al. 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. The incumbent's commitment is credible because the concessionaire has a long-term contract with the State, not only with the incumbent administration.

Even though there is no systematic evidence on the frequency of renegotiation of infrastructure provided under the traditional approach, the above 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 it would incur additional expenditures that must be approved by the legislature.

Renegotiations also generate adverse selection, by attracting firms that are better at renegotiating and 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. A

²⁸For more on renegotiation of PPP contracts, see Guasch et al. (2007, 2009).

²⁹For evidence on renegotiations of US PPPs that benefited private firms at the expense of taxpayers and users, see Engel et al., 2011.

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 by less at the competitive auction and win the concession, in the expectation that in a later opportunistic renegotiation it can recover from having bid less.

As formalized in Engel et al. (2019b), in the competition for government contracts, firms that are worse in both aspects—technical efficiency and the ability to renegotiate—do not survive. They cannot compensate lower technical efficiency with the possibility of higher revenue from renegotiation. It follows that the firm with the highest degree of technical efficiency will also employ less skillful renegotiators, since they will not have to renegotiate to compensate for inefficiency. The implication is that if a substantial part of profits are made in the renegotiation stage, less efficient firms will have an advantage. Hence by self-selection, efficient firms should be attracted to countries in which there is little renegotiation of the initial contract, while countries that renegotiate more will attract technically less proficient firms.

The third mechanism at work is moral hazard. As we have seen before, 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, and the cost-cutting incentives will be equivalent to those under a fixed-price contract or a price cap. In practice, however, private firms foster the belief that PPP contracts should be adjusted to ensure the 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 above). This is not an acceptable argument for a renegotiation of 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 there should be no renegotiation that results in a higher cost of providing the contracted service quality. 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 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 ten 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 they consider 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 obtain better deals when the contract is

renegotiated, as well as more frequent renegotiations.

5.3 Governance and remedies

The common threads behind renegotiations are inadequate rules and governance that foster lowballing in the auction, in the expectation of obtaining rents in bilateral bargaining. The remedies combine proper accounting rules, competitive tendering for additional works, and independent review of renegotiations.

As shown by Engel et al. (2019a), 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 the problems generated by adverse selection and moral hazard is to eliminate the economic rents that are brought about by bilateral renegotiations. On the one hand, this would require for the concessionaire's bid to cap its compensation for the tendered infrastructure (Guasch, 2004). This may be achieved by tendering additions to the original works in auctions where the concessionaire cannot participate. In addition, renegotiations may be subject to review by an expert panel, ensuring that the concessionaire's compensation does not change. The box below 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. By itself, the publication of the modifications and their value is politically costly and therefore tends to harden the negotiating position of the public authority.

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 apply to an arbitration procedure or eventually, the courts. Akinbode and Vickers (2017). show how these procedures can escalate and how 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 the 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 40% of the cases, the parties have agreed to the recommendation. The remaining cases proceed to mandatory arbitration, where the Panel recommendation is considered in the decision.

Chile reformed its PPP law in 2010 and established a Technical Experts Panel (see the box for details) that provides an opinion on whether contract renegotiations above a certain threshold are fair. In addition, The reform also made it mandatory to put to tender any additional works agreed in a renegotiation, and excluded the concessionaire or any related party from the ensuing contract.

Table 5: Renegotiations in Chile: Before and after the 2010 Reform

| | <u>Highways</u> Renegotiation | | <u>Transport</u> Renegotiation | |
|--------------------|----------------------------------|--------------------------|-----------------------------------|--------------------------|
| | No. | (fraction of investment) | No. | (fraction of investment) |
| Before 2010 reform | 29 | 26.1% | 44 | 27.6% |
| After 2010 reform | 15 | 0.7% | 25 | 0.9% |

Table 5 shows renegotiations, as a fraction of initial investment, for Chilean PPPs, both before and after the reform of the PPP law of 2010. Since the time elapsed since the reform is relatively short, we only consider renegotiations during construction, 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 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 for free or charging 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 the 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, and 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, i.e., a user fee that generates enough expected income to compensate for demand risk. At the same time, in order to make projects bankable, governments are forced to pledge revenue guarantees. Also, as discussed in the previous section, fixed-term contracts tend to be renegotiated in times of severe economic stress. In brief, the deficient risk allocation of fixed term contracts is expensive.

In this section we argue that exogenous demand risk and opportunistic renegotiations can be mitigated in PPPs with contractible quality of service and high, exogenous, demand uncertainty, with present-value-of-revenue (PVR) contracts (see Engel et al., 1996, 2001). This applies for highways, airports and other types of infrastructure where exogenous and service quality easy to contract upon. Under a PVR contract, the regulator sets the discount rate and tariff schedule, and firms bid the present value of the user fee revenue they ask for financing, building, operating and maintaining the infrastructure.³⁰ The firm that bids

³⁰User fees considered in the firms' bid are tolls in the case of highways. In the case of airports, they only consider aeronautical

the lowest PVR gets the concession, which ends when the present value of user fees collected equals the winning bid. It follows that the term of the concession automatically adjusts to demand shocks, resulting in a substantial reduction of demand risk borne by the concessionaire. Since tariffs are the main revenue source for the PPP, the contract attains the efficiency gains associated with PPPs discussed in section 4.

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 contract term. Since revenue is in present value, the duration of the PPP does not affect its profitability.³¹ For the same reason, minimum traffic guarantees are no longer necessary to make the project bankable.³²

The efficient assignment of demand risk lowers the overall cost of the project. On the one hand, Engel et al. (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 contracts allow for more flexibility correcting an important deficiency 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 much closer to a complete contract than a fixed-term contract, and a fair value for the early buy back 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 very valuable, for instance to adjust 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.

PVR AND THE TWO MAJOR HIGHWAY PPPS IN THE US DURING THE 1990s^{33,34}

revenues (passenger and airport fees); see Engel et al. (2018a) for details.

³¹Given that damage to the road is driven by usage (specially 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.

³²Availability contracts also shield the concessionaire from demand risk because under them the government pays for both capital and operation costs, and they are useful when user fees cannot be charged.

³³Based on Gifford et al. (2014) and Engel et al. (2014).

³⁴The SR91 project is also analyzed, from a financial valuation perspective, in Lucas and Jimenez-Montesinos (2021).

The Dulles Greenway and the Orange County SR91 are the two main highway PPPs built in the US during the 1990s (see Engel et al., 2011). 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 \$40 million in cash and secured \$310 million in privately placed, taxable debt to finance it. Loans were to be repaid with toll revenues. Tendered as a fixed term, 42.5 year concession, it 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 SR 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 non-tolled lanes, paying up to 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 non-tolled public lanes were suffering congestion, and an expansion was urgently needed. Nevertheless, the contract included a non-compete 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 non-compete 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 non-profit associated with Orange County. After several years of negotiations, with frustrated commuters stuck in traffic in the meantime, the express lanes were bought in January 2003 by OCTA 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 been necessary.

6.2 PVR in practice

United Kingdom³⁵

The first present-value-of-revenue PPP contract that we know of was awarded to Trafalgar House on September 29, 1986, to build the Queen Elizabeth II Bridge, crossing the Thames River at Dartford. The proposal by Trafalgar was deemed the best among eight proposals for crossing the Thames River at Dartford.

The contract stipulated that Trafalgar would buy the two existing tunnels for £43 MM, 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 ten 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.

³⁵Based on Engel et al. (2014a) and Levy (1996).

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 MM (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 8 January 2018, after the required revenue had been collected. At that point responsibility for operating the bridge passed to Highways England, a public entity.

Chile³⁶

Figure 4 shows the cumulative investment in transport PPPs in Chile since the PPP program was launched in 1993 with the El Melón tunnel. 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, after their revenue plummeted during a recession in the late 1990s. By 2017, 29 of the 66 PPPs awarded were variable-term contracts. As Figure 2 shows, by 2017 the cumulative investment in transport PPPs in Chile exceeded USD 12 billion. 55 percent of all investment had been made with (or turned into) variable-term contracts.

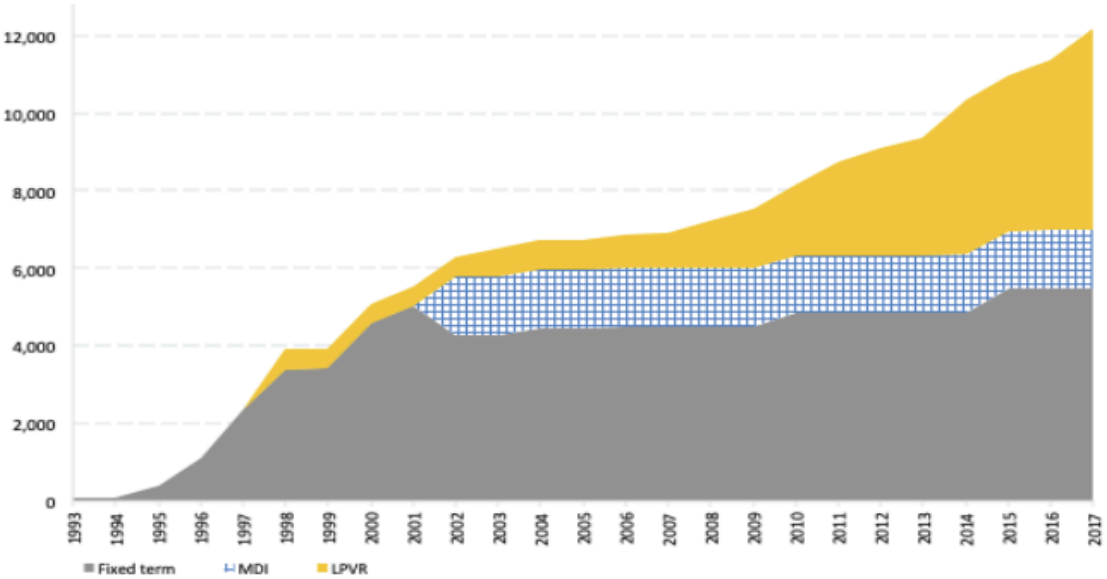


Figure 4: Value of PVR Contracts in Chile. Source: Authors with data from the Ministry of Public Works

³⁶Based on Engel et al. (2019c)

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 in more countries. 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).³⁷ We argue below that this belief is incorrect. Second, it is harder to renegotiate a PVR contract, which may explain why concessionaires sometimes oppose them.³⁸

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, and not on the type of PPP contract. It follows that the main difference between a fixed term and a PVR contract is that the latter lasts longer in low demand scenarios, and ends earlier in high demand scenarios. Therefore, when demand turns out to be low, the concessionaire can automatically tap revenues which are unavailable under a fixed term contract, and use them to repay the debt. This implies that debt holders bear less risk with a PVR contract. Consequently, with a PVR contract the PPP can take a higher leverage.

At the same time, the fact that the contract ends sooner in high demand scenarios implies a higher prepayment risk under PVR. However, the prepayment option does not come at a significant cost to lenders, because it is not triggered by a strategic response of the borrower when interest rates fall. 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 inexistent. The Chilean experience with financing PVR contracts confirms this (see Engel et al., 2019c).

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 compares the amounts renegotiated under fixed-term and PVR, for highway PPPs in Chile (similar results are obtained if airport PPPs are included). The table reports renegotiations,

³⁷For financing of PPPs in general, and the important role of project finance, see, for example, Ehlers et al. (2014), and Inderst (2010, 2013)

³⁸The PPP industry lobbied against PVR when it became the standard contract for highway and airport PPPs in Chile in 2007.

as a fraction of the initial investment, both during construction and during the first eight years of operation.³⁹

Table 6: Renegotiations in Chile: Fixed-term vs. PVR

| Period considered | <u>Fixed term</u> | | <u>PVR</u> | |
|--|-------------------|----------------------------|------------|----------------------------|
| | No. | Renegotiation (average) | No. | Renegotiation (average) |
| Construction: | 20 | 32.0% | 15 | 3.6% |
| First 8 years of operation: | 20 | 25.2% | 15 | 2.5% |
| Total (construction + first 8 years of operation): | 20 | 57.2% | 15 | 6.1% |

Note that the percentage renegotiated fell by an order of magnitude with PVR contracts, both during construction and the first years of operation.

7 Conclusion

PPPs can be a useful instrument of public policy because they can deliver efficiency gains. Experience suggests, however, that successful PPPs require careful project and contract design by the government and good governance, both during the procurement and operation stages. In the last 30 years a set of best practices has emerged.

First, PPPs would become more credible if their link to the intertemporal fiscal constraint is acknowledged. This occurs if investment in PPPs is included in public accounts the same way as public investment, since on the intertemporal fiscal constraint is the same. Second, careful planning, project design, and project management help ensure that PPPs fulfill their promise. Careful planning reduces the frequency of costly mistakes and of events that require modifications to the contract, and thus the need for renegotiations. Third, if renegotiations are reviewed and possibly approved by an independent expert panel, the incentives to renegotiate contracts are reduced. Fourth, if any additional works required by the project once it has been awarded is tendered competitively, there are fewer incentives to attempt to change the conditions of the project by these additions. Last, if concessionaires are not required to bear demand risk which they cannot control, the cost of the project is lower.

In 2010 Chile modified its PPP law, introducing an independent panel to review contract renegotiations and excluded 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. Which

³⁹Considering 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.

illustrates the more general point we make in this chapter, namely that governance and careful contract design are important to reap the benefits from PPPs.

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