Finance and Public-Private Partnerships

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1. Introduction

The use of public-private partnerships (PPPs) to replace or complement the public provision of infrastructure has become common in recent years.[1] Public infrastructure projects that require large up-front investments, such as highways, light rail, bridges, seaports, airports, water, sewerage, hospitals, gaols and schools, are now often provided via PPPs.[2]

A PPP bundles investment and service provision of infrastructure into a single long-term contract. A group of private investors finances and manages the construction of the project, then maintains and operates the facilities for a long period of usually 20 to 30 years, and at the end of the contract transfers the assets to the government. During the operation of the project, the private partner receives a stream of payments as compensation. These payments cover both the initial investment (the so-called capital expense or capex) and operation and maintenance expenses (the so-called operation expense or opex). Depending on the project and type of infrastructure, these revenues are derived from user fees (as in a toll road), or from payments by the government's procuring authority (as in the case of gaols).

As pointed out by Yescombe (2007), the growth and spread of PPPs around the world is closely linked to the development of project finance, a financial technique based on lending against the cash flow of a project that is legally and economically self-contained – a so-called special purpose vehicle (SPV).[3] Project finance arrangements are highly leveraged and lenders receive no guarantees beyond the right to be paid from the cash flows of the project.[4] Because the assets of the project are specific, they are illiquid and have little value if the project is a failure. There is

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1 There exist three broad alternative organisational forms to provide infrastructure: traditional provision; PPPs; and privatisation, perhaps under a regulated monopoly. Each one of these forms includes a number of contractual arrangements. For example, Guasch (2004) lists the following 12 arrangements, ordered by increasing private participation: public supply and operation; outsourcing; corporatisation and performance agreement; management contracts; leasing (also known as *affermage*); franchise; concession; build-operate-transfer (BOT); build-own-operate; divestiture by license; divestiture by sale; and private supply and operation. In what follows, our definition of PPP includes the four cases grouped by Guasch as concessions, namely leasing, franchise, concession, and BOT. We also use the terms PPP and concession interchangeably.

2 Many databases and analyses classify telecommunication networks and power (generation, transmission and distribution) as 'infrastructure'. While there are PPPs in power and telecommunications, we would think that these are better provided by standard regulated utilities (power transmission and distribution) or competitive regimes (telecoms and power generation). Indeed, around the world most PPPs are transportation projects or 'social' infrastructure, for example hospitals, schools or gaols.

3 PPPs are only part of global project finance, but most PPPs are financed with project finance. According to Blanc-Brude and Ismail (2013), project finance around the world finances between US$350 and US$400 billion every year; about 20 per cent goes to oil and gas projects and 80 per cent to infrastructure – mainly water, telecoms, energy, transport and government services. Of these infrastructure projects, between US$60 and US$100 billion per year are PPPs. Around 75 per cent of PPPs are in the transport sector, and an additional 20 per cent finances government services. As a reference, consider that total world private and public infrastructure spending is estimated to be between US$2 and US$3 trillion.

4 According to Blanc-Brude and Ismail (2013), debt finance accounts for 77 per cent of total project finance, on average.

ample scope for moral hazard during the construction stage; banks tend to provide finance during this stage as they are well placed to mitigate this moral hazard by continually monitoring the project. During the operation of the project, bonds, sometimes held by pension funds and other long-term investors, substitute for bank lending. Indeed, after completion, risk is limited mostly to events that may affect the cash flows of the project, which makes PPP projects suitable for bond finance. In Section 2 we analyse the economics and contracting of PPP finance and conclude that the narrow organisational focus forced by project finance and SPVs fosters efficiency and incentive alignment. Moreover, because PPP projects are large, require independent management, and both scale and scope economies across projects are typically small, an SPV seems a particularly suitable organisational form. Thus, project finance contributes to efficiency – a case of finance fostering efficiency gains.

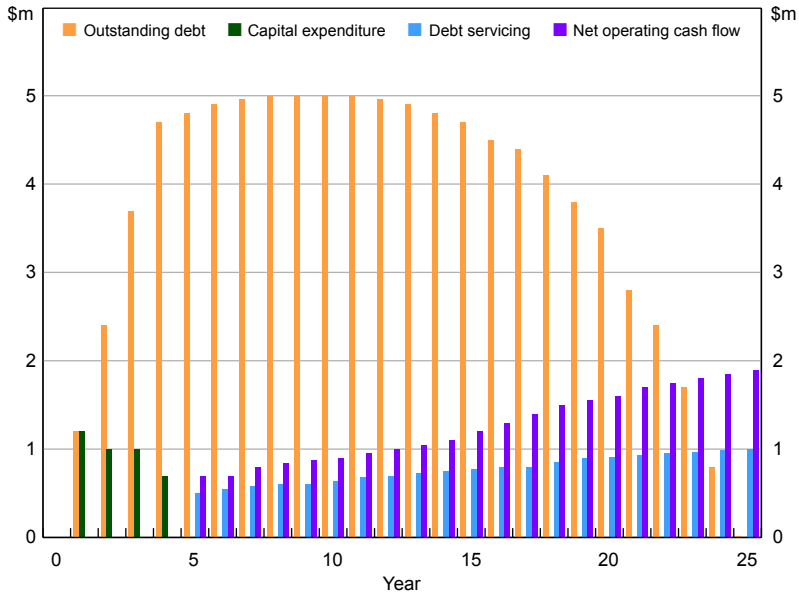
Section 3, by contrast, takes a sceptical view about the differences between private and public finance. We argue that whether a PPP is a better way of procuring public infrastructure depends almost exclusively on the economic characteristics of the specific project, not on the way it is funded or financed. More generally, PPPs work when objective performance standards can be written into the contract between the public authority and the private firm. Moreover, proper intertemporal accounting shows that PPPs do not liberate public funds. Consequently, from the perspective of the public budget and balance sheets, PPP projects should be registered like public projects.

Section 4 examines the relationship between risk and PPPs. The apparently higher cost of financing PPPs – the so-called PPP premium – is not an argument in favour of public provision, since it appears to be due to the combination of poor contract design plus cost-cutting incentives embedded in PPPs. Thus, in the case of a correctly designed PPP contract, the higher cost of capital may well be the price to pay for the efficiency advantages of PPPs relative to public provision. Section 5 presents some conclusions.

2. The Economics of PPP Finance

The typical PPP infrastructure project involves a large initial upfront investment that is sunk, and operations and maintenance (O&M) costs paid over the life of the project. These O&M costs are a comparatively small fraction of total costs, and this fact determines several characteristics of PPP finance. Figure 1 shows the typical time profile of the financial flows of a PPP project, which is assumed to be 100 per cent debt financed. It further assumes that the interest rate is 12 per cent, that revenues grow at 5 per cent each year and that debt payments grow by 3.5 per cent each year. Capital expenditures occur during the first four years. Revenues over the life of the project are used to pay off debt by year 25. After the initial capital expenditure, the main objective of the project is to collect revenues, which are used to pay outstanding debt and generate dividends for the owners.

Figure 1: Time Profile of Financial Flows



Four additional economic characteristics of most PPP projects are important for understanding the choice of financial arrangements. First, PPP projects are usually large enough to require independent management, especially during construction, and frequently even in the operational phase. It is also often the case that there are few synergies to be realised by building or operating two or more PPP projects together. For instance, the projects may be located far apart at the place where the service is consumed, and efficient scale is site specific. This means that project assets are illiquid and have little value if the project fails.

Third, most of the production processes, both during construction and operation, are subcontracted. Hence, any scale and scope economies are internalised by specialised service providers, for example construction companies, maintenance contractors or toll collectors.[5]

Last, it is efficient to bundle construction and operation. Bundling forces investors to internalise operation and maintenance costs, and generates incentives to design the project so that it minimises life-cycle costs. But perhaps even more importantly, when builders are responsible for enforceable service standards, they have an incentive to consider them when designing the project.

As we will see next, the specifics of project finance fit these basic economics of PPP projects.

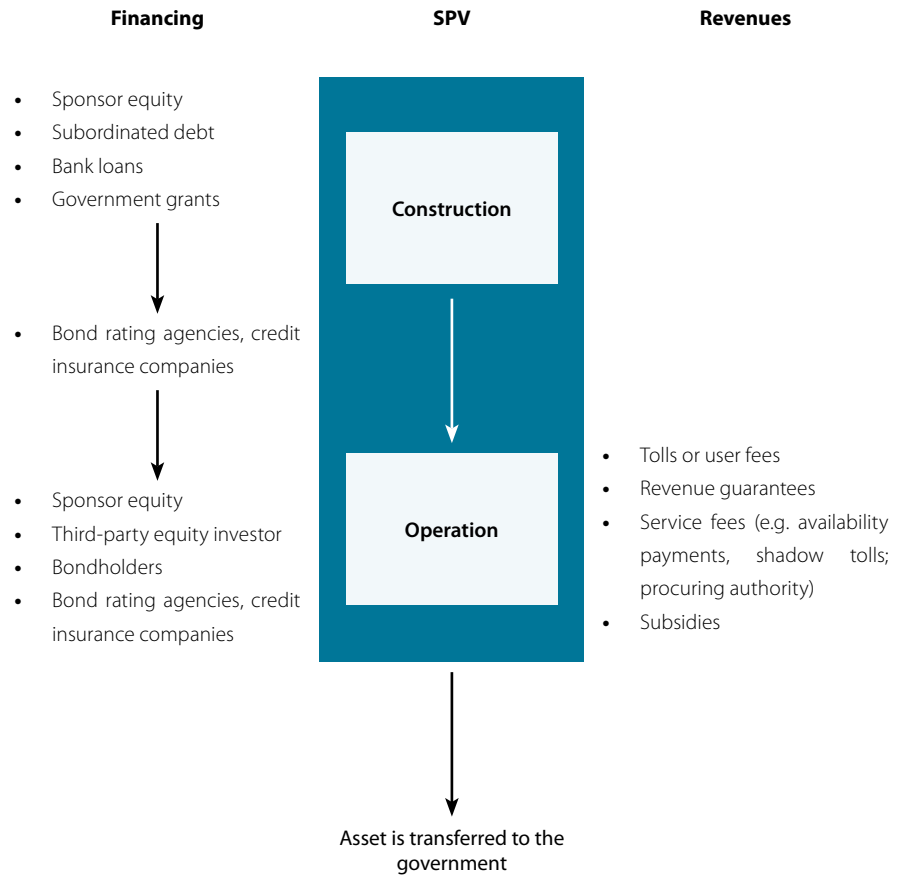
2.1 The life cycle of PPP finance

As pointed out by Yescombe (2007), the growth and spread of PPPs are closely linked to the development of project finance, a technique based on lending against the cash flow of a project

5 For example, Blanc-Brude and Makovsek (2013) show evidence that large construction companies diversify exogenous construction risk across many large construction projects and provide insurance to the SPV.

that is legally and economically self-contained. As can be seen in Figure 2, this is ensured by creating an SPV, which does not undertake any business other than building and operating the project (Yescombe 2002, p 318). Before bidding for the project takes place, an SPV is set up by a *sponsor*. The sponsor is the equity investor responsible for organising the bidding process, and developing and managing the project. They are the residual claimants and are essential to the success of the project. This means that lenders will carefully examine the characteristics of the sponsor before committing resources. Sponsors can be: operational, in the sense that they belong to the industry and will secure business for themselves as subcontractors; or financial, in that they are interested in the financial arrangements for the project.[6]

Figure 2: The Life Cycle of a PPP Project



6 The Queen Elizabeth II Bridge in Dartford in the United Kingdom is an example of the first type of sponsor: the construction division of Trafalgar House Plc organised local landowners plus an investment bank and presented an initial proposal to the government. The Department of Transport approved the proposal and, after seeking other bids, awarded the project to Trafalgar House (Levy 1996). In the Dulles Greenway project in Virginia, which began operating in 1995, the main sponsor was a family-owned investment company, which owned 57.04 per cent of the property (Toll Roads Investors Partnership II; see Levy (1996)).

Initial sponsors supply the initial equity of the project, and in some cases are required to keep a fraction until the end of the PPP contract without the possibility of transferring. The objective of this is to create long-term incentives. This is expensive for the initial sponsor for two reasons: first, because the cost of capital for the sponsor is high; and second, because by tying up resources for a long time, they cannot be deployed to other uses. As the sponsor specialises in the early, building part of the project, this limits its possibilities for future business. This means that projects must be very profitable to compensate the sponsors for this cost.

Even though the SPV remains active over the whole life of the project, until the assets revert to the government, there is a clear demarcation between financing during the construction phase and financing in the operational phase (Figure 2). During construction, sponsor equity (perhaps along with bridge loans and subordinated or mezzanine debt) is combined with bank loans and, sometimes, government grants in money or kind. In the case of projects that derive their revenues from user fees, the initial contribution to investment is sometimes supplemented with subsidies from the government if the project revenues are not sufficient to pay for the project.

As completion of the construction stage approaches, bondholders enter the picture and substitute for bank lending. Bond finance is associated with two additional entities: rating agencies and credit insurance companies. When the PPP project becomes operational, but only then, the sponsor's equity may be bought out by a facilities operator, or even third-party passive investors, usually pension or mutual funds. Bondholders, of course, have priority over the cash flow of the project.

The life cycle of PPP finance and the change in financing source is determined by the different incentive problems faced in the construction and operational phases. Construction is subject to substantial uncertainty and major design changes, and costs depend crucially on the diligence of the sponsor and the building contractor. Thus, there is ample scope for moral hazard in this stage. Banks perform a monitoring role that is well suited to mitigate moral hazard, by exercising tight control over changes to the project's contract and the behaviour of the SPV and its contractors. To control behaviour, banks disburse funds only gradually as project stages are completed. After completion and ramp-up of the project, risk falls abruptly and is limited only to events that may affect the cash flows from the project. This is suitable for bond finance because bondholders only care about events that significantly affect the security of the cash flows underpinning repayment, but are not directly involved in management or control of the PPP. This is appropriate for institutional and other passive investors, who by mandate can only invest small amounts of their funds in the initial stages of a PPP because of their high risk.

2.2 Contracts and project finance

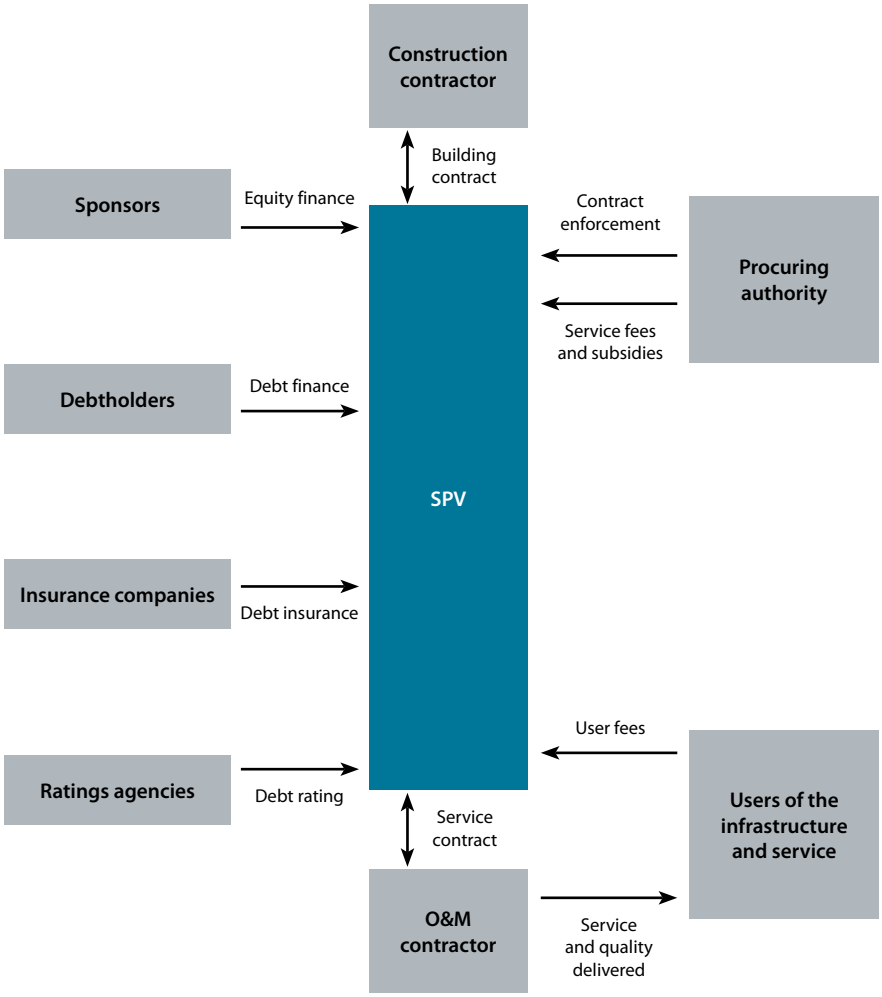
Financial contracts must deal with many incentive problems, which in the case of PPPs can be traced back to the contracts made by the SPV. In this section we examine these contracts and the roles of various agents.

2.2.1 The web of contracts around an SPV

As can be seen in Figure 3, the SPV lies at the centre of a web of contracts. These include contracts with: the procuring authority (usually the local or central government); users of the services provided by the PPP; building and operations contractors; and investors and financiers. Each of

these contracts is a potential source of conflict that may increase the risk borne by debtholders. The success of the SPV in dealing with these conflicts depends on two factors. The first factor is the quality of the legal institutions and laws on which the web of contracts rests. The second factor is that the particulars of each relationship and contract affect risk perceptions of debtholders.

Figure 3: The Web of Contracts around an SPV



The project is intended to provide a service to users, but the fundamental contracting parties are the SPV and the procuring authority, which enforces the PPP contract and represents users of the project. Because contracts give at least some discretion to the procuring authority, cash flows and even the continuation of the concession may depend on its decisions. Thus, ambiguous service standards and defective conflict resolution mechanisms increase risk. In addition, user fees will

be at risk if the political authority is tempted to buy support or votes by lowering service fees, either directly or by postponing inflation adjustments, in so-called *regulatory takings*. Similarly, if a substantial fraction of the SPV's revenues are derived from payments by the procuring authority, these payments depend on the ability (or desire) of the government to fulfill its obligations. It follows that the governance structure of the procuring authority, its degree of independence and the financial condition of the government affect the level of risk perceived by debtholders.

Consider next the relationship of the SPV with construction and O&M contractors. Many PPP projects involve complex engineering. In complex projects, unexpected events are more likely and it becomes harder to replace the building contractor. In these cases, the experience and reputation of the contractor become an issue. Moreover, the financial strength of the contractor is relevant because this determines its ability to credibly bear cost overruns without having to renegotiate the contract. Similarly, while the operational phase is less complex, revenue flows depend on whether the contracted service and quality standards are fulfilled, which depends on the O&M contractor. Again, the experience and, secondarily, the financial strength of the contractor concern debtholders. Debtholders also care about the type of risk-sharing agreements negotiated between the SPV and the contractors. Cost-plus contracts, which shift cost shocks to the SPV, are riskier than fixed-price contracts from their point of view.

Finally, debtholders care about the incentives of the sponsor, who provides around 30 per cent of the funding in the typical PPP project. This large chunk of equity has the lowest priority in the cash-flow cascade, and is theoretically committed for the length of the PPP contract to provide incentives to minimise the life-cycle costs of the project. Providers of funds worry about the financial strength and experience of sponsors, particularly during the construction and the ramp-up phase of complex transportation projects. They value previous successful experience in the industry and technical prowess, and look for evidence that the sponsor is committed to the project, both financially and in terms of time and reputation.[7]

2.2.2 Project revenues, demand risk and finance

SPV revenues depend on the project's availability, the level of user fees, demand volume and the term of the contract. The relevance of each factor varies over projects, but revenues can be classified along two dimensions: the source of payments and the extent to which the SPV is made to bear demand risk (on this issue, see Engel, Fischer and Galetovic (1997, 2001)).

Provided that the SPV meets the minimum quality and availability standards, demand for most PPP projects is exogenous to a large extent. Despite the fact that they cannot affect demand, many PPPs are made to bear demand risk. When revenues are derived primarily from user fees, SPVs assume two types of project risks associated with demand. First, the risk that the project is a failure and will never be able to repay the creditors. This risk represents a market test of the quality of the project and is correctly assigned to creditors. The second risk appears because the term of the concession contract is fixed (say, at 20 years). This means that a profitable project may be unable to repay the debt over the contract term, due to adverse initial macroeconomic conditions, for instance. Even when the primary source of revenues is the procuring authority, the contract may tie payments to use of the project over a fixed term, in so-called *shadow tolls* (or fees). In both

7 Lobbying ability with the procuring authority and its political taskmasters is also considered favourably at this stage.

these cases, bondholders bear the uncertainty that demand over the term of the contract may not generate enough revenues to meet debt payments on schedule. Sponsors face even more risk, and expect large profits as compensation.

Contracts can be designed to make project revenues independent of, or less dependent on, demand in a given time period. This reduces the second type of risk and, therefore, the expected rents to the sponsor as well as the return demanded by bondholders. When the source of revenues is the procuring authority, the contract that eliminates this risk has a fixed term, with payments contingent on the availability of the infrastructure (hence the term *availability payments*). When user fees are the main source of revenue, the appropriate contract is a present-value-of-revenue (PVR) contract, which specifies a fixed present value of revenues under a variable-length contract.[8] In either case, the contract eliminates demand risk to a large extent, and revenue risk is reduced to meeting (hopefully) clearly defined performance standards. For more details see Section 4.2.2.

All things considered, financiers prefer predictable cash flows. Consequently, availability contracts and flexible-term contracts tend to receive higher ratings than contracts where the concessionaire bears considerable demand risk (Fitch Ratings 2010).

2.2.3 Credit rating agencies and credit insurance providers

While the relationship between bondholders and the SPV is kept at arm's-length distance, management behaviour is still (somewhat loosely) monitored by credit rating agencies and credit insurance companies while there are bonds outstanding.[9] The role of credit rating agencies and credit insurance companies is essential to the issuance of bonds. The credit rating agency issues a so-called shadow rating of the SPV. With this rating, the SPV buys insurance that increases the rating of its bonds to investment grade or higher (for instance from BBB to A-), and the bonds are then sold to institutional and other investors. In a market that operates correctly, the insurance premium should be exactly equivalent to the difference between the risk premiums associated with the insured and shadow ratings. In the example, this corresponds to the difference in risk premium between A- and BBB bonds. This premium varies over the life of the project, as risk perceptions and circumstances change. The bond covenants require that the SPV pay the premiums required to preserve the initial risk rating of the bond. This creates the correct incentives for the SPV, as its costs increase with the perceived riskiness of the bonds.

Credit rating companies worry most about the impact of the various risks around the ability of the project to make the scheduled debt payments. This requires the analysis of the expected value and the volatility of the project's net cash flow. In addition, credit rating agencies penalise poor information, ambiguities, complexity and discretion in laws or contracts. Thus, the rating of a bond depends on: the quality and timeliness of the information revealed by the SPV; the opinions of experts (good news from independent experts increases ratings *ceteris paribus*); the quality of laws

8 Under a PVR contract, the concession lasts until the concessionaire receives a set amount in present value. Therefore, the term of the concession is shorter the more the infrastructure is used. A PVR contract can be allocated competitively with a least-present-value-of-revenue auction (Engel *et al* 2001).

9 After the financial crisis of 2008, the various deficiencies of being dependent on rating agencies and monolines (bond insurance companies) have come to light. Our analysis assumes a reformed system of credit rating agencies and credit insurance companies that are not subject to the conflicts of interest that beset the industry up to 2008.

and institutions that have a bearing on the project; and the clarity and conflict potential of the web of contracts. In terms of contract theory, credit rating companies punish contract incompleteness.

In addition to the risks we have surveyed that are inherently related to the economics of the project – construction, operation and revenue risks – exchange rate, political and country risks are also considered in evaluations.

2.3 Leverage and SPVs

There are two possible forms for the financial structure of a PPP infrastructure project: as a project within a company, using corporate debt for financing; or as a stand-alone project, set up as an SPV. While the second form has large transaction costs, it provides advantages that compensate for the added cost of the complex structure.

Most PPP contracts use project finance because it is useful in raising long-term financing for major projects. A characteristic of project finance is that sponsors provide no guarantees beyond the right to be paid from the project's cash flows. Nevertheless, sponsors need to attract large amounts of resources, which leave them highly leveraged, with 70 to 100 per cent of the funds provided by lenders. The level of leverage depends on the volatility of revenues; if revenues are very volatile, the project may not be *bankable*. Governments sometimes provide revenue insurance to improve the bankability of a project. Better alternatives, such as PVR and availability contracts, also allow for high levels of gearing. Conversely, technically complex projects require higher levels of sponsor equity.

There are several reasons why SPVs and project finance are to be preferred over corporate finance. Since SPVs use high levels of leverage, the expected return on equity increases, even after adjusting for the higher financing costs.[10] Moreover, it is more difficult to raise equity than to raise debt, especially in projects with no history, and this leads to higher leverage.

In the construction phase, by separating the project from a larger sponsoring corporation, an SPV precludes underinvestment in the project caused by competition for resources within the sponsor. Moreover, when setting up a PPP as a division within a corporation, the large free cash flows produced by a PPP in the operational phase are subject to costly agency problems, which may divert the revenues from their primary role of repaying the debt contracted to fund the project. Since an infrastructure SPV does not have growth opportunities, the possibility of diverting resources away from creditors is very limited, in contrast to the case of a division within a large corporation. Hence, the project's cash flow can be credibly pledged to pay bondholders and this allows for high leverage.

A final reason for isolating the project within an SPV is that it reduces the possibility of contaminating the healthy corporation with the problems of the independent entity. It must be recalled that even when the problems in a subsidiary of a large corporation do not threaten its financial stability, financial distress in the subsidiary affects the credit conditions facing the corporation.

Of course, these financial advantages of SPVs would be undone if stand-alone projects lose scope economies. But, as argued in Section 2, few, if any, productive efficiency gains can be realised

10 Of course, this is an advantage only if the Modigliani-Miller offset does not wash out the gain; practitioners tend to argue that this is the case in practice.

by pooling multiple PPP projects whose demand is normally location based. Any gains that can be realised by being a sponsor of several PPP projects – for example, previous experience and lobbying proficiency – can be achieved by sponsoring several SPVs.[11]

2.4 Infrastructure as an asset class

The spread of PPPs has nurtured the view in financial markets that infrastructure is a new asset class with distinctive characteristics: high barriers to entry and economies of scale (i.e. many projects are natural monopolies); services with inelastic demand that does not fluctuate much with the business cycle; high operating margins; and long durations (concessions of 20 or 30 years, leases which may last up to 99 years).[12] It is argued that these economic characteristics have attractive financial counterparts: returns with low correlation with the economic cycle and the returns of other asset classes; long-term and stable cash flows that are often covered against inflation; and low default rates. These characteristics are especially attractive to long-term investors like pension funds and insurance companies.

The emergence of infrastructure as an asset class sparked financial innovation. Perhaps the best known innovator is the Australian investment bank Macquarie Group. In 1994 this bank led the Hills Motorway Group, the SPV that financed, built and operated the M2 Motorway in Sydney, which is a 21 kilometre long highway that forms part of the Sydney Orbital Network (Solomon 2009, ch 5). Interestingly, the stapled securities issued by Hills Motorway Group were listed on the Australian Stock Exchange in December 1994, making the M2 Motorway Australia's (and perhaps the world's) first publicly listed toll road.

In 1996 Macquarie launched the Infrastructure Trust of Australia (ITA) Group, its first infrastructure fund, in which investors bought stapled securities backed by income generated by two trusts. One of these trusts, ITA(I), would derive its income from infrastructure assets – for example toll roads, tunnels, bridges and airports – in which the fund did not have a controlling interest. ITA(II), by contrast, would have a controlling interest in each of the assets it owned. Over time, the ITA Group opened new funds, invested in foreign assets, and was renamed Macquarie Infrastructure Group (MIG). Through MIG, Macquarie invested directly in toll roads, bridges and tunnels, and indirectly by buying stakes in multinational infrastructure firms, for example Spain's Cintra. As explained by Solomon (2009, ch 5), each asset was set up as a separate SPV with MIG as a shareholder. And the holders of the debt issued by each SPV did not have recourse to MIG.

While the Macquarie model has spread, the world infrastructure fund industry is quite concentrated; according to Inderst (2013), Macquarie has a share of about 40 per cent of the total and the top five managers control two-thirds of assets. Inderst (2013) reports that between 2004 and 2012 infrastructure funds did between 250 and 300 deals and raised US$214 billion (or about US$20 billion per annum), even though the annual total is volatile, ranging from US$9 billion in 2009 to US$45 billion in 2007.

Most of the funds invest in equity; while debt funds are becoming more common, they are still infrequent and account for less than 10 per cent of total fund raising. Similarly, the direct

11 Note, however, that Tirole (2006, ch 4) suggests that by linking the fates of two independent projects, higher levels of leverage can be achieved than when the projects remain independent.

12 See, for example, Weisdorf (2007), Weber and Alfen (2010) or Bahçeci *et al* (2011). For sceptical reviews, see Inderst (2010a, 2010b).

involvement of pension funds and insurance companies in PPP finance is still quite limited. Thus, considering that annual PPP investment ranges between US$60 and US$100 billion, and that each SPV finances at most 30 per cent of the investments with equity, it seems that infrastructure funds are quantitatively important for the PPP industry.[13]

It seems reasonable to think that financial innovation is necessary for the PPP model to develop. Moreover, infrastructure projects have idiosyncratic characteristics that explain why specialised intermediaries and funds are necessary. Nevertheless, some have argued that fund structures are used to raise debt and disguise excessive leverage, well beyond the leverage intended by the governments who use PPPs (Das 2011, pp 158–161). Also, it is claimed that debt has been used to anticipate dividend payments to fund shareholders during the initial stages, when the infrastructure projects are still producing losses. Last, some have pointed out that fund structures tend to be unnecessarily complex to allow fund managers to charge more in fees many times over.

Be that as it may, one should not lose sight of the fact that private finance, while necessary, is only a means to reach an end – better and more efficient public infrastructure provision. Indeed, in the next section we suggest that some scepticism is warranted and caution about some pitfalls to be avoided.

3. The Irrelevance and Pitfalls of PPP Finance

3.1 Why PPPs?

When delivering infrastructure, governments face three challenges: deciding what and when to build; building in a cost-effective way; and ensuring proper maintenance and service quality thereafter. Part of the appeal of PPPs stems from the glaring shortcomings of public provision. When PPPs began to spread around the world some 20 years ago, many believed that private participation in infrastructure would by itself improve performance. To some extent, this prejudice is warranted. Public agencies in charge of infrastructure (for example, ministries of public works, city governments and municipalities) tend to have many objectives and are accountable to multiple principals, thereby weakening incentives. Moreover, management practices in the public sector are more rigid, and public agencies are constrained by annual budgets – for good reasons. Public managers can neither use the earnings of their organisation to reward employees' performance nor freely allocate factors of production. Indeed, constraints imposed by the legislature and the administration limit hiring, purchasing, contracting and organisational structures (Wilson 1989, ch 7). These constraints also imply that the design of institutions that manage infrastructure is seldom concerned with efficient scale and scope. Thus, while many projects are large enough to assign tasks to specialised service providers such as construction companies or maintenance contractors, public agencies tend to manage all the infrastructure of a jurisdiction (sometimes the whole country), which has a size that far exceeds the efficient scale of operation.

PPPs, by contrast, are the opposite type of organisation. Because each project is managed by an SPV, their focus is narrow and incentives naturally sharp. Moreover, because SPVs are private firms, management is not constrained by public sector rigidities, and their goal is private gain. Also, it

13 The figures are not directly comparable. One reason is that, as said before, not all private infrastructure is provided through PPPs. Another is that not all fund investments are direct – some funds invest in other funds.

is far easier to pitch each PPP to its efficient scale of operation. Last, a long-term contract isolates the SPV from the year-to-year vagaries of the public budget. All in all, PPPs substitute private management practices, strong incentives and focus for public sector rigidities, weak incentives and excessive scale.[14]

It is not surprising, therefore, that when the current trend of PPPs began, its proponents believed that private participation by itself would improve performance. Since then, PPPs have been used to provide traditional infrastructure such as roads, bridges, tunnels, airports and ports, and also complex services such as education, health, information technology and gaols. Yet results have been mixed at best and in retrospect the initial enthusiasm looks somewhat naïve: PPPs are one possible organisational form, and many years of research show that the appropriate organisational form varies with the environment and project characteristics.

Two characteristics define a PPP. First, it is a limited-term intertemporal contract with a private firm and bundles finance, construction and operation. Thus, while bundling differentiates a PPP contract from standard public provision, the limited term differentiates it from privatisation. Second, the private firm owns the assets as long as the PPP contract lasts. This implies that, from the point of view of incentives and control rights, PPPs are akin to privatisation. Given these characteristics, research by Hart (2003) and Bennett and Iossa (2006) identify the basic trade-off: other things equal, bundling stimulates investments and actions that cut life-cycle costs, but cost cutting can be at the expense of service quality and user welfare. Thus, PPPs may or may not be the best alternative depending on project characteristics.

Most transportation infrastructure – roads, tunnels, bridges, ports, airports and rail – are suitable for PPPs because objective service standards can be defined and enforced, and quality made contractible. This makes PPPs the appropriate organisational form, because once service standards are fixed, the firm can be left free to choose the optimal combination of inputs and minimise costs. This is so regardless of the funding source for the project.

The choice is not clear-cut when quality is not contractible, for then the trade-off between cost-cutting and service quality resurfaces. Sometimes it may be possible to regulate service quality indirectly, by specifying the amount and quality of inputs. But this works only if the relationship between inputs and service quality is close. If it isn't, then the public authority must retain at least some control and discretion over managerial decisions, but this weakens the private party's ownership rights and introduces rigidity in its choices. If this is sufficiently severe, public provision is the preferred alternative.

Consider schools. Important aspects of primary and secondary education, about which parents and society care (such as moral values), are not contractible, because they cannot be measured with standardised tests. A variety of inputs can be specified (for example, the number of students per teacher, teacher seniority and degrees, and equipment), but they are only partially related to the overall quality of education. Even if specifying inputs helps to attain reasonable levels of

14 These, of course, are the incentives wrought by asset ownership. It has been pointed out to us that PPPs are just financial contracts, because governments keep the ownership of the physical asset and the SPV only has a claim over the project's cash flow, akin to a total rate of return swap. Nevertheless, a PPP contract typically transfers the control and the operation of the asset to the SPV for the duration of the contract and includes penalties that punish poor performance and maintenance. Consequently, from the microeconomic point of view, the PPP contract tends to replicate the incentives wrought by private ownership of physical assets. (We thank Frédéric Blanc-Brude for making us aware of this point.)

educational quality, it may also limit innovative options that increase efficiency. For example, limiting the number of students per teacher may discourage expenditures on software that partly substitutes for in-classroom teaching or that extends the reach of gifted teachers.

Note that so far we have not mentioned finance. This is not a casual omission, because the case for PPPs in a specific project or infrastructure must stand on productive, allocative and dynamic efficiency, not on finance. Will a PPP lead to lower production costs, better maintenance or higher quality of service? Will users pay the long-run marginal or average social cost of providing the infrastructure? And will a PPP lead to faster adoption of socially valuable innovations? Our main point is that whether a PPP makes sense depends almost exclusively on the economic characteristics of the infrastructure, not on the way it is funded or financed. Indeed, as we will see next, on a first pass the presumption should be that finance is irrelevant. Worse, PPPs may help private firms or governments to use finance in ways that may destroy value.

3.2 The irrelevance of finance

3.2.1 PPPs and the economy's balance sheet

Assume, for simplicity, a project that is fully funded with public debt. With conventional provision, the project adds real capital to the asset side of the government's balance sheet and public debt to its liabilities. At the same time, public debt increases the assets of the household sector and, consequently, its net worth. Consolidation of both balance sheets shows, however, that the increase in the household sector's net worth is equal to the value of the additional real capital – public debt does not appear on the economy's balance sheet because it is a liability of the government but an asset of the household sector and both cancel out.

Now assume that the same infrastructure is built under a PPP. This time the project adds real capital to the asset side of the business sector's balance sheet, and a combination of debt and equity to its liabilities. In turn, the assets of the household sector increase by the amount of the incremental debt and equity, which equals the increase in its net worth. Again, consolidation of both balance sheets shows that the increase in the household sector's net worth is equal to the value of the additional real capital – this time neither the debt of the business sector nor its equity appear on the economy's balance sheet because they are a liability of the business sector but an asset of the household sector, and both cancel out. Hence, on first pass the impact of the project on the economy's balance sheet does not depend on the way it is financed.

The alert reader will immediately recognise that this argument simply extends the Modigliani-Miller proposition to PPPs and, consequently, shares its limitations. Nevertheless, it stresses again, this time from a macroeconomic perspective, that any claim that PPPs create a financial advantage must explain how a particular way of financing an infrastructure project increases its economic value to society. Is some productive or allocative efficiency achievable with a specific financing structure but not with another? Are some innovations more likely to be adopted with some types of financiers but not with others? Ultimately, social value is created by the efficiency with which real capital is deployed and used – the real side of the balance sheet – not by the financial composition of the liabilities side.

3.2.2 Public finance and PPPs

Governments often argue that PPPs free up scarce government resources for use in programs that are socially attractive but not privately profitable. Similarly, they argue that PPPs allow governments to provide the infrastructure without raising taxes.

This argument obviously does not apply to PPPs that have capital costs funded by future government payments and bind the intertemporal budget. In these cases, PPPs help governments perform a useful accounting trick, in which future obligations are kept off the balance sheet for no clear economic reason. For example, the United Kingdom, a major user of this type of PPP, has discovered that the capital charges for past investments are constraining the current budgets of local authorities.

The argument that PPPs can relieve tight government budgets is suspect even for projects where the capital costs are partially or totally covered by user fees, because user fees could have been used to pay the capital costs under public provision as well. The resources saved by the government by not paying the upfront investment under a PPP should be equal, in present value, to user-fee revenue forgone to the concessionaire. That is, from a financial viewpoint, PPPs borrow from the future with no net gain in present discounted terms.

An alternative argument for PPPs, which is also related to public finance, is that of the lower cost of public funds. According to this doctrine, the government collects distortionary taxes to finance infrastructure projects, whereas the private sector can finance projects without these distortions. It follows that PPPs (or privatisation) are to be preferred to public provision. This argument is also incorrect. To see the intuition, denote by f the cost of distortionary taxation, so that a dollar collected by the government has a cost that is more than a dollar to society, say $1 + f$, with $f > 0$. The project can be financed through either user fees or subsidies. The difference between the two financing options is that only subsidies involve distortionary taxation.

The government will save f dollars per dollar invested by the firm in the infrastructure project. However, these savings are offset by the lower revenues collected by government: under a PPP, it collects user fees only after the concession ends, while under public provision, it can start collecting user fees once the project is available to users. Thus, for every dollar of user fees given up to the concessionaire, the government forgoes the opportunity of reducing distortionary taxation elsewhere in the economy.

3.2.3 PPPs and the funding of infrastructure

An additional misconception about PPPs is that they substitute user fees for subsidies. Nevertheless, the decision between public provision and PPPs is not one about the source of funding. On the one hand, PPPs can work with both user fees and subsidies and, on the other hand, public provision is not incompatible with user fees. For example, a private concessionaire may build and operate a gaol, which must be funded with subsidies – obviously inmates do not pay user fees! Similarly, many toll roads are owned by governments.

3.3 PPPs and fiscal accounting

3.3.1 PPPs: Public or private infrastructure?

One of the drivers of PPPs is that governments want to indulge in public works even when restricted by budgetary constraints. Off-balance sheet projects allow incumbents to sidestep spending caps and spend more on infrastructure than would be the case under conventional provision. Similarly, incumbents may use a brownfield PPP to 'sell' assets and spend the proceeds in projects or programs that favour the incumbent. For this reason, organisations that set accounting standards have struggled to determine when a PPP project should be included on the balance sheet of the public sector or whether it is legitimate to keep them off the public balance sheet.

The basic insight here is that as far as the risk profile of the government budget is concerned, PPPs are much closer to public provision than to privatisation (Engel, Fischer and Galetovic 2013). This may seem surprising, but it follows from the fact that when thinking about the risk allocation implied by PPPs, what matters is the volatility of the discounted budget and not the fluctuations in annual revenues. Indeed, as we show in Section 4, an important class of optimal PPP contracts, so-called PVR contracts, exactly replicate the net cash flow streams of public provision in each state of the world. Because all residual risk is transferred to the government and users under these contracts, and the concessionaire recovers the upfront investment in all states of the world, a PPP affects the intertemporal budget in exactly the same fashion as conventional public provision. More generally, it can be shown that cash flows from a PPP project replace either taxes or subsidies at the margin. The conclusion, then, is that from a public finance perspective there is a strong presumption that PPPs are analogous to public provision – in essence, they remain public projects and should be treated as such in the government balance sheet and budget.

Nevertheless, because PPPs are relatively recent, there is little agreement over how to account for them on the government's balance sheet. As pointed out by Eurostat (2010), the key accounting issue is the classification of the assets involved in the PPP contract. If they are classified as government assets they immediately influence the deficit and government debt. In contrast, if they are classified as assets of the concessionaire, the impact on the government deficit is spread over the duration of the contract and governments can keep the assets off their balance sheet, thereby avoiding spending and debt caps. Under public provision, on the other hand, caps on spending or net fiscal debt are, in principle, more effective in controlling the bias toward spending anticipation, because projects must be included in the budget.

One systematic treatment of PPPs is in Eurostat (2010). If user fees are the main revenue source of the PPP, as in a toll road, Eurostat considers the assets to be private during the life of the contract. In contrast, if most of the concessionaire's revenues are government payments (as in an availability contract or shadow toll) the classification of assets depends on who bears the construction, availability and demand risks.

Thus, if the private partner bears construction risk and either availability or demand risk, Eurostat recommends that assets built by PPPs be classified as non-governmental and thus be recorded off the balance sheet. For this reason, a basic concept in classifying PPPs as being off-balance sheet is the existence of risk transfer to the private sector, because this implies that the private sponsor 'has skin in the game' such that the project does not entail a present or future cost to

the government given the incentives facing the firm. However, these general principles allow for considerable discretion. Eurostat's approach can be gamed by governments because of its formal nature. For example, it has problems in the case of minimum revenue guarantees. Contingent guarantees are assumed to transfer risk if they are not likely to be called, and this ambiguity allows for excessive discretion.

The United Kingdom's generally accepted accounting principles (GAAP) are less formal and focus more on the substance of risk transfer. These rules consider a project to be on the balance sheet under any of the following conditions: if the public works authority (PWA) is responsible for the debt under default; if the level of risk is excessive and would only be assumed if lenders face no risks; or if the PWA decides *ex post* the conditions by which the private finance initiative (PFI) contract is fulfilled (Yescombe 2007, p 72). Moreover, the UK GAAP require that any other risks borne by the PWA be quantified and their net present value be compared with the net present value of the project. If the remaining risks represent a substantial fraction of the net present value of the project, the project should be on the government's balance sheet. This means that the 'UK GAAP only included the liabilities if the balance of risk and reward was with the public sector' (House of Lords Select Committee on Economic Affairs 2010, p 17). However, since the interpretation of 'balance' was left to public bodies and their auditors, this led to most PFI projects not being included in the public sector net debt statistics. This changed in 2009, when UK accounting practices began to abide by the International Financial Reporting Standards. Under these standards, assets that are controlled by the public sector, including most PFI projects, have to be included in the departmental balance sheets (House of Lords Select Committee on Economic Affairs 2010). Nonetheless, in practice there exist two parallel accounting standards (the more demanding IFRIC 12 and the older GAAP) and PFI investments continue to be excluded from national debt calculations.

How should PPPs be accounted for in the budget? The key point is that PPPs change the timing of government revenues and disbursements and the composition of financing, but do not alter the net present value of the discounted budget. They should therefore be treated just as standard government investments. To see why, consider a PPP project – built in one year, with no operational or maintenance costs and which is fully financed by future payments from the budget – and a similar project built under public provision. In the first case, under current fiscal accounting there is neither a deficit nor debt. However, each year until the end of the contract, the government has to pay a predetermined amount to remunerate the capital cost of the concessionaire. At the end of the contract, the government becomes the owner of the asset. In the second case, the government initially increases its debt by the amount of the loan necessary to build the project, incurs a budget deficit in the same year and obtains an asset to balance the increased debt. Each year thereafter it pays down the debt and when the debt is run down (assuming the same payments as in the previous case), it has the asset and no debt or payments. From a correct accounting point of view, a PPP just substitutes debt with the concessionaire for standard public debt. Thus, there is no reason to treat those PPPs differently from projects under public provision. It follows that on the award of such a PPP, the present value of the contract should be counted as a public capital expenditure and public debt should be increased by the same amount. Over the life of the concession, debt must be run down in the books.

This proposal runs somewhat contrary to the Eurostat rules, and it is interesting to discuss why. Even under public provision, construction risks are usually allocated to the private firm. Hence, Eurostat rules imply that the government can take the PPP off-balance sheet when either availability or demand risk is assumed by the concessionaire. The problem is that Eurostat have taken a static view of risk allocation. Once we use an intertemporal approach, it is clear that, even if the firm bears all the demand risk during the life of the contract, the discounted budget is still the residual risk claimant. Furthermore, when quality is contractible, as arguably is the case for most PPP investments in the transportation sector, demand risk will be mainly exogenous and therefore does not provide useful incentives. To the extent that taxpayers bear exogenous risk at a lower cost than the firm, the optimal contract then eliminates risk for the firm. Thus, the effect on the government budget is identical to that of public provision.

It should be noted that the adoption of this proposal would require changes in the way that government statistics are recorded.[15] The reason is as follows. The basic building block of accounting and macroeconomic statistics is the institutional unit – the basic unit that generates statistics or accounting data from its economic activities. In the case of PPPs, the institutional location of the SPV largely determines the accounting convention followed by governments; only if the SPV is controlled by the government are transactions related to PPPs automatically consolidated within the government accounts. Therefore, many countries push PPPs off the balance sheet by classifying SPVs as private sector entities. Even when the SPV follows adequate international standards (normally requested by stakeholders for surveillance purposes), its transactions have no impact on government accounts. In contrast, our proposal argues that infrastructure procured via a PPP should be considered public. In our view, it should be a matter of indifference whether the entity performing the function is part of the public sector or privately owned.

Some might argue that counting privately financed investment as public debt may worsen the bias against public spending in infrastructure, which is the result of political incentives, perhaps excessively stringent limits on fiscal borrowing, and faulty accounting rules that treat investment as current expenditure (Blanchard and Giavazzi 2004). According to this argument, keeping PPPs off the balance sheet is a second-best remedy that mitigates the bias and increases the output of socially worthwhile infrastructure projects.

The easy answer to this criticism is that the bias against infrastructure spending should be addressed by changing the incentives within the public sector and improving public accounting. The more realistic answer is that keeping PPPs off-balance sheet assumes a virtuous government. Nevertheless, spending limits exist precisely because governments want to overspend. It is doubtful in principle and, given the experience with PPPs so far, probably wrong in practice to believe that governments will use off-balance sheet vehicles wisely and with prudence.

3.3.2 Government revenue guarantees

Governments commonly grant revenue guarantees to concessionaires, especially when concessions last a fixed term. Guarantees are contingent subsidies. As such, they have an effect on the discounted budget, but their contingent nature makes it difficult to account for them.

15 We thank Katja Funke, Isabel Rial and Shamsuddin Tareq for pointing this out to us.

Under current accounting standards, future obligations will probably remain hidden (Hemming *et al* 2006, p 40). Cash accounting makes guarantees apparent only when they are paid, in which case they appear as current expenditure. Accrual accounting, in turn, records the guarantee as a government liability only if the government considers that the probability of making a payment is higher than 50 per cent and can make a reasonable estimate of the payment. Even then, unless the government makes a provision and sets aside the funds, guarantees are only recorded when they are called. Worse, most countries have poor records of guarantees and when information exists it is locked in individual agencies and ministries (Hemming *et al* 2006, p 42). Some countries, such as Chile, Colombia and New Zealand, have attempted to quantify guarantees within an accrual framework by estimating the expected outlays and correcting for the degree of risk involved (for example, via value-at-risk type measures). Yet any rule that relies on a probabilistic assessment can be easily manipulated, as probabilities are ultimately a matter of judgement. Guarantees thus soften the budget constraint of the incumbent government, allowing it to sidestep normal budgetary procedures and parliamentary oversight. However, when the full amount invested is accounted for as a public capital expenditure, with a corresponding increase in public debt, guarantees are implicitly included and there is no need to make value judgements on the cost of a contingent guarantee.

Accounting for capital and debt payments is somewhat trickier. As in the case of the optimal contract, this 'debt' is backed by a combination of user-fee revenue, guarantees and possible renegotiations of the concession contract. These different items are combined in different proportions as events unfold. In the case of fixed-term PPPs, the private partner assumes the demand risk and may receive capital gains or losses over the life of the concession. This requires a convention for the treatment of project revenues and the gradual extinction of the guarantee as the concession unfolds. In any case, under our proposal the full cost of the project is recognised as debt, so it follows that it will be extinguished when the concession ends.

3.3.3 The Ryrie Rules

While there seems to be considerable confusion about how to account for PPPs in the government's budget and balance sheet, it is worth mentioning that these problems seem to have been understood during the 1980s in the United Kingdom, well before the introduction of the PFI in 1992. As Heald and McCleod (2002) explain, during the 1980s, the provision of private finance for public projects was governed by the 1981 Ryrie Rules. Under these rules, government guarantees were not allowed and private financing could not be additional to public finance – whenever a privately financed project was undertaken, public spending would be reduced, pound for pound. As Heald and McCleod (2002, para 502) point out:

> The rationale for this provision was that there is little macroeconomic difference between the government borrowing on the market to finance public expenditure generally and the private sector borrowing for essentially public projects. The objective of the Ryrie Rules was to stop ministers from insulating private finance from risk so that it could be used to circumvent public expenditure constraints.

It can be easily seen that whenever there is a spending cap, this provision is equivalent to our proposal to count PPP projects as current investment.

It is telling that the Ryrie Rules were formally abandoned in 1989 and that from then on the UK Treasury promoted private financing as additional to public investment. This suggests that incentives and interests rather than ignorance are the reason for the lack of progress in improving PPP accounting rules.

3.4 Renegotiations and finance

One of the problems facing PPPs is the renegotiation of the PPP contract. There are various justifiable reasons for renegotiating a contract, for example a changing environment, new information or discovery of design errors. All parties, including the public, might gain in renegotiating contracts in some cases. In other cases, the only reason to modify the contract is to benefit one or both active parties: either the procuring authority (e.g. in the case of expropriation of the PPP) or the project sponsor (e.g. by helping a failing project with a length extension or lowering the technical standards); or both these parties at the expense of the public. One of the problems of renegotiation is that it is difficult to discriminate between justifiable and non-justifiable renegotiations.

During the construction stage, renegotiations also occur under traditional provision. The difference is that PPPs have a longer time horizon and have additional dimensions for renegotiation, including contract length, user fees and service quality standards, among others. Even when renegotiations are justifiable, the results may not be fair, given that renegotiations occur in the context of bilateral monopoly.

Renegotiations lower the risk of failure, which may help attract willing lenders. On the other hand, the possibility of renegotiating the contract to the benefit of the private participants/sponsor negates many benefits of PPPs. If the sponsor knows that not being efficient (in demand prediction, cost reduction, project design, service quality, etc) does not increase the risk of failure or the losses from the project, the incentive properties of PPPs are lost. Moreover, the results of renegotiation tend to favour sponsors that have strong lobbying skills at the expense of technical expertise, so these firms have an advantage in bidding for PPPs with governments that are known to renegotiate their contracts. As with guarantees, renegotiations allow incumbent governments to sidestep budgetary spending and debt limits, and thus lead to excessive current spending in infrastructure.

Under public provision, caps on spending or on net fiscal debt are reasonably effective in controlling this bias, because any additional expenditure agreed in renegotiations must be included in the budget. In contrast to public provision, renegotiations of PPP contracts can be used to evade spending caps under defective fiscal accounting standards. Essentially, PPP arrangements bundle finance and construction, so the firm can increase 'lending' to the government by renegotiating the contract in return for payments to be made by future administrations. Under the usual fiscal accounting rules, neither the additional investments that take place after renegotiations nor the future obligations originating in the renegotiated agreement are accounted for in the balance sheet. This suggests that the solution to the spending bias is no different to what we have already discussed for PPPs in general: any additions to the project should be counted as current capital expenditures and, therefore, accounted for as debt.

Is there any evidence of renegotiations being used to anticipate public spending? If spending anticipation through renegotiations is a real issue, four features should be observable. First,

firms should lowball their bids, expecting to recover normal or supranormal profits in future renegotiations. Second, additional works should be included when contracts are renegotiated, that is, the additional payments should be in exchange for additional investments by the private partner. Third, there should be major renegotiations shortly after the awarding of the contract, during the construction phase. Fourth, a substantial fraction of the costs of the renegotiation process should be borne by future administrations.

While there is little systematic data on renegotiations, Engel, Fischer and Galetovic (2009) compile information on the 50 PPP concessions awarded in Chile between 1993 and 2006. Total investment increased via renegotiation from US$8.4 billion to US$11.3 billion (i.e. by nearly one-third). Most of the increase (83 per cent) was the result of 78 bilateral renegotiations, while the rest were decisions of arbitration panels. For the US$2.3 billion awarded in bilateral renegotiations, only 35 per cent of the additional cost was paid by the administration that renegotiated. Moreover, 84 per cent corresponded to payments for additional works, while the remaining 16 per cent corresponded to additional payments for works that were included in the original contract. Of the total value of bilateral renegotiations, 78 per cent was awarded during construction. Finally, even though specific provisions in the Chilean concessions law limit the amounts that can be renegotiated, these limits were routinely exceeded.

3.5 Credit constraints

Many financially constrained governments see PPPs as an answer to providing infrastructure services. According to this view, PPPs allow credit-rationed governments to invest in additional socially profitable projects, which may be impossible under public provision because of credit constraints. That is, the current value of the cost of public funds is much higher – infinite if the government has no access whatsoever to credit – than its expected value in the near future.

To evaluate whether PPPs help, it is convenient to distinguish between projects whose capital costs can be partially or totally covered by user fees and projects whose capital costs are funded mainly or entirely by future government payments. Examples of the latter category are availability contracts, which specify a schedule of capital charges payable in the future and which bind the discounted budget. If firms are prepared to invest in these PPP projects, they are in practice lending funds to the government, which means it is not resource-constrained.

However, even PPPs in the first category do not help relax the financial restrictions facing the government. If the government can set aside the flow of revenues generated by the project, then it can use these revenues either to pay off the debt under public provision or to pay off the concessionaire under a PPP.[16] And if it cannot credibly protect the flow of revenues from creditors or other uses, then neither option is available.[17]

16 For this mechanism to work, the legal system should be sufficiently sophisticated to ensure that the revenue flows from the PPP can be assigned by (and even mortgaged by) the concessionaire's financial providers, independently of the firm's financial condition. This means that even if the concessionaire is unable to complete the project or goes bankrupt afterward, the revenue flows cannot be captured in the mass of the concessionaire's debt (at least in countries with inefficient bankruptcy systems), but remain available to financiers if the project provides the services it was contracted to perform. In the case of unfinished projects, the financiers might be required to find another construction firm to complete the project before receiving revenue from the project.

17 Of course, if a law prevents a regional or local government from issuing debt, so that it must pay upfront for any publicly provided infrastructure project, then building a project as a PPP will free up resources.

We conclude that, quite generally, PPPs do not free up government resources *per se*, even though they may do so indirectly if they lead to efficiency gains. In many cases, one of the main advantages of PPPs from the government's perspective, if not from the social welfare point of view, is that they allow for investment while keeping future obligations off-balance sheet and outside of parliamentary control.

4. Risk and PPPs

4.1 Risk and incentives in PPPs

Risk is one of the main themes in the PPP discussion and some risk transfer to the private firm is essential for incentive compatibility. Risks in a PPP contract can be classified into seven different categories, which sometimes are related and overlap:[18] (i) construction risk, including design flaws, cost overruns and delays; (ii) O&M risk; (iii) performance risk, including the availability of the service or infrastructure and uncertainty about service quality more generally; (iv) residual value risk, mainly uncertainty about the value of the assets at the end of the PPP contract; (v) policy risk, ranging from macroeconomic uncertainty, which affects all sectors of the economy, to government actions that mainly affect the project (e.g. investment in alternative roads); (vi) demand risk – that is, uncertainty about the future rate of use of the infrastructure; and (vii) financial risk, including interest rate and exchange rate fluctuations and any other factor affecting financing.

How are these risks to be allocated between the government, the private firm and the users of the project? The principle has been clearly stated by Irwin (2007, p 14): the contract should allocate risks to maximise project value, taking account of moral hazard, adverse selection and risk-bearing preferences. This is quite general, but it implies that controllable risks should be borne, at least in part, by the party best equipped to control them, for a party has weaker incentives to be efficient when it does not bear a risk over which it has some control. Exogenous risk should be shifted to the party best endowed to bear or diversify it. Under public provision, in contrast, most of these risks are borne by taxpayers, with the exception, perhaps, of availability and service quality, as users typically suffer bad quality.[19] Because taxpayers seldom influence governments' decisions, and bureaucrats respond to users' concerns only when forced by political pressures, one may presume that the potential for efficiency gains in PPPs is large.

Consider first construction risk. Completion times and the cost of building usually exceed projections, but most of the time can only be controlled by the builder. Hence, the private firm should bear these risks (perhaps with the exception of delays caused by disputes about the application of eminent domain).[20] Similarly, because design and diligence during construction strongly influence facility availability, O&M costs and service quality, these risks should also be borne by the same private firm. If the transfer of these risks is effective, one should expect

18 See, for example, Hall (1998), Cangiano, Hemming and Ter-Minassian (2004) and Irwin (2007).

19 Construction risks are nominally borne by contractors, but in practice one of the shortcomings of public provision is endemic contract renegotiations that effectively shift risks to taxpayers.

20 When construction risk is excessive due to fundamental uncertainty, as in tunnels, the usual practice is to have cost-sharing agreements that are triggered when geological conditions are much worse than expected. This creates moral hazard problems, but it may be the only option when uncertainty is large because otherwise the rate charged by the concessionaire to protect against tail risk is too expensive.

substantial efficiency gains from PPPs, because under public provision these risks are mostly borne by taxpayers and users, not by those who make the decisions.

Note that bundling, ownership and service standards are all necessary to ensure that these risks are effectively transferred to the private firm. For example, it is harder to make a firm accountable for service quality if it was not responsible for designing and building the facility (hence, the importance of bundling) or if the firm has no control rights over investment and operational decisions (hence, the importance of ownership rights). Similarly, without objective and measurable service standards, it is difficult to transfer service quality risk from the users of the facility to the firm.

Moreover, as Hall (1998) points out, the extent to which risks are transferred depends largely on the choice of payment mechanism. Thus, to ensure that incentives to complete the project on time are strong, payments received by the firm should be triggered only after the facility is in service. Similarly, payments made contingent on the availability of the facility and on meeting service quality standards give strong incentives to provide adequate maintenance and proper management. In contrast, payments that are independent of performance or, worse, that transfer higher costs to taxpayers, reproduce incentives that are similar to those in public provision.

Some of the risks in our list are controlled or even created by the government. Because the residual value of PPP assets depends on government planning decisions (not to mention that most assets are project specific), it is sensible to transfer that risk to the government. This is ensured when the private firm recovers its entire investment over the term of the contract. This also suggests that some policy risks should perhaps be borne by the government to avoid moral hazard.

Policy risks can be classified, broadly speaking, into two categories. First, the government may implement policies that directly affect the project and little else. For example, it may build or expand a road that competes with the tolled PPP. It may even change the rules with the express purpose of expropriating the concessionaire. In general, these policy risks should be borne by the government, mainly to prevent its opportunism and moral hazard.

Second, actions by the government may unintentionally affect the PPP. For example, devaluation of the exchange rate may reduce the foreign firm's return, or a change in environmental standards may require additional investments. In these cases, the government is not acting opportunistically and there is no good reason to have it bear the risk, as the private firm is in the same position as any other private firm in the economy. This principle is routinely overlooked. For example, governments often grant foreign concessionaires insurance against devaluations. Not only does this discriminate against local investors, it also discriminates against foreign firms in other sectors of the economy that must bear exchange rate risk. More generally, policy risks that have little to do with the project and affect most firms in the economy (e.g. those caused by monetary policy) should be treated as exogenous and allocated to diversify risk.

Perhaps the main exogenous risk in a PPP project is uncertainty about the volume of demand over the life of the contract. The general principle, of course, is that exogenous demand risk should be borne by the party best able to diversify it. But note that if the private firm assumes demand risk, taxpayers are in fact purchasing an insurance contract. As Hall (1998) notes, this doesn't seem to be cost-effective. Demand forecasts are notoriously imprecise. In some cases, changes in policy, which are unknown at the time of tendering, may radically affect the usage of the facility and

there is little that the firm can do about it most of the time.[21] In those cases, either a PVR contract or availability payments is the right compensation scheme.

The principle of transferring exogenous demand risk to the government admits one clear exception, however. When the PPP is fully sustained by user fees, the willingness of private firms to take the contract can signal whether there is enough demand for it. This introduces a market test that is usually absent in infrastructure services and helps to avoid white elephants. For example, Chile's port authorities recently put to tender a second container terminal in Valparaíso, one of Chile's main ports. Before the tender, many observers pointed out the severe technical challenges faced by a second terminal and anticipated that it was a poor business proposition. Indeed, no bidders appeared in the auction. This market response signalled to the port authority that the expansion of the port was not a good idea.

One might argue that, like demand risk, financial risk is largely outside the firm's control; hence, the government should also bear interest rate or exchange rate risk. But this overlooks that firms can choose alternative capital structures and that, more generally, it doesn't make much sense to think that governments are particularly efficient at providing and selling financial insurance.

4.2 Is there a PPP interest rate premium?

A recurrent criticism of PPPs is that they cost more per dollar of financing than public debt – the so-called PPP premium. For example, the trade magazine *Euromoney* gives the following argument for public financing:

> The other solution [to highway finance] is to finance the project wholly in the public sector, either with government or multilateral funds. It is, after all, more expensive to raise debt on a project finance basis. When considered alongside the guarantees and commitments which have to be provided to attract commercial finance, the best approach would be to borrow on a sovereign basis.[22]

The numbers that have been quoted for this cost difference vary widely. According to Yescombe (2007, p 18), the cost of capital for a PPP used to be 200–300 basis points higher than the cost of public funds. This cost has doubled since the credit crisis. He also shows that the spread over the lender's cost of funds lies in the range of 75–150 basis points, with highway projects being at the upper limit (Yescombe 2007, p 150). Hence, when governments decide between public provision and PPPs, they trade-off a lower cost of funds under public provision against the supposedly higher efficiency of a PPP.

Other authors, however, argue that there is no PPP premium. One line of argument claims that bondholder risk under public provision is subsumed under general government default risk. Moreover, public debt is cheaper because the public implicitly absorbs the risk through potentially higher taxes or lower public expenditures in case of imminent default on all government debt. As noted by Kay (1993, p 63):

> The view that 'private sector capital costs more' is naive, because the cost of debt both to governments and to private firms is influenced predominantly by the perceived risk of default

21 This is, for example, the case for highways, where actions of the franchise holder have little effect on demand if contracted service levels are adequate and enforced.

22 Cited in Klein (1997, p 29).

> rather than an assessment of the quality of returns from the specific investment. We would lend to the government even if we thought it would burn the money or fire it off into space, and we do lend it for both these purposes.

In other words, while many failed projects go unaccounted for under public provision because taxpayers assume the costs of this risk, under a PPP these risks are made explicit and priced, increasing the measured financing cost of a PPP project. This merely reflects a just reward for carrying those risks.

4.2.1 Diversification

Financial economists distinguish between systematic risk – risk that varies systematically with the market or the economy – and project-specific risk. Systematic risk cannot be diversified and should affect public and private financing in the same way.[23] Is there a *prima facie* reason to think that the public sector is better at diversifying exogenous risks than PPP financiers?

With perfect capital markets, the diversification that can be achieved by government participation in a large number of projects is also achievable through the capital market, so no PPP premium would exist in this case. As Hirshleifer (1966, pp 276–277) points out:

> [T]he efficient discount rate, assuming perfect markets, is the market rate implicit in the valuation of private assets whose returns are 'comparable' to the public investment in question — where 'comparable' means having the same proportionate time-state distribution of returns.

Hence, the PPP premium and the alleged financial advantage of public provision would seem to rest on capital market imperfections that give an edge to diversification opportunities available to the government. Interestingly, this does not require that project returns be independent of the economy (the assumption of the Arrow-Lind theorem[24]), only that some alternatives to spread risks available to the government are unavailable to the capital market (Brainard and Dolbear 1971).

In practice there are transaction costs that preclude the existence of complete markets and limit diversification through the capital market. On the other hand, diversification opportunities available to the government must be weighed against the administrative cost of its bureaucracy.

4.2.2 Contracting and exogenous risk

Given that the government has an advantage in bearing risk, it is useful to consider PPP contracts that assign all exogenous risk to the government. To begin, consider the following scenario: demand for the infrastructure is uncertain, so that the consumer surplus at time t, CS_t, and user-fee revenues, R_t, are random variables determined by the state of demand, υ, which represents one possible trajectory of demand realisations and corresponds to the present discounted value of user-fee revenues in that state. The upfront investment, I, is the same in all demand states and operating and maintenance costs are zero. Finally, the PPP firm is selected in a competitive auction that dissipates rents.

23 As argued by Shugart (2010), if part of the systematic risk premium was something peculiar to the equity markets, then part of the PPP premium would be a true additional cost for PPPs that would not apply to public sector (taxpayer) financed projects. But we see little reason to think that this is the case.

24 See Arrow and Lind (1970).

Table 1 shows the distribution of the present value of cash flows and surpluses in one demand state for alternative sources of funds and procurement mechanisms. Within PPPs, alternative contractual forms are possible, depending on the source of revenues: PVR contracts, fixed-term tolls, availability contracts and shadow tolls.

Table 1: Risk Allocation, Source of Revenues and Contractual Form

Funding	Contractual form		
		PPP	
User fees	Public provision	PVR	Fixed-term toll
Users	$CS_0^\infty(v) - R_0^\infty(v)$	$CS_0^\infty(v) - R_0^\infty(v)$	$CS_0^\infty(v) - R_0^\infty(v)$
Taxpayers	$R_0^\infty(v) - I$	$R_0^\infty(v) - I$	$R_0^\infty(v) - R_0^T(v)$
Firms	$I - I$	$I - I$	$R_0^T(v) - I$
		PPP	
Tax subsidy	Public provision	Availability payment	Fixed-term shadow toll
Users	$CS_0^\infty(v)$	$CS_0^\infty(v)$	$CS_0^\infty(v)$
Taxpayers	$-I$	$-I$	$-R_0^T(v)$
Firms	$I - I$	$I - I$	$R_0^T(v) - I$

Note that under user-fee funding, public provision and PVR are identical. Similarly, under tax-subsidy funding, public provision and availability payments are identical. This is our main claim: independent of the source of funds, there exist PPP contracts that replicate in all demand states the surplus and cash flow distribution of public provision and have the same impact on the intertemporal public budget.

To see this, let X_s^t denote the present value of X between times s and t at time zero and consider first the case in which funding comes from user fees. Under public provision, the project is built at cost I, and the firm receives I before the infrastructure becomes operational (we assume competitive tendering that dissipates all rents). Hence, taxpayers pay I upfront, collect $R_0^\infty(v)$ in state v and receive $R_0^\infty(v) - I$ in present value. Users, on the other hand, receive a net surplus equal to $CS_0^\infty(v) - R_0^\infty(v)$. Under a PVR contract, taxpayers save I upfront, but they relinquish user-fee revenue during the length of the concession, which is equal to I in present value (given that the competitive assumption means that the winning bid will ask for I in present value of revenues). Because the state collects user fees after the concession ends, taxpayers receive $R_0^\infty(v) - I$. Users' net surplus in state v is $CS_0^\infty(v) - R_0^\infty(v)$, as with public provision. This confirms that any risk diversification advantage for the government can be realised with a PPP under a PVR contract and no PPP premium should be observed.

Now consider a fixed-term PPP that lasts T years. The concessionaire collects $R_0^T(v)$ with a surplus of $R_0^T(v) - I$, which is a random variable; in contrast, it faces no risk under a PVR contract. Taxpayers

receive $R_T^{\infty}(v)$, and, in general, their risk falls.[25] A fixed-term contract thus shifts risk from taxpayers to the concessionaire because there is uncertainty about demand for the project during the fixed term *T*.

Next consider projects that are fully funded by taxpayers. Again, with public provision the project is built at cost *I*, which the firm receives before the infrastructure becomes operational – taxpayers pay *I* upfront. When a PPP is financed with availability payments, the timing of disbursements differs, but the present value of payments is still *I*. Hence, neither taxpayers nor the concessionaire bears risk, and the impact of the project on the intertemporal public budget is the same in both cases. Thus, part of the observed PPP premium may reflect faulty contract design rather than a fundamental disadvantage of PPPs.

How large is the premium demanded under a fixed-term contract? To see the effect of contracting on the PPP premium, we consider a simple example. Assume a project that requires an upfront investment of $I = 100$. Annual user-fee revenue is assumed to be constant over time, equal to 7.9 and 12.8 in the low- and high-demand states, which are equally likely. Finally, we assume that firms cannot fully diversify risk (e.g. by providing incentives to owners or managers) and have concave utility, and that the risk-free discount rate is 5 per cent.

The PVR contract lasts until the firm collects 100 (that is, 10 years if demand is high and 20 years if demand is low). The firm bears no risk and therefore charges no risk premium. The implicit interest therefore equals the risk-free discount rate of 5 per cent, and there is no PPP premium.

Consider next a fixed-term contract and assume that firms bid on the shortest contract term. If firms are risk neutral, the winner will bid a contract length that ensures expected discounted revenue of 100, on average. Then the contract term is 13.2 years. If the firm cannot fully diversify risk, it will demand a risk premium. In our example the contract length in this case is 16 years.[26] The firm's expected revenue is larger than 100: in our example, assuming risk-averse firms, the expected revenue at 16 years is 114 and there is a PPP premium.

It follows that a PVR contract can attract investors at lower interest rates than the usual fixed-term PPP contract. The realised sample path of user-fee revenues is the same under both contractual forms, but the franchise term is demand contingent only under a PVR contract. If demand is low, the franchise holder of a fixed-term contract may default; in contrast, a PVR concession is just extended until toll revenue equals the bid, which rules out default. The downside of the PVR contract is that bondholders do not know when they will be repaid, but this risk carries a lower cost than default risk.

PPPs financed via taxes have sometimes resorted to shadow tolls. That is, the state pays a fee to the concessionaire for every user of the infrastructure for a fixed number of years, *T*. This type of PPP contract not only shifts risk to the concessionaire, but also creates risk. Since the concessionaire now bears risk, a PPP premium should be observed (lower right corner of Table 1). Viewed from this perspective, a shadow fee contract is equivalent to adding a lottery to an availability contract. The firm and taxpayers are forced to participate in a zero-sum lottery in which whatever is won

25 For any process with independent increments, as well as any stationary non-deterministic process, it is easy to show that the standard deviation of R_T^{∞} at time zero is decreasing in *T*. It follows that with public provision or a PVR contract, the standard deviation of taxpayers' discounted revenue will be higher than under a fixed-term PPP.

26 With the approximation for the risk premium in Proposition 9 in Engel *et al* (2001), this corresponds to a utility function with coefficient of relative risk aversion equal to 2.15.

by one party is lost by the other. Again, this leads to a risk premium that is not inherent to PPPs, but results from a specific contractual form.[27]

4.2.3 Endogenous risk, efficiency and the PPP premium

There are various reasons why society may be better off under a PPP than under public provision, and these generally impose additional risk on the private party. First, firms control the infrastructure assets during the life of the contract under a PPP, so innovations that use the assets more efficiently do not require extensive negotiations with the regulator. Under public provision, introducing innovations is very cumbersome. For example, investing in cost reductions and other efficiency-enhancing activities usually implies assuming additional risk, which is likely to increase the cost of capital for the firm. The flip side is that if the innovation succeeds, life-cycle costs will be lower than under public provision. This suggests that there will be more innovation under PPPs than under public provision.

A second argument in favour of PPPs, as discussed earlier, is that project finance is structured to provide incentives to internalise life-cycle cost considerations during the construction phase. These incentives are not present under public provision.

More generally, one of the main points of a PPP is to shift endogenous risk to the concessionaire, to prevent moral hazard and strengthen incentives to cut costs and provide adequate service quality. Unless the concessionaire is risk neutral, he will charge for bearing that risk. Moreover, these risks are not diversifiable in the capital market, for if they could be diversified, there would be no incentive to improve performance in the first place. Hence, the 'right' PPP premium would compare financing costs under public provision and an incentive contract (where the agent bears endogenous risk) with financing costs under a PPP. In practice, however, the inability to make remuneration depend on performance means that traditional provision cannot transfer endogenous risks to agents.

In all these cases, the financial arrangements impose risk on the firm, and this translates into a PPP premium. The higher financing costs that result should not necessarily be held against PPPs when comparing them with public provision. In exchange for the high cost of sponsor funds, the procuring authority obtains the services of a company that is focused on reducing life-cycle costs. These endogenous risks provide incentives, and it is a mistake to consider a PPP premium while omitting the improved performance from the calculation. This compensates for the lower risk premiums required under public provision of infrastructure. There is no reason to believe *prima facie* that achieving equivalent incentives with public provision would be cheaper. As Klein (1997) pointed out, the cost of funds cannot be considered independently of the incentive system under which intermediaries collect them.

5. Conclusion

It is perhaps fair to say that the alleged financial advantages of PPPs have been one of the main reasons for their popularity. Newspaper articles often mention that PPPs release government funds, thus expanding the set of projects that governments can undertake. More generally,

27 Of course, a lottery is non-systematic risk *a fortiori*, and should be fully diversifiable through perfect capital markets. Nevertheless, it doesn't make sense to add risk to a contract considering that in the real world there are transaction costs.

sophisticated financial engineering often gives the impression that 'finance makes things happen'. By contrast, we conclude that there is no *prima facie* financial reason to prefer PPPs over public provision. The case for PPPs in a specific project or type of infrastructure must stand on productive, allocative and dynamic efficiency. Will a PPP lead to lower production costs, better maintenance or higher quality of service than conventional provision? Will users pay the long-run marginal or average social cost of providing the infrastructure? And will a PPP lead to faster adoption of socially valuable innovations? Our main point is that whether a PPP makes sense depends largely on the economic characteristics of the infrastructure, not on the way it is funded or financed.

This is not to say that finance is irrelevant. Compared with traditional public provision, the narrow organisational focus forced by project finance and SPVs fosters efficiency and incentive alignment. Moreover, PPP projects are large, require independent management, and both scale and scope economies across projects are typically small. Thus, an SPV seems a particularly suitable organisational form which is much closer to the efficient scale of operation than the gigantic government entities in charge of all public infrastructures of a given country or state. Thus, arguably project finance fosters productive, allocative and dynamic efficiency.

At the same time, some scepticism is warranted. One reason is that, from a macroeconomic perspective, social value is created when real capital is deployed and used efficiently – the real side of the balance sheet – not when the financial composition of liabilities changes. Similarly, it is a mirage that PPPs liberate public funds. PPPs affect the intertemporal public budget in much the same way as public provision. With a PPP the current government saves on investment outlays. But then it either relinquishes future user-fee revenue (if the PPP is financed with user fees) or future tax revenues (if the PPP is financed with payments from the public budget). Governments may be credit constrained but, even then, the increased availability of funds occurs only under very special conditions.

From a public finance point of view PPPs have disadvantages. Because fiscal accounting rules keep most PPPs off the balance sheet, governments have used them to anticipate spending and to sidestep the normal budgetary process, in much the same way that off-balance sheet vehicles helped banks to elude capital requirements and prudential regulation. We conclude that, from the point of view of the public budget, PPPs should be treated as conventional public investments. Similarly, some have argued that fund structures are used to raise debt and disguise excessive leverage, well beyond the leverage intended by the governments who use PPPs. Also, it is claimed that debt has been used to anticipate dividend payments to fund shareholders during the initial stages, when the infrastructure projects are still producing losses. Last, some have pointed out that some fund structures tend to be unnecessarily complex to allow fund managers to charge fees many times over.

We are less convinced that PPP financing is inherently more costly than public provision financed with public debt. Indeed, with adequate contracting, PPPs can replicate the intertemporal risk profile of public provision. Hence, the so-called PPP premium may reflect faulty contractual schemes, which inefficiently assign exogenous risks to the private partner. Alternatively, the PPP premium may pay the concessionaire for assuming endogenous risks that cannot be meaningfully separated from the incentive structure responsible for the efficiency gains under PPPs. For these reasons, the apparent higher cost of capital should not be necessarily interpreted as evidence against PPPs.

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