

Short paper on:

“Incorporating Externalities into the Revenue Line of
Private Public Partnerships”

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Incorporating Externalities into the Revenue Line of Private Public Partnerships

This paper examines the economic issues associated with incorporating externalities into the revenue line of Private Public Partnerships (PPPs). While there are many types of PPP, the distinguishing feature of PPPs is that they combine investment in, and the provision of services from, infrastructure into a single long-term contract. Investors finance and manage the construction phase, and then maintain and operate the facilities for some, typically lengthy, period of time, in exchange for a contractually determined stream of payments. At the end of the period, the infrastructure typically reverts to the government.

To provide background to the analysis, and address common misunderstandings about PPPs, this paper starts by setting out the economic analysis underpinning PPPs. It shows that while PPPs may yield significant benefits, those benefits rely on a number of stringent assumptions being met. Those assumptions relate both to the credibility of the contractual commitments underpinning a PPP and to the extent to which the incentives under the contract align private and social returns on the decisions made by the PPP operator. This leads us to the question of projects' wider impacts, which are an area where there is scope for private and social returns to diverge. On that basis, we consider whether and how wider impacts can be factored into the design and financing of PPPs, before drawing some general conclusions.

The rationale for PPPs

Many claims are made on behalf of PPPs that do not stand up to closer scrutiny. Perhaps the most common of these claims is that they allow taxpayers to avoid bearing the costs of infrastructure projects.

To the extent to which the costs and patronage of an infrastructure project are the same regardless of whether it is undertaken directly by government or provided through a PPP, this claim cannot be correct. After all, under those circumstances, the opportunity cost to the government of contracting the project to a PPP operator is simply the net revenue the project will generate for that operator. As a result, merely undertaking the project as a PPP cannot improve the government's net worth, compared to undertaking it directly.¹

Equally, it is incorrect to think PPPs can in themselves reduce the risks taxpayers bear. Again, if the extent of those risks is unchanged by the form of infrastructure provision, shifting those risks onto private investors simply alters the way risk-bearing is paid for, not the quantum of the costs it imposes. In the case of purely exogenous risks (i.e. risks whose realization does not depend on how the project is managed), there is no social gain from shifting those risks onto the PPP

¹ For instance, under that assumption, the government could have charged the equivalent tolls and used the proceeds to cover the (assumed equivalent) costs. This is the essence of the equivalence theorem demonstrated by Engel, E., Fischer, R. and Galetovic, A. (2007). "The Basic Public Finance of Public-Private Partnerships", National Bureau of Economic Research (NBER) Working Paper No. 13284.

operator and – if government is in a better position to pool those risks than are private capital markets – such risk-shifting will give rise to efficiency losses.²

Rather, the main justification for relying on PPPs is the scope they provide for infrastructure to be more efficiently built and operated than it would otherwise be. That scope reflects the incentives the holders of PPP contracts have to maximize profits by reducing costs and increasing patronage, at a given (generally regulated) level of charges. Moreover, by allocating PPPs on the basis of competitive tenders, governments can seek to ensure PPPs are undertaken by the provider with the greatest ability to achieve those gains.

Put in the language of economic analysis, PPPs therefore seek to resolve two problems: the problem of *adverse selection*, i.e. that the entity undertaking the project may not be that which can do so most efficiently; and the problem of *moral hazard*, i.e. that the entity undertaking the project (the ‘agent’) may have interests that differ from those of the infrastructure planning entity (the ‘principal’) in circumstances where it is costly to monitor its performance and hence align its incentives with the principal’s objectives.

Achieving these objectives requires that the PPP contract provide *high-powered incentives*: in other words, actions which improve the efficiency with which the project is carried out most increase the PPP operator’s profits, while actions which reduce the project’s efficiency must decrease those profits. To the extent to which the contract does in fact provide such high-powered incentives, more efficient operators will have incentives to out-bid less efficient operators for the right to undertake the PPP; and having secured that right, they will have incentives to implement the project efficiently.

In other words, if a proper tender design is chosen, more efficient operators will displace less efficient operators in the competition for the contract, and – once they have the contract – will have incentives to act on any private information they have about ways of increasing the project’s efficiency.³

To the extent to which the PPP contract does indeed provide such high-powered incentives, relying on PPPs may also improve project selection. Specifically, if PPPs are entirely funded through user charges, then only projects valued by consumers at more than their costs will be carried out. This could reduce the incidence of ‘white elephant’ projects, though the mere fact of relying on PPPs will not avoid them entirely.⁴

² Risks are said to be exogenous if their outcome does not depend on decisions taken by the operator. Conversely, if risks are endogenous to a project – in the sense that their outcome is affected by the decisions taken in the course of the project – then allocating them to the PPP operator may be efficient.

³ Information is private if it is known only to one party. For example, an operator may have private information about opportunities to reduce maintenance costs. However, if acting on that information does not increase its profits, it will have no incentive to reveal that information by actually reducing those costs.

⁴ For instance, even in the absence of explicit subsidies, governments may make a socially undesirable motorway project privately profitable by eliminating the competing routes motorists would otherwise have used.

Moreover, the ‘harder’ the budget constraints are⁵, and the greater the sensitivity of the operator’s profits to outcomes, the greater will be the incentives for the operator to efficiently manage endogenous risks (such as the risk of cost overruns).

Finally, allocating the project by competitive tender will ensure some part of the efficiency gain consequent on its operation as a PPP accrues to consumers and taxpayers.⁶ To the extent to which that reduces public expenditure or (for unchanged expenditure) increases the revenue base on which taxes can be levied, it will yield an additional benefit in the form of reduced deadweight losses of taxation.⁷

Assumptions underpinning the efficiency case for PPPs

While the gains noted above can be significant, they rest on important assumptions. Two assumptions are worth emphasising.

Renegotiation and manipulation

First, incentives are only high-powered if contract conditions are not vulnerable to renegotiation by the operator in the face of adverse outcomes or by the government in the event of especially favourable outcomes. If loss-making projects can simply seek government subsidies, while highly profitable projects risk being expropriated, PPP operators will have little interest in securing potential efficiencies. However, it may be difficult for governments to credibly commit not to renegotiating PPP contracts should especially adverse or especially favourable conditions prevail.

Moreover, even if governments could make credible commitments not to renegotiate, there is a trade-off between ensuring budget constraints are indeed binding on the one hand, and allowing adaptation to unforeseen contingencies on the other. The fact that no contract can be complete (in the sense of anticipating in advance all the contingencies that could arise), makes that trade-off all the more complex. This raises difficult analytical and practical issues about the extent to which, and the manner in which, flexibility should be built into PPP contracts.

Without entering into the details of those issues, it is important to note that the greater the degree to which any contractual flexibility provides *de facto* scope for contract renegotiation, the less effective PPPs will be in preventing adverse selection and moral hazard. Specifically, if contracts can be renegotiated, even

⁵ Budget constraints are said to be ‘hard’ when they are not vulnerable to *ex post* renegotiation (so changes in outcomes flow directly into the wealth position of the operator) and ‘soft’ when they are vulnerable to renegotiation.

⁶ As a general matter, the distribution of the gains will depend on the number of competing bidders and the extent of the efficiency differences between them. The greater the number of competing bidders and the greater the degree to which they are symmetrical (i.e. equally efficient), the greater will be taxpayers’ and consumers’ share of the efficiency gain from putting the project out to tender. Of course, in the limiting case, where all information about project operation is public knowledge (so there are a large number of competing bidders), the same gains could be achieved by the planning authority simply contracting out the work.

⁷ By the equivalence theorem, the reduced deadweight losses only apply to the costs saved or revenue gained as a result of the superior efficiency of the PPP.

inefficient operators may have incentives to enter successful bids to undertake those contracts—for example, if their lobbying skills exceed those of more efficient rivals—thus giving rise to adverse selection. Equally, once operators have obtained a contract, they will still have incentives to engage in moral hazard if any losses can be shifted back to taxpayers.⁸ As a result, theoretically achievable efficiencies may prove difficult or impossible to realize.

Exactly the same issues arise when contracts are vulnerable to manipulation. While this may simply be the result of poor drafting, risks of manipulation also arise when contracts involve conditions that are not verifiable.⁹ For example, if the quality of construction and maintenance is difficult to verify, operators will have incentives to degrade that quality, so long as the cost saving from doing so exceeds any reduction in the PPP's ability to charge for its services.¹⁰ Alternatively, where a contract makes remuneration contingent on difficult to verify conditions, that increases the risks each party faces, and can create incentives for them to undertake wasteful investments that are aimed at reducing those risks. Effectively, this kind of manipulation can amount to a form of renegotiation, where the vagueness of contract terms and conditions is used as a trigger for bargaining over the *ex post* distribution of project gains and losses.

Of course, even in these cases, the policy question is not whether PPPs will perform as efficiently as theoretically possible, but how their performance compares to feasible alternatives.

For example, even if renegotiation is unavoidable, the fact that it involves bargaining between different parties (the government and the operator) may still lead to better outcomes than would arise under traditional government provision. The need to reach agreement may, for instance, limit the degree to which a new government can simply redistribute income away from the project

⁸ Additionally, the scope to renegotiate creates incentives for each party to invest in actions that improve its bargaining position if and when renegotiation occurs (or that allow it to trigger renegotiation when that is in its interests). As those investments merely aim at altering the distribution of gains and losses, they are inefficient. For example, PPP operators may choose an inefficiently high level of debt, if that increases their risk of bankruptcy in circumstances where such bankruptcies impose high political costs on governments (see Spiegel, Y., and D. Spulber (1997), "Capital structure with countervailing incentives," *The RAND Journal of Economics*, 28(1), 1-24 and Daniel Danau and Annalisa Vinellay "Public-Private Contracting Under Limited Commitment", Working Paper, 2012). So long as the added cost to government (and hence its willingness to accede to renegotiation on a basis favourable to the operator) exceeds the added cost to the operator, increasing leverage will be privately profitable but socially wasteful. In a remarkable result, Menezes and Ryan show that when debt levels are endogenous and are a strategic variable in the context of PPP renegotiation, more efficient firms are bailed out more often – and extract a higher expected transfer from government – than do less efficient firms _____, "Default and Renegotiation in PPP tenders", Working Paper, April 30, 2012.

⁹ A distinction is drawn in the economics of contracts between conditions that are merely 'observable' and those that as well as being observable, are 'verifiable'. An outcome is *observable* if participants know it has been achieved; it is *verifiable* if that state can be determined to a reasonable degree of accuracy by a third party. Conditions that are observable but not verifiable form a poor basis for remuneration clauses in contracts.

¹⁰ This may help explain the difficulties of PPPs in areas that involve personal services, the delivery of which involves quality dimensions that are inherently difficult to verify.

towards favoured constituencies, if doing so inflicts reputational damage on the new government and compromises its ability to secure future commitments from private investors.¹¹

Equally, even when performance targets are 'noisy', in the sense of being imperfectly verifiable, and hence capable of manipulation, providing some incentive for those targets to be achieved may still result in better outcomes than would be secured under traditional models of service provision. This is especially likely where performance is observable even though not fully verifiable, and where past performance is taken into account in allocating future contracts. In that case, both parties can have appropriate incentives to secure high quality performance: operators can gain (through a higher probability of winning subsequent contracts) by investing in a reputation for so doing; and governments will want to reward such performance so as to obtain it on current and future contracts.¹²

Completeness

A second assumption underpinning the claimed efficiency of PPPs is that the incentives provided under the PPP contract cover the various dimensions that will be affected by the operator's decisions: in other words, that the contract conditions align private and social costs and benefits. More specifically, while gaps between private and social costs and benefits are always potentially problematic, they can become especially so when the incentives under which decisions are being taken are high-powered.

At issue are situations where a PPP contract provides strong incentives for the operator to take particular decisions whose private consequences diverge from their social consequences. This is not merely a question of whether the private returns to an operator from a particular decision reflect the full consequence of that decision; rather, it can also occur when some aspects of behavior are more strongly encouraged than others.

¹¹ Conversely, the need to reach agreements may lead to worse outcomes than would prevail under unitary government control if it induces the new government and the operator to collude against the public. In the extreme case where each party has a veto over the renegotiation, and there are constraints on side-payments between the parties, they may reach agreement on an outcome that taxes consumers or taxpayers by more than a single monopolist would. This is because each party maximizes its own gains, without taking full account of the impact that has on the gains available to others (much as sequential monopolists would do in a non-cooperative setting). The recent agreement between the Australian government, Telstra and NBN Co appears to be a case in point.

¹² In economic terms, this makes high quality performance incentive-compatible for both parties. Note however that the underlying mechanism relies on there being an ongoing flow of PPP contracts; were there no such ongoing flow, the operator would have no incentive to invest in its reputation, while the government would have no incentive to respect its commitment to rewarding good performance (see the analogous result in Levine, P., J. Stern and F. Trillas (2005), 'Utility Price Regulation and Time Inconsistency: Comparisons with Monetary Policy', *Oxford Economic Papers*, 57(3), pp. 447–478). Note additionally that taking account of observable but not verifiable characteristics in contract allocation is not costless: it increases the risk of favouritism in contract allocation and may create an incumbency advantage. To that extent, just as there is always a cost to imperfect information, so in this instance there is no costless way of overcoming measurement difficulties.

For instance, a contract may provide strong incentives to minimize construction costs but contain few incentives to similarly reduce project costs over the project's entire life-cycle. The overall outcome in that situation can be worse than which would occur were all incentives weak: i.e. were cost containment less strongly encouraged for construction, there would be less risk of that cost containment imposing added costs on maintenance. This is a form of the 'multi-tasking' theorem, which states that where the interests of an agent diverge from that of a principal, and the principal can monitor and reward some aspects of performance but not others, uniformly low-powered incentives may provide better outcomes than would the combination of high-powered incentives for those dimensions that can be monitored with low-powered incentives for those which cannot.

As a result, consideration of the completeness of a PPP contract requires attention to two interrelated factors: first, whether the contract aligns private and social rates of return on management decisions affecting those parameters of performance covered by the contract; and second, whether the *relative* strength of the incentives the contract provides, both in those performance dimensions it does cover and those it does not, has the potential to create inefficiencies.

In each case, the focus is on the effect on management decisions: putting risk considerations aside, rewards or penalties triggered by outcomes management does not control are irrelevant, with the rewards being windfall gains and the penalties windfall losses.¹³ In contrast, where outcomes will be affected by the PPP, the question is twofold: Have all the benefits or costs of the project been taken into account in the decision to undertake it? And if the project proceeds, do the incentives the contract provides to the operator align the private and social returns on its decisions?

In this case too it is important to be clear as to what is relevant. The mere fact that a project confers wider benefits than might be captured by the operator is neither here nor there *so long as* the operator has the right incentives at its margins of decision.

For example, assume building a road between A and B at a cost of \$10 million confers net benefits of \$100 million on local landowners; so long as the operator is compensated for the \$10 million it expends, the gain to third parties (which is assumed to be the same regardless of how the road is built and operated) is neither here nor there to the efficient design of the PPP contract. Allowing the operator to secure that \$100 million (or some part thereof), as well as the \$10 million in costs, would simply confer on the operator a windfall gain.

Conversely, if allowing heavy trucks to use the road at night will impose a noise cost on local resident of \$10,000 per hour, and the decision as to whether or not to do so rests with the operator, then the operator should face a penalty of \$10,000 for each nighttime hour it allows trucks to run.

¹³ If the nature and extent of those rewards and penalties is known *ex ante*, they will be factored into the compensation required and are effectively lump sum transfers. However, if they are uncertain, they will add to the project risk and could require additional compensation.

In other words, while the decision about whether to undertake the project should take account of *all* the costs and benefits it imposes, the rewards to the operator should reflect the subset of those costs and benefits its decisions affect and provide it with the minimum compensation required for it to take those decisions efficiently.

That said, the full set of costs and benefits may be relevant to how the required compensation is most efficiently obtained. For example, if the project will increase local land values, it may be more efficient to cover the project's costs by taxing those land values than by imposing tolls. A sewerage facility, for instance, may operate subject to everywhere decreasing marginal costs and those marginal costs may themselves be very low as a share of total costs. Under those circumstances, charging for usage at average cost will distort usage decisions; in contrast, a fixed access charge on local landowners, set to a level that covers the facility's costs, will not. Allowing the operator to thus 'internalise' some share of the wider benefits the facility confers will, in that case, increase efficiency.¹⁴

In short, all project impacts are relevant to determining whether or not to proceed with a project; given the decision to proceed with the project, the revenue stream to the operator should (1) allow it to recover efficiently incurred costs, at least in expectation¹⁵; and (2) to the extent practicable, align the incentives underpinning its decisions with the social costs and benefits those decisions cause.

Dealing with externalities

Those design criteria imply PPP contracts should take account of those externalities whose quantum is affected by management decisions about how the project is constructed and operated. Moreover, where a project confers a range of benefits, efficient charges should take account of that range of benefits so as to secure overall cost recovery in the least distorting way. The sections that follow consider aspects of the practical application of these principles.

Urban road networks

Adding a road managed by a PPP to a densely meshed urban road system will affect traffic levels and patterns throughout that network. Moreover, the way the new road is managed (for example, in terms of the speed with which accidents are cleared) can itself cause wider traffic changes in the network as a whole. So can the charging arrangements for the road, which can create or alleviate congestion on other roads. For the operator to have incentives to take these decisions efficiently, those wider consequences must figure in its decision-making.

For example, at least in principle, an operator could be paid a shadow toll that depends on the impact of its decisions on congestion levels throughout the network. Given such a toll, the operator would have incentives to optimize use of its facility taking account of network-wide effects that it might otherwise ignore.

¹⁴ Equivalently, the government could impose such a tax and use it to fund a capacity payment to the operator.

¹⁵ This is simply the *ex ante* capital maintenance condition. *Ex post*, of course, the project may incur losses, for instance, if it is poorly managed.

There are, however, a number of practical issues associated with such a proposal. Even in a static road network, identifying and properly measuring the relevant spillover effects is complex and likely to prove contentious. The difficulties are likely to be even greater as the road network continues to develop and as land use and settlement patterns change. Making cost recovery dependent on the quantum of those spillover effects can therefore introduce a non-verifiable condition into the contract, with all the problems that involves and that are discussed above.

Benefit capture

Major projects will typically create wider commercial opportunities, as well as some broadly diffused benefits.

For example, building an extension to a rail network creates opportunities for commercial development of the precinct comprising and immediately adjacent to the new railway station. At the same time, it will increase land values throughout the new link's catchment area, as lower transport costs shift out the bid-rent curve.

As a general matter, these effects will be taken into account in the cost-benefit appraisal of the rail project. Indeed, the Henry George theorem implies the expected net value of the project will be capitalised into land values.¹⁶ This raises the question of the role those value increases can play in efficiently financing the project.

It is useful to address this question in two parts. A first relates to the optimal scope of the bundle of assets vested in the PPP operator; the second to efficient revenue raising for projects that confer local benefits reflected in land values. We consider first the issue of bundling, illustrating the points through a discussion of airports, and then turn to the broader question of land values.

Airports and bundling

Where a project involving the construction and/or operation of a facility gives rise to ancillary commercial opportunities, the question arises of the extent to which exploiting the commercial opportunities the project creates should be bundled with the other aspects of the PPP, so that it is the PPP operator that secures those benefits. An obvious example is that of commercial developments at airports, which are typically the responsibility of the airport operator, acting as a landlord and/or real estate developer.

Ultimately, this issue turns on the degree of complementarity between the decisions regarding the facility being constructed and those regarding the optimal use of the commercial opportunities. If there is tight complementarity between those decisions, and high transactions costs would be involved in

¹⁶ For a demonstration of the Henry George theorem, see David A. Starrett (1988) *Foundations in Public Economics*, Cambridge Economic Handbooks, Cambridge University Press, 1988, pages 83 and follows. Abdel-Rahman, H. and Masahisa Fujita (1990) "Product Variety, Marshallian Externalities And City Sizes", *Journal of Regional Science*, 30:2, 165–183, May, show the Henry George theorem holds in a second-best context, with Dixit-Stiglitz product differentiation and agglomeration economies.

coordinating them under separate ownership, then bundling the opportunities into a single project will be desirable. Conversely, if the relevant decisions can be clearly separated (for instance, by being designed as distinct modules with well-defined and tightly specified boundaries), then tendering them separately will likely be efficient.¹⁷

In other words, the decision as to bundling should turn on the degree and nature of the economies of scope. Where it is difficult to gauge, *ex ante*, whether those economies of scope are or are not substantial, putting the distinct components out to tender separately, but with the option of joint bids over both, can help address that question.¹⁸

Assuming nonetheless the decision is taken to bundle the commercial opportunities with the PPP's core task (presumably, the construction and operation of a facility), an issue which frequently arises is that of the treatment of the revenues from those opportunities. For instance, in the context of airports, whose aeronautical charges are usually regulated, the question is whether revenues from non-aeronautical services (such as airport parking lots or shopping malls) should be credited against the costs of the aeronautical services.

There are broadly two approaches to this question, which are commonly referred to as 'single till' and 'dual till' charging¹⁹. While the choice between these has given rise to lengthy and inconclusive controversies between airports and airlines, the relevant economic issues can be simply set out.

Broadly, under the single till approach to pricing, airport revenues are determined by setting an appropriate rate of return on all assets that are used for the provision of services at the airport, irrespective of whether those services could be defined as aeronautical or non-aeronautical, and irrespective of whether those services are considered to be contestable or not. Airports then determine the prices for aeronautical and non-aeronautical services within this

¹⁷ In economic terms, the question is not whether there are economies of scope between these activities but whether there exists a decentralized mechanism that can secure those economies of scope. There may, for instance, be very substantial economies of scope between a power plant and an adjacent coal mine, but those economies could be capable of being fully captured by a long term contract. Conversely, the economies of scope between above and below rail operation may be weaker, but not capable of being efficiently dealt with through the price mechanism. Ultimately, this can be shown to turn on whether the set of alternatives that needs to be considered in decision-making is convex (which means that if two choices are available, any combination of those choices is also available), and whether the objective function (that is, the function that measures how outcomes, such as profits, vary depending on the decision taken) is concave (which means that if two choices lead to the same outcome, then a combination of these choices would lead to a higher outcome). See John Roberts (2004), *The Modern Firm: Organizational Design for Performance and Growth*, Oxford University Press, pages 41 and follows.

¹⁸ However, some care is needed, as there is a risk that poorly specified interfaces between the project components and the conflicts they give rise to will act as triggers for renegotiation (which, for reasons discussed above, is socially costly). More generally, on the scope to modularize projects, and the gains from doing so, see Carliss Y. Baldwin and Kim B. Clark (2000) *Design Rules, Volume 1: The Power of Modularity*, The MIT Press, pages 246 and follows.

¹⁹ In a single till approach, all revenues are set against all costs; conversely, under a dual till approach, aeronautical and non-aeronautical activities are accounted for separately, and typically, only aeronautical service charges are regulated.

overall revenue constraint. The single till system has been used for airport pricing in the United Kingdom and for most airports in the United States. This pricing approach is sometimes referred to as the ‘single indivisible enterprise’ approach or, in the United States, as ‘residual financing.’

Under the dual till approach aeronautical and non-aeronautical services are treated as distinct. For aeronautical services, the dual till approach requires that revenues cover the directly attributable costs of providing these services, including an appropriate return on assets that are solely used for these services, as well as a contribution to costs that are common to both aeronautical and non-aeronautical services. For non-aeronautical services a further distinction is typically made between contestable and non-contestable services. Non-aeronautical services that are considered to be contestable are not subject to regulation, but instead are disciplined by competition or the threat of entry. Non-aeronautical services that are deemed not to be contestable are subject to the same regulation as aeronautical services, that is, the revenues from non-contestable non-aeronautical services must cover the directly attributable cost of providing the service and a contribution toward common costs.

Under a dual till approach airports will have the incentive to maximise profits by setting prices for unregulated non-aeronautical services to the profit-maximising level and setting the prices for the regulated aeronautical and non-aeronautical services to the maximum level possible under the regulatory constraints.²⁰ To the extent that unregulated non-aeronautical services are not effectively disciplined by competition, prices for these services will be set above cost.

Taking airport services as a whole, the dual till approach is therefore likely to result in revenues in excess of total costs. In the extreme, if all non-aeronautical services are deemed contestable (and hence unregulated), airports will assign all costs that are common to aeronautical and non-aeronautical services to aeronautical services, as these costs will be included in the regulated asset base, while charging the profit-maximising price for non-aeronautical services.²¹ The outcome often observed under the dual till model – that is, high aeronautical charges relative to the outcomes produced by the single till approach – is consistent with some degree of over-recovery and hence implies a degree of allocative inefficiency.

However, the dual till approach does have the attractive feature that it does not impose regulatory intervention on non-aeronautical services that are considered to be competitive. More generally, under the dual till approach, regulators, which have incomplete information, are not required to make decision regarding the optimal level of investment in non-aeronautical services.²² As a result,

²⁰ Assuming those constraints are binding, i.e. limit prices to less than the monopoly level.

²¹ Again, assuming the regulated charge for aeronautical services is below the monopoly profit-maximising price.

²² It seems reasonable to suppose that it is more difficult for regulators to determine the efficient level of provision of non-aeronautical services than of aeronautical services: there is, in other words, a greater degree of information asymmetry between regulators and operators in respect of the former than of the latter. As a result, efficiency requires that operators receive a greater information rent on the provision of non-aeronautical services than of

airport operators have strong incentives to develop the revenue-enhancing lines of business, increasing efficiency and consumer welfare. This feature of dual till systems is likely to encourage a greater level of dynamic efficiency in the provision of competitive non-aeronautical services compared with the single till alternative, in which a high implied tax rate is imposed on revenues from non-aeronautical services. Moreover, the greater the difficulty regulators face in gauging the efficient level of investment in, and provision of, these non-aeronautical services, the greater the gains will be from the dual till approach.

That said, while it may forego those gains, the single till approach does not create the incentive to load common costs onto aeronautical or regulated services. Rather, because the single till involves regulation of all revenue, it should provide airports with the incentive to recover common costs efficiently between aeronautical and non-aeronautical services. However, regulators have often expressed concerns that this allocation of common costs can result in aeronautical charges that seem very low relative to average and even incremental costs. These low charges have been regarded as cross-subsidies and presumed to be inefficient.

While regulators are right to be concerned about cross-subsidies, they should not necessarily be concerned that prices for a specific service are below the directly attributable or incremental cost of that service. For example, a shopping centre may build a bus stop and provide a free bus service to customers. This does not necessarily constitute a cross-subsidy. Rather, it is efficient to do so provided the incremental revenue to the shopping centre, which derives from extra custom at the shops and hence additional rental income to the owner, is in excess of the incremental cost of providing the bus.

In the case of airports, additional passenger aircraft movements generally give rise to increased passenger numbers and a concomitant increase in demand for concession services such as food outlets and parking. Suppose, then, that the airport chose to levy no landing charges. This would not constitute a cross-subsidy if the incremental revenue the airport earned from the increased concession activity was in excess of the incremental costs of providing the aeronautical services.

The relevant test of cross-subsidy, in other words, is not whether the aeronautical charges exceed the incremental cost of providing the aeronautical facilities. Rather, the extra revenue achieved from concessionaires must be no greater than the additional net revenue earned by the concessionaires as a result of the extra customers generated by the lower aeronautical charges. In other words, the cross-subsidy floor test does not require the marginal revenue for each functionally distinct service derived from charges for that service to be no less than the marginal cost of that service. Rather, it requires that the marginal revenue to the operator for each functionally distinct service be no less than the marginal cost of providing those services.

aeronautical services. This in turn implies more light handed regulation of non-aeronautical services than of aeronautical services.

In short, whether commercial opportunities should be bundled with the primary facility being built and/or operated under the PPP depends on the extent and nature of the complementarities between decisions regarding construction and operation on the one hand, and decisions involving the optimal exploitation of those opportunities on the other.

As a general matter, there is no presumption that these should be bundled; moreover, to the extent to which the intention is to use revenues from those opportunities to help fund the relevant infrastructure, that can be done even in the absence of any bundling, though the transactions costs involved in organizing that cross-financing would need to be taken into account.²³ That said, where coordinating the construction/operation decisions and those relating to commercial development is crucial, and the transactions costs involved in securing that coordination as between separate entities would be high, bundling is likely to yield efficiencies. This may raise issues of revenue control, as in the single till/dual till controversies. Determining those issues turns on the trade-off between the inefficiencies of regulating activities that are inherently difficult to regulate (e.g. the provision of shopping services at airports) and potentially subject to competition, and the risk of over-compensating the operator.

Benefit taxation

As noted above, the net benefit of infrastructure projects will be reflected in land values. That creates scope to finance these projects through benefits taxes on land values, which may be more efficient than relying on direct user charges.²⁴

Benefits taxation has a long history in Australia. Changes in leasehold rates for improved land and sales of land at improved values financed much of the infrastructure built during the colonial era. Subsequently, explicit benefit taxes on improvement in local land values were initially used to finance the Sydney Harbour Bridge and the Melbourne rail system's city centre local loop. These were taxes hypothecated, at least nominally, to the project, on the argument that they reflected the spillovers the project conferred on local landowners.

While this argument is correct, the difficulty with benefits taxes has been ensuring they endure. For instance, the taxes imposed to finance the Harbour Bridge and the Melbourne loop were first eroded and then removed long before the projects' costs had been recovered. Once the project had been built, it proved politically expedient to appease the relatively narrow groups on which the taxes

²³ In the simplest case, for instance, concessions could be put out to tender for the infrastructure and the associated opportunities separately, and the revenue raised from the latter used to help defray the costs of the former. Indeed, even if the two are bundled and provided to a PPP operator, there must be a reasonable likelihood the operator would itself put those opportunities out to tender. As a result, the question must be the relative efficiencies of that approach compared to the government effecting the unbundling and associated financial transfers directly. That will depend on the extent to which the decisions about precisely how the commercial opportunity is exploited need to be coordinated with those about the construction and operation of the facility.

²⁴ User charges should reflect the marginal costs each user imposes. For projects that involve local public goods, those marginal costs will be zero or close to it. Imposing charges above that level for each instance of use (assuming use can be directly or indirectly measured) will consequently be distorting.

fell by shifting their burden on to the community more generally. In other words, governments found it impossible to credibly commit to those taxes, which undermines their role as a screen or test for whether the project is socially worthwhile.²⁵

As a result, where a project is most efficiently financed through levies on local beneficiaries, and where its ability to recover costs through those levies is integral to ensuring it is worthwhile, some means is needed of locking in those levies. An obvious way of doing so in situations where a project opens up new areas to real estate developers is through up-front levies on those developers – in other words, through developer contributions. Although such contributions are frequently criticised by developers, they are merely a capitalized form of benefits taxation and share its efficiency properties.

Finally, it is worth noting that helping addressing time inconsistency problems²⁶ such as those associated with benefits taxes may be one of the merits of PPPs. If governments find it difficult to credibly commit to imposing charges that will ultimately recover costs, but imposing such charges is important to screening out ‘white elephants’, giving such commitments contractual form may be beneficial.²⁷ Obviously, this requires that the charges that are thus being locked in are a more efficient method of cost recovery than feasible alternatives.

Conclusions

PPPs are a widely used means of undertaking infrastructure investment. Where private operators can reduce the costs and/or improve the quality of infrastructure, PPPs can yield efficiency benefits. For instance, by combining the construction and operation phase within a single contract, they can provide greater incentives to better manage life-cycle costs than might arise under traditional procurement.

However, whether those efficiencies are obtained depends on the extent and credibility of the incentives specified in the PPP contract. If there are substantial risks of renegotiation, the PPP operator’s incentives to invest in cost reduction or revenue enhancement will be blunted. Additionally, the possibility of renegotiation will induce parties to make investments that are merely aimed at improving their bargaining power and hence are socially wasteful. Equally, if performance metrics are vague or poorly defined, *de facto* renegotiation may occur, as disputes over the interpretation of the contract degenerate into rent-shifting battles. In this case too, wasteful investments will be made in *ex post*

²⁵ Given the Henry George theorem, projects whose benefits exceed their costs should be capable of being financed through benefits taxes on improved land values. As a result, only allowing projects to proceed if local landowners are willing to pay their costs through such taxes is a method of screening out ‘white elephants’.

²⁶ Time-inconsistency arises when a policy that is optimal (from the point of view of the policymaker) *ex ante* turns out not to be the optimal policy *ex post*. If the policymaker cannot commit to a policy, it may then find itself wanting to change its policy *ex post* (say, after a firm has made its investment decision), regardless of what it said *ex ante*. Such an approach to policy is said to be time-inconsistent.

²⁷ See Eduardo Engel, Ronald Fischer and Alexander Galetovic (2010) “The Economics of Infrastructure Finance: Public-Private Partnerships Versus Public Provision”, EIB Papers, 15:1 pp.40-69.

bargaining power, dissipating the potential gains from PPPs. Finally, if the incentives provided by the contract do not align the social costs and benefits of the operator's decisions, there is a danger of those decisions creating harmful externalities or underproviding positive externalities.

All these issues come together in the question of how externalities should be dealt with in PPP contract design. In theory, the answer is simple: to the extent to which the operator's decisions confer external costs or benefits, those external impacts should be reflected in its incentives. Reality, however, is more complex. We illustrate those complexities by focusing on three aspects.

First, even in situations where the broad nature of the externalities is obvious, quantifying their extent and translating that metric into compensation may pose serious problems.

For example, the proper pricing and management of an urban road may yield significant benefits in the form of reduced congestion throughout an urban transport network. In principle, therefore, those benefits should be reflected in payments to the operator, ensuring it has the right incentives to achieve them. However, there may be no feasible way of accurately measuring those benefits, especially as the urban road network continues to evolve. As a result, introducing them into the contract may create the *de facto* renegotiation problems noted above. Moreover, even absent *de facto* renegotiation, errors in measurement may distort the incentives the operator faces. Whether those problems will be so severe as to offset the benefits of thus extending the contract's completeness is obviously an empirical question.

Second, the greatest scope for internalizing wider benefits is when they involve spillovers immediately adjacent to the facility at issue. Even then, however, there are trade-offs to be considered.

For example, extending rail links creates commercial opportunities at the new stations. Whether those opportunities should be bundled with construction and operation of the new link is not a matter of financing: rather, it depends on whether there are ongoing complementarities in the decisions about construction and operation and those about the best manner of exploiting the new commercial opportunities; and if so, whether those complementarities are best managed through joint ownership. Moreover, even where there are strong advantages to joint ownership, consideration needs to be given to the regulatory problems it can create—regulatory problems readily apparent in controversies about the control of charges for aeronautical and non-aeronautical services at airports.

Finally, socially worthwhile infrastructure projects will increase land values, most obviously in the case of local public goods. The provision of such local public goods confers what amounts to an externality on local landowners, raising the question of whether benefits taxes can be used to finance the public good at issue. In principle, such benefits taxes can be highly efficient, not least because they avoid the need for distorting user charges. Additionally and importantly, the ability to recover costs by levying such taxes differentiates projects that are socially beneficial from those that are not, and hence acts as a screen against

'white elephants'. However, in practice, such taxes are frequently subject to *ex post* renegotiation; whether they, or equivalents, can be locked in through PPPs remains to be seen.