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Abstract

This paper reviews the theoretical debates on the extent to which PPP demands changes in how cost-benefit analysis needs to be conducted for public projects. It presents first a simple conceptual discussion which shows that the comparison between PPP and public procurement boils down to:the difference between the discount rate and the total cost difference between the best PPP bid and the best public sector option (including in the cost difference the allocation of operational risks and the likelihood of these risks). It then looks at international practice and shows that pragmatism, and sometimes ideology, dominates theory in the use of cost benefit analysis to compare the two forms of provision.

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1. Introduction

Public-private partnerships (PPPs) are mostly, although not exclusively, about sharing, between the public and the private sector, risks associated with investment aimed at meeting public service needs. Assessing PPPs is somewhat complex as the private and the public partners have different objectives. For the public partner, roughly, a project specific PPP is desirable if: (i) the expected (net) social payoffs are at least as large as the private payoffs and (ii) the partnership is the most cost effective way of delivering the project, accounting for quality requirements, budget constraints and distortions introduced by financing. For the private sector, the decision should be simpler. Its payoffs have to be at least as high as the payoffs to equivalent risks that it could obtain without a partnership with the public sector.[2]

The two perspectives imply that a PPP decision should, ideally, be based on a cost benefit analysis (CBA) ensuring the proper measurement of both the social and the private rate of return of the project. The experience suggests that it is common to consider the private rate of return to be a lower bound for the social rate of return and to avoid conducting a proper assessment of the social return. Yet, there are plenty of reasons why this assumption may be wrong. But conducting a social CBA is not enough. It has to be done right and that in itself is a challenge as there are many methodological options for some very basic dimensions. Different choices of key parameters lead to different rankings of projects.

How to do it right in practice has been the subject of an intensive policy debate for over a decade. Most of this debate has taken place in a few countries (Australia, Canada, and New Zealand) with a strong tradition of public debates on key policy decisions. The questions raised in these debates are not unexpected. They include the extent to which the discount rate, the risk premia, the opportunity cost of public funds and others factors need to be adjusted to account for the PPP. The debate is still very much alive as no definitive theoretical answer is available. [3]

If getting it right seems to be so complex and so uncertain, why are PPPs so popular among politicians and some policy advisors? A combination of ideology and of pragmatism is probably what best explains the sustained interest for PPPs of governments around the world. Not only can ideology drive the decision to adopt PPPs without any basic assessment of the social rate of return associated with this delivery option, it can also influence the choice of key parameters when efforts are made to quantify the social return. But as seen in the international experience reviewed later, pragmatism may drive many of the government preferences even more so than ideology. Differences in constraints and circumstances often explain the differences in choices made. Given that most of these decisions are taken in highly imperfect and uncertain environments, the

[2] In practice things can be a lot more complex since the private partners are often an heterogeneous group combining construction companies, business operators, banks, non-bank investors and others. Each of these groups have different objectives and probably most importantly in the context of a discussion of cost benefit analysis, each has a different time horizon for its business interests and hence time preferences.

[3] Many of these issues parallel those raised in the context of the analysis of policies to deal with climate change. The recent papers/books by Gollier (2011, 2012) provide a good overview of what these issues are and how they can/should be dealt with in the context of projects with long lived consequences.

differences in approaches will be shown to be probably justified—if the theory of second best is to be taken seriously. [4]

The paper is organized as follows. Section 2 explains why it is relatively easy to see that many decisions regarding PPP are based on a combination of ideology and pragmatism. This sets up the stage to explain why and when theory offers no clear answer, arbitrary decisions are relatively easily made in the policy world, even if these decisions are often nicely dressed into a theory. Section 3 offers a very brief reminder of the main theoretical concepts surrounding cost benefit analysis that are needed to assess the need for change in the context of PPPs. Section 4 explain why and how PPP could impact these key concepts. Section 5 surveys the international experience in adopting adjustments to CBA to deal with PPP. Section 6 concludes.

2. Ideology, pragmatism and realism in selling PPPs

The ideology built-in the political decision to look for PPP can be induced from biases and omissions built-in many theoretical, empirical and business publications on PPP. Whether for OECD countries (Hodge and Greve (2009) or for developing countries (Estache (2006, 2010)), there is no real general objective assessment of PPP which recognizes the multidimensionality of their impacts. Counterfactuals in the evaluations are still the exception rather than the norm in the case of PPPs.

Too much of the discussion is partial and the direction of the bias often reflects the biases of the authors, whether advocates or opponents to PPP. Each side has enough to pick from in the evidence to tell its stories. The fact that that there is still so much scope for subjectivity in the ex-ante and ex-post assessment of PPP is somewhat surprising. It may be useful to have a sense of the evolution of this debate over the last 20 or 30 years or so. It gives a better sense of how unclear and hence unreliable the evidence still is on the circumstance under which PPP are desirable or not.

A lot of this research is anchored into lots of solid theory which started the debate. This theory tried to figure out under what circumstance private provision of public services was more desirable than their public provision. An old short book by Stiglitz (1989) provided then a robust overview of the vision that theoretical academics had on the issue at the end of the 80s. A lot more theory has been written since but it could be argued that it boils down to improvements in our understanding of the many factors that could be relevant. Most concludes that the best, ex-ante, is to look at the specific constraints case by case and, ex-post, to look for empirical evidence on the average relative importance of all of these factors. [5]

It seems that the volume of solid evidence has been lagging the volume of solid theory over the years and that the gap is growing. Although there was also some empirical evidence at the end of the 80s, mostly in the US context where quasi-natural experiments had been taking place, there was not much of it. Anecdotal evidence was however omnipresent around the world. There was, indeed, a growing generalized feeling that the public sector was delivering well below expectations and/or at an excessive fiscal

[4] Stiglitz (1982) made this point quite well over 30 years ago already in a narrower context.
[5] Elisabetta Iossa and David Martimort are currently among the most creative and thorough contributors to the theoretical debate on the cost and benefits of PPPs. See for instance, Iossa and Martimort (2011)

or user costs. For instance, infrastructure costs were high, delays in getting access to service long and average service quality low. The available evidence allowing comparisons between public and private provision of public services started after two major events took place.

The first major event that can be credited with the increase in the volume of evidence is the analysis of the initial record of the Thatcher revolution in the UK and the "Chilean Chicago connection" associated with the Pinochet regime. There was also growing evidence from the 1990s reforms in Australia, New Zealand, Eastern Europe and Latin America. Given the really poor initial conditions of service quality in the countries who had decided to experiment with the private sector, the initial set of evidence suggested that the change had been for the better. Then overtime, the diversity of experiences revealed a diversity of outcomes and the evidence started to become less robust. As academics and policymakers started to look in some details however, the storyline should have become more subtle. The efficiency and fiscal gains were often in the short run. Renegotiation or refinancing would often offset some of the initial gains, in particular for transport and water PPPs. Equity and governance dimensions had been underestimated, and corruption issues equivalent to those that prevailed under public provision also appeared when projects were scrutinized. In a nutshell, there was plenty of food for second thoughts on the potential gains from PPPs even though there was also good evidence that these projects can work in specific sectors, under specific governance structures.

The second key fact associated with new evidence on the impact of PPPs was the technological revolution in the telecoms industry and the simultaneous liberalization which provided an amazing laboratory to assess the potential gains from changes. This included the side effects of the revolution in other sectors as information was an input into many public services. Unfortunately, this second event also provided an opportunity for advocates to assimilate the payoff of technological changes, in particular in the telecom sector, with those of competition and of PPP of various types.

Ultimately, it could be argued that ideological subjectivity has dominated the debate. Caricaturing a bit, one only needs to pick the right sector, the right projects, the right country or the right time period to get the story one wants to tell. But ideology can also be found in methodology. Analysts enjoy enough flexibility in the choice of methods, including in the design of ex-ante and ex-post cost-benefit analysis to bias stories one way or another. For instance, as discussed later, it can boil down to picking the right discount rate to tell the story one wants to tell.

The most puzzling part of this historical overview is that, in spite of the mixed evidence, the policy and political messages have throughout remained dominated by the advocates of PPP—at least in OECD countries. That would seem to be reasonable evidence of the importance of ideology in this debate but it could be misleading to reach that conclusion as ideology is not the only possible explanation. And indeed, the domination of advocates may also be the result of pragmatism. This would explain why left and right-wing parties all continue to look into PPPs as an option in many countries.

The main driver of this sustained commitment is, in fact, probably fiscal policy and this, for two main reasons. The first was the desire to compensate for the fiscal

commitment to infrastructure and some other traditional public activities. In Europe, outside of the UK and to some extent, Portugal, PPPs have however not taken a large role in compensating lower fiscal commitments to traditional public sector activities. Where PPPs have been adopted, it is often stimulated by the EU commitment to develop network integration in energy and transport. The second motivation is more subtle and fits better in a discussion of the relevance of cost-benefit analysis as a public policy tool. Pushed by the UK and Australia, the importance of the value for money philosophy has slowly but surely crawled up the agenda. In particular, it has increased the popularity of quantitative ex-ante evaluation of PPPs.[6] It has also increased its popularity. If the budget constraint for the public sector becomes too binding and the private sector is not too keen on taking too much risk alone, one solution is to try to get the PPPs to push costs down. Increased competition for the right to provide the service increases the value for money comes from. The bet on PPP was thus a very clever and pragmatic way of dealing with fiscal concern while minimizing the apparent impact on the level, and sometimes the quality, of service.

The pragmatism is understandable, but it also raises a number of issues. First, there were the accounting games which were played by governments to minimize the apparent fiscal impact of guarantees and other support provided through PPPs.[7] Governments, the IMF and the EU ended up issuing guidelines on how to minimize these games.[8] Second, the pragmatism was also assisted by the scope of subjectivity in the implementation of ex-ante evaluations, which could easily be managed to justify a fiscal preference for PPPs.

3. Some relevant theory and its policy use

It may seem a bit odd to claim that it is useful to revisit the theory of cost-benefit analysis. There are plenty of good textbooks that provide the essence of what needs to be done to assess public investment decisions in theory.[9] The most theoretical discussions have trickled down into practical guidelines on how to identify direct and indirect costs and benefits, tangible and intangible, on how to assess them when there is no market value, on which decision rule to focus on and how careful to be with the choice of the discount rate when computing the net present values. The EU has now been pushing such guidelines for over 20 years and many OECD governments have done so at the country level (although many have also failed to do so).[10]

A quick review of these guidelines across countries or agencies suggests that decision makers have reached an implicit consensus on which parts of the theory to deal

[6] See survey of 20 countries reported for 2010 by Burger and Hawkesworth (2011)
[7] See Engel, Fisher and Galetovic (2007) for instance.
[8] See for instance Canadian Council for Public-Private Partnerships (2008) and for the UK, Grimsey and Lewis (2005)
[9] Just et al. (2004) or Brent (1996) are good examples in English, combining solid theoretical presentations with good intuition for implementation, A lot of it has also been revised recently in the context of debates on the climate change. Gollier (2012) provides a great review of the state of the art in that context. A lot of what is discussed in this section is discussed much more precisely and encompassingly in many recent papers by Gollier available on his web site.
[10] Chile probably still enjoys the best set of guidelines to assess public projects. It has however not updated these guidelines to deal with PPPs.

with and which parts to ignore. For instance, shadow pricing, distributional concerns, indirect effects highlighted by second best theory and similar issues are often absent from the implementation of ex-ante evaluation of public projects. They may be spelled out in the guidelines sometimes, but usually end up being paid lip service at best at the actual evaluation stage.[11]

One of the distortions still subject to hot debates is the distortion in capital markets which impacts the efficiency of intertemporal resources allocation. When there are distortions (capital taxes, borrowing constraints, externalities arising from interdependent preferences over time across generations, misallocations of risks…), the basic market interest rate is unlikely to reflect the rate at which society compares discounts future consumption to compare it to current consumption. Something else is needed. [12]

Roughly speaking, there are three main approaches. The first comes from the public/welfare economics literature which argues that governments want to have a sense of the rate at which their constituency wants to assess the degree of preferences for current consumption over future consumption. In the literature, it is called the **"social rate of time preference"**. It gives an idea of the degree of impatience of population or myopia with respect to future. Formal estimations of the inter-temporal inequality aversion and prudence generate rates of 3%-4%.[13] But there are lots of disagreements on the value that best represents society's valuation of the future. The Stern Report (2007) argues that it should be much lower (accounting for the risks of human extinction. In practice, it seems to end up being a somewhat arbitrary value picked to reflect the degree of concern society seems to have for the future generations of the author of the CBA.

The second approach comes from the financial economics literature and takes the viewpoint of investors rather than society. It argues that the discount rate should reflect the "**social opportunity cost of capital"**. In a perfect world, it should be equal to the long term real interest rate paid on the loans needed to pay for current investment costs not yet covered by current income.[14] When the private sector is involved, in practice, it is approximated by the private opportunity costs of capital and estimated from the capital asset pricing model (CAPM). The CAPM is commonly used to estimate the required pre-tax rate of return demanded by private investors in their evaluation of projects. This is the

[11] As we'll discuss later, the same omissions largely characterize the design and implementation of guidelines in the of ex-ante assessments of PPPs.

[12] This is no minor issue. This is well illustrated by Fitzgerald (2004). The author looks at 8 Australian projects and finds that using a 8.64% discount rate led to a 9% cost saving as compared to a traditional public procurement while using a 5.7% rate lead to a 6% higher cost with PPP.

[13] H.M. Treasury (2003)

[14] In a basic textbookish theoretical framework, when credit markets are efficient and the price signals are right , the intertemporal rate of marginal substitution of current and future consumption is equalized to the rate of return of capital which is given by the interest rate. In a nutshell, in a perfect world, the two approaches would argue that the interest rate is the right discount factor. But the world is full of distortions and each approach has its advocates.

minimum return rate that can be expected from private sector investments that have similar risk characteristics.[15]

The third approach combines the opportunity cost of capital with the concerns for the social value of time. Conceptually, it is derived from a model of consumer behavior (the Ramsey model). The model leads to a simple formula which sets the discount rate as follows:

$$\mathbf{r = \theta + \eta g}$$

with θ as the pure rate of time preference, η as the absolute value of the elasticity of the marginal utility of consumption/income and g is the expected growth rate of consumption/income.[16]

In the UK, this is the official choice. The assumptions are that long run income growth is 2%, marginal utility of income falls by 1% for every 1% increase in income and the pure rate of time preference is 1.5%. This leads to a discount rate of 3.5%.[17] This approach thus leads to a discount rate which is a combination of an after-tax risk free rate (typically a top rated government bond rate) and of the expected growth rate in per capita consumption weighted by the negative elasticity of marginal utility with respect to consumption—which is often taken to be 1 to reflect a moderate aversion to income inequality**.**

The standard public economics approach raises conceptual issues which are beyond the scope of this paper but some deserve a discussion as they are likely to influence the evaluation of PPPs.[18] Among those is that it is difficult to adapt it to the importance of the opportunity cost of capital when private funding is considered, at least, without some degree of arbitrariness. The main problem of the financial economics view is that it forces the evaluation of public funds matching private funds to be at the private opportunity cost of funds. This view also raises questions with respect to the evolution of this opportunity cost. In the regulation of private utilities for instance, it is common to review average tariffs on a regular basis—usually within 4-5 years, more frequently when unscheduled contract renegotiations take place-- to adjust returns to the evolution of financing conditions. This demands scheduled revisions of the opportunity cost of capital and implies that, ceteris-paribus, there is no reason for ex-ante and ex-post evaluations of projects with private funding to be the same. Moreover, the approach usually ignores the importance of distortions in the capital market. This can be a major issue since the

[15] It's interesting to note that one way of reconciling the first two approaches is simply to argue that the social opportunity cost of capital could be taken as a proxy for the rate of time preference instead of relying on an ad-hoc assessment of this rate.

[16] There are at least 5 ways to assess this elasticity: surveys, constant elasticity demand models, almost ideal demand models, quadratic almost ideal demand models, lifetime consumption models and revealed social values. Most of these models have been assessed for the UK , the US and a few other countries. Most of this research is based on data at least 10-15 years old. The values found vary, mostly, from 1.1 to 1.9.

[17] Zhuang et al (2007) surveyed the estimates for the rate of time preferences and finds values ranging from 0.1 to 3. Harrison (2010) argues that g should range around 1 to 2%. Based on all these estimate, the discount rate measured by the third approach implies a very wide possible range from 1% up to 7%, with an average of 4%. This fits into the range of estimates surrounding the debates between Stern (2007) who argues for 1.4 and his critics Nordhaus (2007) or Weitzman(2007) who argue for 5.5 and 6 respectively.

[18] Spackman (2007, 2010, 2011), in different contexts (general, PPPs and climate change respectively).

evidence suggests that the government's opportunity cost of capital is much lower than indicated by the CAPM.[19] Finally, the main problem of the combined approach is that it compounds the problems of the previous two since it compounds the effects any arbitrary assumption that may be needed to pick the risk free rate and to assess the prospects and valuation of future consumption. [20]

The last dimension of CBA that needs to be highlighted to set up the assessment of PPPs through CBA is the relevance of the costs of public funds. When public projects are financed by taxes rather than user fees, this causes an excess cost which should be included in the costs of the project. For every unit of tax revenue, the added cost is the marginal cost of public funds (MCF). It is typically estimated as a factor *by which* factor should the marginal resource cost of a public project be scaled to take into account any distortion. Once more, theory is divided into two schools of thoughts within the public economics profession. The old tradition (as early as Pigou) argued that this factor is higher than one. The more recent school (which includes Atkinson, Stern or Stiglitz) argues that it could be higher, equal or lower than one, depending on the type of project (not just a simple gift of society by the state as textbooks sometimes assume) relative importance and the revenue effects of the tax among other factors. [21] They are usually estimated via general equilibrium models of the economy. In the end, the value of the MCF depends on the tax considered, current tax rates and the behavior change that result from the tax change. Values for developed economies tend to range from 1.2 to 1.5 and derived mostly from the marginal cost of raising revenue through tax on labor.[22] The main point however is that if this MCF is larger than 1, for whatever reason, it means that the benefits that the project needs to generate are likely to be higher than if the project had be financed with a lump sum tax or a user fee—as in the case of self financed PPPs, for instance. This is why it is quite important to get a sense of this value, even if many practioners tend to see it as a theoretical concept too complex to implement.

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[19] More technically, this is what the debate on the equity risk premium puzzle is all about -i.e. returns on equity are much higher than risk-free rates over long periods of time in contrast to what theory predicts. If the return on equity is a better proxy of the return on capital and hence of the intertemporal rate of substitution than the interest rate, relying on the interest rate (i..e the risk free rate) has intertemporal distributional implications penalizing the current generations, in particular the poor ones. The longer the horizon of the project, the stronger this bias. This is one of the reasons why researchers such as Gollier (2011 and 2012) push more decreasing term structure for discount rates when projects are really long lived. This does not really matter for a road, a thermal power generator for which asset lifes without significant rehabilitation are at most 30 years, but could easily be an important consideration when considering a dam or a nuclear PPP for instance. Gollier (2012) makes a strong case to use a real discount rate between 1% and 2% for time horizons exceeding a century as a ways of accounting of uncerstainty regarding the prospects of future generations. This is probably why these sorts of projects never get built without subsidies. Note that Gollier also argues that because green projects have highly uncertain distant socio-economic benefits, a risk premium should be added to the discount rate. This risk premium should be proportional to the socio-economic beta of these green projects.

[20] This is why both policy units in government and top academics argued that the same rate should be used to discount public and PPP projects, i.e. irrespective of the source of financing for the project. HM Treasury (2003), Engel, Fisher and Galetovic (2007)

[21] For a recent review of our collective knowledge on the topics see Dahlby (2008),

[22] Beaud (2008) finds an MCF around 1.2 for France

4. What PPP implies for CBA: why it boils down to the discount rates [23]

The main purpose of this section to highlight in some more details, and somewhat more analytically, the key drivers of the difficulties encountered in using CBA to PPPs with purely public projects. It also allows the transparency of the drivers of the comparison of the social benefits of public procurement and PPP and in particular, it highlights why the choice of discount rates for both the public and the private options to deliver public projects is so crucial.

Consider a simple project that could be delivered under standard public procurement practice or under a PPP. The duration of the project is typical for infrastructure projects and could range from 10 to 30 years—i.e. we are not dealing with the long run issues raised by climate change. The project could be financed from user fees or from subsidies, but the cost recovery approach is the same under either delivery mode—i.e. there are no obvious differences in the subsidy requirements of the project.

The annual social surplus (*b*) of the project, whether it is implemented through standard public procurement (pub) or PPP is easy to identify and forecast—i.e. we know about systematic risks. We can thus assess its net present value. Over the lifetime of the project, this surplus (*B*) depends on the annual surplus as well as on the discount rate (*r*) used.

$$Bppp = \sum_{t=0}^{T} \frac{b_t^{PPP}}{(1+r^{PPP})^t} \qquad \text{and} \qquad Bpub = \sum_{t=0}^{T} \frac{b_t^{Pub}}{(1+r^{Pub})^t}$$

What stands out in the comparison is the difference in the discount rate (*r*) used for the public sector and for the PPP. They are different to account for the fact that financing costs (under normal circumstances) are lower for the public project than for the PPP. We can however approximate a relationship between the two discount rates. We spell it out as:

$$r^{PPP} = r^{Pub} + risk \qquad \text{with risk} > 0$$

This reflects the idea/assumption that, in this very rough 1st order approximation, the opportunity cost of public funds is lower than the opportunity cost of private funds and that the difference between the two is driven by risk.[24] How different the two opportunity costs are is a recurrent issue in policy debates and this is why it is so important to find a way to highlight where it matters. [25]

A second key dimension that can lead to misunderstandings is the relevance of how the costs are recovered. The revenue of the operator (*Rv*) is the sum of the net present value of revenue it recovers from users (*Sales*) and of subsidies it gets from government (*Sub*). As mentioned earlier, we assume that the revenue recovered from users by the project when procured publicly is the same as for PPP on an annual basis.

[23] A very elegant conceptualization of the debate is offered in a very recent paper by Engel and Galetovic (2012) but also their forthcoming book with R. Fisher (Engel et al. (2013)).
[24] Grout (2002) and Grimsey and Lewis (2004a).
[25] It is not sure that thinking of Greece, Spain or Portugal that this would be a reasonable assumption to work with in the current crisis context. Some companies are able to place bonds at much lower rates than governments.

This is not an unreasonable assumption in this context—think of most transport or utilities services where user fees are collected by both public and private operators.

The subtlety however is that even if the cost recovery strategy looks similar, revenues are discounted at a different rate under the two types of provision—i.e. the public and the private sector can use a different discount rate. In practice, it should not really influence the government decision to invest or not in the project. However it influences the private sector in its decision to bid or not for the right to participate in the PPP.[26] Moreover, what this shows is that private operators simply discount faster their income than the government would because their discount rate is higher and that this may explain why some government analysts who ignore the differences in discount rates (or assume there are none) may have a biased view of the scope for interest of the private sector for the opportunity to enter a PPP—under most standard discount rate assumptions, they overestimate it. More formally, this can be spelled out as follows:

$$\boldsymbol{Rv^{PPP} = Sales^{PPP} + Sub^{PPP} = C}$$

$$\boldsymbol{Rv^{Pub} = Sales^{Pub}} < C$$

and more explicitly,

$$\boldsymbol{Rv^{PPP} = \sum_{t=1}^{T} \frac{rev_t^{PPP}}{(1+r^{PPP})^t}}, \quad \boldsymbol{Sales^{PPP} = \sum_{t=1}^{T} \frac{sales_t^{PPP}}{(1+r^{PPP})^t}} \text{ and } \boldsymbol{Sub^{PPP} = \sum_{t=1}^{T} \frac{sub_t^{PPP}}{(1+r^{Pub})^t}}$$

This is useful to see that subsidies are discounted by PPP operators at their own rate in their evaluation of the decision to participate or not. From the public sector perspective however, their policy decision to support or not the project would have to be based on a NPV of the subsidies discounted at the public sector discount rate. This distortion in the valuation of the business can also be seen in the government valuation of the user fees generated by the PPP, as

$$\boldsymbol{Sales^{Pub} = \sum_{t=1}^{T} \frac{sales_t^{PPP}}{(1+r^{Pub})^t}}$$

A third subject of controversy in assessing the scope for PPP is related to subsidies also but focuses more on its macro implications. For the PPP, total revenue includes an explicit subsidy from the government (Sub). For the public provision, it is implicit but it is also very much part of the financing requirements for the project. This suggests that the fact that the subsidies are implicit or explicit at the project level is irrelevant from a macro fiscal viewpoint. The existence of this subsidy should only be relevant to the extent to which the distortions its financing imposes reduces enough the net social benefits of the project to turn them into a negative figure which implies the project should not be built.

[26] Other concerns such as the likelihood that the government may be willing to enter a renegotiation to change the term of the contracts enough to maintain the initial private rate of return at least at its initial level is another dimension that needs to be considered but that goes well beyond the scope of this note.

With this initial identification of the key variables sorted out, one can now make a more formal comparison of the differences in social valuation of the two approaches to deliver public services. Assuming that the net benefit B is >0, whether the project is procured by the public or the private solution (i.e. the project is not a white elephant or a political whim), the project should be delivered by the private sector if

$$\boldsymbol{Bppp} = \sum_{t=1}^{T} \frac{\boldsymbol{b_t^{PPP}}}{(1+\boldsymbol{r}^{PPP})^t} > \boldsymbol{Bpub} = \sum_{t=1}^{T} \frac{\boldsymbol{b_t^{Pub}}}{(1+\boldsymbol{r}^{Pub})^t} \qquad (*)$$

and by the public sector in the opposite case.

Any difference between the net benefits can be modeled as a markup, *M, centered on 0* to reflect what is known about a specific sector or project. [27] Unless we have good reasons to do so, there is no ex-ante reason to assume that M is always positive or negative. It depends on the specific firm, the sector, the region, the country or the timing of the project for instance.

We can then write:

$$\boldsymbol{b_t^{Pub}} = \boldsymbol{b_t^{PPP}}(1+\boldsymbol{M}) \qquad (**)$$

The effect of this markup on the comparison between the two modes of provision can then easily be tracked down.[28] For instance, Bonnafous (2005) argues convincingly that it would be reasonable to assume that private operators are capable of cutting operating and investment costs which would imply $M<0$. In other words, for a given social benefit, the costs are lower with private provision than with public provision according to Bonnafous.[29] Note that *M* can also be used to reflect the distribution of risk between the public and the private sector to the extent that it may influence costs for instance. Any of these differences fits into the markup story. Within this simple representation, the preferred mode of provision seems to boil down to whether

$$\boldsymbol{Bpub} = \sum_{t=1}^{T} \frac{(1+\boldsymbol{M}).\boldsymbol{b_t^{PPP}}}{(1+\boldsymbol{r}^{Pub})^t} > \text{or} < \boldsymbol{Bppp} = \sum_{t=1}^{T} \frac{\boldsymbol{b_t^{PPP}}}{(1+\boldsymbol{r}^{PPP})^t}$$

If there are good reasons to believe that benefits and/or costs are not different under public or PPP provision, M=0. This assumption is a bit what underlies the Value-for-Money methodology increasingly popular around the world following the UK experience and in spite of its mixed reviews.[30] The intuition is to work with a best practice estimate of the cost of delivering a project if publicly provided. It is very

[27] The alternative to model it as a source of cost to be accounted for in cash flows. The cost effects of risks are assessed by comparing the net benefits of the project with and without the risks. Each risk can be assigned a probability (e.g. based on historical records or a Monte Carlo simulation).

[28] Note that M could also be used to reflect any difference between social and private benefits when the project is a PPP. Indeed, the gross benefits should be unbundled into those that accrue to the private operator and those that accrue to the rest of the economy as well. The r^{PPP} should apply to the private benefits and the r^{Pub} to the non exclusively private benefits. This is the correction that would also have to be included into M.

[29] This is not necessarily so, in particular in a developing country context. Estache and Rossi (2002)

[30] Grimsey and Lewis (2005), p352, 3rd paragraph nicely summarize the nicely summarize the role of the public sector comparator (PSC) in the Value for Money approach as follows: "…, the PSC is based on estimates of full costs, revenue and risks, set out in cash flow terms, discounted at a public sector rate to an NPV." This is the benchmark to which the options retained are compared.

tempting to simply assume that the best practice is the lowest cost and that if the lowest cost is the cost offered by private provision, the benchmark should be set to a common C since the M=0.

If M=0, the ranking of projects boils down to the discount rate and as discussed in the next section, that's what many real world agencies and academic debates surrounding the choices made by these agencies have been focusing on. The fact that the cost saving expected from getting involved with the private sector can be assumed to come in large part from this key financial variable is not totally surprising. Indeed, this is the variable that picks up risk and risk transferring from the public to the private sector is usually expected to be one of the main benefits from PPPs. But if for any reason, it is useful to highlight the differences in operational expenditures (opex) or capital expenditures (capex), the markup approach allows easy simulations of the evolution of the importance of the difference between the different drivers of the discount rates as a function of the differences in opex or capex.

All this seems simple enough but it hides a number of potentially important assumptions that may or may not have an impact on the final analysis but that deserve some ex-ante consideration as they entail a number of potential drivers of the choice between the two modes of provision which may simply be ignored if the CBA is oversimplified. For instance, most real world analysis assume that there is no rent accruing to the private operator because it was eliminated by the auction organized to award the PPP. Many ignore any issue implying possible differences in quality and in operation expenditures for instance, but this can also easily be addressed with a markup factor that does not change much the overall modeling. Most ignore differences in asset life length (t) which are quite common as well.

Then there are a few more damaging assumptions. It is often convenient to focus on consumer surplus and ignore producer surplus. Yet the producer surplus may drive the net social benefit. For instance, ignoring it underestimates total surplus when the providers are national firms and may overestimate it when they are foreign firms. Most importantly maybe, the composition of the surplus and its distribution between operators and consumers is a big part of the drivers of the political economy of PPPs. Just as important for both the political economy and the economics of PPP is the underestimation of the risks of contract renegotiations, a relatively strong assumption in the water and transport sector based on the international experience. Finally, a more general problem in the context of infrastructure PPPs in particular for energy, transport and water is that most of the theoretical background used to justify the choice of a discount rate does not really deal with environmental impact much beyond some estimation of the immediate externalities. Yet, the debate between Nordhaus and Stern suggests that this is also a crucial dimension that is not as simple to insert into CBAs, whether for a PPP or not.

Finally, there is the relevance of the pragmatic fiscal argument to prefer PPP. There is also quite a wide range of discussions on this issue. Bonnafous (2005, 2006, 2010) shows that the interactions between private and social returns are much more complex than often assumed. Indeed, he shows that public and private returns are not necessarily positively correlated. One of the most complex issues is the extent to which subsidies are needed to get the net benefits to be >0—i.e. user fees are not enough. If

subsidies are needed, the marginal cost of public funds should be a part of the story as well. Once more, it could be built as a markup, MCF (<0), to get, $b^{'Pub}$, the benefits inclusive of this correction for distortion which increases costs. The most obvious consequence of the recognition of the existence of MCF is that the net benefit needed from a private option to leave the government indifferent between a public and a private provision can now be lower than what it was when MCF was ignored.

The equation to compare the net benefits (**) would then become:

$$b_t^{'Pub} = b_t^{Pub}.(1+MCF) = b_t^{PPP}.(1+M).(1+MCF)$$

While it is an important factor in deciding whether to take on the project or not, assuming that the private and public operator have the same opportunity to collect user fees, the subsidy requirement is the same. This does not change much to the comparison between public and PPP provision.[31] It simply impacts the cost of the project to society by the extent of the added physical cost (opex or capex) priced at the MCF. The driver of the story is thus M and not MCF in this case—as well as the difference in discount rate of course. Intuitively, of course, it is likely to increase the range of projects for which the private sector becomes attractive. This may be easier to see with an expression that relates the net benefits of the private option as a function of those of the public option, which is just a rewrite of the previous expression:

$$b_t^{ppp} = \frac{b_t^{'Pub}}{(1+M)(1+MCF)} = \frac{b_t^{Pub}(1+MCF)}{(1+M)(1+MCF)} = \frac{b_t^{Pub}}{(1+M)}$$

Note that if M is negative (i.e. the private sector can deliver a given project at a lower capex and opex), the expression shows that it influences the decision in favor PPP just as much as the MCF. It is only if the public sector can cut costs more than the private sector that M (, i.e. if M is positive) can offset MCF.

A final point of interest is a more "visual" sense of the extent to which risk is matters in the decision. This can be done by going back to (*), the comparison boils down to this expression to identify when a PPP is better than public procurement

$$B_{PPP} = \sum_{t=0}^{T} \frac{b_t^{PPP}}{(1+r^{PPP})^t} > B'_{pub} = \sum_{t=0}^{T} \frac{b_t^{'Pub}}{(1+r^{Pub})^t}$$

$$B_{PPP} = \sum_{t=0}^{T} \frac{b_t^{Pub}/(1+M)}{(1+r^{Pub}+risk)^t} \geq \sum_{t=0}^{T} \frac{b_t^{Pub}.(1+MCF)}{(1+r^{Pub})^t}$$

$$\Rightarrow \sum_{t=0}^{T} \frac{b_t^{Pub}}{(1+r^{Pub})^t * (1+risk)^t (1+M)} \geq \sum_{t=1}^{T} \frac{b_t^{Pub}.(1+MCF)}{(1+r^{Pub})^t}$$

$$\Rightarrow \sum_{t=0}^{T} \frac{b_t^{Pub}}{(1+r^{Pub}+risk)^t (1+M)} \geq \sum_{t=1}^{T} \frac{b_t^{Pub}.(1+MCF)}{(1+r^{Pub})^t}$$

$$\Rightarrow \frac{1}{(1+M)} \sum_{t=0}^{T} \frac{b_t^{Pub}}{(1+r^{Pub}+risk)^t} \geq (1+MCF) \sum_{t=1}^{T} \frac{b_t^{Pub}}{(1+r^{Pub})^t}$$

[31] Keeping in mind that this assumes that the alternative to a PPP with a combination of user fee and subsidies is not a public provision with more subsidies and less or no user fees.

$$\Rightarrow \frac{1}{(1+M)(1+MCF))}\sum_{t=0}^{T}\frac{b_t^{Pub}}{(1+r^{Pub}+risk)^t} \geq \sum_{t=1}^{T}\frac{b_t^{Pub}}{(1+r^{Pub})^t}$$

This simply tells us formally the way the various variables interact to impact the rate of return achieved from public provision ignoring distortions in any tax financing by the public sector. It should be quite intuitive for the types of markets for which PPPs are considered. A quick rule of thumb that emerges is that for B'_{ppp} to be larger than B'_{pub}, we need (and keeping in mind the fact that M can be positive and negative, that MCF is modeled as a negative variable and that risk is positive):

(i) the MCF to be high

(ii) the risk level not to be too high

(iii) the operational and capital cost advantage of the private sector to be quite high or vice versa, the opex and capex advantage of the public sector not to be too high (i.e. the value of M)

How large M and what is its sign is one of the main topics covered by the empirical literature on auction theory comparing PPP and public provision of services. This is also what justifies all the efforts to achieve value for money. It is indeed useful when assessing public and private options to have a benchmark for the lowest cost possible for both public and private options. How high is the risk level is covered by a fair amount of research on the cost of capital in regulated industries. The empirical literature on the MCF is less developed, but enough to be able to generate educated guesses for a wide range of countries. A final observation is that there is not much publisher research on the relevance of the interactions between these variables, even if in practice, it is a key elements of the financial and economic models used to support or reject a PPP (when due diligence is followed by the financing agencies or the regulators).

In sum, this little exercise highlights why the debate on the discount rate should continue to enjoy as high a profile in the context of PPP as it does in the context of climate change. It also shows why there has to be a discussion on what are "best practice" costs, similar to the discussion around the assessment of public sector comparators conducted in the context of the assessment of value for money and in the context of assessment of efficiency in the performance of public operators for opex and capex. Some regulators (and many academics) have a solid experience in doing this in the context of tariff revisions or various types of benchmarking exercises but this knowledge does not seem to have crossed over to the PPP units of the world. [32]

5. International practice on the choice of the discount rate in public policy

We have thus established that the risk level associated with PPP built-in the choice of the discount rate is essential to the comparison between public or PPP provision. This section surveys the international experience with respect to the choice of discount rates and its effective use in the comparison between public and private options in the delivery of public services. Conducting the survey turned out to be a less than obvious

[32] See for instance Coelli and Lawrence, ed. (2006) for utilities and OECD (2008) for transport

exercise. If countries did systematically conduct a CBA when assessing a PPP, the information on the discount rate should easily be available. But this is not the case.

A review of their experience of PPP in 20 OECD countries in 2010 by Burger and Hawkesworth (2011) find that 17 claim to assess PPP based on public sector comparators which should generate the information needed (M and r). They also find that only 12 countries claim to conduct CBA for traditional infrastructure projects. Moreover, the survey also shows that only one country claims not to have a formal guideline for the choice of a discount rate for PPPs but 8 recognize that there are none for public projects. For PPPs, 9 out of the 20 OECD countries covered by the survey have a single prescribed rate for all projects (Czech Rep., Denmark, France, Greece, Hungary, Ireland, Korea, Mexico and the UK), 7 spell it out project by project (Australia, Austria, Chile Germany, Netherlands, South Africa and Spain) and 1 sector by sector . It is only in 6 cases that the rates are the same for public and private projects.

While this is useful information, it is disappointing from the viewpoint of a specific assessment of international practice in picking discount rates. The first problem is that Burger and Hawkesworth do not report the information on these discount rates chosen at the national level by governments. This was relatively easily addressed by looking on the web site of the national agencies. But their approach has a second drawback which made the web site search somewhat more complex. Indeed, in some of the most experienced countries in terms of PPP, the policy evaluation is actually conducted also by subnational governments (i.e. provinces or states) and that within countries such as Australia or Canada for instance, there is evidence of heterogeneity across subnational governments. This is what Table 1 shows. Table 1 is a very partial survey of the information relatively easily available on the choice of discount rates in OECD countries with a long commitment to PPP.

What stands out in Table 1 is the diversity of experiences in method and values. The options can be categorized according to a number of margins which reflect the fact that the public and PPP rates could be the same or not, that the rates can be set at different levels (country, sector or project), that the discount rate can follow any of the theoretical methods (and hence focus on risk free rates or risk inclusive rates), that risks can be assessed following a very general model (CAPM), or somewhat micro-managed with very specific guidelines on how to reflect various dimensions of risks in the computation of risk and finally whether the project is net cost or net revenue.

More formally, this can be expressed as followed:

i) $r^{Pub} = r^{PPP}$ *vs.* $r^{Pub} \neq r^{PPP}$
ii) Country *vs.* Sector *vs.* Project specific r
iii) r^{Pub} = government bond rate *vs.* r^{Pub} = Ramsey rate
iv) r^{PPP} = standard WACC (CAPM) *vs.* r^{PPP} = micro-managed WACC (CAPM with set asset beta and/or equity risk premia) *vs.* r^{PPP} = government bond rate + risk
v) r^{Pub} = risk free vs WACC depending on whether net cost or net revenue and r^{PPP} = risk free vs WACC depending on whether net revenue or net cost
vi) risk assessment following the CAPM *vs.* less transparent (often more ad-hoc) risk assessments

From a conceptual viewpoint, in most cases, we know what drives the upper and lower bound of a valuation and we also understand well how a specific choice of one of the key variables is more likely to lead us to a specific ranking of a PPP over a public alternative than another choice. More generally, we know that higher discount rates usually get us to more easily reject an option. This may be the reason why it is not uncommon to see arguments in favor of $r^{Pub} = r^{PPP.}$ This avoids any temptation to manipulate the discount rate to be used for the public option, the private option or both. Clearly, this option raises other issues. Following the Ramsey discounting model has the advantage of increasing the transparency of the choices as it focuses the subjectivity on the rate of time preference. The specific choices identified in Table 1 show which type of biases specific governments have chosen to introduce in their ex-ante evaluations of PPPs. This also gives us a sense of the extent to which governments are more or less ideological in their assessments of PPPs.

Table 1: Choice of discount rate for public projects and PPPs

Country	Rules and value to assess the discount rates	Source
Australia	• The guidance provided by Infrastructure Australia recommends that the future costs of P3 scenarios be discounted at a higher rate than the future costs anticipated from a traditional public sector procurement approach. • Subnational specificities apply different discount rates for net cost projects and net revenue projects; net costs projects are discounted at the risk free rate if government bears all risks and at the WACC if the government bears no risk; for net revenue projects, the opposite holds o Victoria: ▪ A jurisdiction specific long term bond rate for the risk free rate (currently 3%) ▪ For PPP: CAPM with 1.4% to 5.4% real risk premium as of 2012 ▪ specific guidelines for the asset betas varying from .4 to .9 depending on sector o New South Wales: ▪ public sector comparator discounted at the risk free rate (10 year yield on AAA government bonds, ▪ PPP are discounted at the risk free rate + a margin for systematic risk transferred to the private sector	National guidelines for PPP Partnership Victoria web site New South Wales Treasury (2010)
Canada	•Social opportunity cost of capital for country average 7.3% (from a range from 6% to 8.6% depending on risk level in sector) •Different jurisdictions use different procedures: o Ontario: government cost of borrowing o British Columbia: weighted average cost of capital of preferred partner o Both adjust for the value of risk transferred to the private partner although in different ways o Same for public sector comparator and for PPP	Brean and Burgess (2010) Burgess and Jenkins (2010)
New Zealand	• Public projects: 10% • Projects with private parent or exposure to risk: WACC suggested but subject to discussion and demands following specific guidelines on asset beta, equity risk premia (7%), risk free rates (10 years NZ government bonds) which results in different discount rates for building, infrastructure and technology projects	Treasury (2008)
UK	• 3.5% (real) for public projects and PPP since then 2003	UK Treasury web site

From a more quantitative viewpoint, the impression left by Table 1 is that discount rates for public projects can be as low as 3.5% (real) when quite a general formula is used to set it, to whatever the cost of borrowing may be (10% in New Zealand). For private projects, they also start at 3.5% in this sample and can go as high as the market requires (which can easily be 10-15% in many OECD countries). For this sample, the risk premia that drives a wedge between the public and the private discount rate is at most 7%.[33] It is obviously not a totally fair comparison as in countries like the UK, the risk impact is built in the cash flow rather than in the discount rate. But it is an order of magnitude to which differences in costs between the public and the private options can be compared.

Although there is no robust meta-analysis of costs differences between the two delivery mode over another, there is enough anecdotal to get a sense of the difference between the risk premium. For the UK, according to Regan et al. (2011), cost savings based on a comparison of the risk-weighted benchmark for traditional procurement (the public sector comparator) were within the range 10% to 20% which is quite significantly larger than the average risk premium implied by Table 1. For Australia, Fitzgerald (2004) found an average 9% cost saving from PPP for a portfolio of diversified projects. More recently, for Australia as well, Duffield (2008) provides useful additional insights, even if he does not really discuss specific cost differences. He shows that 16.7% more PPP projects were completed within the original expected cost estimate over the full period as compared to projects undertaken under public procurement. The issue of excess cost and time has actually been identified in a larger number of countries by Flyvbjerg et a. (2003). This is one of the reasons why the risk dimension cannot simply be based on what emerges from the financial side of the business. The difference beween ex ante and ex-post evaluation is nicely documented in Blanc-Brude et al. (2006). First they show that the assumption that PPP should be expected to show lower costs ex-ante is too strong. They find for a sample European PPP roads projects that ex-ante cost under PPP were actually higher than in case of traditional procurement coefficient by between 0.21 (%) and 0.38 (%). However, they also find that this ex-ante difference in favor of traditional projects corresponds roughly to ex post cost overruns in traditionally procured public roads.

Finally, Table 1 is also a reminder that the choice of a WACC is not a straightforward matter. In the context of regulated industries is indeed not yet a settled matter. In recent years, the use of the WACC has indeed been criticized—although nobody really has a better option to identify the allowed return for these industries. One of the most vocal critics is Helm (2009) and his suggestion is to refine the use of the cost of capital rather replacing it by an arbitrary value though, as seen in the context of PPP in some of the experiences covered in Table 1. His main argument is that that the cost of capital should be split into two parts, one related to the regulatory asset base ("RAB"), and the other related to future opex and capex. He also suggests a change to indexing the cost of debt year-by-year rather than using a cost of debt which applies to the entire regulatory cycle. The split cost of capital approach would then be one way of estimating the effect of this risk transfer on the cost of capital of an operator. For new projects, the

[33] Assuming that the MCF does not play a role here as discussed earlier.

cost of capital used at the time a PPP has been evaluated should be consistent with the capex and matching capex estimated in the context of a tariff revision in the regulated industry relying on a PPP to expand its asset base. The expected outcome is that the cost of capital for the asset base would be lower since less risky. It seems that this concern for a differentiation of the cost of capital for different types of projects and situations is already on the agenda of some PPP agencies. It is however not explicit but may deserve some more thoughts, in particular in the view of the central role it is taking in many countries in the comparison of public and PPP solutions

6. Concluding Comments

CBA is one of the many fields in economics with a potential for greatness in helping policy decisions and yet still full of limitations in practice. The good news is that we are still learning. We understand better where limitations come from and what we can do about it. In particular, in the context of this paper, we have a good sense of how to set up key parameters to influence the risks of accepting a bad project or rejecting a good one.

It turns out that a lot of the knowledge acquired over the years translates relatively well in the context of the use of CBA to assess PPP. The less good news is that the combinations of the imperfections of the theory still leaves lots of room for subjectivity in a field in which ideology continues to matter more than it needs to.

It is however reasonable to put a positive twist on this subjectivity and hence on ideology. If fiscal pressure is such that PPP makes sense at a macro level, it is possible to decide how the evaluation of a project should weight the risks associated with its public or its private provision through a PPP. The degree of aversion with respect to the risks associated with PPPs and with public provision can, indeed de facto, be managed by the choice of the method adopted to discount the benefits and the costs of the projects. Simply looking at the choice made by a given government gives an idea of the ideological preferences. The transparency of the choices provides enough safeguard to avoid white elephants, no matter what the preferred approach is. Ideally, this transparency in method has to be matched by a transparency in data related to public and PPP projects and that seems to be more difficult for many governments and private operators. Ultimately, this transparency data and method is the real pragmatic touch that allows the minimization of the risks of ideological biases in the evaluation of PPPs…and of public projects.

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