A comparative analysis and evaluation of specialist PPP units' methodologies for conducting value for money appraisals

A COMPARATIVE ANALYSIS AND EVALUATION OF SPECIALIST PPP UNITS' METHODOLOGIES FOR CONDUCTING VALUE FOR MONEY APPRAISALS*

by

Anthony E. Boardman
Sauder School of Business
University of British Columbia
Vancouver, BC, V6R 1L6
Canada

And

Mark Hellowell
School of Social & Political Science
University of Edinburgh
Chrystal Macmillan Building
15a George Square
Edinburgh, EH8 9LD

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Abstract

Governments throughout the world are turning to public-private partnerships (PPPs) as a means of providing new infrastructure. The decision to adopt a PPP over conventional government procurement is usually based on a value for money (VfM) appraisal, but this analysis is conducted differently in different countries. This paper describes the correct way to conduct VfM analysis if the goal is to minimize the present value of the costs to the Treasury and if the goal is to maximize social welfare. It then compares the documented methodologies of nine specialist PPP units. It identifies four ways in which these methodologies depart from either of the correct approaches, and shows how each departure favors the PPP option. Finally, it shows how the UK approach might be augmented to determine the best value to society.

Key Words: Public-Private Partnership, Value for Money, Comparative Evaluation, Discount Rate, Risk, Social Welfare, Optimism Bias

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Introduction

Many governments have used public-private partnerships (PPPs) to provide new public infrastructure across a range of sectors, including healthcare, education, prisons, defence and transport. Between 2004 and 2015, EU governments entered into PPPs with a total capital value of €222 billion (EPEC 2015); and such contracts are also a prominent feature of US investment programs at the state and federal levels (Istrate and Puentes 2011). Governments are drawn to PPPs for many reasons, including their ability to address the so-called "infrastructure deficit" without adding immediately to official measures of public spending.

In the provision of new infrastructure, the term PPP applies to a long-term contract between a government entity and a consortium of private companies. For each new project, the private partners typically establish a special purpose vehicle (SPV) which manages the design, build, financing, operation (sometimes) and maintenance of the facility.[1] Thus, the private sector provides an extensive bundle of services. Another key feature is that the government transfers some of the risks associated with project delivery to the SPV. In return, the consortium receives an income stream from the government and/or service users, contingent on the specified infrastructure and services being available and/or their usage. This paper focuses on new infrastructure, not asset-monetization concessions in which existing infrastructure assets currently owned by government are sold or leased to the private sector. However, the same principles apply to the evaluation of all types of PPPs.

Where government authorities can engage in PPPs, they need to supplement the traditional *investment decision* (whether to undertake the project or not) with a *procurement route decision*. This paper assumes that the project has been approved and focuses on the latter decision, that is, whether to procure the project via a PPP or via traditional government

[1] An SPV is a separate legal entity that is formed specifically to deliver a particular project, and limits the financial liability of the parent companies if unexpected costly events occur or in cases of default.

procurement. There is general acceptance among scholars and practitioners that this decision should be based on which option provides the best 'value for money' (VfM) (Farquharson et al. 2011). In VfM analysis, the present value (PV) of the expected total whole-life costs incurred by government of a PPP is compared to that of an equivalent (but usually hypothetical) project in which financing and management are provided by the public sector. The latter is usually referred to as the 'public sector comparator' (PSC). A PPP is judged to provide VfM if the PV of its expected whole-life cost is lower than that of the PSC.

Many governments have set-up specialist PPP units (henceforth PPP units), either as separate organizations or as dedicated agencies within national finance ministries. Although the roles and functions of these units vary, they usually include the structuring and/or execution of VfM analyses. This paper examines and compares the methodologies employed in eight countries by nine such units that describe their VfM methodologies in public documents.

Many authors have noted that governments prefer PPPs to traditional procurement for various reasons, ideological and political. Boardman, Siemiatycki and Vining (2016) discuss five such reasons. First, governments may believe that the scope of private control is greater than in traditional procurements, and this is likely to lead to greater efficiency in infrastructure supply (Pollitt 2002). Second, PPPs reduce downside risk from government's perspective, which provides political benefits. Indeed, one of the often-stated benefits of a PPP is that project risks are shifted to the party "best able to manage them" and that projects are more likely to come in "on time and on budget". Third, government might want to curry favour with financiers and consultants (Hellowell 2010). Firms that deliver PPP services – including major banks, civil engineering firms and consultants - are often major contributors to political parties, and have significant lobbying power. Fourth, PPPs may circumvent government's borrowing constraints, even in cases where PPPs generate debt-like obligations

(Irwin 2012). Fifth, and related to the previous point, governments can "rent to own", that is, provide infrastructure now but defer the costs until the future. Thus, governments have incentives to adopt appraisal methodologies that skew the outcome in favor of PPPs.

The following sections draw on finance theory and cost-benefit analysis theory to show how VfM analysis *should* be conducted in order to achieve specific government goals. We first show how to conduct the analysis if the goal is to maximize the value to government, that is, to minimise the PV of the (net) financial cost to the Ministry of Finance, Treasury or the Exchequer (henceforth the Treasury). Then, we show how to conduct the analysis if the goal is to maximize the value to society, that is, to maximise allocative efficiency or the PV of the net social benefits. The correct way to perform VfM varies with these goals. Next, we describe and compare VfM methodologies among PPP units set up by governments in nine jurisdictions. Presuming that the goal is to maximize value to the Treasury, we identify four important modifications to the correct approach, each of which is used in at least one jurisdiction, and all of which favor the PPP over the PSC. Finally, we show how the UK method might be adjusted to correctly determine which option will maximize the value to society.

Value for Money Analysis from the Treasury's Perspective

In private-sector investment decision-making, the net financial cash flows and returns to an investment are usually positive. For new infrastructure projects, however, the cash flows and financial returns are usually negative *from the government's perspective*. Instead of trying to maximize negative cash flows (i.e. make them less negative), it is more intuitively appealing to conduct the analysis in terms of minimizing costs. The UK's National Audit Office (2013, p. 23), for example, has argued: "it seems reasonable that any decision about whether to use [a PPP] for a given project ought to consider whether [this route] is the cheapest way to the

exchequer of doing that project." Consistent with this statement, this section assumes that the goal of VfM analysis is to minimize the PV of the whole-life costs to the Treasury. Given this goal, and drawing on standard capital budgeting theory, the annual costs to the government of each option should be discounted at the risk-free rate adjusted for the systematic risk *to government* of that alternative (Berk and DeMarzo 2013). The rationale for this approach is provided in the sub-section below on adjusting for risk.

Estimating (Net) Financial Costs

There is broad agreement about how the government's cash costs should be estimated before taking account of risk and making adjustments for other factors (discussed below). For both the PPP and PSC, the costs are initially estimated with reference to similar recent projects, and these estimates may, in some cases, be adjusted during the procurement stage as bids are received and PPP units obtain better information about market prices for various activities.[2]

Prior to discounting, costs are estimated for the year in which they are expected to occur. The annual costs to the Treasury of the PPP vary depending on its "form".[3] In the most common situation, the government's costs are specified contractually in advance. We refer to this form of PPP as 'availability-based' because the payments are made to the SPV *as, when, and to the extent that* the specified assets and services are made available to government (and service users). In the less common situation the government pays the SPV a 'shadow toll' based on usage. We refer to this form of PPP as 'usage-based' because payments depend on the use of assets. In either case, and for the PSC, the estimated annual costs are subsequently adjusted for transaction costs.

[2] In some countries, such as France and the UK, the analysis is conducted prior to the procurement process and is not repeated thereafter.

[3] The *SPV's* net cash flows may vary with some characteristics of the SPV, such as the SPV's debt structure and its cost of capital, which may change over time. However, *from the Treasury's financial perspective*, the only relevant costs for VfM analysis are those that it incurs.

These costs are also adjusted for financial inflows to government. For example, there may be adjustments for corporation tax, VAT and for user fees received by government, although government rarely (if ever) receives user fees in the situations we consider. In any case, although we refer to costs, strictly speaking they are *net* costs.

Adjusting for Risk

The actual costs of each option are unknown *ex ante* and, therefore, need to be adjusted for risk. Usually, analysts identify different outcomes (or scenarios) for the PPP and PSC and attach probabilities to each outcome, resulting in a distribution of the PVs of the costs under each alternative. The PVs used in VfM analyses are the means of these distributions. By definition, total risk (or just risk) is the variance of this distribution.

There are two distinct components of total risk: systematic and non-systematic risk. Non-systematic risk applies to a specific project and can be eliminated through diversification. Governments engage in thousands of different programs. The net benefits or returns to a particular project are positively correlated with some projects and negatively correlated with others. By spreading the risk over a broad portfolio of different projects, governments eliminate non-systematic risk. Thus, the risk of any one project can and should be ignored for the purposes of determining the discount rate.

In contrast, systematic risk applies in some degree to all assets in a portfolio. It depends on the covariance between a project's net benefits (here, cash flows) and financial returns to the market overall. As systematic risk applies to all holdings in a portfolio of assets, it cannot be reduced by diversification and the discount rate of each option should be adjusted for the systematic risk *for that option*. From the Treasury's perspective, the systematic risk of an option depends on the correlation between the financial returns to Treasury associated

with that option and the return on a perfectly diversified portfolio. This correlation will vary according to the type of PPP.

For an availability-based PPP, government's costs are independent of market conditions as they are based only on the SPV's performance in ensuring availability of the assets and delivering services at agreed standards. Thus, the financial costs and the returns to government are uncorrelated with market returns. Consequently, in this case, the Treasury bears no systematic risk and the costs should be discounted at the risk-free rate.

For a usage-based PPP, the correlation between the financial returns to the Treasury and market returns is likely to be *negative* for projects that provide normal goods (for which demand rises as income increases). Most road infrastructure projects with no tolls, for example, are normal goods. As economic conditions (and market returns) increase, traffic flows are likely to increase. As the usage-based payments to a PPP increase, the Treasury's costs will increase and its financial returns will decrease. Therefore, the systematic risk of this PPP from the Treasury's perspective is *negative* and its cash costs should be discounted at a rate *lower* than the risk-free rate. Consequently, the PV of the costs will be larger than if the costs were discounted at the risk-free rate and the procurement method will be estimated to provide less VfM and is less likely to be selected, holding all else constant. This result may appear counter-intuitive because the likelihood of adopting this alternative *decreases* as the systematic risk decreases. However, the usage-based payments made by the Treasury are risky in the sense that they are positively correlated with economic conditions and, consistent with intuition, it would want to reduce the likelihood of pursuing this option.

In contrast, some social infrastructure projects, like hospitals, prisons and perhaps some schools, may be inferior goods and have fewer patients, prisoners or students as aggregate income increases. If government makes usage-based payments for a PPP that provides an inferior good, the economy improves and market returns increase, its cash costs

would decrease, and its financial returns would *increase*. Therefore, the systematic risk is *positive* and the PPP cash costs should be discounted at a *higher* rate than the risk-free rate. This result is also consistent with intuition: the Treasury's usage-based payments are not risky in the sense that they are negatively correlated with economic conditions and, consistent with intuition, the Treasury would want to increase the likelihood of pursuing this option.

Now consider the cash costs paid by government for a traditional procurement, represented by the PSC. The government may not enter a fixed-price construction contract and it would be unusual to have long-term, fixed-price contracts for operations, maintenance and related activities. These costs depend on labor wages and equipment costs, which are likely to be positively correlated with market returns (i.e. they will increase as economic conditions improve). Usage will also affect costs and financial returns. For a normal good, demand will increase and the costs of inputs will increase as general economic conditions improve. Consequently, there is likely to be a positive correlation between the annual operating costs and market returns, and a negative correlation between government's financial returns and market returns. Therefore, these PSC's cash costs should be discounted at a *lower* rate than the risk-free rate. For an inferior good, input prices may increase but usage of the facility and the quantity of some inputs may decrease as economic conditions improve. The net impact on financial returns is ambiguous but is not likely to be large. Therefore, these costs should be discounted at a rate close to the risk-free rate, possibly slightly higher. These results are summarised in Table 1.

Insert Table 1 about here

It is instructive to compare the correct discount rates for different procurement options. Comparing the columns in Table 1, for a usage-based PPP that provides a normal good, the Treasury's costs should be discounted at a similar or lower rate than that used to discount the costs of a PSC. This result differs from Grout (2003) who argues that a higher

rate should be applied to costs of a PPP for a normal good.[4] In contrast, the costs to Treasury of a usage-based PPP that provides an inferior good should be discounted at a higher rate than the costs of a PSC. For an availability-based PPP that provides a normal good, the Treasury's costs of a PPP should be discounted at the same or a higher rate than that used to discount the costs of a PSC. In contrast, the costs of an availability-based PPP that provides an inferior good should be discounted at a lower rate than the costs of a PSC.

Adjusting the Estimated Costs for Optimism Bias

The actual costs of a project may be higher or lower than expected. If the costs are estimated objectively, then over a large number of projects there should be little deviation between the average actual cost and the average expected costs, that is, the estimates should be unbiased. Sometimes, however, there is consistent under-estimation of costs, which is a type of optimism bias (Krause, Lewis and Douglas 2013). Flyvbjerg, Bruzelius and Rothengatter (2003) and others have found that the cost of government infrastructure projects - especially large projects - are routinely over-estimated. This evidence provides a rationale for adjusting the expected costs upwards ex ante, especially the costs of the PSC.

Optimism bias is an estimation issue, not one of risk, and the two issues should be treated separately. Rather than adjusting costs by an arbitrary amount, a better way to handle this problem is for analysts to improve their cost estimation abilities in order to obtain an unbiased estimate of the expected cost of each alternative. Analysts should specify the possible outcomes carefully and attach realistic probabilities, based on contemporary

[4] Grout (2003) incorrectly defines systematic risk in terms of the covariance between revenues or costs and aggregate income rather than in terms of the covariance between net benefits and aggregate income or between the *returns* to the investment (procurement option) and the *returns (i.e., growth)* in aggregate income. Also, he focuses on the operating period and ignores construction risks.

evidence. Outcomes should reflect the possibility of failure, not just cost over-runs, but bankruptcy and default. The probabilities of these events should be estimated accurately.

Value for Money Analysis from Society's Perspective

The key normative criterion for most government decision-making is allocative efficiency. PPPs relate to such areas as custodial services, defence, education, healthcare, and transport that are subject to market failures. Government intervention is commonly justified on the grounds that it can address market failures to the benefit of society as a whole (i.e. enhancing social welfare or, more narrowly, allocative efficiency). Consistent with this, PPP units generally acknowledge that the *investment* decision (i.e. whether to engage in a particular project) should be made at least in part on the basis of allocative efficiency (see, for example, Infrastructure Australia 2008a, p. 17). It seems reasonable that the procurement route decision should also be made on this basis.

The VfM to society as a whole can be estimated by discounting the annual net social benefits (i.e. social benefits minus social costs) associated with each procurement option at the social discount rate (SDR), which reflects the *social* opportunity cost of capital, not the government's cost of borrowing.[5] The SDR is the relevant discount rate because social welfare concerns the utility that individuals (or a representative individual) obtain from consumption, and is the rate at which individuals are willing to trade-off consumption now for consumption in the future.

Adjusting for Risk

In theory, the correct way to handle risk in government policy evaluation is to convert risky outcomes to their certainty equivalents and then discount the certainty equivalents at the risk-

[5] See, for example, Boardman et al. (2010). Note, however, that social costs are opportunity costs, not financial costs.

free social discount rate (Gollier 2012).[6] However, computing certainty equivalents is rarely practical. We propose an alternative approach that is similar to the standard approach to capital budgeting discussed above, except that it focuses on net social benefits (and social returns), not net financial benefits (or financial returns). Again one must consider non-systematic and systematic risk, but *from the perspective of society as a whole*, not the Treasury. Since the government and other agents in society provide a wide range of services whose returns are not highly correlated, non-systematic risk is eliminated by diversification and can be ignored (Arrow and Lind 1970). Systematic risk from society's perspective, which we refer to as *social systematic risk*, depends on the correlation between the net social benefits of an option and aggregate net social benefits (i.e. consumption) or, equivalently, on the correlation between the social returns of an option and aggregate social returns (i.e. the growth in consumption).[7] The SDR should be adjusted up when the net social returns to a project procured in a particular way are positively correlated with growth in aggregate consumption (or general economic growth) and adjusted down when the net social returns are negatively correlated with growth in aggregate consumption.

The net social returns for a new infrastructure project are likely to depend more on the nature of the project itself than on how it is procured and, therefore, *the net social benefits of a PPP and a PSC should generally be discounted at a similar rate*. Suppose the economy is growing. For either a normal good or an inferior good, the social (opportunity) cost of the resources employed in a project will increase, which will reduce the net social returns. For an inferior good the social benefits will also decline. Therefore, for an inferior good, the social systematic risk is likely to be negative, whether procured as a PPP or a PSC, and the discount

[6] Suppose one faces a risky decision and one is indifferent between that decision and receiving (or paying) an amount CE with certainty. CE is the certainty equivalent of the risky decision.
[7] Hansen and Lipow (2013) incorrectly propose the adjustment should be based on the correlation between *each cost or benefit* and consumption instead of the correlation between *the net social benefits* and consumption.

rate should be lower than the SDR. For a normal good, however, the use of the infrastructure will increase, and the social benefits will therefore rise (as will the social costs). On balance, the net social returns are probably (slightly) positively correlated with consumption growth, and the project will have positive social systematic risk, whether procured as a PPP or a PSC. Thus, the net social benefits of each option should be discounted at a rate (slightly) higher than the SDR.

Comparison of Value for Money Methods Used by PPP Units

This section describes and compares the VfM appraisal methods used in nine jurisdictions, namely: Australia, British Columbia (BC) in Canada, France, Germany, Ireland, the Netherlands, Ontario in Canada, South Africa, and the UK.[8] In Australia, BC and Ontario, the appraisal methods are designed and implemented by statutory bodies (namely, Infrastructure Australia, Partnerships BC and Infrastructure Ontario) that are arm's length from government departments and are staffed by professional specialists (Rachwalski and Ross 2010). The roles of these agencies vary, but they usually have a mandate to promote PPPs and are, therefore, sometimes referred to as PPP 'supporting units' (Van den Hurk et al. 2015). In contrast, in Ireland, France, Germany, South Africa, the Netherlands and the UK, dedicated agencies are within national finance ministries - although they, too, are often staffed by individuals with private sector origins and expertise (OECD 2010).

Table 2 provides an overview of the key characteristics of the VfM appraisal methodologies adopted in each jurisdiction. Clearly, there is no agreement among jurisdictions about how VfM analysis should be conducted. Eight of the nine jurisdictions

[8] The discussion of the UK approach focuses on its operation until December 2012, when the "quantitative tool" was withdrawn by the UK Treasury. The UK Treasury has stated that it intends to introduce updated VfM guidance while retaining a similar theoretical framework (National Audit Office 2013), but this had not been published as at this writing.

(i.e., all but the UK) initially discount the annual costs to government of both procurement options at a financial discount rate (i.e., based on the government's borrowing rate or the SPV's cost of financing, that is, the project's Weighted Average Cost of Capital, WACC). Then they adjust the annual cash costs or the resultant PVs for the risks associated with that option. These actions suggest that these jurisdictions aim to determine which option provides the most VfM *to the Treasury*. In contrast, the UK discounts at the SDR and does not adjust the costs or the PV of the costs for risk. Thus, it appears that the UK, in contrast to other jurisdictions, attempts to determine which option provides the most VfM *to society*. The UK also differs from the other because it explicitly adjusts the estimated costs for optimism bias.

Insert Table 2 about here

The Choice of Discount Rate by PPP Units

France, Germany, Ireland, Ontario and South Africa use a discount rate which is referenced to the interest rate on the bonds issued by the government of the jurisdiction (Central PPP Unit 2006, Infrastructure Ontario 2007, National Treasury (South Africa) 2004). Usually, the rate is that on bonds with the same term to maturity as the project itself.[9] This is considered to be a risk-free rate. Infrastructure Ontario (2007, p. 15) explains its use of this rate on the grounds that the government can borrow "virtually unlimited" amounts of money at that rate.

In contrast, the Netherlands and British Columbia determine the systematic risk of a project *from the perspective of the special purpose vehicle (SPV)*. They use the capital asset pricing model to estimate the WACC of the SPV. The approach in British Columbia varies depending on the stage of procurement at which the analysis takes place. Before tendering commences, its approach is the same as that of the Netherlands (Ministry of Finance

[9] South Africa may add a risk premium to this rate when "it is not possible to reflect the effect of all risks in cash flow estimates" (National Treasury (South Africa) 2004, p. 22).

(Netherlands) 2013; Partnerships BC 2011). However, once a preferred bidder is appointed, the bidder's cost of capital is used. This rate is used to discount the costs of both alternatives for a particular project. Partnerships BC (2011, p. 26) rationalizes this approach by emphasizing the importance of "correctly formulating the problem facing government as an asset portfolio investment problem" – a rationale that we examine in detail in sections below.

In Australia, for projects with no systematic risk, the predicted costs of both the PPP and the PSC are discounted at the risk-free rate. However, where cash flows are exposed to systematic risk, a risk premium is added to the discount rate applied to the PPP. In Infrastructure Australia's (2008b) methodology, this premium is always positive and can vary from 1.8 percent for availability-based projects, such as hospital facilities, to 3.0 percent for water, transport and energy projects, and 5.4 percent for telecommunications, media and technology projects, in which usage-based payments (and user fees), which are likely to be affected by economic conditions, provide a greater component of the revenue stream.

Adjusting Financial Costs for Risk Transferred

Eight of the jurisdictions adjust the annual costs or the PV of the costs for the risk transferred to the PPP. In an illustrative example, Infrastructure Australia (2008a, p. 141) values the risks transferred to the SPV as 25 percent of the cost of the risk-adjusted PSC (36% of the cost of the raw PSC). Infrastructure Ontario adjusts the costs of both options, but makes a far greater adjustment on average to the total cash costs of the PSC (58 percent) than to those of the PPP (11 percent) (Siemiatycki and Farooqi 2012).

Adjusting for Optimism Bias

In the UK, larger adjustments for optimism bias are applied to the PSC because it is assumed that the risk transfer mechanisms relating to the latter serve to limit the public sector's

exposure to cost increases attributable to optimism bias (HM Treasury 2011). These adjustments can be large. For example, in a recent hospital PPP, adjustments for optimism bias increased the estimated capital (construction) and operating costs of the PSC by 19 percent and 16 percent, respectively (The Royal Liverpool and Broadgreen University Hospital NHS Trust 2010).

Amendments that Favor the PPP over the PSC

Because different jurisdictions use different appraisal methods, they may reach different conclusions about whether the PPP or the PSC procurement option provides the best VfM. Empirical evidence, however, shows that the overwhelming majority of VfM analyses undertaken find in favor of the PPP (Winch and Onishi 2012). In light of the different methods being used in the different jurisdictions, the consistency in outcomes is surprising. This section illustrates how the methodologies used by PPP agencies tend to favor the PPP over the PSC and discusses how they differ from the theoretically correct method assuming the goal is to determine which option has the best VfM from the Treasury's perspective.

This illustration assumes that the government is deciding whether to procure new infrastructure that provides a good that is neither a normal good nor an inferior good. It will be procured as an availability-based PPP or a PSC. If procured by a PPP, it would be 100% financed by the private sector. It ignores transaction costs and assumes there are no positive financial inflows. If the project were undertaken as a PSC, it assumes government would incur construction (including design) costs of $115 million per year for three years and would then pay annual operations (including maintenance) costs of $24 million per year for the life of the PPP contract (30 years). In contrast, suppose the PPP would be more efficient and its annual construction and operations costs would be only 90 percent of those of the PSC. Assuming that the SPV extracts no rents, its real WACC is 6 percent and that it receives

compensation for construction as an annuity over the 30-year life of the contract, government would pay $23.94 million per year for 30 years for construction. Suppose, further, government would pay the SPV $21.6 million per year for operations.[10]

In this situation, according to Table 1, the annual cash costs of both procurement methods should be discounted at close to the risk free rate, which we assume is 2.5 percent (real). The PV of the costs to the Treasury of the PSC and the PPP would be $801 million and $891 million, respectively, as shown in Columns (1) and (2) of Table 3. Thus, *the PSC would provide $90 million more VfM than the PPP*. Two points are worth making. First, this VfM analysis is conducted from the perspective of Treasury, which does not consider the risks borne by taxpayers or other costs (or benefits) borne by society as a whole; it considers only its own financial position. Second, the main reason the PV of the cost of the PSC is less than that of the PPP is because the Treasury's financing cost is lower than the SPV's financing cost. In order to reach the opposite conclusion—that PPPs provide more VfM than PSCs from Treasury's perspective, PPP units employ some modifications, which we now discuss.

Insert Table 3 about here

The first modification concerns the discount rate. PPP units in Australia, British Columbia and the Netherlands adjust the discount rate upward to reflect the systematic risk borne by the SPV. From the Treasury's perspective, most of the costs of the PSC are concentrated in the early years of the project, in which construction is paid for as the work proceeds, while the costs of the PPP are amortised over 25-30 years. Hence, discounting reduces the costs of a PPP more than those of the PSC, and a higher rate favours the former over the latter. The results are illustrated in Columns (3) and (4) in Table 3, which show that

[10] These illustrative costs are loosely based on Partnerships BC's analysis of the new Abbotsford Hospital (Auditor General of British Columbia 2005).

if the costs of both alternatives are discounted at a real rate of 6%, then the PPP is found to provide VfM of $79 million.[11]

The second modification relates to discounting the costs paid to the SPV at a higher rate than the PSC's costs. Infrastructure Australia (2008a, p. 3) recommends this on the grounds that more systematic risk is transferred to the PPP. Suppose for illustrative purposes that a PPP unit discounts the PSC's costs at the risk-free rate as in column (1) but discounts the amounts paid to the SPV at the SPV's WACC as in column (4); then, the VfM of the PPP rises to $269 ($801-$532) million. It *is* appropriate to use different discount rates for different procurement methods if the systematic risk *varies from the perspective of the Treasury*. However, discounting the SPV's costs at a higher rate than the PSCs costs will, as shown in Table 1, be incorrect for an availability-based PPP project that provides an inferior good or for a usage-based project that provides a normal good.

The third modification relates to larger positive adjustments to the PSC's costs or the PV of these costs than to the costs of the SPV for the transfer of risk to the SPV. All PPP units except the UK adopt this approach. Assume, as is representative of practice in Ontario and illustrated in Columns (5) and (6), that the cost of the PSC is adjusted upwards by 58 percent ($461 million) and the cost of the SPV is adjusted upwards by 11 percent ($97 million). Now the PPP provides VfM of $274 million. Siemiatycki and Farooqi (2012) argue that such risk transfer is critical in tipping the balance in favour of PPPs in Ontario.

A key question is whether such risk transfer provides benefits to the Treasury. If costs are discounted as in Table 1, there is *no financial reason* to make any further adjustments for risk. Doing so would be equivalent to taking out insurance on each PPP project. In principle,

[11] Several authors argue that the cost of government's funds should reflect the risk of default, which is borne by taxpayers (Boyer, Gravel and Mokbel 2013; Lucas 2014). However, Treasury's costs depend on the rate it has to pay for funds. Risks borne by taxpayers or any other segment in society do not directly affect Treasury's decision-making if its goal is to minimize its costs.

to minimise the Treasury's costs, governments should self-insure, just as most individuals do when they buy a particular stock for their portfolio.

The fourth modification relates to adjustments for optimism bias. None of the jurisdictions that use a financial discount rate explicitly do this. However, Column (7) illustrates the impact of assuming that the PSC costs are underestimated by 15 percent. Now the PPP would provide VfM of $23 million. The current UK optimism bias adjustment is based on a study by a technical advisory firm within the PPP industry (Mott MacDonald 2002) which has been the subject of extensive criticism. For example, Pollock, Price and Player (2007) raised concerns about the non-comparability of the projects included in the study, the small sample size, and numerous sources of measurement bias. If optimism bias adjustments are applied, it is clearly important to base them on objective, high quality and, as far as possible, contemporary data. If this is not the case, the legitimacy of the adjustment is in question.

This illustrative example highlights some important ways in which jurisdictions modify their VfM analyses, all of which advantage PPPs over PSCs.[12] Some jurisdictions employ a combination of these modifications. For example, BC, the Netherlands and Australia, use risk-adjusted discount rates *and* make further adjustments to the costs for risk, both of which favour the PPP over the PSC; and in the latter case, a higher discount rate is sometimes applied to the PPP, such that the advantage is compounded.

The UK Method as a Way of Determining Value from Society's Perspective

[12] Another way that PPP units may improperly advantage PPPs is by incorrectly estimating transaction costs. Vining, Boardman and Poschmann (2005) argue that the government's transaction costs are generally higher for PPPs than for PSCs, but PPP unit VfMs often assume they are equal.

As discussed earlier, one way to calculate value from society's perspective is to discount the benefits and the (opportunity) costs at the SDR adjusted for social systematic risk if necessary. An alternative, equivalent approach is to consider the impacts on users (consumers), producers (including consultants and bankers), employees and government (Treasury). More specifically, analysts could use cost-benefit analysis to estimate consumers' surplus, producers' surplus, employees' surplus and government surplus, computed by discounting the relevant impacts at the SDR (Boardman et al. 2010). By definition, the UK approach to VfM, which discounts the Treasury's net financial costs at the SDR, provides an estimate of (minus) government surplus. This approach would provide an estimate of the difference in the social value between the procurement options if producer, consumer and employee surpluses did not differ.

However, producer surplus is likely to be higher for a PPP than for a PSC. Failure to include it in the analysis, therefore, is likely to bias VfM analysis towards the PSC from a social welfare perspective. Perhaps for this reason the UK finds it necessary to make such large adjustments for optimism bias. By definition, producer surplus equals the difference between the amount that a supplier or factor of production receives for a unit supplied and the marginal cost of supplying that unit (integrated over the units supplied). It is a form of Ricardian rent and is analogous to what are often called 'supernormal profits' or 'excess returns' (Hellowell and Vecchi 2012). There has been little research on the magnitude of producer surplus in PPPs, partially because estimation is difficult. If all of relevant markets were perfectly competitive then produce surplus would be zero. However, markets for the provision of PPPs are generally oligopolistic due to high barriers to entry (Colla et al. 2015) and, therefore, some producers may generate considerable rents. Producer surplus that accrues to consultants and financiers should also be included in the estimation of benefits.

It is important, however, to take account of only benefits (or costs) to producers with *standing* – those considered to be part of the *defined society* whose welfare is to be included in estimating benefits. Some goods and services may be supplied by companies based outside of the relevant (typically national) geographical boundary. If so, then no weight should be given to benefits (or costs) accruing to these companies.

The PPP and PSC may also differ in terms of consumer surplus. For example, the cut-and-cover technology used on the underground part of the Canada Line in Vancouver made it possible to build the high speed rail stations closer to the surface. Relative to the PSC, access by transit users was easier, but it was far more disruptive to traffic during the construction period and had a significant adverse impact on retailers in the surrounding area. Some consumer impacts are sometimes acknowledged in procurement route decisions outside of the quantitative analysis. For example, Partnerships BC recommended a PPP for the Sea-to-Sky Highway, even though it cost was more than for the PSC, on the grounds that it contained improvements that would result in additional time savings and reduced accident risks. It would be more transparent to estimate such consumer surplus benefits as part of the analysis.

Conclusion

This paper describes how VfM analysis should be conducted if the goal is to determine the best value to the Treasury and how it should be conducted if the goal is to determine the best value to society. It explains how to properly adjust for risk under either goal, correcting prescriptions in the existing literature. Specifically, to determine the best VfM from the Treasury's perspective, the costs of each alternative should be discounted at the risk-free rate adjusted for systematic risk *from the perspective of the Treasury*. This paper explains how this adjustment should vary according to whether the infrastructure provides a normal good or an inferior good and according to the provision option and type (whether the PPP is

availability based or usage based). To determine the best value from society's perspective the social benefits and the opportunity costs should be discounted at the SDR adjusted for *social systematic risk*.

This paper then reviews and compares the procurement route appraisal methodologies applied in a variety of jurisdictions with documented VfM procedures. It shows that even if a PPP provides and operates infrastructure with greater technical efficiently than the PSC, VfM analysis conducted correctly from Treasury's purely financial perspective will generally conclude that the PSC provides greater VfM. This outcome conflicts with many ideological and political goals of governments. However, perhaps in order to achieve the "right answer", PPP units modify their VfM procedures in various ways. We focus on four such modifications and illustrate how each one favors the PPP, thus leading to incorrect decisions about the most appropriate procurement method. The financial cost to governments many run into billions of dollars.

Even if VfM analysis is conducted correctly from the Treasury's financial perspective, this approach may conflict with the normative goals of government, specifically maximizing social welfare or allocative efficiency. One way to take account of this goal is to use cost-benefit analysis to calculate and sum consumer, producer, employee and government surpluses, using the SDR to calculating PVs. The UK's VfM methodology estimates government surplus. However, if the proper goal of government is to determine which procurement route offers best value to society, more attention needs to be paid in the appraisal process to the other surpluses, and to producer surplus in particular.

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Table 1

Appropriate Discount Rates Assuming the Goal is to Minimize the PV of the Cost to the Treasury

	Availability-based PPP	Usage-based PPP	PSC
Normal Good	Discount the SPV's annual cash costs at the risk-free rate	Discount the SPV's annual cash costs at a lower rate than the risk-free rate	Discount the PSC's fixed annual cash costs at the risk-free rate and others at a lower rate
Inferior Good	Discount the SPV's annual cash costs at the risk-free rate	Discount the SPV's annual cash costs at a higher rate than the risk-free rate	Discount the PSC's fixed annual costs at the risk-free rate and others at a slightly higher rate.

Table 2

The Major Differences in VfM Appraisal Practices in Jurisdictions with Institutionalized PPP Programs

Jurisdiction	Discount rate	Adjust the cash costs or PVs for risks transferred	Adjust the PSC's cash costs for optimism bias
Australia	Each procurement method's risk-free rate, adjusted for systematic risk	Yes	No
British Columbia, Canada	PPP's WACC	Yes	No
France	Government borrowing rate	Yes	No
Germany	Government borrowing rate	Yes	No
Ireland	Government borrowing rate	Yes	No
Netherlands	PPP's WACC	Yes	No
Ontario, Canada	Government borrowing rate	Yes	No
South Africa	Government borrowing rate	Yes	No
UK	Social discount rate	No	Yes

Table 3

Illustrative Impacts of Adjustments to VfM Analysis by Specialist PPP Units that Favor PPPs

	Costs of PSC Discounted at the Risk-Free Rate (1)	Costs of SPV Discounted at the Risk-Fee Rate (2)	Costs of PSC Discounted at the PPP's WACC (3)	Costs of SPV Discounted at the SPV's WACC (4)	Costs of the PSC Discounted at the Risk-Free Rate and Adjusted for Risks Transferred (5)	Costs of the PPP Discounted at the Risk-Free Rate and Adjusted for Risks Transferred (6)	Costs of the PSC Discounted at the Risk-Free Rate and Adjusted for Optimism Bias (7)
Construction Costs							
Construction Costs (Yrs 1-3)	115	104	115		115		132
PV (Construction Costs)	328	465	307	277	328	465	378
Operation Costs							
Operating Costs (Yrs. 4-33)	24	22	24	22	24	22	28
PV (Operating Costs)	466	420	298	250	466	420	536
PV (Total Costs excluding risk transfer)	795	885	605	526	795	885	914
VfM of PPP (excluding risk transfer)		**-90**		**79**		**-90**	**29**
Value of Risk Transferred to SPV		0		0	461	97	0
VfM of PPP		**-90**		**79**		**274**	**29**