International Transport Forum

Private Sector Participation in Infrastructure: Can the Price of Risk Transfer be Efficient?

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Abstract

There is a drive towards delivering and operating public infrastructure through public-private partnerships as opposed to traditional approaches. The assessment of the value for money achieved by the two alternative approaches rests on both the cost of financing, and the efficiency in delivery and operation. This paper focuses on the cost of financing, and in particular the cost associated with transferring risk from the public to private sphere. If capital markets are efficient and complete, the cost of private and public financing should be the same, with the relative delivery and operational efficiency remaining as the primary determinant of value for money. However, evidence suggests the risk transfer to a public-private partnership entails an inefficient risk pricing premium. We argue that a high price for public-private partnerships results from large risk transfers, risk treatment within the private sector, and uncertainty around the past and future performance of PPP consortiums. The corollary of the finding is that the efficiency gains from a PPP need to be much higher than previously understood to deliver better value for money than under a traditional approach.

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Introduction

Many countries have identified substantial infrastructure investment needs, particularly in the transport sector. Initiatives to increase the volume of available finance, including the promotion of private participation in infrastructure through Public-Private Partnerships (PPPs)[1], have been advanced to address these needs. Transport infrastructure represented a substantial part of the total PPP transaction volume in recent years (EIB 2014). Against this trend, the debate on the relative cost of public and private finance is still not settled (Green et al. 2015).

Various countries attempt to determine when a PPP would be expected to offer a better value for money than traditional infrastructure procurement (World Bank 2013). The relative cost of public capital versus the cost of private capital is one of the essential components of these assessments.

At face value, it appears that private financing always requires a higher cost of capital than public borrowing, which would make a value for money comparison difficult. However, this is at least partly due to the way that risks and their costs are expressed in each case (Helm 2010, 19; Klein 1997). For publicly financed investments, borrowing is at a low, risk-free rate ex ante, yet the taxpayer implicitly bears much of the risk (covering cost overruns ex post). For the private sector, there is no "ex post taxpayer" option, so the risk must be expressed ex ante. That is, since the true risks and costs of government borrowing are partly obscured, they cannot be directly compared with those of the private sector, which are clearly expressed in the required rate of return.

One solution to the challenge of incomparability of costs of capital is to argue that the Efficient Markets Hypothesis (EMH) holds in the market for PPPs. If the relevant capital markets are competitive and complete (i.e. all risks can be traded), the private cost of finance will represent the efficient cost of the risks involved in the project: the financing costs of the public and private approaches would be equivalent (Brealey et al. 1997). Under this approach, value for money assessments would depend solely on the efficiency differential between public and private ownership and management.

There is empirical evidence that suggests that the EMH does not adequately describe PPP-related capital markets so that the cost of capital question cannot so easily be swept away. Specifically, the evidence suggests that investors in PPPs have made excessive returns, PPP bidders demand excessive risk premiums, and there is insufficient competition for contracts. This paper reviews this empirical evidence and concludes that governments pay a high price for public-private partnerships primarily due to large risk transfers, risk treatment within the private sector, and uncertainty.

Section two of this paper presents the subject of our analysis – capitally intensive project finance PPPs. Section three sets out the theoretical background on risk pricing efficiency, including some

[1] PPP covers a variety of arrangements, from management concessions of existing infrastructure to project finance contracts for the delivery and operation of new infrastructure. This paper treats the latter. We are grateful to Michael Spackman and Daniel Veryard for support and comments on an earlier version of this paper.

conventional challenges to the EMH. Section four sets out our analytical approach that looks at some PPP-specific challenges to the EMH. Section five presents the implications of uncertainty on the ex-ante versus ex-post risk performance of PPPs and reviews the evidence on competition in PPPs. Section six discusses implications of the findings and concludes.

Many countries have identified substantial infrastructure investment needs, particularly in the transport sector. Initiatives to increase the volume of available finance, including the promotion of private participation in infrastructure through public-private partnerships (PPPs)[2], have been advanced to address these needs. Transport infrastructure represented a substantial part of the total PPP transaction volume in recent years (EIB 2014). Against this trend, the debate on the relative cost of public and private finance is still not settled (Green et al. 2015).

Scope

The analysis in this paper will focus on risk pricing efficiency in capitally intensive project finance PPPs in public infrastructure, such as roads and railways. Project financing of an infrastructure project is based on a financial structure where investors and the lenders are repaid from the cash flow generated from the project once it is operational, and where investors have limited or no recourse.

Building on Yescombe (2013) several general features distinguish PPPs from traditional infrastructure procurement:

- Normally a project-dedicated company is created, called the Special Purpose Vehicle (SPV), which enters the contractual relationship with the public sector.
- A high leverage is characteristic for the SPV (e.g. a 90:10 debt to equity ratio).
- The public-private agreement defines an output specification i.e. what the project is meant to achieve, as opposed to what the project is (the input).
- There is a bundling of all procurement phases from design to operations in one long-term contract (e.g. the Design Build Finance Maintain Operate contract).
- PPPs commit the public sector to paying a pre-agreed income to the SPV, provided the required service delivery and quality criteria are met. Alternatively the public sector can grant the SPV the right to collect revenues from the use of the infrastructure.
- Lenders generally require that risk is transferred from the SPV to other parties to the extent possible to reduce the risk exposure for the SPV.

[2] PPP covers a variety of arrangements, from management concessions of existing infrastructure to project finance contracts for the delivery and operation of new infrastructure. This paper treats the latter.

With regard to the last point in PPPs, and project finance in general, risk is managed through a network of contracts (Blanc-Brude 2008, Gatti 2013). For example, fixed-price and date-certain turnkey contracts[3] are required to transfer construction risk.

"Efficient" pricing of risk

In standard finance theory, investors in any project or asset face two types of risk: systematic and non-systematic risk. Systematic risk relates to the risk that is not diversifiable. Non-systematic risk relates to idiosyncratic project characteristics, such as geology, complexity of construction, country or counterparty risk, which is diversifiable. The private sector's standard tool for pricing risk within a portfolio of assets is the Capital Asset Pricing Model (CAPM) (Markowitz, 1952). In CAPM, the required rate of return on a risky asset is derived from (i) the risk-free rate, (ii) the market-risk premium and (iii) the correlation between the asset and the market ("beta"[4]) alone. Non-systematic risk is not relevant for pricing as it can be diversified away by including other assets in the portfolio.

In practice, potential investors do not blindly follow CAPM outputs when setting required rates of return, but instead apply minimum "hurdle" rates of return or include a mark-up for non-systematic risks (Jensen and Meckling 1976; Tan 2007; Mehra and Prescott 1985; Fama and French 1992). Arrow and Lind (1970) also note that from the perspective of an individual manager's career and income, the variance of returns on a single investment may be important. A mark-up may therefore be applied as a premium for the non-systematic risk – even if this risk is not a material concern to shareholders.

Against the argument of return mark-ups is the possibility that competition between investors may be sufficient for any extraordinary profits to be eroded in the long-run. In this case, the CAPM-estimated prices for risk can (eventually) be considered as efficient. That is, the market will be efficient if the conditions for the EMH hold, including that prices reflect all available information.

Depending on how "all available information" is defined, financial theory distinguishes between three versions of the EMH. The version closest to reality and mainly accepted from financial economics is the weak version (Doran et al., 2010). It assumes prices incorporate information on past prices and will change only when new information becomes available.

The applicability of the EMH to asset markets has been questioned on methodological grounds (e.g. Mandelbrot and Hudson 2004 criticize the inadequacy of the random walk assumption) and on a more

3 Alternatively, in cases (e.g. construction companies in developing countries), where the construction companies are financially unable to accept the construction risk, the construction budget of the SPV includes a sizeable contingency. Clearly though in this case the incentive for the construction company to efficiency manage risk will be much reduced and an important part of the PPP rationale is lost.

4 Beta is the (weighted) covariance between the return on the asset and the return on the equity market. A beta of one signifies the asset is perfectly correlated with the market (e.g. the traffic demand for a road project is strongly dependent on the state of the national economy, so will have a beta close to one). The equilibrium return on the asset in this case is the return on the market portfolio. A beta with the value of zero implies no correlation between the asset and the market, hence the equilibrium return is the risk-free rate of return. In theory investors shoud demand the equilibrium expected return to be compensated for "receiving" or "holding" the risk.

fundamental level for assuming rational behaviour by investors (Thaler and Sunstein 2008). Numerous relevant biases of human decision making under uncertainty have been documented, including overconfidence (Fischoff and Slovic 1980; Barber and Odean 2001; Gervais and Odean 2001), overreaction (DeBond and Thaler 1986), herding (Huberman and Regev 2001), psychological accounting (Tversky and Kahneman 1981), miscalibration of probabilities (Licthenstein et al. 1982), hyperbolic discounting (Laibson 1997), regret (Bell 1982; Clarke et al. 1994) and loss aversion (Kahneman and Tversky 1979; Shefrin and Statman 1985; Odean 1998).

In response to criticisms, EMH proponents insist that the effects of the biases are temporary so that the market will eventually always bring the prices to rational levels (Lo 2004). Several studies attempt to demonstrate that markets in developing and developed economies asymptotically approach efficiency, though the issue remains contested (Hull and McGroarty 2014; Alvarez-Ramirez et al. 2012). This interpretation of the EMH assumes all uncertainty will ultimately become quantifiable as a distribution of probabilities. Unknowable (Knightian) uncertainty[5], if present, is eventually resolved.

Methodology

If risk in PPPs is priced efficiently as per the EMH, then value for money questions in PPPs can be greatly simplified. To date, the debate over the applicability of the EMH has generally taken place in the context of homogeneous risky assets such as equities, where deep historical datasets are available. Little current research has accounted for the specific context of PPPs and infrastructure, where past information on asset performance is difficult to access or compare. The debate also largely ignores the complexity of risk treatment and allocation within a PPP contract.

The efficiency of risk pricing in the case of PPPs primarily depends on two related components: the degree of competition for contracts, and the way in which investors/lenders understand and price risk.

Competition for the contract is the more straightforward element to assess. Reasonable data is available on the number of PPP consortiums bidding for the contract, and it can be assessed for the project as a without considering the nature of each consortium's internal structure. The second component (which also influences the first) is more difficult to assess due to the complexity and diversity of the risk transfer contracts within each PPP consortium.

[5] Knight (1921, 233) defined risk as a situation in which the distribution of the outcome in a group of instances is known and uncertainty, when it is "impossible to form a group of instances, because the situation dealt with is in a high degree unique". Later, Ramsey and De Finetti developed the methods of measurement and handling of subjective probabilities (Gillies 2003). In effect, when we have no historical data (and are subject to uncertainty in line with Knight), we can derive a subjective probability, by asking the investors or groups of investors on the bets they would be willing to place. To the extent that the individual facing the lack of historical statistical data to inform his decision and doubts his own subjective bet against uncertainty, he may assume that the rest of the world is perhaps better informed. Effectively, the individual becomes influenced or follows the behaviour of the majority or the average. This situation is then referred to as intersubjective probability. Both the subjective or intersubjective probabilities are in line with Keynes (1936, 161-162) subject to his "animal spirits", the fluctuations in the investors disposition, optimism or pessimism.

Our approach to the second component of risk pricing efficiency is to look for direct evidence of systematic abnormal profits earned by private parties in PPPs, and for indirect evidence of a lack of information prohibiting efficient risk pricing under the EMH. The approach necessarily takes a number of different angles, including one that considers the contract structure holistically. The efficiency of risk pricing in a PPP depends on the total "volume" of the transferred risk – the part at the level of the SPV and each part transferred to related parties. Ideally each part of transferred risk should be assessed separately.

Risk pricing efficiency performance would be easiest to assess at the SPV level, because any market index would reflect the performance of SPVs alone. For risks that are transferred out of the SPV this would be more difficult. In construction companies for example the outcomes of specific PPP projects will be private information held within the cash-flows of numerous other activities a construction company may pursue. In these cases we attempt to assess the risk performance indirectly, by measuring systematic project performance in terms of major project risks, such as construction or operations risk. If the materialized (ex-post) risk systematically undershoots the expected (ex-ante) risk, then this could indicate abnormal profits and one or both of the conditions for efficient pricing is not met.

In this paper we review existing empirical studies using large samples to tackle the following:

- Direct observation of PPP risk pricing efficiency:
    - Is there a homogenous market index of PPP risk performance available and is inference on EMH efficiency possible?
    - Can systematic abnormal returns be observed in PPPs?
- Indirect observation of PPP risk pricing efficiency:
    - Can the risk performance of PPPs be indirectly inferred through *ex post* outcomes of the main building blocks of risk and return in a PPP - demand, construction risk, and operations risk?
- What is the level of competition for the contract in PPPs to work towards reducing the risk premium?

In our analysis we assume that the incentives present within the contractual framework of a PPP will be the same regardless of the sector and therefore that findings are transferable between sectors. For example, Blanc-Brude and Makovšek (2013) find that insights on construction risk (excellent on-time and on-budget construction of infrastructure under project finance) do not depend on the project sector, geography or time.

Risk pricing efficiency in a Public-Private Partnership

Several decades after the roll-out of the PPP model in the UK and the model's proliferation to other countries, there is still a dearth of information on the financial performance of such projects. Nevertheless, a coherent picture is beginning to emerge based on the partial information available.

The following sections follow the design of the analytical approach outlined above. (Though no relevant research was encountered on operations risk so this is not treated.)

Availability of risk performance information at the SPV level

While there is some information available on the exposure of the lenders to risk in PPP contracts[6] there are no consolidated data sources about the exposure of investors. A recent review of literature concluded that – for our purposes – all existing papers or indices on infrastructure suffer from a study design problem, aggregating "financial instruments that are labelled as 'infrastructure' based on industrial categories and without attempting to isolate methodically the contractual and regulatory characteristics" (Blanc-Brude 2013, 57). The performance and risk profile of a regulated utility will be substantially different from a PPP and having such information pooled is not very useful. A related challenge is that a lot of the investment performance information is private and not publicly available (ibid).

The lack of information on the infrastructure investment performance directly contradicts the "full information" requirement for the EMH to hold, suggesting that any quantitative testing for EMH is pointless. This gap has also prompted several initiatives to collect the relevant data (e.g. EDHEC Risk Institute[7], OECD[8], FSB[9]).

Are there abnormal returns possible for PPPs?

To observe abnormal returns, a view on the "normal" returns is necessary. Not having a homogenous market index makes it impossible to directly establish this view empirically. Nevertheless, there are studies that indirectly indicate abnormal returns by observing a systematic differential between expected returns at financial close (when the financing of the project was secured and contracts were signed) and ex-post returns. This will not reveal the full range of potential abnormal returns (as they may have already existed at the financial close), but it will provide some indication between expected risk exposure and materialized risk.

NAO (2012) and Vecchi et al. (2013) used an alternative approach to the classic financial assessment or risk and return (e.g. assessing volatility, Sharpe ratio). They compared expected ex-ante returns at financial close and actual ex-post returns.

NAO (2012) analysed 118 projects, and in 84 cases expected returns were equalled or exceeded, while in the remaining 34 cases the returns were lower than expected. NAO (ibid.) noted that the projects were still in operation and had not yet reached the stage where significant refurbishment might be needed, so their conclusions (based on the realisation of costs) could change.

Vecchi et al. (2013) using a similar, but a more elaborate approach than NAO on a sample of 77 UK availability-based PPP hospital projects, showed that the ex-post returns to investors were substantially

6 Moody's study (Davidson et al. 2013) of 954 PPPs for example notes, that "The 10 year cumulative default rate is 3.9%, which is consistent with 10 year cumulative default rates for corporate issuers in the Baa ratings category."

7 http://www.edhec-risk.com/multistyle_multiclass/Meridiam_Infrastructure_and_Campbell_Lutyens_Research_Chair

8 http://www.oecd.org/finance/private-pensions/institutionalinvestorsandlong-terminvestment.htm

9 http://www.financialstabilityboard.org/wp-content/uploads/r_140916.pdf

above expected ex-ante returns at the financial close. The average blended equity IRR[10] was 9.3% (with a range of 4.5% to 17.4%) above average expected financing cost at financial close.

Thus the available evidence suggests the distribution of PPP returns is skewed to the left with returns on average being substantially above expected returns. This is the case despite the fact that in the cited examples the only real risk exposure comes from operations (and potential contractor default), as all other risks are negligible:

- Regulatory and political risks are not a serious issue in the UK. A survey of 171 PFI projects from all sectors showed that changes in the contracts amounted to a mere 1.1% of the annual service payments from the state to the private provider (unitary charges) for projects in question (NAO, 2008). The majority of changes (82%) involved values of £5000 or less and almost all originated from the public sector requests.

- There is no demand-based risk in the samples considered; and

- Construction risk is fully passed to the company with the construction contract (NAO 2012).

Indirect inference on risk performance – demand risk

Demand risk performance relates to whether actual ex-post demand undershot, met or overshot expected demand ex ante. If the pricing for this risk were efficient, then on average over many projects risk performance should not exhibit a significant systematic error. Put simply, systematic demand shortfalls should not exist, since this would imply lenders/investors are on average losing money. Conversely, a small systematic excess of actual demand (as opposed to expectations) would however be acceptable as a reflection of the risk aversion of investors. A large systematic excess of actual demand on the other hand would signal that either the lenders/investors have a poor idea about the actual risks, which manifests in large risk aversion, and/or there is insufficient competition.

Most evidence of ex-post analysis comes from toll roads and rail and concerns only risk exposure, without a view on returns. Demand risk in this case cannot be managed and relates to traffic forecasting. This is not an exact science and systematic errors have been observed in traditionally procured projects and private toll concessions.

Traffic risk must be assessed for each project specifically, using historical information and expected developments in the future. Traffic forecasting is a scientific field in its own right. An investor or a lender cannot directly observe the riskiness of the project by comparing some of his characteristics to similar projects. But he may get a limited view by observing systematic errors in expectations for similar projects. This is the subject of ex-post analysis. Related evidence is summarized below.

Bain (2009) presented evidence on 104 toll road concessions from around the globe to find that on average traffic demand is 23% overestimated. By contrast, in the sample of traditionally procured and

[10] The equity stakes plus the subordinated portion of debt in the SPV end up in each sponsor's balance sheet (i.e. the blended equity). The remuneration for these investments is represented by the blended IRR of the SPV. Sponsors need to have a view whether or not the project will increase the wealth of their shareholders and will compare the blended equity IRR with their respective WACC. If this difference is positive, the project is economically attractive for each of the sponsors (Vecchi et al 2013, 248), with the expected earnings above average.

predominantly European road projects Flyvbjerg et al. (2005) and Naess et al. (2006) found a systematic error in the opposite direction: actual traffic averaged 9.5% higher than forecasted traffic. Button and Chen (2014) examine pure public and public–private US highway investment traffic demand forecasts to find no evidence that latter are more accurate.

In the case of rail, Dehornoy (2012) reviews cases of PPPs with demand risk since the 1980s. Of the 14 projects reviewed, 5 were not yet developed enough to allow analysis, but in the remaining 9 the average ridership, assessed at different years of operation, was 63% below estimates. Flyvbjerg et al. (2006) reports a -54% average error on 25 projects, though these may include many of the ones already studied by Dehornoy (ibid) (which the authors did not reveal).

The demand forecasting errors in PPPs noted above should not be simply interpreted as losses to investors, however. Contract renegotiation experiences from around the world show that many PPPs are subject to strategic behaviour from the public and the private sector, although this challenge appears to be greater in developing, rather than developed, countries (Makovšek et al. 2015).

That being said, there are cases, where systematic errors do translate to investor/lender losses. Bain and Oxera (2012) show that in Australia all 7 toll road projects have underperformed since 2005 and argue that this is the result of deliberate overestimation by (private) project sponsors to attract investors[11].

Recently EPEC (2014) reported that in 2012 over 90% of PPP transactions[12] closed were without demand risk. It is plausible to assume that given the considerable uncertainty of demand investors (and lenders) have learned to avoid its transfer.

Indirect inference on risk performance – construction risk

Construction risk relates to cost and schedule overruns against the contract or estimates at financial close[13]. The logic here is slightly different than in the case of demand risk, because the construction risk performance of the construction contractor in a PPP is private information embedded within the fixed price charged for the project. How this was approached at the level of the construction contractor is explained further below. Construction risk however has an impact at both the SPV level and the construction contractor level. The SPV level is treated first.

Construction risk at the SPV level

Lenders and investors generally do not have good understanding of construction risk exposure and seek to transfer the construction risk to the party best able to manage it, namely the construction contractor.

11 The private sponsors of the failed projects have become the subject of class action law suits as in the case of CLEM7 tunnel in Brisbane (http://www.wsj.com/articles/SB10001424052702304434104579379351959645932).

12 Looking only at the transport sector is still representative of the market. Transport accounts for the majority of the PPP volume on the market in Europe (over two thirds in 2014; EIB 2015), with road projects typically dominant.

13 Another definition of construction risk measures *ex-post* costs against those at the formal decision to build (i.e. well before the contract letting/financial close). That definition is more relevant to the process of investment appraisal and investment selection, such as in the research by Bent Flyvbjerg and others.

Yet construction risk has an impact also at the SPV level. In the only such study, the risk transfer from the SPV to the construction contractor is found to be fully successful, with a median cost overrun of zero across 75 large project-finance infrastructure projects worldwide (Blanc-Brude and Makovšek 2013). This implies that, for the investors in the SPV (including lenders), construction risk is fully diversifiable, and hence should not be relevant to the cost of financing (save for the transaction cost of its diversification). Historical analysis has shown that this was not the case, and that the required return of the projects declined sharply after the construction phase was finished (Blanc-Brude and Ismail 2013). Accordingly refinancing is common after the completion of the construction phase, suggesting lenders applied a premium to the construction phase of the project, in spite of the risk being fully diversifiable. This is indicative of abnormal returns at the SPV level and may reflect the insufficient portfolio size of lenders that constrains them from diversifying their risk.

Construction risk and the construction contractor

For the construction company the relevant measure of risk exposure is a risk contingency, which is an amount added to a central estimate of cost to cover future cost overruns that are realised. A range of techniques for quantifying construction risk have been propounded in academic construction literature, including deterministic methods, probabilistic methods and fuzzy-logic (Baccarini 2006). However, there is a lack of historical information and inherent complexity to allow construction companies to apply these methods to major infrastructure construction projects. Accordingly, construction risk (and the resulting contingency amount) is normally estimated subjectively through risk workshops, experts scrutinise the design and assign probabilities and impacts of various events (IRG 2013). Though such exercises are invaluable in terms of due diligence, there is no empirical research available on their ex-post accuracy, making it difficult to form a view on the accuracy of contractors' perceptions of risk.

Studies like that of De Silva et al (2008, 164) confirm that private sector assessments of risk for complex projects are rough. The study treated traditional highway procurement, where the risk exposure of the construction company is lower than in PPP projects. Oklahoma's Department of Transportation changed its procurement policy to make the state's internal cost estimates public during tendering. After this information was released winning bids on average reduced by 11% for more risky/complex (bridge construction) projects but were unaffected for low risk projects (asphalt pouring). The authors applied a difference-in-difference approach, observing thousands of bids over multiple years. In general the availability of the state's estimates improved bidders' willingness to reduce their contingencies.

Ideally we would directly assess expected and ex-post outcomes for the construction contractor, however this private information is unavailable. Instead, we must make observations at the level of the overall PPP contract between the SPV and the state. Here, we attempt to match the probability of risk transferred from the state, with the cost they paid for it. This requires two pieces of information:

- The extent of the construction risk transferred from the state to the PPP (and from the SPV to the construction contractor); and

- The cost of infrastructure, when built by the state (traditionally) and the cost of infrastructure, when built by the PPP.

The extent of construction risk transferred from the state to the PPP can be inferred from the comparative performance of traditional procurement and PPPs. The previous subsection highlighted that construction risk appears to be fully transferred from the state to the SPV and from the SPV fully to the construction contractor in PPP contracts: the median cost overrun was zero, and the average overrun was 2.3%, for a large sample of projects (Blanc-Brude and Makovšek, 2013). In contrast, for traditionally

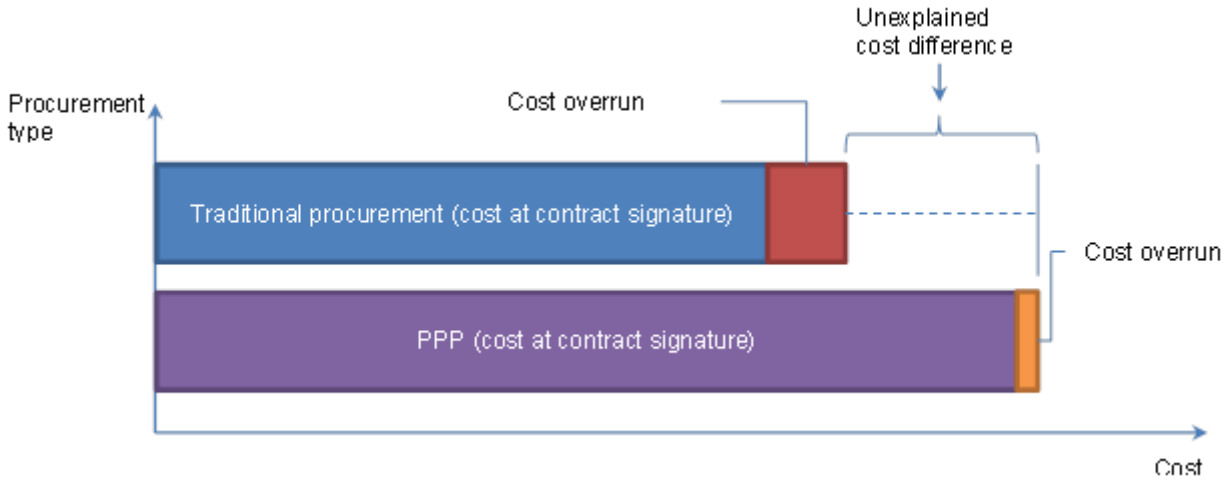
procured road projects, large cost overruns were absorbed by the state. These cost overruns (measured against the detailed design or contract value) reached on average up to 9% over large samples in different studies (ibid).

Whether the project is delivered using traditional procurement or a PPP, the primary cause of cost overruns is scope creep, at least in the case of transport infrastructure (Makovšek 2013). Under the terms of either contract, it is the responsibility of the procuring authority to define what it wants to build, so in either case the cost overrun is not necessarily a risk to the construction company or the SPV as the additional cost can be passed back to the procuring authority. To the extent that much of the 9 % mentioned above would reflect the responsibility of the procurement authority in defining the scope, the actual risk to be managed in a PPP would be smaller.

Despite the relatively small amount of risk transferred to PPPs, there is clear evidence that the cost of infrastructure is higher when built via a PPP than when it is built via the state traditionally. Blanc-Brude et al. (2006) observed ex-ante construction cost (contract prices) in 162 traditionally procured and 65 PPP road projects in Western Europe. The PPPs were found to be 24% more costly on average than equivalent traditionally procured projects (ceteris paribus).

Makovšek (2013) argues that given the level of cost overruns at contract close phase in traditional procurement, PPPs are still substantially more costly even after the expected cost overruns risk in traditional procurement is accounted for: He illustrates the cost advantage over PPPs in the Blanc-Brude et al sample remains around 14–19% without accounting for cost growth in PPPs (to illustrate - we would have to add the 3.2% mentioned above to establish the full difference). The Blanc-Brude et al approach was also replicated using US data and yielded an even greater cost premium of 64% for PPP road projects over traditionally procured ones (Daito and Gifford 2014). Figure 1 below illustrates the two dimensions described above: higher cost overruns with traditional procurement, yet higher overall construction costs with PPPs.

Figure 1. Traditional procurement and PPP cost performance, cost overruns vs total cost



Taken together these strands of evidence suggest that the cost to governments of the transferring risk to the private party in a PPP is significantly above the efficient price (The unexplained cost difference in Figure 1 above). Two further arguments may compound this finding. First, lenders and investors may avoid the riskiest of projects, suggesting the portfolio of projects delivered as PPPs is actually lower risk than the traditionally procured one. Second, traditional procurement mainly relies on

cost-plus contracts, which provide fewer incentives to efficiently manage risk while the PPP model relies on fixed-price turn-key contracts, which are likely to be better managed. Interestingly, practitioners report that the use of lump-sum turnkey construction contract generally involves a premium of 20% against less restrictive contract types, such as design-bid-build, regardless of whether it is part of a PPP or not (Yescombe 2013).

An argument against a conclusion that these outcomes are a source of inefficient risk pricing or extraordinary profits in PPP projects is that higher quality infrastructure is being built to optimise the life cycle cost of infrastructure management. This should be true for capital intensive PPPs in any sector. There is however little evidence to suggest that this is the case or that in all traditionally procured projects the opposite is true. On a declarative level there is a widespread embrace of life-cycle cost optimisation principles in PPPs in UK (Meng and Harshaw 2013), but there are practical obstacles to its execution. The single available study by NAO (2007) suggests the contrary. A construction review of PPP hospitals in the UK found that these were not built to a higher standard of quality than traditionally procured hospitals.

Competition for the contract

Competition is one of the key conditions for the EMH to hold. It is generally accepted that transferring risk to a risk-averse private party will incur a risk premium, with the size of the premium depending on the level of risk aversion and the degree of competition.

Empirical data on competition for PPP contracts is currently limited to the UK, though this evidence consistently suggests that competition is limited, due to complexity and transaction requirements (House of Commons Treasury Committee 2011). For example:

- The NAO (2007) found that one third of PFI projects attracted two bidders or fewer between 2004 and 2006 mainly because of lack of bidder interest since very few firms have the economies of scale and asset base to absorb the exposure and high bid costs.

- Zitron (2006) reported that on average there were three bidders for each SPV contract in his sample of 86 PPPs in the UK, and in a quarter there were fewer than three bidders.

- Hellowell (2012) finds that over the period 1997–2010 that the market for private finance of PPP hospitals is an oligopoly with a very limited number of firms, and that churn and market penetration rates are extremely low. In addition he finds no improvement over time.

- Blanc-Brude (2013) suggested that the transfer of risk deters smaller firms unable to absorb or manage it from bidding. He finds evidence in the UK PFI school market that the distribution of bidding firms is skewed towards the largest firms (which also have the most capacity to absorb major risk transfers through fixed-price/fixed-date contracts).

Discussion

Economic theory assumes the public and the private sector can both diversify non-systematic risk well. It disagrees about whether the systematic risk equity market premium is relevant to the taxpayer. Given the review of the available evidence for PPPs, the current perspective of economic theory appears to be too narrow and possibly focused at the wrong end of the problem.

EMH in economic theory assumes that non-systematic risk is quantifiable and can be eliminated by diversification of a portfolio. There is evidence that a limited version of the EMH applies for homogeneous assets, such as equities or commodities. However, this paper has raised significant doubts about the applicability of the EMH to infrastructure assets, particularly to project finance PPPs.

A central challenge to the applicability of the EMH in PPPs is the difficulty in quantifying risk. The heterogeneity of contracts and project scopes means that the pricing performance history that could enable modelling and quantification of risks has not been available to bidders or governments. If risks cannot be clearly identified or quantified, it is implausible that market actors will be able to eliminate non-systematic risk of an infrastructure asset through careful diversification, since they will not be able to identify those assets with imperfectly correlated returns.

Several international institutions are seeking to establish PPPs as a formal asset class by collecting performance data on contracts between governments with SPVs. Additional contract and performance data will clearly help to illuminate the nature and magnitude of the risks taken on by SPVs. If successful, this initiative should lead towards a reduction in the risk premiums demanded by SPVs as information and competition improves.

Unfortunately, the picture is not so simple within a PPP. The contractual arrangements between the SPV and other parties generally disperses significant risks beyond the scope of the SPV. For example, the risk of cost overruns often gets transferred away from the SPV onto the construction contractor so as to reduce the risk exposure of lenders and reduce the debt interest rate. Consequently, newly collected SPV data is not expected to illuminate the nature or the pricing of these transferred risks.

Construction contractors and other private participants accept the risks transferred to them as part of the PPP contract at a premium. They lack the data to support the quantification of these risks, but also the opportunities to adequately diversify their portfolio. As such, the premium they charge is likely to be above the efficient level that might be predicted by the EMH.

Evidence examined in this paper provides some support for this position. Construction costs for equivalent infrastructure were found to be higher under PPPs than traditional procurement. This difference is not explained simply by SPVs having incentives to minimise whole of life costing through construction of better assets upfront. Instead it is more likely attributable to the inability to quantify risk and the PPP risk transfer both deterring competition in the bidding and attracting high risk premiums among those consortiums who do bid. Within the PPP contract structure, the construction company carrying the construction cost risks is likely to embed a relatively large risk contingency in their cost estimate.

The risk premiums embedded by parties within the PPP structure (such as construction cost contingencies) will drive costs above those charged by a government. There are two reasons to expect this: First, in contrast to the private parties in a PPP, the state is generally reasonably well placed to

diversify risks due to its large balance sheet, and diverse set of risks to its outlays and revenues it naturally faces. Second, the state can face the lack of information about risk with risk neutrality[14], because it can draw on taxpayers *ex post* to pay any shortfalls *if and when they occur*.

This does not imply the state should not care about risk or that it should not try to assess it and use it in decision making. It means that the taxpayers in traditional procurement pay a price that is closer to the actual cost of risk than they would under a PPP.

Conclusion

This paper is a contribution to the long debate on the comparative cost of public and private financing in traditional procurement and project finance PPPs. In an interdisciplinary effort, we have explored if the assumptions of the EMH fit with the practice of risk transfer to PPPs and its allocation within a PPP. The aim was to pool available empirical evidence and to propose a narrative that would adequately explain it.

Our findings suggest that defining infrastructure as an asset class will be insufficient to achieve efficient risk pricing for PPPs, when considered holistically. Much of the risk is transferred off the SPV as well. These risks will still be difficult to identify and quantify.

Evidence on construction risk suggests that with a lack of information about risk, combined with large risk transfers through high powered fixed-price/fixed-date contracts, yield high risk premiums and inherently reduce competition. These contracts reduce the risk exposure for the lenders (and the cost of financing they offer) at the level of the SPV, but in-turn increases the principal that has to be financed, since the construction company will charge a high contingency value.

In this way, it can then be argued that the state has an advantage in the cost of financing infrastructure PPPs. It is better able to spread diversifiable project risk and has the ability to approach the lack of information about risk in a risk neutral manner, paying for any shortfalls if and when they occur.

A basic corollary to these findings is that the efficiency gains from a PPP would need to be much higher than previously understood to be preferred to the traditional approach. In light of the limited available evidence, this conclusion must be regarded as tentative. Future research would benefit from more data on project performance in diverse sectors.

Two recommendations follow from our analysis. Firstly, a clearer understanding on which risk items are manageable (and to what extent) might give us a better picture of which risks should remain with the state (or be shared with the private sector). Secondly, the incentives and efficiency outcomes in

[14] A given overspend has the same direct social cost with either public or private financing (the risk of such an overspend will be reflected in private financing costs, and ex post also in public financing costs). The private contractor and/or private shareholders may be more averse than the government to such risks, because of the possible subsequent collapse of the contractor and/or serious personal or reputational loss to the financiers. While if the cost falls on taxpayers there will be no further costs or this kind as the financial loss is widely spread.

both PPPs and other options for private participation in infrastructure need to be better understood. There is a wealth of evidence that suggests economic regulation with privatisation can bring increased efficiency (e.g. privatisation of regulated utilities) yet we understand little about the value for money of that model compared to project finance PPP.

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