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Public-private Partnerships, Commitment and X-Inefficiency

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Abstract

We examine the formation of public private partnerships (PPPs), one of the most important organisational forms to evolve over the last few decades. Given the volume of infra-structural investment required, PPPs seem essential for India's development. We unearth a role for PPP formation that is new in the literature, namely its role as a commitment device. In particular, we argue that the presence of the private firm allows a PPP to credibly commit to discontinuing the project when efficiency considerations demand so.

Key words: Public private partnerships, risk sharing, X-inefficiency, commitment.

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1 Introduction

A public-private partnership (PPP) is a long term contractual arrangement between a government and a private party for the provisioning of assets, and delivery of services. It also includes sharing of risk and rewards among the private and the public entities. Such PPPs have been widely used not just in the developed counties, e.g, in Europe, Canada, and the USA, but in less developed countries as well. In fact, in the period between 1990 and 2003, about 1000 projects and 47% of investments in Latin American and Caribbean countries involved the use of PPPs according to the World Bank's Private Participation in Infrastructure (PPI) database.

Interestingly, India has a long history in this respect and could boast of PPPs as early as the 19th century, e.g. the Great Indian Peninsular Railway Company (1853), and the Bombay Tramway Company (1874). PPPs really mushroomed in India around the 1990s though, with the period between 2006 to 2011 generating a spectacular growth in the number of PPPs, from 450 projects worth Rs. 2242 billion in November 2009, to 758 PPP projects worth Rs. 3833 billions in July 2011. Drawing on the PPP database from the Department of External Affairs, Ministry of Finance, we find that in July 2011, top 5 states accounted for 58.3 per cent of the total value of PPPs. These include Andhra Pradesh, Maharashtra, Karnataka, Gujarat and UP, with these states focusing on roads, ports and airports.[1]

The literature seems divided on the efficacy of such PPPs.[2] A report commis-

[1] In Andhra Pradesh prominent projects include the HITEC City, Hyderabad, RGI Airport, and the Krishnapatnam Port. Projects in the pipeline include Hyderabad metro rail project, bridge across Godavari at Rajahmundry, Machilipatnam port, etc. The RGI airport, Hyderabad, partnered with the GMR group, handled 5.8 mn. domestic and 1.9 mn. international passengers in the financial year 2011. It boasts of the second longest runway in India, 146 check-in counters, and 46 immigration counters. It was rated the world's best airport for Airport Service Quality (ASQ) in the 5-15 million passenger capacity in the financial year 2011.

[2] While Manmohan Singh, our ex-Prime Minister, said that "PPP projects ..... will not only enable us to leverage our limited public resources, but also improve efficiency of service delivery", The New Zealand Treasury was much more circumspect "There is little reliable empirical evidence

sioned by the Treasury Taskforce estimated a savings of 17 per cent on PPPs in UK, as compared to public procurements. NAO (2003) reported that innovative designs helped reduce the level of staffing and thus led to an overall cost reduction of 30 per cent in UK. Private Finance Initiative (PFI) projects in UK seem to be delivering cost savings compared to the traditional procurement. Improvement in completion time and costs of delivery have been achieved and 76% of the PPP projects have been completed on time as compared to 30% of the traditionally procured projects (Anderson, 2000). However, Blanck-Brude *et al.* (2009) studied a sample of road projects in all the EU-15 countries plus Norway. They found that *ex ante* construction costs are 20 per cent higher for PPP roads. Similarly, PPPs have resulted in higher water prices than traditional procurement in France, and seem to be unsuitable for fast moving sectors in UK.

We next discuss some specific examples of PPPs, both successful, as well as not so successful. Success stories include the Indira Gandhi International Airport in New Delhi, a partnership between the government of India and the GMR group, one of top five airport developers. Its terminal 3 (T3) was built in an impressive thirty seven months. It is the only airport in India with three runways, one being India's longest at 4430 meters. The T3 can also boast of 168 checkout counters, 92 wakalalators, 31 escalators, 78 aerobridges, and 12 baggage reclaim belts, handling 20.6 million domestic, and 9.3 million international passengers in the financial year 2011. Further, it was rated world's 4th best airport for *airport service quality (ASQ)* in 15-25 million passenger category in FY 2011. Other examples of successful PPPs include the Rajiv Gandhi International Airport in Hyderabad, India.

The PPPs tasked with upgrading the London tube on the other hand provide some cautionary tales. In 1993 this project was awarded to two different infra-

about the costs and benefits of PPPs."

firms, Tubelines and Metronet. Tubelines were awarded the Jubillee, the Northern and the Picadelly lines, while Metronet got (a) the Bakerloo, Central, and Victoria, and (b) the District, Circle, Hammersmith and City lines. The negotiations were extremely complex, requiring 19 months of contract negotiations, with the work being phased over 30 years.[3]

Metronet ran into significant problems however. By April 2005, Metronet had only started work on 13 out of 32 scheduled stations, and was also 12 months behind on the refurbishment of 78 district lines.[4] Moreover, it received only 121 million pounds out of the 551 million needed to cover its cost overruns. Metronet went into administration between July 2007 and May 2008, after which it was bought by two Transport for London (TFL) subsidiaries. The remaining one-third of the PPP, being run by Tubelines, was taken back into public control in May 2010 after seven and a half years for a purchase price of 310 million pounds. While Tubelines did not have overspending problems, there were delays.[5]

As our discussion suggests, there are many upsides, as well as downsides to forming a PPP. In this paper we want to focus on one possible positive aspect of PPP formation. This has to do with the idea that, because of bureaucratic budget maximization, government operation of PPPs generates Leibensteinian X-inefficiency, and, following from it, that PPPs can play a role in controlling such inefficiencies. In order to make this point we develop a simple analytical framework that extends Roy Chowdhury and Roy Chowdhury (2016, 2018). Roy Chowdhury and Roy Chowdhury (2016) builds on the consensus in the literature to argue that

[3]Tubelines and Metronet were to do the upgradation, while the London Underground Limited (LUL) was to provide the final services. In fact the complexity of the contract meant that advisory services themselves cost 109 million pounds. Further, the delay in project allocation meant that the LUL had to provide substantial compensations to the various bidders, including the losers.

[4]In the first years deductions amounted to 32 million, and bonuses were only about 12 million. Despite the delays Metronet had significant profits at higher than the market average rate, suggesting the penalties were not too large.

[5]See, among others, Iossa and Martimort (2016).

one major advantage of PPPs, among others, is that of risk-sharing.[6] Given that most projects undertaken via PPPs are reasonably large, various risks, including demand shocks are a serious concern, and consequently risk sharing becomes important. They argue that depending on whether governance is weak or strong, PPPs may or may not form. In Roy Chowdhury (2018) we show that PPPs are more likely to form in case the externality gains out of the project are significant, and the agents are quite risk averse. Otherwise, PPP formation may lead to bribery and sub-optimal project choice, and the government may opt for government control instead.

In this paper we extend Roy Chowdhury and Roy Chowdhury (2016, 2018) and allow for the fact that government departments have a preference for larger budgets. The idea that bureaucracies prefer larger budgets was first proposed in a series of studies by Niskanen (1968,1971, 1975, 1978, 1987). His essential argument was that the level of bureaucratic budget was positively correlated with things like salary, perquisites, public reputation, and patronage, all of which enter the utility function of the bureaucrats. Later on Dunleavy (1985, 1989, 1991) extended this framework to allow for the fact that bureaucratic decision making is often a collective process, though people higher up at the bureaucracy have a greater say in such decisions. His conclusion was that budget maximization is still a reasonable assumption, at least for certain elements of the budget which fund their own operations, the so called core budget.[7]

We formalise this idea by positing that in some states of the world project implementation may be too costly, as well as inefficient. Given the private benefits from project implementation however, a government bureaucracy may still want to continue with the project. We argue that this provides a rationale for PPP

[6]There are other reasons of course, most notably synergy between the private and government sectors.

[7]We refer the readers to Iossa and Martimort (2015) and Martimort and Poyet (2008) for an introduction to some of the theoretical literature on PPPs.

formation since the private partner would act as a disciplining factor, forcing the project to close down whenever it is unprofitable to continue with it. We demonstrate that under very general conditions PPP formation dominates alternative governance mechanisms, i.e. allocating the project either to the private sector, or to a government department.

In the next section we discuss the formal model, before turning to the analysis in Sections 3 and 4. Finally Section 5 concludes.

2 A Formal Framework

We develop a formal model consisting of the government, a government department (denoted G) and a private firm (denoted F). There is a single public project which might be taken up by either G, or by F, or by a public-private partnership (PPP) between F and G. It is the government which decides whether it wants to use the governmental department to implement the project. In case the government decides otherwise, it can either invite the private sector, or alternatively try and form a PPP to implement the project.[8]

We next describe the various gains out of implementing the project. The project yields a benefit of X to those sections of the population directly affected by it, and an indirect benefit of P to some other section of the population, where $X, P > 0$. Moreover, the government department gets an additional *private benefit* from merely undertaking the project, denoted R, where $R > 0$. R captures the idea that bureaucracies have a preference for a larger budget, where this preference arises because a larger budget allows bureaucrats to pursue various other objectives that are not part of their mandate, including influence peddling, pandering to specific clienteles, reputation building, etc. Society, i.e. the government, though

[8]In order to focus on the issue of interest, we abstract from several aspects of reality, in particular strategic interactions in project allocation, i.e. lobbying.

puts no weight on this component, and ignores this while making welfare calculations. In this paper we do not provide a micro-foundation regarding how this R arises, but instead consider a reduced form formulation where this R is taken to be exogenously given.[9]

The project is brought to fruition in two stages, build and operate. Both the stages can be handled by the government department, as well as the private firm. The per stage cost for both firms is c_1 if the state is 'bad', and c_2 if the state of the world is 'good', so that $c_1 > c_2$. Let p_i denote the probability that the cost is c_i, where $0 < p_i < 1$ and $\sum_i p_i = 1$. For ease of exposition, here we assume that the cost of each stage is the same for G and F. This is not to deny of course that one of the primary reasons behind PPP formation is actually the potential synergy in case of PPP formation between the government and the private firm. Rather this assumption allows us to simplify the analysis, and make the basic point that, even in the absence of any synergy, there can be other reasons for PPP formation.[10]

The direct benefit, X, can be extracted from the population by the project authority in the form of usage fees etc. The indirect benefit P however, is in the nature of an externality, and cannot be extracted. Further, we assume that all agents can access 1 unit of capital at its opportunity cost of 1.[11]

The objective of the government is welfare maximization, where welfare is defined to be the sum of utilities of the government department and the private firm, net of any reputational benefits that might accrue to the government department.. Notice that in this formulation the whole of the consumers' surplus goes to the organization in charge of this project, thus the consumers' surplus does not explic-

[9] In future work, we plan to take up this issue in greater details. However, the qualitative results should not be affected by the specific details of such micro-foundations, though naturally additional results would arise.

[10] One can allow for there being some synergy between the governmental department and the private firm. Doing so, only makes the case for a PPP stronger.

[11] It is possible that the cost of accessing capital is different for the government department and the private firm. However, we abstract from it for simplicity.

itly enter the welfare calculus. The objective of the other agents will be described as we go along.

The timeline is as follows. We consider a one period two stage game:

Stage 1. The government decides on the organizational structure, i.e. whether the project is to be implemented by the government department, the private firm, or the PPP.

Stage 2. The state of the world is revealed, with the agents in charge of project implementation getting to know the exact state of the world. Next the organization implementing the project deciding on whether to continue with the project or not. In case of a PPP, a veto by either partner is sufficient to cancel the project, with the project going through if and only if both G and F agree.

We solve for the subgame perfect Nash equilibrium of this game.

3 The Analysis

We next turn to the analysis.

3.1 The utility functions

Recall that the *government department* cares about not just the externality P and its own income, but it also gets an additional private benefit of R if it completes the project. Formally the utility of the government department whenever the project is implemented is given by

$$P + R + u(g), \tag{1}$$

where $u(g)$ denotes the component of the government department's utility it gets from a project income of g, where $u(.)$ satisfies the usual conditions, i.e. $u(0) = 0,\ u'(.) > 0,\ u''(.) < 0$. Note that $u(.)$ is concave, which shall play an important role in the analysis.

The utility of the private firm running the project, when it has a direct payoff of f, say, is also given by

$$u(f). \tag{2}$$

It is straightforward to extend the analysis to the case where the utility function of the private firm is different from $u(.)$.

The following assumption allows us to focus on the case of interest.

ASSUMPTION 1. *(a)* $0 > P + 2u(X/2 - c_1)$.

(b) $P + u(X - 2c_2), X - 2c_2 > 0$.

(c) $P + R + u(X - 2c_1) > 0$.

Assumption 1(a) states that if the state of the world is bad, in that the cost of project implementation is c_1, then doing the project is inefficient. In fact, given that $u(0) = 0$ and $u'(.) > 0$, assumption 1(a) implies that continuing with the project in the bad state of the world yields a negative profit as well, i.e. $X < 2c_1$.[12] Assumption 1(b) ensures that in the good state of the world it is efficient to implement the project, and doing so also yields a positive profit. Finally, Assumption 1(c) implies that given the private benefits from merely implementing a project, the government department has an incentive to continue with the project even in the bad state of the world.

As is usual, we start by solving the second stage game first, before solving for the optimal organizational structure.

[12] This follows since $0 > P + u(X - 2c_1) > u(X - 2c_1)$. Given that $u(0) = 0$ and $u'(.) > 0$, this in turn ensures that $X - 2c_1 < 0$.

3.2 Government department does the project

In case the state of the world is good, i.e. the cost of project implementation is c_2, the project is implemented. This follows since from assumption 1(b),

$$P + R + u(X - 2c_2) > P + u(X - 2c_2) > 0.$$

Next suppose that the state of the world is bad. Then welfare maximization dictates that the project should not be implemented. This follows since

$$0 > P + 2u(X/2 - c_1) > P + u(X - 2c_1),$$

where the first inequality follows from assumption 1(b), and the second inequalityfrom the concavity of $u(.)$. Given Assumption 1(c) however, the department in its own interest will implement the project. Thus the expected utility of the department is

$$P + R + \sum_{i=1}^{2} p_i u(X - 2c_i). \tag{3}$$

Thus the expected aggregate welfare is given by

$$W^G = P + \sum_{i=1}^{2} p_i u(X - 2c_i). \tag{4}$$

PROPOSITION 1. *In case the government department is in charge of the project, it is implemented irrespective of the state of the world. The social welfare is*

$$W^G = P + \sum_{i=1}^{2} p_i u(X - 2c_i).$$

3.3 Private firm does the project

Given assumption 1(a), recall that $X < 2c_1$, so that pursuing the project is unprofitable whenever the state of the world is bad and the project is scrapped. The project goes through only in the good state of the world, when from Assumption 1(b), $X > 2c_2$. Thus social welfare is given by

$$W^F = p_2[P + u(X - 2c_2)]. \tag{5}$$

PROPOSITION 2. *Under a private firm, the project is implemented iff the state of the world is good, and is discontinued whenever the state of the world is bad. The social welfare is given by*

$$W^F = p_2[P + u(X - 2c_2)].$$

Note that given assumption 1(b), it is individually rational for the private firm to agree to run the project if offered.

3.4 Public private partnerships

Under a PPP the two participants agree to bear the responsibilities of investing in one of the stages. For concreteness suppose the private firm invests in building the project, whereas the government department takes care of the operational stage. Further, for simplicity, assume that the private firm and the government department each obtains half the surplus, i.e. $X/2$, in case the project is implemented.

If the state of the world is good, then given Assumption 1(b), the project is implemented. Given that $P + R + u(X/2 - c_2) > 0$ (this follows since P, R and $u(X/2 - c_2)$ are all positive), the government department gains from implementing

the project. Similarly the private partner also wants to implement the project given that $X/2 > c_2$ (from Assumption 1(b)).

Whereas if the state of the world is bad, then the private firm has no incentive to pursue the project since from assumption 1(a), $X/2 < c_1$. Thus in the bad state of the world the project will be scuttled since the private firm will veto the project. Thus aggregate welfare is given by

$$W^{PPP} = p_2[P + 2u(\frac{X}{2} - c_2)]. \tag{6}$$

PROPOSITION 3. *Under a PPP, the project goes through only in the good state. The level of welfare is given by*

$$W^{PPP} = p_2[P + 2u(\frac{X}{2} - c_2)].$$

Note that given assumption 1, it is individually rational for both the government department, as well as the private firm to agree to the PPP contract.

4 The government's organisational decision in stage 1

We then turn to stage 1, showing that optimally the PPP is going to form. Straightforward calculations yield

PROPOSITION 4. *(a) Welfare under private ownership exceeds that under government ownership.*

(b) Welfare under PPP exceeds that under either government, or private ownership.

Proof. (a) From a comparison of (3) and (5), we note that W^F exceeds W^G whenever

$$p_1[P + u(X - 2c_1)] < 0,$$

which is true given Assumption 1(a).

(b) Given Proposition 4(a), it is sufficient to argue that the welfare under a PPP exceeds that under F. Note that

$$W^{PPP} = p_2[P + 2u(X/2 - c_2) > p_2[P + u(X - 2c_1) = W^F,$$

given concavity of $u(.)$. □

The central trade-offs are as follows. Private ownership dominates government ownership since under government ownership, the bureaucratic nature of government control, with its focus on budget maximization, ensures that the project may be implemented even if there are no efficiency justifications for doing so. Comparing PPP with private ownership, note that while project implementation is identical under both organizational forms, the extent of risk diversification is higher under a PPP. Thus, to summarise, there are two justifications for PPP formation in this framework. First, that it allows for risk diversification, which is an idea that is already present in the literature. Second, the presence of the private firm allows a PPP to credibly commit to discontinuing the project when efficiency considerations demand so. To the best of our knowledge this idea is new in the literature.

5 Conclusion

Given the volume of infra-structural investment required, PPPs seem essential for India's development. We analyse a phenomenon that is new in the literature,

namely its role as a commitment device. In particular, we argue that the presence of the private firm allows a PPP to credibly commit to discontinuing the project when efficiency considerations demand so.

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