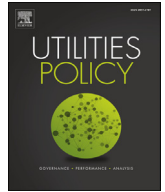




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## Efficient risk transfer in PPP wastewater treatment projects

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## ABSTRACT

Risk transfer in public private partnerships (PPPs) may not always be conducive to efficient management due to principal agent problems. This paper identifies three parameters: (i) competition, (ii) monitoring and (iii) incentives, for transferring risks in a principal agent relationship. These parameters are applied to three PPP wastewater projects. The findings illustrate that competition determines the private sectors' ability to bear risks, monitoring reduces ex-post information asymmetry and incentive ensures that risks are efficiently managed. The lessons learnt from the case studies can provide guidance for governments in transferring risks efficiently in PPP wastewater treatment projects.

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## 1. Introduction

Public private partnerships (PPPs) are long-term arrangements where a number of risks are transferred to the private sector, for which they are financially compensated (Wibowo and Mohamed, 2010). It is evident from previous studies that the private sector is better than the public sector at managing project risks (Ng and Loosemore, 2007). This is because the private sector is driven by profit which makes them better at managing the risks more efficiently (Hayford, 2006). So theoretically, allowing the private sector to manage these risks should result in lower costs. However in reality, the private sector will not bear risks of high magnitude at a low price, even though they are better suited to manage them. In such cases, governments will find it difficult to offer sufficient incentives for private companies to take on these risks and even though the public sector may not be sophisticated at managing risks, they may remain saddled with those risks (Quiggin, 2005). The consequence is that a whole range of risks may be inefficiently allocated.

So how can governments design contracts that allow the right amount of risks to be transferred to the private sector? To answer

this question, it is important to discuss the relationship between the public and the private sector in PPP contracts. PPPs generally do not sit within the traditional norms of partnerships in which the two partners work together in achieving the same goals and where the profits as well as risks are shared. The relationship is one of a principal and an agent in which information asymmetry is present (De Palma et al., 2009). In an environment where principal agent problems exist, transferring risks may not always result in efficient management by the private sector. Therefore, the application of the principal agent theory (PAT) can provide a better illustration of how risks can be transferred and how the private sector can be motivated to manage them more efficiently.

PPPs are implemented in a principal agent setting and consequently, agency problems have been recognized (Mu et al., 2010; Wang and Liu, 2015). The dilemma of PPP is that while private participation offsets procurer cost burdens, it also puts the private partner in significant control of the whole project, inviting actions that siphon off benefits to themselves at the cost of the procurer, whose interests they are supposed to serve. Despite the implications of principal agent problems in PPPs, little attention has been paid to the application of the PAT in defining risk transfer. This study was an attempt to fill that gap. The parameters for risk allocation derived from the PAT were examined empirically to demonstrate efficient risk transfer PPP wastewater treatment (WWTP) projects. The findings from this study can offer strong implications for the public sector to plan and to develop efficient

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mechanisms for risk allocation in PPP contracts.

## 2. Principal agent problems in PPP projects

Much of the risk in PPPs accrues from the complexity of the projects; they involve substantial resources, committed over long periods of time, under changing and uncertain conditions (Zou et al., 2014). There is a large body of research analyzing risks in PPP projects (Chan et al., 2014; Ameyaw and Chan, 2015; Carbonara et al., 2015). Generally, the findings from these previous studies indicate that the critical risks in PPP projects include both endogenous and exogenous factors that affect projects differently. Moreover, the impact of these risks as perceived by the governments and the private sectors are also different (Shrestha et al., 2017). Furthermore, allocating risks efficiently among parties whose goals may not always be congruent is a major challenge (De Palma et al., 2009).

Efficient risk allocation is understood as an instrument to apportion risks such that the party with the (superior) ability to manage the risks also bears the responsibility to manage them (Abdel Aziz, 2007). However, risks in PPPs are not always allocated to the party best able to manage them, but to the party least able to refuse them (Jin and Zhang, 2011). When governments are too keen to attract private investment via PPPs, it is generally the private sector that has greater influence during risk allocation negotiations. As a consequence, government may have to pay considerable premiums in order to transfer those risks to the private sector reducing the value for money (VfM) in these projects (Witt and Liias, 2011).

The lack of ex-post competition and the high costs associated with changing PPP contracts at the ex-post stages may create a shift in the bargaining power among the players. Higher bargaining power of the private sector may lead to issues such as the *holdup* problem, which Williamson (1985) has recognized as one of the key issues associated with projects with high sunk costs. The *holdup* problem can force re-negotiation of the contracts as the government has much more to lose than the agent (Chang, 2014). Moreover, higher bargaining power of the private sector can also create a *private monopoly* leading to reduced efficiency or quality (Fourie and Burger, 2000; Ashuri et al., 2012).

On the other hand, when governments maintain a strong bargaining power, more risks can be transferred to the private sector. Nevertheless, when risks are inefficiently transferred, the private sector may either change high premiums or look for ways to reduce their costs by compromising quality. Furthermore, they may also try to protect their private information as a strategy to protect future rents (Guasch et al., 2008), which then leads to information asymmetry making it harder for governments to monitor the performance of the private sector. This creates the potential for mistrust and morality issues (Wang and Liu, 2015). Worse even, the private sector may provide false information in an attempt to re-transfer the risks back to the government.

Several contributions have been made in the area of risk allocation in PPPs, for example, Medda (2007) examined risk negotiations using a game theory model; Jin and Doloi (2008) proposed risk allocation on the basis of transaction costs; Clifton and Duffield (2006) suggested alliancing principles to attain better VfM; and more recently, Carbonara et al. (2014) that focused on building a win-win risk sharing mechanisms via efficient concession terms. However, previous studies have generally overlooked the ex-post problems arising from information asymmetry between the government and the private sector in PPP contracts.

PAT assumes that there will always be information asymmetry between the principal and the agent (Eisenhardt, 1989) and that credibility will always be an issue when the private sector is involved (Posner, 2002). The PAT highlights two main problems

resulting from information asymmetry and opportunism, i.e. (i) adverse selection and (ii) moral hazard (Picard, 1987). The adverse selection problem is associated with the principal hiring an agent who is not the most suitable, while moral hazard deals with the agent not performing in the principal's best interests.

According to the literature on PAT, there are three main schools of thought on how the principal agent relation can be structured in order to achieve the best outcome for the principal. The first is through competition (Fama, 1980; Müller and Turner, 2005), the second, via monitoring (Alchian and Demsetz, 1972; Strausz, 1997) and the third, by providing incentives (Holmstrom and Milgrom, 1991; Laffont and Martimort, 2002). These concepts have been discussed in the context of PPPs by several researchers. For example, Fourie and Burger (2000) argued that weak competition leads to the ex-post problems related to opportunism. Jefferies et al. (2002) and Kwak et al. (2009) discussed the importance of well structured tendering process in PPP contracts to avert adverse selection by selecting a concessionaire that is experienced and capable in managing risks, while Silvestre (2012) concluded that the delivery of PPP water services results in lower VfM primarily due to weak competition.

In regards to the ex-post stages of PPP, Amagoh (2009) argued that a good monitoring system is vital to overcome problems of information asymmetry and moral hazard. Similarly, Iossa et al. (2007) and Gordon et al. (2013) focused on the need to monitor and control the private sector to ensure that the terms of the contract are carried out. Bloomfield (2006), Gordon et al. (2013) and Wang and Liu (2015) among others have highlighted the role of incentive systems in PPP contracts, arguing that incentives can ensure good performance and attain the desired outcomes in the projects. These incentives systems include positive inducements such as rewards, cost-sharing and pricing arrangements or negative incentives such as penalties and payments for non-compliance.

So, based on the review presented above, three parameters were identified, i.e. (i) competition, (ii) monitoring and (iii) incentives. The objective of this study was to demonstrate how risks can be efficiently transferred to the private sector in WWTP projects using these parameters.

## 3. Methodology

A case study method was adopted in this study. This type of research is more amenable to analysis through case study as the focus of the analysis is highly contextual (Yin, 2003). Moreover, exploring the research objectives through real life cases can facilitate in recognizing the best practices and allowing lessons to be drawn in illustrating efficient risk transfer.

Three PPP WWTP projects were analyzed; two in China and one in Australia. The three cases are fairly different in terms of their size, scope and structure. However, all projects fall under the PPP category and more importantly, these projects were identified as successful projects (at the time of the study) and there are lessons to be learnt from these projects in regards to risk transfer.

Data from the three WWTP projects was collected through face-to-face interviews and by reviewing project documents. Primary data was collected through semi-structured interviews; specifically one interview was conducted for each of the three projects. The head PPP consultants to the government were interviewed in the two Chinese cases and the project director of the public utility was interviewed for the Australian case study. The interviews were recorded and transcribed.

Additionally, the original PPP contracts from the two Chinese projects were broadly analyzed. Documents analyzed for the Chinese case studies included the *Franchise Agreement*, the *Operation Rights Transfer Agreement* and the *Wastewater Service Agreement*

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