

Opportunism-Focused Transaction Cost Analysis of Public-Private Partnerships

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Abstract: While the higher efficiency due to better pooling of resources is greatly emphasized in public–private partnerships (PPPs), the embedded transaction inefficiencies are often understated or even ignored. Through the lens of transaction cost economics (TCE), this paper aims to answer why and when PPPs may become a costly governance structure. Specifically, the authors develop a TCE-based theory of PPPs as a governance structure. This theory suggests that three major opportunism problems embedded in infrastructure PPPs are possible to cause substantial transaction costs and render PPPs a costly governance structure. The three main opportunism problems are principal–principal problem, firm’s hold-up problem, and government-led hold-up problem. Moreover, project and institutional characteristics that may lead to opportunism problems are identified. Based on these characteristics, an opportunism-focused transaction cost analysis (OTCA) of PPPs as a governance structure is proposed to supplement the current practice of PPP feasibility analysis. As a part of theory development, a case study of the channel tunnel is performed to evaluate the proposed theory and to illustrate how the proposed OTCA can be applied in practice. Policies and administration strategies for infrastructure PPPs are derived based on the proposed theory. DOI: 10.1061/(ASCE)ME.1943-5479.0000361. © 2015 American Society of Civil Engineers.

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Introduction

Public–private partnerships (PPPs) have become one of the most popular and important governance structures to deliver public infrastructure or services, especially in transportation (Geddes 2011). Proponents of PPPs typically emphasize the benefits due to better financing from private sectors and higher efficiency through private ownership or market competition. From the resource-based view (RBV) of governance strategy, the financing capability, innovation ability, and managerial efficiency of private parties are the main resources that attract governments or public agencies to team up with private parties. In particular, in emerging or developing countries, PPPs may be the fastest way to provide the infrastructure needed. However, while PPPs are a promising alternative to providing transport infrastructure, many failed PPP projects have made it evident that PPPs, under certain situations, can be very costly or even a wrong choice of governance structure. Garvin (2010) discussed the opportunities and challenges of applying PPPs for transportation in the United States. Cheung and Chan (2011) proposed an evaluation model for assessing when PPPs are suitable for a project. Ahmadjian and Collura (2012) presented a four-step process for assessing the benefits, costs, and other impacts associated with the use of PPPs. According to a literature survey on the studies

of PPPs by Tang et al. (2010), there are few theoretical studies that provide a comprehensive analysis on when PPPs are a suitable governance structure. In this paper, the authors shall discuss this issue from the perspective of governance structure choice, which emphasizes that high transaction costs could render PPPs an inferior governance choice for transport infrastructure. Specifically, based on the transaction cost economics (TCE), a theory of PPPs as a governance structure is proposed. This theory may supplement the current practice in evaluating PPP feasibility and managing PPP projects. Note that economic analyses in new institutional economics, such as TCE, rely heavily on comparative analysis of the trade-offs in different governance alternatives, using contrast and comparison rather than mathematical modeling. The transaction cost analysis performed in this study follows the style of most new institutional economic analyses.

This paper is organized as follows. The next section explicates how PPPs can be viewed and analyzed as a governance structure through the lens of TCE. Subsequently the authors discuss the problematic profit structure of PPP promoters, which tends to cause a significant incentive for opportunism in PPPs. The next section then analyzes the opportunism problems, the subsequent transaction costs, and the major characteristics leading to those opportunism problems. Based on the analysis, three propositions are developed. A case study is performed to evaluate the propositions and illustrate the application of PPP transaction cost analysis. The final sections propose policy implications on infrastructure PPPs and offer conclusions.

PPPs As a Governance Structure for Delivering Infrastructure

TCE View of Governance Structure

Governance structures can be regarded as an organizational arrangement for completing a specific series of transactions. Governance structures are typically categorized into markets governance,

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hierarchies governance, and hybrid governance. Markets refers to the arm's length market exchange governed by contracts, whereas hierarchies refers to the internal organization governed by unified ownership and internal control. Hybrid governance refers to the mixed control of transactions characterized by interfirm co-operation such as long-term contracts, alliances, and franchising. TCE argues that different transactions characterized by certain observable dimensions should be aligned with different governance structures, which differ in their cost and competence, so as to create an economizing result. Different governance mechanisms present different trade-offs between benefits and transaction costs; therefore, choosing from alternative schemes should be based on careful evaluation of the comparative costs and benefits (Parker and Hartley 2003).

TCE is one of the most important theories for studying strategic management, organization, and governance structure choices. According to TCE, governance structure is considered as a cost-minimizing and discriminating alignment between organizational control and the transaction costs caused by potential opportunism (Williamson 1985). TCE's analytic framework relies on two main assumptions about human behaviors (i.e., bounded rationality and opportunism) and two key dimensions or characteristics of transactions (i.e., asset specificity and uncertainty) (Rindfleisch and Hiede 1997; Geyskens et al. 2006). According to Williamson (1985), opportunism is described as "self-interest seeking with guile," where bounded rationality makes the guile possible. TCE argues that the main problem causing transaction costs is opportunism, and the information problem caused by bounded rationality makes the opportunism possible. Furthermore, certain characteristics of transactions tend to cause opportunism problems in transactions.

First, transactions that exhibit higher transaction-specific or asset-specific investments and/or uncertainty will be more prone to opportunism. Transaction-specific assets/investments are investments made for a particular transaction and have a significantly lower value—zero value in the extreme—if they must be redeployed for other purposes. For example, asset-specificity is often associated with specific individuals (e.g., transaction parties who are almost irreplaceable) or special production specifications. Asset/investment specificity is considered the major driving characteristic for hold-up exploitation, the major opportunism problem concerned in TCE. The term hold-up in TCE generally means that one party holds something effectively against the other party to yield a favorable agreement through negotiation or renegotiation. Therefore, the transaction party who commits significant irreversible, transaction-specific investments can be easily held up by the other party for renegotiation.

The second transactional characteristic leading to the opportunism problem is uncertainty. The impacts of uncertainty are twofold. In terms of environmental uncertainty, when the relevant contingencies concerning a transaction, such as product demand, are too unpredictable to be addressed *ex ante*, it is difficult to have an efficient contract that eliminates or safeguards against potential renegotiation and the resulting hold-up. In terms of behavioral uncertainty, the shirking problem, which is the second major opportunism problem in TCE, occurs when it is difficult to ascertain contractual (i.e., behavioral) compliance *ex post*.

According to TCE, if the transaction costs caused by opportunism problems exceed the production advantages of markets governance, then hierarchies, in the form of internalization of all involved parties into a single organization, will become a better governance structure than markets for this transaction. Alternatively, if relational capital, such as trust, exists between transactional parties, hybrid governance may reduce the transactional hazards and the

associated transaction costs and become a better governance structure than markets or hierarchies.

TCE View of PPPs As a Governance Structure

Whereas TCE has profound impacts on the study of governance structure decisions in the private sector, researchers have recently just begun to extend the TCE to studying government organizations and functions. Dixit (1996) studies policy-making and regards the private and public bureaucracies as two distinctive governance structures analogous to markets and hierarchies, respectively. Similarly, Williamson (1999) considers the problems faced by governments as the choices of governance structures among private firms (full privatization), regulated privatization (private firms under regulation), and public agencies (traditional government functions). Williamson (1999) studies why public bureaucracy, widely believed to be inefficient, can be a well-suited governance structure to certain governmental functions. However, Williamson's (1999) major focus is on the choice between private firms and public agencies, instead of the regulated privatization. In terms of the governance structure, infrastructure PPPs can be regarded as regulated privatization, characterized by the mixed control of transactions between private firms and public agencies.

While, in TCE terms, private firms and public agencies correspond well to markets governance and hierarchies governance, respectively, regulated privatization is not consistent with the concept of hybrid governance by the following two reasons. First, the authors argue that the relational capital emphasized in hybrid governance tends to be insignificant in regulated privatization, such as PPPs. In particular, since governments are commonly—but certainly not always—constrained by anticorruption laws and institutions, cooperative or partner-like conduct toward private parties based on trust, mutual understanding or informal decision making is often politically problematic and difficult to be justified as legitimate. Therefore, the relational capital emphasized by hybrid governance cannot truly exist in public-private partnerships. Second, whereas regulated privatization emphasizes the regulations imposed by formal institutions, the interactions between government and private parties are governed mainly through a series of complex contracts as in markets governance. Based on the two reasonings, the authors argue that the TCE view of PPPs should be viewed as regulated markets, a special case of markets governance with a focus on institutional environments and transaction arrangements. Thus, the TCE view of PPPs focuses on the distinctive opportunism problems embedded in the concession contracts and the associated transaction costs, instead of the relational capital emphasized in hybrid governance.

The TCE view of PPPs concerns when and why transaction costs in PPPs may be high. The base case for this transaction cost analysis is hierarchies governance, i.e., public agencies governance, characterized by traditional procurement and delivery methods such as design-bid-build or design-build. Thus, this study can be considered a transaction cost analysis of governance structure choices between regulated privatization and public agencies. Specifically, in regulated privatization/markets, since the objectives of PPP promoters (parent companies) and the objectives of PPP concession firms are often inconsistent and exhibit conflict of interests, unique opportunism problems will be induced. Moreover, the government's learning curve for PPPs is often very slow due to the complexity of PPPs and the inefficiency of bureaucracy. As a result, the opportunism problems in PPPs are aggravated by government's slow learning curve.

Although practitioners and some researchers sometimes use the term transaction costs in typical PPP feasibility analysis methods,

such as value for money (VfM) or public sector comparator (PSC), their concept of transaction costs is different from that in the context of TCE. The transaction costs in typical feasibility analyses account mainly for the explicit transaction costs that are associated with the distinctive procurement process, higher capital costs, and/or higher management costs. For example, Dudkin and Valila (2006) estimate the transaction costs of the PPPs in the United Kingdom and conclude that the costs related to the procurement phase of PPPs alone amount to well over 10% of the capital costs of the project on average. Therefore, a large portion of the opportunism-induced transaction costs cannot be accounted for. For example, consider a contract under high environmental uncertainty and asset specificity. The transaction costs in TCE include the loss due to project failure that is caused by the opportunistic behaviors that actually take place. In fact, many, if not most, of the financial and operation difficulties in PPP projects are directly or indirectly caused by opportunism problems, and the costs for resolving these difficulties are not analyzed and evaluated *ex ante* in typical feasibility analyses. Thus, it is important to develop a TCE view of PPPs as a governance structure so that the transaction costs of PPP projects can be fully accounted for.

PPPs' Unbalanced Profit Pool Syndrome

In this section, it is argued that the unbalanced profit pool syndrome embedded in many, if not most, PPP projects is the driving factor of opportunism problems. Since this syndrome is not defined elsewhere in literature, the authors shall define the syndrome and its related terminologies here.

Promoters' Profit Pool in a PPP Project

The profit pool of a PPP investment can be better explained by the PPP business model illustrated in Fig. 1, which shows that the promoters' profit pool may include equity returns, construction contract returns, and operation contract returns (Ho 2013). Detailed discussions of each component in a profit pool are given as follows:

- First component: equity investment returns. The equity investment returns of a PPP firm are defined as equity value minus equity investment. In PPPs, the promoters will be one of the major shareholders of the PPP firm and also the "controlling shareholders" responsible for the project development. The equity invested by nonpromoters is considered to be the "passive equity." Unlike the passive shareholders, the equity returns may not be the only profits sought by the promoters or controlling shareholders in a PPP project.
- Second component: construction contract returns. The construction contract returns refer to the profits from the promoters' undertaking of construction contracts during the construction phase. In practice, construction firms are the most active players in promoting PPP projects, even though most of them do not possess the expertise in the project-related business. The economic rationale for this phenomenon is that construction firms usually earn the highest returns from being a promoter. This phenomenon plays a crucial role in the transaction cost analysis of PPPs.
- Third component: operation contract returns. The operation contract returns refer to the profits from the promoters' undertaking of operation-related contracts during the operation phase. The operation contract returns are often guaranteed as long as the PPP firm continues with the operation. Those who are capable of undertaking operation contracts and consider these contracts profitable may invest in the project as one of the controlling shareholders. As the authors will discuss later, this difference between contractors' short-term focus and operators'

long-term focus plays an important role in the transaction cost analysis of PPPs.

Unbalanced Profit Pool Syndrome

Unbalanced profit pool in PPPs refers to a PPP profit pool skewed to the short-term profits, in particular, the construction contract returns. The major reason for the unbalanced profit pool is that PPPs heavily rely on project financing, as characterized by the large debt financing with small equity investment. Because of the small equity requirement, promoters are able to undertake large and lucrative construction contracts with a relative small equity investment. This has given constructors a major incentive to become the PPP promoters and to focus on short-term construction returns. To some degree, the equity investment may be well compensated by the high construction contract returns. As a result, PPP projects often exhibit the unbalanced project pool syndrome. Unfortunately, this syndrome is one of the major sources that may induce opportunism problems in PPPs.

Opportunism Problems, Contributing Characteristics, and Transaction Costs in Infrastructure PPPs

PPPs combine many contractual arrangements in a unique way that creates very special contractual hazards that are not seen in the TCE literature. The distinctive characteristics of infrastructure PPPs and their impacts on opportunism problems call for the need to have a framework for analyzing infrastructure PPPs. In this paper, a TCE-based theory of PPPs as a governance structure is proposed. The authors identify three major types of opportunism potentially embedded in PPP governance and discuss how the opportunism problems could cause significant transaction costs. Moreover, the main transaction characteristics that may lead to opportunism in PPPs are identified. The TCE-based view of PPPs is expressed as three propositions, each for one opportunism problem.

Principal–Principal Problem in Infrastructure PPPs

Principal–Principal Problem and Transaction Costs

The principal–principal problem refers to the negative impacts caused by the controlling principal's exploitation of the passive stakeholders, such as minority shareholders, lenders, and debt guarantee providers. The principal–principal opportunism may result from the business group structures, concentrated ownership, and weak legal protection of minority shareholders (Young et al. 2008). The controlling principal who appoints the major directors of the board and top managers of the firm might exploit their private information and dominant positions to appropriate from passive stakeholders, such as minority shareholders, institutional investors, and bond lenders. Even though in practice major lenders may have a powerful position in PPP projects through robust monitoring procedures (Shaoul et al. 2008; Demirag et al. 2010), the asymmetric information places the lenders in a significantly disadvantageous position, as in the principal–agent problem. The authors argue that principal–principal conflicts are unfortunately embedded in PPPs due to the unbalanced profit pool syndrome of PPPs, even when projects are undertaken in developed countries. Typical forms of appropriation include over-market-price outsourcing to the private holdings or parent companies of the controlling shareholders (Su et al. 2008) and aggressive investments on risky projects for the benefits of the controlling principal. Similar to the principal–agent problem, the promoters, being the controlling principal of PPP projects, often have the capability to exploit their private information in

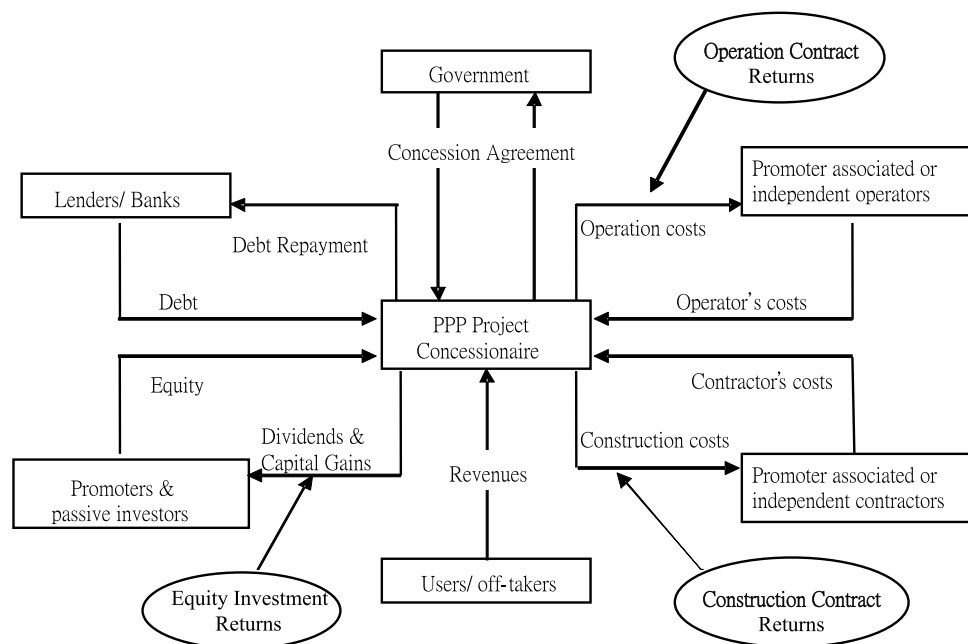


Fig. 1. Promoters' profit pool in PPP projects

seeking rents from passive investors. For example, the procurement contracts in PPP projects are often criticized for being awarded to the contractors or suppliers owned by, or associated with, the controlling shareholders with much more favorable clauses.

While principal–principal conflicts may result in the wealth redistribution between the controlling shareholders and the passive stakeholders, the principal–principal opportunism also gives rise to many problems in PPP projects, which may seriously impair the performance and financial situation of the project. The resulting transaction costs can be decomposed into *ex ante* (before project awarding) inefficiency and *ex post* inefficiency.

- *Ex ante* inefficiency during the project tendering: opportunistic bidding, aggressive investment, and high equity premium.

Because of the promoters' excess profits from principal–principal conflicts, promoters have a strong incentive to bid opportunistically or invest aggressively to win the project. With regard to opportunistic bidding, promoters, in their proposals, may intentionally understate the possible costs or risks involved and/or overstate the project profitability to outperform other bidders. An overly optimistic proposal can have a higher chance of winning, given the facts that many of the crucial and promoter-specific project information in the bid proposal are very difficult to be verified and that the government tends to favor those proposals with optimistic financial forecasts. From the TCE perspective, opportunistic bidding or investment can be regarded as a sophisticated guile for rent seeking in principal–principal opportunism. When the project's environment/demand uncertainty is high, opportunistic bidding is often an effective strategy for winning the project. The inefficiency due to opportunistic bidding and investment is profound. Opportunistic bidding distorts the true information and misleads the government to make wrong awarding decisions that drive out the honest bidders. Because of the wrong awarding decisions and the promoters' subsequent opportunism after project awarding, projects will often face early failures and/or need government bailouts. On the other hand, if the potential transaction hazards and subsequent costs are expected by the foresighted or experienced passive principal, the transaction costs will be reflected in

a higher required equity premium (i.e., discount rate for cash flows) that corresponds to higher risk of exploitation. More seriously, as more lenders or institutional investors realize that they are exposed to serious principal–principal exploitation, they may not be willing to provide the financing needed for PPP projects without government guarantees, through which the exploitation risks are transferred to the governments.

- *Ex post* inefficiency during the project construction and operation: shirking behaviors, high monitoring cost, and financial distress.

The principal–principal conflicts also discourage the controlling shareholders to adopt strategies that are in the best interests of the project/concession firm's overall performance. As argued previously, under unbalanced profit pool, promoters' major concern is the returns to the controlling principal rather than the returns to the passive shareholders or the concession firm. This opportunistic behavior is the shirking problem (Holmstrom and Milgrom 1991, 1994; Hart et al. 1997) associated with the behavioral uncertainty and monitoring problem in TCE. Based on their argument, providing an agent (e.g., the controlling principal in PPPs) a strong incentive to pursue one objective (e.g., personal gains) can lead to his shirking on other objectives, such as quality. Specifically, the controlling principal in PPPs, who appoints and controls the board of directors, may benefit from manipulating the outsourcing prices and clauses, while the passive stakeholders, who are subject to information asymmetry, may suffer from losses in equity returns or a higher default risk. Although such opportunistic behaviors may also reduce the controlling principal's returns on equity, the controlling principal's overall returns from the profit pool may be maximized because of the considerably small equity investment of the controlling principal under the project financing scheme used in PPPs. Alternatively, foresighted passive stakeholders may focus on monitoring the controlling principal or safeguarding against shirking. However, due to information asymmetry and bounded rationality, the costs of monitoring or safeguarding can be significant, although maybe lower than the impacts of actual shirking. In the worst case, the project may suffer from financial distress or project failure.

Accordingly, the authors propose Proposition 1 about the relationship between the principal–principal problem in PPPs and the resulting transaction inefficiencies.

Proposition 1: The more severe the principal–principal opportunism is in an infrastructure PPP project, the more likely the project will be subject to high transaction costs.

Project and Institutional Characteristics Leading to Principal–Principal Opportunism

Principal–principal opportunism in PPPs is induced mainly by transactional characteristics or situations that are related to unbalanced profit pool and information asymmetry. Accordingly, the project and institutional characteristics that may lead to principal–principal opportunism are identified. Since these characteristics are observable and can be assessed, these characteristics can be used to evaluate the severity of potential opportunism.

Project Characteristics:

- The profit pool is attractive mainly to constructors, not to future operators. This characteristic usually indicates lucrative construction contract profits but low future equity returns. As a result, there will be a high probability of having an unbalanced profit pool in PPPs and the constructors will often become the controlling shareholders who can exploit rents in the principal–principal conflicts. From this perspective, this characteristic can be considered the main driving factor of the principal–principal opportunism.
- The uncertainty of demand/revenues is too high to have a satisfactory forecast. High demand/revenue (volume) uncertainty will aggravate the information asymmetry, the crucial condition for successful opportunistic bidding and the shirking. In addition, because of the high uncertainty, promoters will heavily discount their long-term equity returns and operation returns and then inevitably focus on short-term construction contract returns.
- The project complexity is high. High project complexity often implies information asymmetry that facilitates the ex ante guile (e.g., opportunistic biddings) for opportunism and ex post shirking.
- The project scale is large. In practice, large or mega projects might refer to those ranging from hundreds of millions to billions of U.S. dollars. Large project scales often aggravate the impacts of the many characteristics that lead to opportunism. For example, when a project exhibits unbalanced profit pool syndrome, large project scale will aggravate the impacts of unbalanced profit pool by the large profits from construction contracts.

Institutional Characteristics:

The institutional characteristics have significant impacts on the interactions between public agencies and private parties. Since PPP governance involves public sectors, regulations, and capital market, the authors argue that institutional characteristics stand out as the driving characteristics of opportunism:

- The government is inexperienced in PPPs. Government agencies often have very limited or even no experience in managing PPPs. An inexperienced government does not have sufficient knowledge about the unbalanced profit pool syndrome and the resulting principal–principal conflicts in PPPs. Therefore, governments may tend to follow the mind-set in traditional design–bid–build that focuses primarily on the bidders' financial forecast or cost estimate and, thus, tends to award projects to opportunistic bidders, who can benefit from principal–principal exploitation.
- The capital market is immature. An immature capital market can be characterized by small capital market, low financing capacity,

incomplete information, or the lack of professionals in finance. As a result, governments will be frequently involved in helping promoters obtain loans/debts for projects and, in turn, the lenders will tend to require government guarantees on the debts. As a result of government guarantees, the lenders will lose the incentive to take additional efforts in monitoring the controlling shareholders or safeguarding against the principal–principal exploitation.

Firm Hold-Up Problem in Infrastructure PPPs

Here the authors will discuss the hold-up problem, analyze the associated transaction costs, and identify the contributing transactional attributes. The hold-up problem discussed includes firm hold-up and government hold-up.

Firm Hold-Up in PPPs and Transaction Costs

Different from the typical TCE markets governance, governments in PPPs are more prone to open the door for renegotiation and are more reluctant to enforce the contract clauses concerning project distress. Renegotiations generally give contracting parties better ex post payoffs under adverse situations (Hart 1995). As observed in practice, when PPP projects are in distress, governments are often willing or compelled to renegotiate and provide various aids, such as helping the concession firms to acquire more loans or to be relieved of some financial obligations, granting direct or indirect subsidies, and extending the concession duration. Ho's (2008) case study of Taiwan High Speed Rail project, one of the largest PPP projects in the world, gives detailed analyses of the major renegotiation events throughout different project phases and shows the severity of hold-up/renegotiation problems. Through a game-theoretic analysis, Ho (2006) concludes that, because renegotiations are a highly probable game equilibrium in PPP projects, renegotiations will often be expected ex ante by PPP promoters. The transaction costs due to hold-up opportunism can also be decomposed into ex ante inefficiency and ex post inefficiency.

- Ex ante inefficiency: opportunistic bidding and aggressive investment.

The expectation of renegotiation destroys the incentive mechanism. If a request for renegotiation is expected to be granted, promoters will bid or invest aggressively to win the project (Ho 2006; Schaffer 1989). More seriously, renegotiation due to hold-up will cause commitment loss; that is, if abused in the past, the public sector's reputation may be ruined, and this can reduce the incentive power of future contracts and distort competition in future tenders.

- Ex post inefficiency: shirking behaviors, high monitoring costs, renegotiation, and project distress.

Renegotiation can often be observed when public agencies are held up by firms. Bolton and Dewatripont (2005) maintain that if renegotiation is expected, the agent may choose inefficient actions ex post that reduce overall or social efficiency but increase the agent's payoffs. From this perspective, similar to the principal–principal problem, the shirking behaviors during project performance may also occur if renegotiation is expected. For a foresighted government, the resulting inefficiency may be reflected in the high monitoring costs against shirking. In the worst case, the project may suffer from financial distress or project failure.

Accordingly, the authors derive Proposition 2 about the relationship between hold-up problem in PPPs and the resulting transaction costs.

Proposition 2: The more serious the firm hold-up opportunism is in an infrastructure PPP project, the more likely the project will be subject to high transaction costs.

Project and Institutional Characteristics Leading to Firm Hold-Up Opportunism

According to Ho's (2006) model, the probability of renegotiation depends mainly on the opportunistic costs of replacing the incumbent concession firms, the impacts of project failure, and the institutional environment concerning government bailout. Thus, the authors can identify several project and institutional characteristics that may lead to hold-up in infrastructure PPPs.

Project characteristics:

- The project-specific investment from government is high. In infrastructure PPPs, governments often need to invest substantial capitals and extended time and efforts. These government investments include long and complicated procurement processes, capital for land acquisitions, and complicated financial and legal arrangements. As a result of these high project-specific investments, governments can be easily held up.
 - The project is politically and/or economically important. Many infrastructure projects are prone to becoming a political agenda or serving certain political purposes. For example, the development of a high-speed rail or a mass rapid-transit system in a country often raises political debates and becomes a national focus. In such cases, project success or failure will have significant political implications, especially for election campaigns. Because the political costs of failure in these projects are very high, governments usually have low tolerance for project failure and tend to bail out these projects if the projects are in distress. From this perspective, governments can be easily held up in such PPP projects, and the hold-up opportunity will be expected ex ante. Note that project importance in PPPs can be regarded as a variation of asset specificity because the government's reputation invested in an important PPP project is highly specific to this particular project.
 - The project scale is large. As discussed earlier, large project scales often aggravate the impacts of other characteristics. Large scales also make the project economically and politically more important.
 - The uncertainty of demand/revenue is too high to make a satisfactory forecast. Coupled with information asymmetry, uncertainty is one of the major transaction characteristics that lead to hold-up opportunism. In infrastructure PPPs, if the demand/revenue uncertainty (i.e., volume uncertainty) is high, it is difficult to have an efficient contract that safeguards against potential renegotiation and the resulting hold-up.
 - The project complexity is high. Since complex projects usually involve high-tech facilities, complicated operation system and management, and highly skilled professionals, the costs of replacing incumbent distressed firms or interrupting daily operation tend to be high, and the government can easily be held-up.
- Institutional characteristics:
- The government is inexperienced in PPPs. Inexperienced governments are often tempted to use PPPs for large or important projects because PPPs seem to solve their funding problems. In addition, inexperienced governments are often more reluctant to allow distressed projects to fail.
 - The capital market is immature. When the capital market is immature, there are very limited alternatives to handle a distressed project other than the subsidy from government. Furthermore, in an immature capital market, due to the insufficient financing capability, governments often get actively involved in arranging debt financing by providing loans or guarantees. These arrangements eventually transfer the project risks back to the governments. Therefore, when the capital market of a country is immature, governments can be easily held up for renegotiation.

- Legitimacy of government rescue is high. Legitimacy of government rescue is closely related to the political institutions and national culture of a country. In developed countries, the public is an important stakeholder of PPPs, and the public wants to know whether PPPs will put public interests over private profits (Papajohn et al. 2011). Therefore, the formal and informal institutions usually get low legitimacy for the government's rescue of distressed PPPs. Rescues without strongly justifiable reasons will usually cause harsh criticisms. However, in most developing or emerging countries where democracy is still in its infancy, governmental rescue can be justified more easily. This phenomenon is often referred as the "soft budgeting constraint" problem (Kornai 1979; Kornai et al. 2003), which often happens in developing or emerging countries, where governments are economically or politically vulnerable to the failure of important projects or firms. Qian and Roland (1998) argue that fiscal centralization would lead to softer budget constraints. According to Ho's (2006) model, when the legitimacy of government rescue is high, promoters will form ex ante expectation on the opportunity for hold-up and renegotiation.

Government-Led Hold-Up, Political Risks, and Transaction Costs

Opportunism can also be initiated by governments. For example, obsolescing bargain can be considered the opportunism by government through government hold-up. According to Vernon (1971), obsolescing bargain originally refers to a model of interaction between a multinational enterprise (MNE) and a host country government, in which the MNE and the government initially reach a bargain that favors the MNE, but over time as the MNE's fixed assets in the country increase, the bargaining power shifts to the government. Similarly, in PPPs, the government can hold up the concessionaire once the project has been built and is in operation and initiate the so-called government-led renegotiation (Guasch et al. 2007) to reduce the tariffs or tolls paid to the concessionaire or increase taxes or royalties paid to the government. While renegotiations may reflect the need for ex post Pareto improvement in response to the changes of or shocks from the environment, Guasch and Straub (2006) argue that most government-led renegotiations are opportunistic, with politicians trying to please their constituencies.

From the TCE perspective, government's opportunism through government-led renegotiation also causes substantial transaction costs in terms of ex ante and ex post inefficiencies.

- Ex ante inefficiency: government's aggressive investment and high-risk premium.
- If the institutional environment permits or even encourages government-led renegotiation, governments may tend to invest aggressively in infrastructure PPPs by offering contractual terms that are very favorable to the concessionaires during project procurement. These terms may lead to future renegotiations, lawsuits, expropriations, or project failures. Eventually, the potential of government hold-up will be expected by the concessionaires and be reflected in a much higher risk premium imposed by the promoters or in a high political-risk insurance cost.
- Ex post inefficiency: mediocre performance, information concealing/distortion, renegotiation, and expropriation.

When government-led renegotiation is expected to happen, the concessionaires may lose their incentives to maximize project profits and be content with mediocre performance. Alternatively, the concessionaires may focus on how to conceal the profits or, even worse, on how to benefit from principal-principal opportunism if the unbalanced profit pool syndrome exists. Or, if renegotiations

actually take place, the time, money, and efforts spent in renegotiations also constitute significant transaction costs. Therefore, Proposition 3 is proposed.

Proposition 3: The more serious the government-led renegotiation problem is in an infrastructure PPP project, the more likely the project will be subject to high transaction costs.

Project and Institutional Characteristics Leading to Government-Led Hold-Up

The authors argue that, unlike promoters' hold-up, the price for government hold-up is very high in the long run because the government's loss of credibility and reputation will increase future projects' political risk premiums required by promoters. Therefore, governments with mature institutional environments would have less incentive to behave opportunistically. Following this logic, it is argued that project characteristics are less likely to lead to government opportunism.

Institutional characteristics:

- The legal environment is immature. A mature legal system provides promoters protection for their investments and property rights. In PPPs, it is broadly recognized that the legal protection against governments' breach of contracts or government-led renegotiation is critical to the concessionaires. As is often observed, in many emerging and developing countries, because of their weak legal institutions, the government hold-up opportunism is often considered by promoters the major political risk for PPPs.
- Government's income is low. Governments of low-income countries have more incentives to renegotiate the concession provisions, such as royalties or unitary charge, when a project exhibits excess profits.
- The political and policy stability is low. As argued by Guasch and Straub (2006) and Ramamurti (2003), obsolescing bargain or government's breach of contracts often happens before, during, or after an election with politicians' intention to please their constituencies. Even in a country where the legal system is matured, the political debates and motives could sometimes impair the normal legal protection and create substantial government hold-up risks. The political and policy stability is usually very persistent and easy to be observed.

Case Study: Transaction Cost Analysis of the Channel Tunnel Project

The objective of this case study is to show how the proposed PPP governance structure framework can be applied to evaluate the transaction costs of the Channel Tunnel project, the most-discussed PPP project in literature.

Project Background

Channel Tunnel is one of the largest PPP infrastructure projects in the world. As a result of expenditure cuts on public projects and the depression of the construction market in the United Kingdom during the late 1970s and early 1980s, the development of the channel and its financing became important issues in the United Kingdom during the early 1980s. The British government finally decided that the project should be financed by private parties and developed in a PPP scheme.

In April 1985, promoters were solicited to submit proposals for a fixed-link channel crossing. In January 1986, the Channel Tunnel concession was awarded to CTG/FM (Channel Tunnel Group/France-Manche), the former name of Eurotunnel, the concession firm of Channel Tunnel. Later on, Eurotunnel awarded the single

contract of designing and building the Channel Tunnel to a construction consortium called TML (TransManche Link), which was formed by France and the United Kingdom's 10 major contractors. Note that these 10 contractors were also the major founders of CTG/FM, but they withdrew from the CTG/FM three months before the bid submission deadline at the request of the governments to avoid conflicts of interest. At last, Eurotunnel awarded the single contract of designing and building the Channel Tunnel to TML. Ideally, CTG/FM and TML could have worked in a normal client and contractor relationship. However, as the authors shall discuss later, the request for changing PPP ownership structure was made too late so that the seed of future opportunism was sown. Finally, the project was completed with a one-year delay and a serious cost overrun. The formal estimated construction cost shown in the 1987 shareholder prospectus, Offer for Sale (1987), was £4.8 billion. The actual overall construction cost upon Channel Tunnel's completion was about £10.5 billion, more than twice the estimate. The actual revenues from 1994 (the inauguration) to 1999 were on average about 50% of the projected amount.

The overall shortfall in traffic volume, the escalation of construction costs, and the price reductions as a result of the price wars, all together, led to Eurotunnel's financial difficulties (Anguera 2006). In 1995, there were approximately £8 billion of bank loans, and the interest burden was about £2 million a day. On September 14, 1995, Eurotunnel announced a moratorium on the repayment of its junior debt, which comprised the bulk of its nearly £8 billion of outstanding debt. This action initiated the debt-restructuring process. The restructuring package with the French court's intervention in negotiation was eventually achieved among the company, shareholders, and creditors.

After the 1995 restructuring, Eurotunnel still continued to struggle with financial difficulties due to the high level of outstanding debt. Thus, the second financial restructuring took place. On July 11, 2006, Eurotunnel sought legal protection of the Commercial Court of Paris pursuant to the French law *procédure de sauvegarde*. With the assistance of the court-appointed representatives, the creditors, suppliers and bondholders voted in favor of the restructuring plan proposed by Eurotunnel.

Analysis of Principal-Principal Problem

In this project, a severely unbalanced profit pool, the proposed driving factor of principal-principal opportunism, can be clearly identified. Because of the lucrative construction contract profits from this megaproject, the 10 largest construction firms from the United Kingdom and France were attracted to form a consortium, CTG/FM, and be the project promoter. Being aware of the unbalanced profit pool, the two governments insisted on their new policy of separating the project contractor from the project owners shortly before the submission deadline. Although three months or so before the bid submission deadline these founders did withdraw from CTG/FM, it was too late to prevent the principal-principal opportunism. The main reason was that it was impossible for Eurotunnel to prepare a satisfactory proposal in three months without the help from the founding firms. As Fetherston (1997) pointed out, "the only ones who could help were ... the contracting companies who had created CTG/FM (later became Eurotunnel), whose executives still sat on and controlled its board (after their withdrawal)" and "it meant that the contractors would be signing contracts with an entity they had created and still dominated." This problem can be manifested by the fact that "a number of staff oscillated between the two [Eurotunnel (concession firm) and TML (contractor)] for several months" (Fetherston 1997). Therefore, despite of the governments' efforts, this project still exhibited a severely unbalanced

profit pool. Even worse, because the founding construction firms had withdrawn from the equity holders, they would share none in the loss of project equity no matter how the project was performed. As a result, the unbalanced profit pool and the resulting principal–principal opportunism were aggravated to the extreme. In the end, the terms and conditions were very favorable to TML but unfavorable to Eurotunnel and the project (Genus 1997; Grant 1997). The construction contract signed was based on the Stansted Protocol, which stipulated that if no agreement emerged at Stansted Airport, the contractors would not participate in the next day's Submission to Governments (Fetherston 1997). The protocol guaranteed good profits, limited liability, and promised bonuses if the work was finished within seven years (Fetherston 1997).

Moreover, the fact that the Channel Tunnel suffered from 100% cost overrun, 50% revenue shortfall, and serious financial distress can be regarded as the result of transaction inefficiencies due to the principal–principal opportunism. First, the overly optimistic cost estimate and revenue forecast may imply possible opportunistic bidding and aggressive investment. As Holliday et al. (1991) argued, “the Eurotunnel prospectus . . . must be seen as too optimistic” and “Eurotunnel's revenue forecasts are always likely to be suspect . . .” Second, the 100% cost overrun may also indicate the direct result of the controlling principal's manipulation.

Analysis of Firm Hold-Up Problem

Note that actual hold-up did not happen in this project even though the project had been in serious financial distress and many banks as debt holders went bankrupt. Why? The most plausible explanation lies in the governments' preventive strategy that minimized the hold-up opportunism. In February 1986, soon after the project was awarded to Eurotunnel, the U.K. and French governments committed themselves to hard budget constraints by signing the Treaty of Canterbury. The Treaty of Canterbury provided that “the Channel fixed link shall be financed without recourse to government funds or to government guarantees of a financial or commercial nature.” Under the hard budget constraints, governments' rescue actions would have very low legitimacy. Thus, any attempts of governments to provide ex post subsidies would induce political condemnation and, consequently, the concessionaire had much fewer chances to hold the government up for rescue. This can be shown by the fact that during the course of the first financial restructuring, there were virtually no subsidies from the governments for bailing out the project. Furthermore, the governments' preventive measures against hold-up opportunism indicate that originally the Channel Tunnel was highly subject to hold-up opportunism, which was driven by the fact that this project was too large, too complicated, and too important to fail.

Analysis of Government-Led Hold-Up Problem

Concerning the government-led hold-up, neither this problem nor the characteristics leading to the problem are observed. This may be explained by the reasoning that a country with a healthy and mature institutional environment would tend not to engage in government-led hold-up.

Case Conclusion

This case study analyzes the sources of transaction costs in the Channel Tunnel project. First, the authors conclude that the high transaction costs and large revenue shortfalls in the Channel Tunnel could be explained by the observed principal–principal opportunism, driven mainly by a severely unbalanced profit pool. Second, the fact that there were few subsidies from the governments for

bailing out the project could be explained by the governments' precommitment to hard budget constraints. Third, the fact that there was no government-led hold-up in this project could be explained by that both the United Kingdom and France had a mature institutional environment. These case study findings are consistent with the proposed three propositions.

Illustration of Opportunism-Focused Transaction Costs Analysis for Feasibility Analysis

The proposed transaction cost analysis framework can be integrated into the feasibility analysis of PPP projects. Following the above discussions of the Channel Tunnel project, in this section, it is illustrated how the proposed framework for the evaluation of transaction cost can be applied in practice. In this project, the authors first organize the opportunism-prone project/environmental characteristics into three categories, corresponding to the three proposed opportunism problems. In each category, the characteristics are further divided into three dimensions as illustrated in Fig. 2. For each dimension, a weighting is assigned according to the assessed relative impacts of the dimension. The weightings can be adjusted for different types of PPPs or for other contingencies. Second, each characteristic in Fig. 2 is to be evaluated and assigned a score. The second column of Fig. 2 records the score evaluations of the project/institutional characteristics. In practice, the weights and scores can be obtained from a joint evaluation of experts and authorities. Scores can be evaluated using any scoring system, such as the Likert-type scales or 0–100 points. The weightings and assessed scores shown in Fig. 2 are according to the authors' judgment based on their professional experiences and are mainly for illustrative purposes. Although the authors do not insist on the weightings assigned in Fig. 2, these weightings generally reflect their evaluation of the relative impacts of the concerned characteristic dimensions on opportunism problems for most infrastructure PPPs. Then, the weighted average score of each opportunism problem is calculated. Last, the maximum of the three scores is taken to represent the magnitude of potential transaction hazards and the resulting costs. The reason for taking the maximum rather than the average score of all the three opportunism problems is that any one of the three opportunism hazards can induce similar inefficiencies and cause serious transaction costs. Fig. 2 shows that the main opportunism hazard of the Channel Tunnel project is the principal–principal problem, with assessed score 6.1 on the seven-point Likert scale. This final score indicates that the transaction opportunism concern and the resulting transaction costs are between high and very high, indicating that PPPs are very likely to be a very costly governance structure for the Channel Tunnel project.

Policy Implications and Administration Strategies

By applying the proposed theory of PPPs, implications on PPP policies and administration strategies can be derived. These implications focus on the hotly debated high-speed rail PPPs in the United States and the PPP feasibility analysis and project tendering and administration.

High-Speed Rail PPPs Are Highly Prone to Opportunism

Due to their project characteristics, high-speed rail PPPs tend to suffer seriously from the principal–principal problem and the hold-up problem. First, since high-speed rail projects are often novel projects in a country, the demand and subsequent revenues

Opportunism-Prone Characteristics and Their Weightings (in parentheses)	Scores*	Facts and analyses: the basis for assigning scores
1. Principal-Principal Problem		
• Unbalanced profit pool syndrome (0.5)	7	• Original project promoters were the main contractors. Promoters' construction (including procurement) contract profit was extremely large, compared to their equity investment profit.
- High construction contract profits with low equity investment	7	
• Information asymmetry (0.3)	6	• Because of the novelty and technical challenges of Channel Tunnel, this project exhibited high complexity and revenue uncertainty.
- Project complexity	5	
- Uncertainty of demand/revenue	7	
• Institutional deficiency (0.2)	4	• The governments had experiences in PPP projects, but no experiences in high speed rail PPPs. Both countries had a mature capital market.
- Government's inexperience	6	
- Immature capital market	1	
Weighted Average Score	6.1	
2. Hold-up Problem		
• Project specificity (0.4)	7	• Investment specific to the project is high, including land acquisitions, political efforts and policy formation, and the complicated tendering process. The project was one of the largest PPPs in the world (budgeted construction cost, \$4.8 billions) and was politically and economically important to both countries.
- Investment specificity	7	
- Project importance	7	
- Project scale	7	• This project exhibited high complexity and revenue uncertainty.
• Information asymmetry (0.2)	6	
- Project complexity	5	
- Uncertainty of demand/revenues	7	
• Institutional deficiency (0.4)	2	• The governments had experiences in PPP projects, but no experiences in high speed rail PPPs. Both countries had a mature capital market. The Treaty of Canterbury signed by the two governments declared their policy of hard budget constraints, making the legitimacy of government rescue very low.
- Government's inexperience	6	
- Immature capital market	1	
- High legitimacy of government rescue	1	
Weighted Average Score	4.8	
3. Government-led Hold-up Problem		
• Immature legal environment (0.3)	1	• For the two countries with mature institutional environments, this problem is minimal.
• Low fiscal capability (0.3)	1	
• Low political/policy stability (0.4)	1	
Weighted Average Score	1	
Score for Transaction Hazards	6.1	The score is calculated by $\text{Max}(6.1, 4.8, 1) = 6.1$. This score indicates that the transaction opportunism concern and the resulting transaction costs are between "high" and "very high."

*Scores are on the seven-point Likert scale, where 1 is very low, 4 is moderate, and 7 is very high. The scores indicate the degrees of the concerned characteristics, opportunism dimensions, or transaction hazards.

Fig. 2. Opportunism-focused transaction cost analysis (OTCA) of the Channel Tunnel project

of high-speed rail are often very difficult to predict. Moreover, because of the project novelty, there are few or even zero existing high-speed rail companies in the country who can participate as a promoting shareholder. As a result, both opportunism problems can be easily induced. Second, because of the high project-specific investments from the government, such as land acquisition and lengthy tendering process, high-speed rail PPPs are prone to hold-up opportunism. Third, because of the high project costs, high-speed rail projects can easily become a national focus and/or a political agenda. Consequently, high-speed rail PPPs are prone to hold-up opportunism. Fourth, since high-speed rail projects are often complex in terms of technology and operation, the costs of replacing distressed project firms or interrupting the operation will be high and the potential of hold-up opportunism will also be high. Thus, overall, the transaction costs of high-speed rail PPPs tend to be high. By using the same logic of the above analysis, the transaction cost evaluation may be extended to other types of transport PPPs. For example, toll road PPPs, due to their characteristics, generally tend to have much lower transaction costs. In addition, to more accurately assess and benchmark the transaction costs of different types of PPPs, it is suggested that researchers and practitioners can adopt the numerical approach of transaction cost analysis as illustrated in Fig. 2.

Conducting Opportunism-Focused Transaction Cost Analysis in PPP Feasibility Analysis

Although some practitioners claim that the transaction costs have been incorporated into standard/typical PPP feasibility analyses such as VfM and PSC, these transaction costs mainly reflect the complex procurement process and higher capital costs, which account for only a portion of the TCE-based transaction costs. This

may explain why the threshold for passing VfM or PSC evaluation is criticized to be so low that governments can justify the use of PPPs for almost any projects. Therefore, the major problem of PPP feasibility analysis is that the opportunism-focused transaction costs and inefficiencies are not well accounted for. From this perspective, the authors suggest that the opportunism-focused transaction cost analysis (OTCA) as illustrated in Fig. 2, should be explicitly conducted in PPP feasibility analysis, together with VfM and/or PSC. The term opportunism-focused transaction cost is adopted here to prevent the confusion caused by the ill-defined transaction cost in PPP practice.

Project Tendering and Administration Strategies

According to the proposed theory, public agencies should place major emphases on avoiding or mitigating those characteristics that may lead to opportunism, rather than on the promoters' proposals that are plagued by information asymmetry. Particularly, public agencies should place more emphasis on reducing the information asymmetry problem, mitigating the unbalanced profit pool syndrome, reinforcing the incentive mechanism, and establishing the institutions that discourage hold-up or renegotiation. PPP promoters' unverifiable, optimistic financial forecasts should receive lower weightings in project tendering. Policies on project tendering and administration are proposed as follows:

1. Encourage future operators to be the leading/controlling promoters by explicitly giving preferences in bid evaluation.
2. Establish explicit or formal institutions that reduce the legitimacy of renegotiation or governmental rescue.
3. If public agencies have limited or no experiences in PPPs, they should start with smaller, less complex, less uncertain, and less politically sensitive projects.

4. Since initial public offerings (IPOs) tend to increase the unbalanced profit pool syndrome and information asymmetry, IPOs should not be allowed in PPP projects before the operation phase.
5. If subsidizing funds are necessary, they should only be offered to subsidize the operation through schemes such as unitary charge or shadow tolls. Offering subsidies up front during the construction phase will aggravate the opportunism problems.

Conclusions

The impacts of transaction costs embedded in PPPs are often understated or ignored. The transaction costs of a PPP project may significantly undermine the project's expected overall benefits and may become a burden to the society. In this study, a TCE-based theory of PPPs as a governance structure is developed. The authors argue that principal–principal opportunism, firm hold-up opportunism, and government-led opportunism embedded in infrastructure PPPs may lead to substantial transaction costs, as stated in Propositions 1, 2, and 3, respectively. The major transaction inefficiencies/costs may include opportunistic bidding, aggressive investment, excessive monitoring, high equity premium, renegotiation, and financial distress. The study also identifies the driving characteristics for the proposed opportunism problems.

A case study of the Channel Tunnel is performed to evaluate the proposed theory and to illustrate how the proposed opportunism-focused transaction cost analysis can be applied in practice. The findings of the case study of the Channel Tunnel are consistent with the proposed three propositions. Last, practical implications on policies and administration strategies for infrastructure PPPs are derived based on the proposed theory.

This study contributes to the literature by providing a TCE-based theory of PPPs as a governance structure and by establishing the causal relationships between the PPP characteristics, the opportunism problems, and subsequent transaction costs. This study also contributes to practices by proposing a practical framework for PPP's transaction cost analysis and by suggesting PPP policies and administration strategies.

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