



# Valuation of strategic options in public–private partnerships



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## ABSTRACT

This paper investigates the feasibility of and develops an economic valuation model for strategic options in Comprehensive Development Agreements (CDAs). A CDA is a form of public–private partnership whereby the right to price and collect revenues from toll roads is leased to a private entity for a long but finite period of time. In exchange, this provides local and state governments with a quick influx of cash and/or additional infrastructure. Uncertainty associated with such long-term leases is of substantial public concern. This paper examines five different strategic options, namely a buyout option, a conditional buyout option, a revenue-sharing option, and two types of minimum revenue guarantee options. The buyout option in particular could give the public sector additional control over the future use of leased facilities and address potential concerns regarding long-run uncertainty and possible unforeseen windfalls for the private sector. The paper's contributions include the analysis, feasibility assessment and valuation of several strategic options, sensitivity analysis of the solutions, an economic consumer demand-based revenue model for purposes of cash flow simulation, and analysis of option price sensitivity to “moneyness”. The main conclusion is that strategic options can provide useful risk reduction, but generally have significant value relative to the lease itself. By scaling down payoffs, options could be realistically included in CDAs and other PPPs. For some parameter values, option values to the developer and public authority are offsetting, allowing for costless risk reduction.

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## 1. Introduction

The difficult state of public transportation budgets since the 1990s and particularly since the Great Recession of 2007–2009 has motivated the public sector to investigate “innovative financing” strategies to meet their budgetary shortfalls.<sup>1</sup> Indeed, traditional revenue-raising mechanisms have struggled to keep up with the demand for public infrastructure construction and repair. For example, U.S. federal gas taxes that finance the Federal Highway Administration's

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<sup>1</sup> In 2009, the Federal Highway Administration's Trust Fund faced a shortfall of \$20 billion, despite the addition of \$8 billion to the Fund by the U.S. Congress in 2008 (Crawley and Lambert, 2009; Government Accountability Office, 2008). The Trust Fund's financial condition improved in 2010, ending the fiscal year with a balance of \$29.2 billion. However, this was a result of “[...] Congress's General Fund cash infusions and a decline in outlays due in part to the roughly \$36 billion that the American Recovery and Reinvestment Act of 2009 (ARRA) provided to States for highway infrastructure and mass transit projects” (U.S. Department of Transportation, 2012, p. 2). The Fund was established shortly after 1956 legislation that created the Interstate Highway System, and was intended to be funded using federal gasoline taxes.

Trust Fund have remained at 18.4 cents per gallon. Meanwhile, costs have increased, vehicle efficiency has improved, and more revenues are dedicated to non-infrastructure needs (Puentes and Prince, 2003).

### 1.1. Innovative financing for transportation projects

To address this budgetary crisis, proponents of innovative financing have suggested as one of the delivery mechanisms transportation public–private partnerships, such as Comprehensive Development Agreements (CDAs). A CDA is a form of public–private partnership whereby the right to price and collect revenues from toll roads is leased to a private entity for a long but finite period of time, in exchange for providing local and state governments with an initial influx of cash and/or additional infrastructure. These arrangements include concessions and leases, can be used for new or existing projects, and generally involve design, construction, operation, and, eventually, transfer of the facilities. Typically, a higher degree of privatization of the project implies greater risk transference from the public sector to the participating private firm or consortium (see Fig. 1).

### 1.2. Contribution of the paper

This paper develops an analytical framework to value strategic options in CDAs, with an emphasis on new (Greenfield) transportation projects. The framework can be generalized to PPPs in different sectors. The strategic options considered are a buyout option, a conditional buyout option, and revenue-sharing options for the public agency, and minimum revenue guarantee options for the private sector (both annual and one-time cumulative). Although it is clear that all of these options have positive value, we cannot tell without further study their magnitudes or interaction effects. Our paper makes the following contributions:

- First, we analyze and provide valuations for different types of strategic options in PPPs, only one of which has received significant attention in the literature.
- Second, we compare the option solutions for different specifications and in particular the feasibility of “out-of-the-money” options (buyback price relative to original value; share of revenue-sharing; proportion of revenue guaranteed).
- Third, while much of the previous literature has directly modeled project cash flows, we open the “black box” of revenue generation and model the economic and transportation variables that determine cash flows.
- Fourth, this enables us to conduct sensitivity analysis on the option solutions to determine which parameters have the greatest impact on option valuation and therefore must be estimated the most accurately.

These options are, practically speaking, clauses written into CDA contractual agreements (or other PPPs). For example, the buyout option reduces the likelihood that CDAs will be seen *ex post* as a windfall for private sector developers at the expense of taxpayers and road users. Understanding how to price these options is important for contract negotiation. Even if they are included at no cost, the option price solution represents the value foregone by one of the parties. Moreover, including out-of-the-money options<sup>2</sup> may be a useful method to reduce risk for both parties. Such options would have low cost, only paying off in exceptional circumstances, and would be easier to include in the contract. Lastly, for purposes of contract negotiations, such options may reduce the developer’s incentive to provide very low revenue estimates, and the refusal to allow for out-of-the-money options might signal less than honest bargaining.

A further benefit of strategic options is to counter the “prisoner’s dilemma” aspect of individual contract negotiations. It may be collectively beneficial for private firms to negotiate less aggressively in order to reduce windfall profit and therefore increase the public sector’s willingness to grant PPP contracts. However, an individual firm may be tempted to obtain a superior contract, even at the cost of making future PPP contracts less likely due to political backlash. Therefore, including strategic options can be beneficial for private operators collectively as they will reduce the likelihood of windfall profit without affecting firm compensation (options being priced in the contract).

The paper’s main findings suggest that baseline buyout, revenue-sharing, and minimum revenue guarantee options have significant value relative to the value of the concession. This is because the options are likely to be “in-the-money”, meaning there is a high probability they will be exercised and generate revenues. In contrast, the baseline conditional buyout option has only a small value, since it is most likely to be out-of-the-money throughout the life of the concession. The results suggest that while strategic options are useful to reduce revenue risk for both counterparties, keeping their cost low requires either scaling down their payoffs, designing them as initially deep out-of-the-money (so they provide worst-case insurance), or including options for both counterparties designed such that their values offset.

### 1.3. Previous literature

The literature on real options is large (for surveys, see e.g. Sick, 1995, or Trigeorgis, 1996). For real options in projects, analytical approaches are often not available, so numerical methods have been developed for valuation purposes (e.g.,

<sup>2</sup> An out-of-the-money option has zero intrinsic value and thus cannot be profitably exercised today, but remains valuable because it might be profitably exercised in the future (time value). An in-the-money option may be profitably exercised today.

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