Highway Infrastructure: Issues Concerning Private-Sector Participation

Robert Krol

MERCATUS CENTER
George Mason University

3434 Washington Blvd., 4th Floor, Arlington, Virginia 22201
www.mercatus.org

Robert Krol. "Highway Infrastructure: Issues Concerning Private-Sector Participation." Mercatus Research, Mercatus Center at George Mason University, Arlington, VA, July 2018.

ABSTRACT

This paper examines the economic issues and evidence surrounding the role of the private sector in providing highway infrastructure. The focus is on public-private partnerships (PPPs) or long-term concession agreements between governments and private firms. PPP proponents have called for shifting infrastructure construction to the private sector to take advantage of more efficient provision of projects and the transfer of project risk from taxpayers to investors. Evidence from the United States and abroad does not consistently support this contention, although limitations in the research paradigms make a significant portion of the evidence of limited value. It is likely that idiosyncratic issues related to a particular project and the type of government involvement or oversight come into play. Another issue associated with expanding the use of PPPs for public investment is the design of concession contracts. Some contracts are renegotiated, distorting incentives for bidding up front and for efficient production once the project moves forward. To get the incentives right, PPPs should involve competitive bidding, no contract renegotiation, and the potential for bankruptcy for participating private firms who overestimate the revenues that can be generated or underestimate the costs in their initial bids.

JEL codes: H54, K32, K33, K43

Keywords: public-private partnerships, competitive bidding, bankruptcy

This paper can be accessed at https://www.mercatus.org/publications/federal-fiscal-policy/private-sector-highway-participation

The Trump administration has indicated an interest in expanding the role of the private sector in the construction, maintenance, and management of infrastructure in America.[1] More recently, however, the president has expressed doubts about expanding the private sector's role.[2] This paper examines private-sector participation in public transportation projects (public-private partnerships, or PPPs) through the lens of economic theory. The paper includes a critique of existing empirical evidence that attempts to compare the performance of private-sector provision with traditional government provision of infrastructure projects in the United States and abroad. Studies that evaluate the relative efficiency of the two approaches for providing public infrastructure have mixed results, and many of these studies have methodological issues. Drawing firm, evidence-based conclusions is difficult.

PPPs involve a concession agreement between the government and private firm(s) that can encompass an extensive set of project responsibilities, including design, construction, finance, and maintenance for a set period of time. Typically, government agencies establish project performance standards that must be met by the private firm(s) managing the project.

Proponents of PPPs argue that private-sector firms can handle the project responsibilities more efficiently. Another reason for using PPPs to build infrastructure is to shift part of the project risk to the private sector.

None of this is as straightforward as it appears. Designing PPP concession contracts is a costly and complex endeavor. If contracts can be renegotiated, the result is distorted incentives for accurate bidding up front and for efficient production once the project moves forward. The potential for renegotiation also reduces the shift of project risk to investors from taxpayers. To get the incentives right, PPPs should involve competitive bidding, no contract renegotiation, and

1. David Van Slyke, "Trump's Infrastructure Plan: How 'Private' Will He Go?," *Politico*, June 7, 2017.
2. Ted Mann and Siobhan Hughes, "Lawmakers: Trump Calls Public-Private Partnerships 'More Trouble Than They're Worth,'" *Wall Street Journal*, September 26, 2017.

the potential for bankruptcy for participating private firms that overestimate the revenues that can be generated or underestimate the costs in their initial bids.

Market-oriented policy analysts and others have long promoted shifting infrastructure construction to the private sector to take advantage of more efficient provision of projects and the transfer of project risk to investors. Politicians and government agencies like the way they can use PPPs to avoid tax increases in countries where debt and taxes are already high. Some redevelopment agencies take advantage of this structure to raise funds for public capital investment.[3]

PPPs require careful analysis and evaluation before expanding their use in providing infrastructure.[4] This paper first defines PPPs and compares the incentive structure to that of traditional government provision of infrastructure projects. This is followed by an examination of regulatory and contracting issues associated with concession agreements. Next, the empirical evidence on PPP performance is reviewed. The paper ends with a discussion of lessons that can be drawn from this analysis.

I. THE ECONOMICS OF INFRASTRUCTURE PROVISION

A. Organizational Structures

The public sector plays an important role in providing highway infrastructure in the United States. This has not always been the case. Fully private roads played a central role in US transportation during the 19th century.[5] Today, the primary organizational structures for providing highway infrastructure include traditional government provision and PPPs.

With traditional government provision, government departments of transportation design, build, and maintain highways using tax revenues. Local or state governments often hire private engineering or construction firms to do part of the work. In the end, governments—or, more correctly, taxpayers—own the highways.

3. Shirley Svorny, "Why California Dissolved Its RDAs," *Regulation* 37, no. 2 (2014): 16–19.
4. Bob Poole, "Public-Private Partnerships Have a Good and Under-Appreciated Infrastructure Track Record," *Reason.org*, November 22, 2016, https://reason.org/commentary/public-private-partnerships-have-a-good-and-under-appreciated-infrastructure-track-record/.
5. See Daniel Klein and John Majewski, "America's Toll Road Heritage: The Achievements of Private Initiative in the Nineteenth Century," in *Street Smart: Competition, Entrepreneurship, and the Future of Roads*, ed. Gabriel Roth (Oakland, CA: Independent Institute, 2006).

PPPs have played a growing but still limited role in the provision of highway infrastructure. They are the most common form of private participation in highway provision globally.

In a PPP, the government contracts with a private firm to manage a project or concession. The responsibilities of the concession vary widely. For example, the concession may be linked only to the design and building phases of the project. Or the concession may include designing, building, financing, operating, and maintaining the project for a period of time. Depending on the scope of the concession responsibilities, these agreements can be as long as 100 years. When the concession includes financing responsibilities, the private firm or consortium typically uses a combination of debt and equity to fund construction. The loans and shareholders' returns are funded by either tolls or annual payments from the government, so long as the concession holder fulfills its responsibilities as part of the agreement.[6] The concession may include performance indicators such as maximum levels of allowable congestion or highway surface condition requirements. Contracts often include limits on toll rates.

Ideally, bidders compete through a competitive auction for the right to manage a project. In other cases, it is simply a bilateral negotiation between the government transportation department and a private firm or consortium. Because this is a concession arrangement, the government retains ownership.[7]

The most recent *Annual Privatization Report* by the Reason Foundation reports that there were 32 transportation-related private concessions worth $42.6 billion operating in the United States at the end of 2016.[8] According to the same report, two new US projects were ranked in the top ten globally for 2016.[9] This indicates that the private sector is playing a limited role in building US transportation infrastructure. One deterrent is that not all states have passed legislation to allow PPP investments in highway and other infrastructure projects. According to the National Conference of State Legislators, in 2015, 33 states,

6. When these payments are linked to traffic volume, they are called shadow tolls.
7. Robert W. Poole Jr., "Availability Payment or Revenue-Risk Public-Private Partnership Concessions? Pros and Cons for Highway Infrastructure" (Policy Study No. 458, Reason Foundation, Los Angeles, 2017); R. Richard Geddes, *The Road to Renewal: Private Investment in U.S. Transportation Infrastructure* (Washington, DC: AEI Press, 2017).
8. Baruch Feigenbaum, *Annual Privatization Report 2017 Surface Transportation* (Los Angeles: Reason Foundation, 2017).
9. These new US projects are the Purple Line in Montgomery County, Maryland (ranked second with a value of $2.65 billion), and State Highway 288 in Houston, Texas (ranked ninth with a value of $1.06 billion).

Washington, DC, and Puerto Rico had legislation in place to allow PPPs to build and manage highway projects.[10]

B. Incentive Issues in the Different Organizational Structures

Each organizational structure has a different set of managerial incentives that affect how a highway is run.[11] The easiest way to understand this issue is from a principal-agent perspective.[12] How do the principals or owners (taxpayers or private investors) get agents (bureaucrats or managers, respectively) to act in the owners' interest?[13] It is up to the principals to create an incentive structure to accomplish the desired outcome and to establish ways to monitor the agents' behavior. The effectiveness of monitoring hinges on the costs and other incentives (e.g., campaign contributions to legislators who vote on an agency's budget), and these are not the same for each organizational structure. The differences in costs and incentives will affect outcomes.

A private firm's goal is clear—to maximize the owner's profits, to avoid liability for malfeasance, and to protect its reputation should it want to bid on future highway projects. Where private roads charge a toll, the quality of the trip and the level of congestion will affect a driver's willingness to pay.[14] This creates an incentive to manage congestion, maintain a smooth road surface, and offer acceptable services (restrooms, gasoline, etc.). Because toll revenues depend on consumer satisfaction, private firms face incentives to operate a highway in a way that satisfies users. We can expect them to allocate resources to profit-enhancing actions that improve driver satisfaction and to keep costs low. A private firm also

10. Kevin Pulo, "Public-Private Partnerships for Transportation: A Toolkit for Legislators (May 2015 Updates and Corrections)," National Conference of State Legislatures, May 2015, http://www.ncsl.org/Portals/1/Documents/transportation/PPP-Toolkit-Update-May-2015.pdf.
11. Federal Highway Administration, *Transportation Infrastructure Investment* (Washington, DC: n.p., n.d.).
12. Michael C. Jensen and William H. Meckling, "Theory of the Firm: Managerial Behavior, Agency Costs, and Ownership Structure," *Journal of Financial Economics* 3, no. 4 (1976): 305–60; Eugene Fama and Michael C. Jensen, "Separation of Ownership and Control," *Journal of Law and Economics* 26, no. 2 (1983): 301–25.
13. In the case of PPPs, there is a third principal-agent problem between the bureaucrats and the private managers. In this case, the aligning of the incentives must be accomplished using contract performance standards. Financial penalties can be used when the private managers fail to meet these standards. The problem is whether we can expect bureaucrats to impose and enforce contract performance standards that align the incentives of those involved with those of taxpayers.
14. Sometimes the firm receives payments from the government rather than directly from users paying tolls. These are called either shadow tolls or availability payments. These funds come from general revenues.

faces incentives to build a highway with minimal delays and on budget. Unlike public agencies, private companies face a hard budget constraint.[15]

Since the firm both builds and maintains the highway, it also has a strong incentive to build in a way that minimizes lifetime costs, which include the costs of both construction and maintenance. This can result in higher initial construction costs because the firm might use better materials that reduce future maintenance costs, lowering lifetime costs. Poorly managed highways can result in inadequate traffic flows and therefore reduced revenue flows, making it difficult for a private firm to service debt. There is an incentive to use new technologies that can reduce the cost of management and maintenance over time because the owners capture any gains from innovation.

The owners of a private firm have an incentive to monitor its managers to ensure their behavior aligns with the profit goal of the firm. To create the right incentives, owners can link managerial salaries to the performance of the highway through profit-sharing compensation arrangements. The potential to fire managers who shirk their responsibilities also provides incentives for managers to align their behavior with the interests of the owners. Finally, if the firm is underperforming, the "market for corporate control" may take over, with new owners buying the company with the express intent of replacing management and improving revenues and, therefore, improving the market value of the firm. Either way, management is replaced. Under private ownership, the goals are clear, and, with limited or concentrated ownership of the firm, monitoring costs are manageable. However, government regulations such as limits on tolls can reduce profits. A private firm must factor these risks into any project bid.

With traditional government provision, the goals of the agency managing the highway are not always well defined. Is the goal to maximize traffic volume and ignore costs? If tolls are charged, is the goal to break even, offering little incentive to control costs? Or is the agency supposed to manage the highway in the public interest—a vague notion that is often left undefined? There may be multiple goals. Furthermore, goals may vary from one elected administration to the next.[16] Without a quantifiable performance measure, such as profits for a private firm, it is difficult to determine whether managers and workers are doing a good job. Firing underperforming workers is less likely, and there is no market for corporate control as a check on poorly run projects.

15. This is only true if governments are generally unwilling to renegotiate contracts.
16. Geddes, *Road to Renewal*.

Cost overruns are common when governments design and build highways.[17] In many cases, when there are cost overruns or unexpected costs, elected officials simply provide additional funding. Government-run projects are subject to what is called a soft budget constraint, offering only a weak incentive to control costs and get projects done on time.

The behavior of a government agency is heavily influenced by elected officials. A bureaucrat's salary and job tenure often hinge on an outcome that satisfies the political interests of elected officials. As a result, politics can outweigh economics when it comes to decisions about highway investment, construction, tolling, and maintenance.[18] Interest groups such as public unions exert considerable political pressure to influence policy choices. These political pressures should be less effective under private provision, although some may be written into contracts (such as requirements to use union labor). Public managers may be highly competent, but with unclear goals and poor incentives, questionable choices are often made. Finally, the owners (taxpayers) are a diffuse group, making active, effective monitoring costly and difficult. As a result, publicly run highway projects are often managed inefficiently.[19] This can also be an issue with PPPs.

C. Regulatory and Contracting Issues Associated with Public-Private Partnerships

There are a number of economic issues associated with using PPPs to build, maintain, and manage transportation infrastructure. These issues include the following: How should the franchise holder's pricing policies be regulated? What are the contracting issues surrounding PPPs? How would the bidding process be designed for PPP concessions? Finally, an important question is whether private firms should be bailed out or held accountable for not being able to pay their debts. Bankruptcy provides a way for firms to resolve debt problems while still being accountable.

---

17. Robert Krol, "Political Incentives and Transportation Funding" (Mercatus Research, Mercatus Center at George Mason University, Arlington, VA, July 2015); Robert Krol, "Transportation Cost-Benefit Analysis Can Be Highly Misleading," *Regulation* 38, no. 4 (2015–2016): 9–11.
18. Krol, "Political Incentives and Transportation Funding."
19. Geddes, *Road to Renewal*; William L. Megginson and Jeffry M. Netter, "State to Market: A Survey of Empirical Studies on Privatization," *Journal of Economic Literature* 39, no. 2 (2001): 321–89; Clifford Winston, "How the Private Sector Can Improve Public Transportation Infrastructure" (Working Paper No. 14–16, Mercatus Center at George Mason University, Arlington, VA, 2014); and Andrei Shleifer, "State versus Private Ownership," *Journal of Economic Perspectives* 12, no. 4 (1998): 133–50.

1. Regulation. The concession holder of a particular highway may have significant market power: the concession holder can set the toll at a higher price than those that would be charged in a competitive environment. Consumers would be worse off under this arrangement, as a net loss to society would result if fewer vehicles used the highway as a result of the higher toll.

The amount of market power associated with running a highway depends on the number of alternative routes and other possible modes of transportation, such as buses and rail systems.[20] It does not automatically follow that a PPP road will have the market power to price the toll like a monopolist.

If market power is a problem, it would be better to regulate the toll rather than the firm's rate of return. Regulating a firm's rate of return was formerly a common approach applied to public utilities.[21] However, because this approach results in a normal rate of return no matter how revenues are spent, there is little incentive to make investments to improve operational efficiency or to innovate; such investments have little or no impact on the owner's rate of return.

An alternative approach is to impose a price cap to limit the maximum toll charged on the highway. This approach is similar to how telecommunication and electric utilities are now often regulated. If congestion pricing is being used, the cap can limit the average toll, allowing for above-average tolls during peak driving times and below-average tolls in off-peak driving times. It would also provide an incentive to improve operational efficiency and service, because these efforts increase profits. A large literature shows that price cap, rather than rate-of-return regulation, in the telecommunications and electricity industries has produced substantial gains to both consumers and investors. Prices have stabilized and even declined for some services. Productivity growth and industry modernization have also increased. Earnings are higher and quality remains stable. In some cases, costs have declined.[22]

---

20. Geddes, *Road to Renewal*, chap. 8; and André de Palma and Robin Lindsey, "Private Roads, Competition, and Incentives to Adopt Time-Based Congestion Pricing," *Journal of Urban Economics* 52, no. 2 (2002): 217–41.

21. W. Kip Viscusi, Joseph E. Harrington, and John M. Vernon, *Economics of Regulation and Antitrust* (Cambridge, MA: MIT Press, 2005).

22. Geddes, *Road to Renewal*, chap. 8; David E. M. Sappington and Dennis L. Weisman, "Price-Cap Regulation: What Have We Learned from Twenty-Five Years of Experience in the Telecommunications Industry?," *Journal of Regulatory Economics* 38, no. 3 (2010): 227–57; Dennis L. Weisman and Johannes P. Pfeifenberger, "Efficiency as a Discovery Process: Why Enhanced Incentives Outperform Regulatory Mandates," *Electricity Journal* 16, no. 1 (2003): 55–62; and "Symposium on Price-Cap Regulation," *Rand Journal of Economics* 20, no. 3 (1989): 369–472.

2. Contract issues. Noncompete clauses in contracts limit the expansion of existing highways or the construction of new highways near a privately managed highway. This arrangement is attractive to the concession holder because it reduces competition and raises traffic flows on the privately managed highway. Unfortunately, noncompete clauses result in significant highway congestion on nearby roads, as a region grows and total area traffic increases.[23]

A key problem in PPPs is that governments often lack experience in contract negotiations or are under financial pressure to maximize up-front revenues to generate funds for current spending. Both of these problems can result in the inclusion of overly restrictive noncompete clauses. Instead of an outright ban on building additional capacity nearby, contracts should include metrics of congestion levels that could allow capacity expansion on competing highways. Generally, this can be expected to lower private bids, but it makes long-run economic sense. Timing is critical, as it is probably unwise to negotiate contracts with private firms to run highway projects when a government's budget is under financial stress. Of course, this is when the up-front revenues generated from PPPs will look the most attractive to politicians.

The fact that PPP agreements are essentially a type of borrowing, where a private-sector firm agrees to provide a service that taxpayers or users will pay for in the future, is an appealing feature for politicians. They do not show up as part of public debt, making it possible for politicians to provide services now and pay for them later without adding the amounts to growing public debt totals that can make politicians look bad.

For PPPs, a contract must be negotiated between a government agency and the private firm that will build and run the highway. Expect the negotiated contract to be, of necessity, incomplete. First, the two parties involved cannot anticipate all future developments. Second, contract negotiations are costly. The contractual assignment of control over operational decisions such as project construction is important in determining whether or not to contract out government services. Because contracts are inherently incomplete, contracting the highway to a private firm or providing it through traditional government means remains a tough question.[24]

There are a number of factors that can complicate the decision to use a private firm to produce a public good, rather than the traditional government

23. Edward C. Sullivan, "HOT Lanes in Southern California," in Roth, ed., *Street Smart*.
24. Stanford J. Grossman and Oliver Hart, "The Costs and Benefits of Ownership: A Theory of Vertical and Lateral Integration," *Journal of Political Economy* 94, no. 4 (1986): 691–719; and Oliver Hart, "Incomplete Contracts and Control," *American Economic Review* 107, no. 7 (2017): 1731–52.

provision. Government officials may have project goals that do not align with the goals of the concession holder. For example, a concession holder may live up to the contract requirements but carry out cost-cutting actions that reduce quality, conflicting with a government goal. On the other side, the concession holder has a profit incentive to innovate, which can be consistent with a government goal.

Because future governments may carry out actions that might reduce the value of the project, private bids may be adjusted downward in anticipation of this contingency. The ability of a government to commit to its promises will certainly influence private willingness to participate. So, the assignment of control rights over decision-making is critical in determining whether private or public provision makes the most sense.[25]

Oliver Hart, Andrei Sheifer, and Robert Vishny analyze the implications of incomplete contracts in the context of prison privatization.[26] They point out that government goals would include escape prevention, humane treatment of prisoners, and the rehabilitation of prisoners. Since contracts are incomplete, control rights are important. In the case of prisons, contracts generally allow the concession holder to control not only the quality of guards hired but also the use of force by the guards to control inmates. This is problematic because the private firm can increase profits by hiring less qualified guards. When this occurs—and if the value from maintaining guard quality outweighs the costs of renegotiation—the contract should be renegotiated. But the potential costs associated with renegotiation may make private provision an unattractive option. And, of course, the costs associated with monitoring and controlling private providers should be compared to those associated with monitoring and controlling public prisons.[27]

Hart, Sheifer, and Vishny argue that in this case, public provision makes more sense than privatization because, under government provision, officials could bar the hiring of low-quality guards, resulting in a more humane treatment of prisoners. But government provision means giving up the cost-lowering innovations private firms have an incentive to adopt. Private firms may develop a prisoner rehabilitation program that turns out to be more effective and cheaper. Hart and his coauthors conclude that the choice to use private providers may

25. Oliver Hart, "Incomplete Contracts and Public Ownership: Remarks and an Application to Public-Private Partnerships," *Economic Journal* 113, no. 486 (2003): C69–C76; and Oliver Hart, Andrei Shleifer, and Robert W. Vishny, "The Proper Scope of Government: Theory and an Application to Prisons," *Quarterly Journal of Economics* 112, no. 4 (1997): 1127–61.
26. See Hart, Shleifer, and Vishny, "Proper Scope of Government."
27. See, for example, Maya Lau, "L.A. County Women's Jail Lags behind National Standards on Preventing Sexual Abuse, Report Finds," *Los Angeles Times*, April 1, 2018.

depend on the particular public service under consideration. They argue that prisons, the army, and the police, which offer multidimensional services, should be provided publicly, while a service such as garbage collection can be done privately because the service is one dimensional and quality is fairly easy to monitor.

In their analysis, Hart and his coauthors assume that government officials act in the best interest of the public. However, government officials often act in their own self-interest. This can lead to corruption and patronage problems that influence the choice between traditional government and private provision. A corrupt official is more inclined to support private provision because private providers may offer financial incentives in the form of campaign contributions or opportunities for postgovernment employment. This creates an incentive to choose private provision even if it is not the most efficient option. Alternatively, interest groups may offer services to help an official get reelected in exchange for actions that benefit the group. For example, public unions are known to help to bring out the vote during an election in return for support for higher wages and pensions.

Along these lines, economists Florencio Lopez-de-Silanes, Andrei Shleifer, and Robert Vishny provide evidence that the presence of strong public unions discourages the use of the private sector in providing public services.[28] Given the growth in public-sector unions in the United States, expanding the private-sector role in providing public goods such as roads may be a challenge.[29]

What does the analysis of Hart and his coauthors tell us about using private firms to provide highway services? The objective of a highway is clear: to provide drivers with cost-effective travel. Monitoring highway performance is fairly straightforward because the government already collects detailed data on highway conditions.[30] Because the government has good data on road conditions, it would be difficult for a private concession holder to shortchange the government. In addition, it would be fairly simple to include road surface criteria in the contract. For toll rolls, electronic tolling is fast, simple, and efficient. So, while incomplete contracts may be an issue in some PPPs, they should not be a

28. Florencio Lopez-de-Silanes, Andrei Shleifer, and Robert W. Vishny, "Privatization in the United States," *Rand Journal of Economics* 28, no. 3 (1997): 447–71; and Rhiannon Jerch, Matthew E. Kahn, and Shanjun Li, "The Efficiency of Local Government: The Role of Privatization and Public Sector Unions," *Journal of Public Economics* 154 (2017): 95–121.
29. More than one-third of government employees are unionized. US Bureau of Labor Statistics, "Union Members—2017," news release USDL-18-0080, January 19, 2018, https://www.bls.gov/news.release/pdf/union2.pdf.
30. Robert Krol, "America's Infrastructure Isn't Crumbling" (Mercatus on Policy, Mercatus Center at George Mason University, Arlington, VA, May 16, 2017).

formidable constraint for the use of PPPs in the construction and maintenance of highways, bridges, and tunnels. However, just because something can be done efficiently does not mean that the incentives will align to produce that result. One should expect that public unions and the elected officials they support will oppose partnerships with the private sector in transportation or will lobby for union wage and job protection standards in any contracts that are considered.

3. Design of highway public-private partnership auctions. One of the biggest challenges associated with bidding for a highway contract is forecasting the traffic flow. Forecasting errors can be quite large.[31] For example, the Dulles Greenway private toll road, which runs from Dulles International Airport to Leesburg, Virginia, had an initial daily vehicle forecast of 35,000 vehicles. The initial traffic flow was only 8,500 vehicles. Once toll rates were lowered, the vehicle flow increased to 23,000.[32] Because there is usually a significant debt burden in the early years of a private highway, the wrong forecast can cause significant financial stress early in the road's life. Economic downturns or slower-than-expected growth can result in lower-than-expected traffic flows and bankruptcy. This was a driving force behind the Indiana Toll Road Concession Company's bankruptcy in 2014.[33]

Economists Eduardo Engel, Ronald Fischer, and Alexander Galetovic have proposed an alternative auction/contract arrangement that can reduce the risks associated with unpredictable traffic flows. They propose optimal risk-sharing contracts, also called "Least-Present-Value-of-Revenue" (LPVR) auctions.[34]

They point out three aspects of private highway financing that need to be addressed. First, a large proportion of the costs (construction) occurs before highway demand is known. Second, as mentioned earlier, forecasting traffic flows is inaccurate, producing large errors. Finally, the highway project is usually financed by tolls that are paid by users. Because the highway is self-financed by these tolls, private proprietors may require higher tolls than needed to avoid congestion problems in order to cover expenses.[35]

---

31. Robert Bain, "Error and Optimism Bias in Tollroad Traffic Forecasts," *Transportation* 36, no. 5 (2009): 469–82.
32. Eduardo Engel, Ronald Fischer, and Alexander Galetovic, "Privatizing Highways in the United States," *Review of Industrial Organization* 29, no. 1–2 (2006): 27–53, at 36.
33. Aaron Renn, *The Lessons of Long-Term Privatizations: Why Chicago Got It Wrong and Indiana Got It Right* (New York: Manhattan Institute, 2016).
34. This section draws on Eduardo Engel, Ronald D. Fischer, and Alexander Galetovic, "Least-Present-Value-of Revenue Auctions and Highway Franchising," *Journal of Political Economy* 109, no. 5 (2001): 993–1020; and Eduardo Engel, Ronald D. Fischer, and Alexander Galetovic, *The Economics of Public-Private Partnerships* (New York: Cambridge University Press, 2014).
35. This assumes demand is price inelastic.

Given the high level of uncertainty concerning traffic volume, it might make sense to design a framework where compensation varies with actual traffic volume. This is what an LPVR auction accomplishes. Under this arrangement, given the construction specifications of the highway and toll schedule, each firm bids an amount equal to the present value of the expected toll revenues they would like to earn from the highway project. Bids would need to cover loan repayments associated with building the highway and maintenance costs. In other words, in order for firms to be willing to bid on the project, the expected present value of revenues must exceed the expected present value of the costs. If this outcome is unlikely, firms will not bid on the project. The lowest bid wins the auction, and the franchise ends when actual revenues generated by the tolls equal the value of the bid. At that point, ownership of the road returns to the state. Competition between the bidding firms results in the winning firm earning a normal profit from the enterprise.[36]

The key feature of this arrangement is the fact that the length of the franchise period can vary. If traffic volume turns out to be less than expected, the length of the contract is increased. If the traffic volume turns out to be higher than expected, the length of the contract is shortened. In both cases, the private concession holder earns a return equal to what was expected in the bid, eliminating the demand risk associated with the project.

Yet another potential complication is associated with PPPs. As Oliver Williamson has pointed out, although the auction is competitive, once the concession holder is selected, there is a bilateral monopoly between the government and concession holder. This leads to possible opportunistic behavior on the part of both parties.[37] Because the investment in the highway is already made (or sunk), if the government changes the rules, it will not be possible for the firm to move the highway to a more hospitable location. Although it would harm the government in future contract negotiations with private parties, the government can take advantage of this and impose additional rules (e.g., lower tolls) that harm the concession holder.

On the other hand, it is difficult to punish a firm if it does not live up to the terms of the contract (e.g., quality may be less than the agreed-upon amount) because a takeover by the government can be costly. So both sides will try to renegotiate the contract in their favor. There is evidence to support this claim. J. Luis Guasch found, in 1,000 concession cases in Latin America between 1985

36. Harold Demsetz, "Why Regulate Utilities?," *Journal of Law and Economics* 11, no. 1 (1968): 55–65.
37. Oliver Williamson, "Franchise Bidding for Natural Monopolies—in General and with Respect to CATV," *Bell Journal of Economics* 7, no. 1 (1976): 73–104.

and 2000, firms initiated almost 55 percent of the transportation-related contract renegotiations during the first three years of the contract. This reduces any cost advantages of PPPs.[38]

Because contract renegotiations in the early stages of a long-term contract are common, they can cause adverse selection and moral hazard problems that reduce the effectiveness of PPPs.[39] For example, concession holders often renegotiate the agreement when they have financial problems and try to shift losses to taxpayers. Private firms with lobbying experience sometimes may offer a low bid thinking they can make up the difference when they renegotiate the contract with the government.

Frequent renegotiations will attract firms that are good at lobbying and negotiating rather than being the most efficient road-building company. These companies can make lowball bids and get the contract, expecting to capture additional funds in the renegotiation. This results in less efficient construction and management of the highway. It also further increases the chances that highways of questionable economic merit will be built. Renegotiations create incentives for the firm building the highway to be less careful in controlling costs. The firm expects to be compensated for cost overruns in the renegotiation. An LPVR auction reduces the chances of these problems because the variable length of the contract ensures the firm earns a normal return on the investment.

With LPVR agreements, there may be less of an incentive to maintain quality because any revenue shortfall due to poor road conditions is made up with a longer term protecting the present value of the project's return. These agreements require an institutional arrangement that verifies that minimum quality standards are met and that imposes financial penalties for noncompliance. Under these agreements, firms have a weak incentive to make costly improvements that would increase demand because they will get the same return on their initial bid with or without the improvements.

If the government has a buyout option, it could pay a franchise holder an amount equal to the difference between the revenue bid and actual revenues earned up to that point. This would remove the firm that fails to meet quality standards. Still, the owners of the project earn a payment equal to their bid,

38. J. Luis Guasch, *Granting and Renegotiating Infrastructure Concessions: Doing It Right* (Washington, DC: World Bank, 2004); and J. Luis Guasch, Jean-Jacques Laffont, and Stéphane Straub, "Renegotiation of Concession Contracts in Latin America: Evidence from the Water and Transport Sectors," *International Journal of Industrial Organization* 26, no. 2 (2008): 421–42.
39. Engel, Fischer, and Galetovic, *Economics of Public-Private Partnerships*.

weakening incentives to maintain quality. If the government has another LPVR auction, the problem could repeat itself.

To ensure that the right incentives are in place, governments must require firms to have met requirements of previous contracts in order to bid on new contracts. Absent this, the firm's concern over reputation and liability offers the primary incentive to guarantee that a project meets minimum quality standards. Having a strong reputation as a business that lives up to terms of a contract agreement may have a significant value to private firms, but only if performance measures are made public.

Some examples of LPVR auction agreements in the United Kingdom include the Queen Elizabeth Bridge over the Thames River in 1991 and the second Severn Bridge over the Severn Estuary in 1996. In 1998, the LPVR approach was used in Chile for expanding a highway between Santiago and a seaport in Valparaiso.[40]

The LPVR auction approach for financing highways offers a way to manage demand risk in a potentially cost-effective way. However, governments that take this route must enforce quality standards by way of reputation or penalties that offset the incentive to cheat without changing the length of the contract.

D. The Role of Bankruptcy

An alternative approach is for governments to allow PPPs that build and manage highways the option of declaring bankruptcy (Chapter 11, Title 11, *US Code*) if they have financial problems. If the highway concession is not profitable and becomes insolvent, it would face the same consequences as any other private business.[41] This can be preferable to renegotiating the contract on more favorable terms at the taxpayers' expense. After all, the purpose of these arrangements is to take advantage of the greater production and management efficiency the private sector brings to the table in handling these projects, thereby saving the taxpayers money by using funds elsewhere or by providing tax relief.

Another issue with bankruptcy is whether a private firm is in a better position than the government to manage project risk. If a firm has a diversified portfolio of projects, it can likely manage individual project risk efficiently. However, if

40. Engel, Fischer, and Galetovic, "Privatizing Highways in the United States."
41. Todd J. Zywicki, "Bankruptcy," in *The Concise Encyclopedia of Economics*, ed. David R. Henderson (Carmel, IN: Liberty Fund, Library of Economics and Liberty, 2008); and Michelle J. White, "Economics of Bankruptcy," in *The Oxford Handbook of Law and Economics*, Vol. 2: *Private and Commercial Law*, ed. Francesco Parisi (New York: Oxford University Press, 2017).

the risk stems from changes in project specifications or toll limits because of political forces, the government may be in a better position to manage these risks. If the private firm faces such political risks, project costs may rise unnecessarily.

Embracing bankruptcy can impact the highway construction and management process in a number of ways. First, it encourages careful forecasts of costs and traffic flows by private investors when highway construction is being considered. As pointed out above, traffic flow forecasts have been notoriously inaccurate, resulting in costly renegotiations and, to some extent, gaming of the bidding process by some firms. The result is that projects for which the costs are greater than the benefits will move forward.

With bankruptcy as an option, the investor's funds are truly at risk, creating an incentive to critically evaluate estimates of costs and revenues. Of course, investors will demand compensation for taking on this risk by raising the planned tolls to more realistic levels, reducing the chance of bankruptcy. For this to work and be credible, governments must not bail out the private investors.

Adding bankruptcy to the mix would strengthen the desired incentive structure to make bids based on careful cost and traffic forecasts. This also provides investors with an incentive to monitor the process from bidding through operation.

Of course, political incentives for elected officials to "do something" when a PPP gets in financial trouble can be strong and can weaken the influence that bankruptcy has on decision-making. Formal legislation is needed to establish rules in order to make bankruptcy credible. Otherwise, even if the current government is unwilling to renegotiate, future governments might if they receive support from the highway businesses during elections.[42]

Bankruptcy provides an orderly process of reorganizing the operation and its assets. Initial investors may experience losses, but that is the whole point. In the case of railroad bankruptcies during the early 20th century, when bankruptcy occurred, the assets were not taken apart and sold as scrap. The network was kept whole, and service continued during the process. New creditors were repaid from revenues generated from future operations.[43] The same thing occurred in the Indiana Toll Road and the more recent Texas State Highway 130 bankruptcies. Service was not interrupted, and new owners were attracted by future toll revenues.

---

42. This problem is referred to as the "time inconsistency" problem in economics. See Finn E. Kydland and Edward C. Prescott, "Rules Rather than Discretion: The Inconsistency of Optimal Plans," *Journal of Political Economy* 85, no. 3 (1977): 373–92.
43. Zywicki, "Bankruptcy."

A possible drawback to the bankruptcy approach is that it might dampen the private sector's interest in bidding on highway projects. However, those that do bid will be far more focused in getting it right. Furthermore, a lack of bids suggests a project is not economic and should not be undertaken. Bankruptcy is often viewed as a drawback associated with using the private sector in highway construction and management. This is wrong, as one reason for using the private sector is to transfer risk from the taxpayer to the investor. Bankruptcy accomplishes this risk transfer.

II. PRIVATE PARTICIPATION: EMPIRICAL EVIDENCE

There have been a number of evaluations of the effectiveness of PPPs' ability to provide infrastructure in a cost-effective way. Graeme Hodge and Carsten Greve provide two recent overviews of studies that examine the performance of PPPs.[44] They report that despite the growing popularity of PPPs, the evidence on their performance is mixed. A study by the Congressional Budget Office concludes that PPPs can build highways "slightly less expensively and slightly more quickly" than the traditional approach.[45] However, systematic evidence is limited.

A. Cross-Country Evidence

In a 2009 article, Hodge and Greve reported on studies of long-term PPP contracts that covered a wide range of infrastructure projects in industrialized countries. They evaluated 25 studies of projects undertaken in Australia, Canada, Denmark, Finland, Scotland, the United Kingdom, the United States, and groups of EU countries. The types of infrastructure projects ranged from highways to hospitals. Only nine of the twenty-five projects provided taxpayers value for their money; that is, in only nine of the projects did private efforts produce lower costs than traditional government provision.

As Hodge and Greve pointed out, these mixed results are due to a number of problems with most studies on the relative performance of PPPs. Some studies are based on a small sample of contracts. Others use early estimated costs rather than long-term actual costs. Weak control variables on project complexity,

44. Graeme A. Hodge and Carsten Greve, "On Public-Private Partnership Performance: A Contemporary Review," *Public Works Management & Policy* 22, no. 1 (2017): 55–78; and Graeme A. Hodge and Carsten Greve, "PPPs: The Passage of Time Permits a Sober Reflection," *Economic Affairs* 29, no. 1 (2009): 33–39.
45. Congressional Budget Office, *Using Public-Private Partnerships to Carry Out Highway Projects*, 2012, vii.

type of contract, or a lack of a well-specified control group also make the results unreliable. Finally, results may be biased if studies are produced by individuals or groups taking on an advocacy role because they benefit from PPPs.

Frédéric Blanc-Brude, Hugh Goldsmith, and Timo Välilä evaluated 227 road projects in the European Union, of which 65 were PPPs.[46] The projects were built during the period from 1990 to 2005. They focused on the bid real construction costs of the projects. After controlling for project country, size, labor costs, and the technical characteristics of the projects, they found the costs were 24 percent higher on average for PPPs compared to non-PPPs. However, these results are difficult to interpret because the roads built by PPPs may have been built to reduce future maintenance costs (using better, more costly materials). Also, if some of the risks of unexpected cost changes are the responsibility of the private contractor, the bids would have a risk premium built into the cost data used in the study.

The US Federal Highway Administration published a cross-country study of PPPs. They found PPPs could complete highway projects at lower cost and on time (or sooner) with greater predictability.[47] There is also evidence indicating cost savings from private highway management and maintenance compared with traditional government provision. A US Department of Transportation study concluded that PPPs result in construction cost savings of between 6 percent and 40 percent and have a smaller chance of generating cost overruns.[48]

B. Country Evidence

The United Kingdom has been one of the most active users of PPPs as a means to invest in public infrastructure. As of March 2016, there were 716 PPP projects in the United Kingdom with a capital value of £59.4 billion.[49] The four largest sectors for PPP projects were the health sector, with a value of approximately

46. Frédéric Blanc-Brude, Hugh Goldsmith, and Timo Välilä, "A Comparison of Construction Contract Prices for Traditionally Procured Roads and Public-Private Partnerships," *Review of Industrial Organization* 35, no. 1–2 (2009): 19–40.
47. Geddes, *Road to Renewal*; and Janice W. Brown et al., *Public-Private Partnerships for Highway Infrastructure: Capitalizing on International Experience* (Washington, DC: Federal Highway Administration, 2009). Also see Gerard Hampton, Andrew N. Baldwin, and Gary Holt, "Project Delays and Cost: Stakeholder Perceptions of Traditional v. PPP Procurement," *Journal of Financial Management of Property and Construction* 17, no. 1 (2012): 73–91.
48. Geddes, *Road to Renewal*; and US Department of Transportation, *Report to Congress on Public-Private Partnerships*, 2004.
49. Using the US$/£ exchange rate at the time of the report, this figure equals almost $85 billion.

£13 billion, followed by defense and education at £9.5 billion and £8.6 billion, respectively. The transport sector had £7.8 billion of PPP activity.[50]

The UK's PPP program, the Private Finance Initiative (PFI), was introduced by John Major's Conservative Party government in the fall of 1992.[51] The Labour Party joined ranks to endorse the program in 1994. Under the PFI program, "groups of private companies finance the design, building, and maintenance of new economic and social infrastructure" in the United Kingdom.[52] The government contracts with a group of private firms (e.g., a construction company, a facilities management company, possibly a financial institution, and other equity investors) to provide a bundle of services associated with a public project such as a road or school building over a set contract period. The government specifies the outputs or services that must be provided.

One impetus for programs like this is political. It allows politicians to fund construction without getting voter approval for increased taxes or overriding statutory limits on public debt. An important component is upfront financing provided by the firms. The government is supposed to oversee the project and only continue annual payments (including interest) if the firms meet project requirements over the life of the contract.[53] The financing aspect of the program is ostensibly designed to give private managers incentives to provide efficient services, but it relies on government enforcement for accountability.

An attractive feature for politicians and the people who elect them is that under current accounting standards, the debt associated with these projects is not counted as traditional public debt.[54] Although the debt does not show up on

50. HM Treasury and Infrastructure and Projects Authority, "Private Finance Initiative and Private Finance 2 Projects: 2016 Summary Data," Gov.uk, December 20, 2016, https://www.gov.uk/government/publications/private-finance-initiative-and-private-finance-2-projects-2016-summary-data.
51. The UK experience draws on Mark Hellowell, "The UK's Private Finance Initiative: History, Evaluation, Prospects," in *International Handbook of Public-Private Partnerships*, ed. Graeme A. Hodge, Carsten Greve, and Anthony E. Boardman (Cheltenham, UK: Edward Elgar, 2010); Paul Hare, "PPP and PFI: The Political Economy of Building Public Infrastructure and Delivering Services," *Oxford Review of Economic Policy* 29, no. 1 (2013): 95–112; and Engel, Fischer, and Galetovic, *Economics of Public-Private Partnerships*, 23–30. In 2012 the PFI program was reviewed, reformed, and renamed PF2. The reforms included the government's holding a minority equity share, increased transparency, and the bidding period lasting a maximum of 18 months. See HM Treasury and Infrastructure and Projects Authority, "Private Finance Initiative and Private Finance 2 Projects."
52. Hellowell, "The UK's Private Finance Initiative," 307.
53. In the case of a toll facility, the toll revenue is the primary source of payment to the firms.
54. UK National Accounting Office, *Lessons from PFI and Other Projects*, 2011.

the public ledger, payments to the firms still must be made.[55] However, in the one empirical study that examined this issue using PPPs in the United States, researchers did not find a positive relationship between a state's fiscal limits and the use of PPPs to finance highway investment.[56]

A drawback to this type of financing arrangement is that the interest rate for private borrowing may be higher than the government borrowing rate.[57] This makes the arrangement efficient only if greater private-sector innovation and productivity offset the higher borrowing costs and the costs associated with the bidding process. Even considering these factors, a direct comparison of borrowing costs is misleading.[58] Lenders factor in project risk for the private borrower, raising the interest rate on any loan. In contrast, the promise of government repayment is stronger, so lenders do not factor in project risk when the government borrows to fund projects. In this case the risk is still present and remains the liability of taxpayers.

Advantages in using private firms include the potential for projects to be completed on time and on budget. Greater certainty over project completion is an attractive feature, especially for term-limited politicians.[59] Another advantage of this approach, if properly structured, is that it can shift financial risk from the taxpayer to the investor. This does not imply that PFI projects have lower costs. The limited available data suggest that operating costs are similar or higher.[60]

Our principal interest is in program effectiveness. Will a specific financing arrangement provide superior value? Two government reports offer insights. A 2003 report published by the British Treasury (HM Treasury) in 2003 examined 61 PFI projects out of 451 possible projects.[61] The researchers found that only 12 percent of the PFI projects were late, compared with 30 percent of those financed via traditional government methods. One serious weakness in these

55. Eric Maskin and Jean Tirole, "Public-Private Partnerships and Government Spending Limits," *International Journal of Industrial Organization* 26, no. 2 (2008): 412–20; and Stéphane Saussier, Carine Staropoli, and Anne Yvrande-Billon, "Public-Private Agreements, Institutions, and Competition: When Economics Theory Meets Facts," *Review of Industrial Organization* 35, no. 1–2 (2009): 1–18.
56. Zhenhua Chen, Nobuhiko Daito, and Jonathan L. Gifford, "Do State Fiscal Constraints Affect Implementation of Highway Public-Private Partnerships? A Panel Fixed Logit Assessment," *Journal of the Transportation Research Forum* 53, no. 2 (2014): 111–28.
57. Hellowell, "The UK's Private Finance Initiative," 319–21.
58. I thank a referee for this point.
59. Engel, Fischer, and Galetovic, *Economics of Public-Private Partnerships*.
60. UK National Audit Office, *Report by the Comptroller and Auditor General: PFI and PF2*, 2018, https://www.nao.org.uk/wp-content/uploads/2018/01/PFI-and-PF2.pdf.
61. HM Treasury, *PFI: Meeting the Investment Challenge*, 2003; and Engel, Fischer, and Galetovic, *Economics of Public-Private Partnerships*.

results is the lack of a control group of government-produced projects with similar characteristics and complexities. Without a control group it is impossible to make meaningful comparisons. The report found an average of four bidders for each project, which was interpreted to mean that bidding was competitive. Of course, this may not have been the case for many of the projects, where the number of bidders may have been below the average.

The second report was produced by the British National Accounting Office in 2009.[62] The authors examined 114 PFI projects. They found that 69 percent of the projects were finished on time and that only 18 percent of the PFI projects were delayed by six months or more. Project lead times averaged 22 months. Sixty-five percent of the PFI projects were on budget. Thirty-five percent of the contracts were renegotiated, raising the cost.

Due to criticism of the earlier HM Treasury report, the report also looked at 50 non-PFI projects. Unfortunately, data differences made comparison difficult. For the non-PFI projects, 63 percent were finished on time and 54 percent were on budget. Design changes by the government were the biggest reason for delays or cost overruns. Just looking at the studies, one might conclude that the difference between PFI and non-PFI projects is not dramatic. However, because we can't know if the projects are comparable, it is difficult to draw conclusions about the general advantages of the British PFI method over other methods of project funding.

Nongovernment evaluations of the UK PFI program have produced conflicting conclusions. Using different samples in separate studies, Michael Pollitt and Mott Macdonald each concluded that the private provision resulted in a higher percentage of projects being completed on time and at lower cost.[63] Studies by Rob Ball, Maryanne Heafey, and Dave King and by Jean Shaoul found just the opposite.[64] Clearly, additional empirical work that compares similar PFI and non-PFI projects is needed to draw any conclusions as to the relative advantage or disadvantage of using PFI funding for highways and other public

62. UK National Accounting Office, *Performance of PFI Construction*, 2009; and Engel, Fischer, and Galetovic, *Economics of Public-Private Partnerships*.

63. Michael Pollitt, "Learning from the UK Private Finance Initiative Experience," in *The Challenge of Public-Private Partnerships: Learning from International Experience*, ed. Graeme Hodge and Carsten Greve (Cheltenham, UK: Edward Elgar, 2005); and Mott Macdonald, *Review of Large Public Procurement in the UK* (Croydon, UK: Author, 2002).

64. Rob Ball, Maryanne Heafey, and Dave King, "The Private Finance Initiative in the UK," *Public Management Review* 9, no. 2 (2007): 289–310; and Jean Shaoul, "The Private Finance Initiative or the Public Funding of Private Profit," in *The Challenge of Public-Private Partnerships*, ed. Hodge and Greve.

infrastructure.[65] It may be that idiosyncratic aspects of these programs preclude effective comparisons that could be used to inform policymakers.

Australia is another country that has used PPPs as a means to finance transportation infrastructure. It uses a standard approach, allowing private firms to build, operate, and maintain a highway or a tunnel for a fixed period of time—often 35 years. The concessionaires charge tolls to finance the projects.

The first PPP project in Australia was the Harbour Tunnel in Sydney. Construction began in 1987, and operation started five years later at a cost of US$749 million. The project was financed entirely with debt. The tolled tunnel was built in order to reduce traffic congestion heading into the central business district and will become a city asset in 2022. This project was followed by additional PPP highway and tunnel projects in the city. PPP projects were quickly undertaken in other cities. For example, Melbourne began constructing a 14-mile tollway in 1996, which opened for business in August 1999. The US$2.2 billion cost was financed using both debt and equity.[66]

R. Richard Geddes reports on a study that compares 21 Australian PPP projects worth US$4.9 billion to 33 non-PPP projects worth US$4.5 billion.[67] The study found cost savings up to 30 percent associated with the PPP projects. Cost overruns for PPP projects were not statistically different from zero, while non-PPP project cost overruns were significantly different from zero. PPP projects tended to be finished ahead of time. In contrast, 24 percent of non-PPP projects finished behind schedule. The advantages of PPP projects were larger for more complex projects. This last result is promising. However, given the very small sample sizes and inadequate controls for project differences, it is not clear that we can draw any conclusions from this work.

For the United States, Nobuhiko Daito and Jonathan L. Gifford recently published a careful empirical analysis that compares PPP highway construction projects with non-PPP projects.[68] Fifty-three projects, each worth $50 million or more, are examined. While there was a wide range of potential projects which could have been examined, the article focuses only on projects that added lanes

65. In Jean Shaoul, "A Review of Transport Public-Private Partnerships in the UK," in *International Handbook of Public-Private Partnerships*, ed. Hodge, Greve, and Boardman, Shaoul points out that limited data make comparison difficult and concludes that the limited data are inconclusive in terms of the advantages of PFI projects compared to traditional provision.

66. Geddes, *Road to Renewal*, 107–14.

67. Geddes, *Road to Renewal*, 112.

68. Nobuhiko Daito and Jonathan L. Gifford, "U.S. Highway Public Private Partnerships: Are They More Expensive or Efficient Than the Traditional Model?," *Managerial Finance* 40, no. 11 (2014): 1131–51.

to a highway. Project cost is measured as the closing bid price for the project rather than the project's long-run life-cycle costs. Defining project characteristics include the number of lanes added and lane mileage.

Daito and Gifford find that the costs of PPPs were 22 percent higher than those associated with non-PPP projects. The impact was larger for projects that bundled more responsibilities into the contract. For example, projects that included design, building, financing, operations, and maintenance had higher costs than a more limited project with only design, building, and financing components. These results are similar to those reported by Blanc-Brude, Goldsmith, and Välilä in their 2009 article that used the same statistical approach for a sample of EU road projects.[69] In this study, cost is measured by the bid price on a project, but if the transaction costs of making a bid and risk factors are high for PPP contracts, the cost measure overstates the true cost of construction. In other words, the long-run life-cycle costs of a project might be reduced if the private sector is used to provide the portions of the project it can produce more efficiently than the public sector. This is especially true when construction and maintenance are bundled together.[70]

A Reason Foundation study compares the operation and maintenance costs to toll revenues (cost-take ratio) for 35 toll facilities in the United States, some of which were public toll roads and others of which were privately owned and managed.[71] The authors find that the cost-take ratio for publicly run toll roads was 42.6 percent, compared with 23.4 percent for private roads. This seems large, but if the facilities are not comparable in size, the variability in the measure across facilities may also be large, so the difference may not be statistically meaningful.

Those looking for indications about the success of PPPs should be careful, as anecdotes of successful PPPs get the most attention. An example is the 1996 contract arrangement between the Virginia Department of Transportation and a private company, VMS, to provide maintenance and operation services for over 250 miles of interstate highways for a five-and-a-half-year period.[72] The company was responsible for pavement and bridge quality, along with services such as snow removal. The contract saved the state 16 percent of its expected costs.

---

69. Blanc-Brude, Goldsmith, and Välilä, " Comparison of Construction Contract Prices for Traditionally Procured Roads and Public-Private Partnerships."
70. Blanc-Brude, Goldsmith, and Välilä also conduct an efficiency analysis for PPP and non-PPP projects. Efficiency is defined as maximizing the output from a given set of inputs. While they found PPPs to be less efficient than non-PPPs, this finding was not statistically significant.
71. Robert W. Poole and Peter Samuel, *Pennsylvania Turnpike Alternatives: A Review and Critique of the Democratic Caucus Study* (Los Angeles: Reason Foundation, 2008).
72. Geddes, *Road to Renewal*, 106.

New South Wales, Australia, experienced a 60 percent cost saving on highway maintenance by using a performance-based contract with Transfield Services. Sweden experienced a 50 percent reduction in costs using private contractors.[73] However, it is inappropriate to draw conclusions from these examples, which may or may not be representative of the broad swath of PPPs.[74] There is a strong incentive for those involved (on both the public and the private side) to publicize results where projects result in cost savings or other efficiencies and to keep quiet when they do not.

An unpublished study by Allan D. Chasey, William E. Maddex, and Ankit Bansal examined 12 completed PPP projects in North America, each worth more than $90 million.[75] They used data from previous studies to construct benchmark non-PPP projects for comparison. They found that cost overruns occurred in less than 1 percent of the projects. For non-PPP projects, cost overruns were almost 13 percent.

Adding to the anecdotal evidence, there have been a number of problems with PPP projects in the United States. Contract details are important when reaching an agreement on PPPs. In California, State Route (SR) 91 in Orange County began operation in 1995.[76] This was a privately financed project that built additional electronic variable toll lanes along the existing SR 91 highway route. The project was a financial success. However, economic growth in the area led to growing congestion on surrounding highways. The agreement contained a strict non-compete clause in order to protect the owners from revenue losses. The state was prohibited from building new highways along the 30 miles of the toll road. The resulting conflict was resolved when the Orange County Transportation Authority purchased the toll lanes for $207.5 million in 2002. While private owners prefer to limit competition, some flexibility must be built into the contract. For example, traffic and economic indicators can be used to establish thresholds that, once reached, allow some additional highway construction to take place.

A recent study of six surface transportation PPPs in the United States was conducted by the Center for Transportation Public-Private Partnership Policy at

73. Geddes, *Road to Renewal*, 106.
74. Michael Klein, *Public-Private Partnerships: Promise and Hype* (Washington, DC: World Bank, 2015), 1, concludes that PPPs work "a bit better" than public provision.
75. Allan D. Chasey, William E. Maddex, and Ankit Bansal, "A Comparison of Public-Private Partnerships and Traditional Procurement Methods in North American Highway Construction" (unpublished manuscript, March 15, 2012, Microsoft Word file).
76. Engel, Fischer, and Galetovic, "Privatizing Highways in the United States"; and Robert Krol, "Tolling the Freeway: Congestion Pricing and the Economics of Managing Traffic" (Mercatus Research, Mercatus Center at George Mason University, Arlington, VA, 2006).

George Mason University.[77] Researchers examined a wide range of objectives that influence the desirability of PPPs beyond cost savings and timing. Did the project shorten drive times during peak hours? The six projects studied did help reduce congestion problems. For example, the Virginia Interstate 495 (I-495) express lanes that were produced by PPP reduced travel time during rush hour by an average of 17 minutes. The project was on budget and completed two months ahead of schedule. The other projects examined had fairly similar results. These results are positive but do not tell us whether the results are better than those of comparable non-PPP projects.

The Indiana Toll Road Concession is an example of allowing the bankruptcy process to work when owners overestimate traffic volume on a highway. The Indiana Toll Road began operation in 1956, before the US interstate highway system was built. It later became part of Interstate 90. By 2005, the highway consistently broke even financially but still had $200 million in debt.[78]

Indiana governor Mitch Daniels put the highway up for lease, and Cintra-Macquarie Consortium won the lease. Cintra-Macquarie paid the state $3.85 billion for a 75-year lease. The agreement required Cintra-Macquarie to introduce electronic tolling, make certain highway improvements, and maintain a specified level of service in both urban and rural areas of the highway. Under the agreement, tolls could be raised (and they were) until 2010. After that time, toll increases were linked either to a 2 percent inflation rate or to the actual rate of per capita GDP growth, whichever was larger. There was also a noncompete clause that prohibited the state from building a competing interstate highway. The agreement was approved by the legislature in 2006. The state used the funds it received to retire the highway's existing debt, provide aid to local governments for infrastructure projects, extend Interstate 69, and repair 1,190 bridges and 4,000 miles of pavement. Five hundred million dollars was placed into a long-term reserve fund.[79]

Problems arose during and after the recession of 2008–2009. The deep downturn and slow recovery resulting in actual traffic being significantly less than anticipated. The Cintra-Macquarie Consortium filed for bankruptcy in 2014 because it was unable to service its debt. At that time, the highway was purchased

77. Lisardo Bolaños, Morghan Transue, Porter Wheeler, and Jonathan L. Gifford, *Transportation Public-Private Partnerships: Objectives and Evidence* (Arlington, VA: Center for Transportation Public-Private Partnership Policy, George Mason University, 2017).
78. Renn, *Lessons of Long-Term Privatizations*.
79. Renn, *Lessons of Long-Term Privatizations*.

by Australia's IFM Investors, moving the toll road out of bankruptcy in 2015 without any disruption in service.[80]

This example illustrates how bankruptcy can resolve the financial problems that may arise in PPPs, thereby alleviating the need for messy contract renegotiation with the government. In this case, the original owners experienced a capital loss, but there was no disruption in service. There was no need for the government of Indiana to renegotiate the contract. This example offers a model for how to handle unexpected events that impact PPPs.[81] It provides an example of a situation where risk is truly shifted to private companies or to the banks that lend to them, creating incentives for careful assessment of future traffic.

In other evidence, the Conference Board of Canada published a study of the Canadian experience that compared the construction cost of private provision to traditional approaches. The report found project savings ranging from 0.8 percent to 61.2 percent.[82] A study of private highways in France found that construction costs were 23 percent lower per kilometer than the construction costs associated with government provision.[83]

III. CONCLUSIONS

For government officials interested in expanding the private sector's role in highway provision, what lessons can they learn from economic theory, empirical evidence, and experience?

The contract that is written between the government and private providers is complex and incomplete; it will not include solutions for every situation that arises over the life of the contract. Because of this, not all public investments are good candidates for PPPs. Projects with multiple goals, such as national defense or prisons, are better off being provided using the traditional government approach. Highways, bridges, and tunnels are better PPP candidates because they have a clear single objective—to provide cost-effective travel. Given publicly

80. Renn, *Lessons of Long-Term Privatizations*.
81. The Dulles Greenway in Virginia required refinancing of its debt after it overestimated traffic. State Highway 130 in Texas is also in bankruptcy. However, in each case, there was no disruption in service, as markets resolved the problems.
82. Geddes, *Road to Renewal*; and Mario Iacobacci, *Dispelling the Myths: A Pan-Canadian Assessment of Public-Private Partnerships for Infrastructure Investment* (Ottawa: Conference Board of Canada, 2010).
83. Geddes, *Road to Renewal*; and Jose A. Gomez-Ibanez and John R. Meyer, *Going Private: The International Experience with Transport Privatization* (Washington, DC: Brookings Institution, 1994).

available data on travel flows and pavement conditions, monitoring performance is straightforward. Today's technology makes paying tolls simple.

A major problem for private participation in highway investment is accurately forecasting expected traffic flows. Forecast errors can result in the inability to service project debt. There are three options for handling the uncertainty over future traffic flows. First and most common, the terms of the contract can be renegotiated. When this occurs, taxpayers often end up footing the bill. This approach defeats the purpose of PPPs in shifting at least some of the traffic flow forecast risk to private investors, who then have strong incentives to make accurate forecasts. The same problem occurs when the cost of constructing the project unexpectedly changes. The potential for renegotiation weakens the incentives to design, construct, and forecast effectively. It also distorts bidding by encouraging underestimates of the true cost or overestimates of the expected revenues.

Second, the government could sell the lease rights using an LPVR competitive auction. In this case, if traffic is less than forecasted, the length of the contract is lengthened, ensuring the normal return. This approach eliminates the risk associated with traffic forecast errors. A drawback to this approach is that it dampens a private owner's incentive to make investments to attract new drivers and maintain quality.

Third, and perhaps the best approach, is to allow the owners to go into bankruptcy when traffic flows are low or costs increase, thereby leading to debt-service problems. If this approach is credible, which is difficult in a political environment, it will sharpen bidders' forecasts, forcing them to evaluate the potential project risk more carefully. It may result in higher tolls in bid proposals. It will also result in building only worthwhile projects (those for which the expected value to users is greater than the expected cost)—a criterion for project selection that makes sense for an efficient allocation of society's resources.

Other details of a contract between the government and a private firm are critical to achieving the desired outcome. For example, does the contract include a noncompete clause? This can be a problem in areas of the country that are experiencing significant growth. With a strict noncompete clause (as was the case for California SR 91), when additional highway capacity was needed, the contract limited expansion of public highways in the area. Instead, clear guidelines need to be put in the contract allowing new highway construction when a specific criterion is met. At issue is whether government agencies have the expertise to negotiate these complex contracts. A poorly written contract can be worse than a less efficient government agency managing the project.

Expanding the role of the private sector in the provision of highway services will likely meet resistance from public employee unions affected by the reform. Transparency and openness in the bidding process is important in allowing all interested parties to bid in order to weaken this opposition. Another solution is to allow competitive bidding for contracts and to allow the government agency that has been providing the service to bid. In some cases, the existing agency may win the bid.[84]

The main reason for expanding the private sector's role in transportation is to take advantage of the efficiency and management skills of the private sector, thereby lowering costs and speeding up delivery. To get the incentives right, PPPs should involve competitive bidding, no contract renegotiation, and the potential for bankruptcy for participating private firms that overestimate the revenues that can be generated or underestimate the costs in their initial bids. But even this does not guarantee a desirable outcome. The gains from private-sector involvement need to be large enough to offset the likely higher risk-adjusted financing costs associated with private-sector financing of highways, the costs of managing the bidding process, and the costs of government oversight, including poor government oversight. Policymakers may encourage low bids with the option of renegotiation, even if only implicit, to move projects forward that benefit their supporters or that make them look good, even if these projects will saddle a community with costs that extend into the future.

When it comes to the empirical evidence, the bulk of the studies cannot be relied on for guidance because they do not compare private efforts to similar government efforts very well. The few careful studies do not find private provision to be superior. These studies may also be misleading because they use construction costs rather than project life-cycle costs. Given the incentives in the private sector to efficiency and the lack of evidence in support of PPPs, we can only conclude that public-sector involvement (in the form of renegotiation, for example) can change the incentives and distort the performance of private firms. Anecdotal stories of excellent outcomes with private provision may not be representative. Unfortunately, at this time it is difficult to satisfactorily resolve the empirical question as to which approach consistently provides the greatest value for money. The devil is in the details, so buyer beware.

84. Dirk Johnson, "In Privatizing City Services, It's Now 'Indy-a-First-Place,'" *New York Times,* March 2, 1995.

ABOUT THE AUTHOR

Robert Krol is a professor of economics at California State University, Northridge; a senior affiliated scholar for the Mercatus Center at George Mason University; and a member of the Heartland Institute's Board of Policy Advisors. He also worked as an economist at Security Pacific National Bank in Los Angeles and the Milken Institute in Santa Monica, California. He received his PhD in economics from Southern Illinois University, Carbondale, in 1982. He has more than 20 years of research experience publishing articles on infrastructure issues in leading economics journals and newspapers.

ACKNOWLEDGMENTS

The author would like to thank Tracy Miller, Bob Poole, Shirley Svorny, and the reviewers for many helpful comments and discussions that improved the paper.

ABOUT THE MERCATUS CENTER AT GEORGE MASON UNIVERSITY

The Mercatus Center at George Mason University is the world's premier university source for market-oriented ideas—bridging the gap between academic ideas and real-world problems.

As a university-based research center, the Mercatus Center trains students, conducts research of consequence, and persuasively communicates economic ideas to solve society's most pressing problems and advance knowledge about how markets work to improve people's lives.

Our mission is to generate knowledge and understanding of the institutions that affect the freedom to prosper and to find sustainable solutions that overcome the barriers preventing individuals from living free, prosperous, and peaceful lives.

Since 1980, the Mercatus Center has been a part of George Mason University, located on the Arlington and Fairfax campuses.