

# DO PUBLIC-PRIVATE PARTNERSHIP ENABLING LAWS INCREASE PRIVATE INVESTMENT IN TRANSPORTATION INFRASTRUCTURE?

Daniel Albalade

Department of Econometrics, Statistics and Applied Economics  
University of Barcelona  
Av. Diagonal, 690 08034 Barcelona  
Tel: 34.93.4031131 Fax: 34.93.4024573 E-mail: albalade@ub.edu

Germà Bel

Department of Econometrics, Statistics and Applied Economics  
University of Barcelona  
Av. Diagonal, 690 08034 Barcelona  
Tel: 34.93.4021946 Fax: 34.93.4024573 E-mail: gbel@ub.edu

R. Richard Geddes<sup>a</sup>

Department of Policy Analysis and Management  
Cornell University  
434 Kennedy Hall  
Ithaca, NY 14853  
Phone: (607) 255-8391  
rrg24@cornell.edu

**February 5, 2019**

<sup>a</sup> Corresponding author.

**Keywords:** Transportation infrastructure; public-private partnerships; private infrastructure investment; state public-private partnership enabling laws; fiscal constraints.

**JEL Codes:** L14; L33; L51; L92, L98.

**Acknowledgments:** This work was supported by the Spanish Government under the project ECO2016-76866-R; the Catalan Government under project SGR2017-644. We are grateful to Matthew Barnett, Andre Gardiner, Priya Mukherjee, and Benjamin Wagner for research assistance, and to Robert Poole and Werner Troesken for helpful comments and suggestions. We have benefited from suggestions during presentations at the Université Paris I – Panthéon Sorbone (EPPP Chair), at the First Catalan Economics Society Conference and at the University of Pittsburgh.

## ABSTRACT

The use of public-private partnerships, or PPPs, is an important development in U.S. infrastructure delivery. PPPs are detailed contracts between a public-sector infrastructure project sponsor and a private-sector provider that bundle together key delivery services. PPPs represent a middle ground between pure-public project delivery and complete privatization. As of 2016, thirty-five U.S. states had enacted PPP enabling laws. That legislation defines the broad institutional framework surrounding a PPP agreement. It addresses such questions as the mixing of public- and private-sector funds, the treatment of unsolicited PPP proposals, and need for prior legislative approval of PPP contracts, among other critical issues. We provide the first thorough empirical assessment of the impact of PPP enabling laws on a state's utilization of private investment. We analyze the overall effect of a state having a PPP enabling law while controlling for a variety of factors, including the state's indebtedness, its broad political disposition, union membership, per-capita income, and other variables. We then assess the impact of thirteen individual PPP enabling-law provisions. We develop an expert-informed weighted index reflecting the degree to which a state's law is encouraging or discouraging of private investment. We find that more favorable PPP enabling laws increase private investment: when our favorability index increases by one-tenth, the proportion of infrastructure investment delivered via PPP in a state increases by 0.5-0.6.

## 1. Introduction

There is a robust global discussion decrying the lack of infrastructure investment across numerous economic sectors (Woetzel et al 2016). By one estimate, the global infrastructure gap – the difference between current investment rates and investment needs – is \$350 billion annually (ibid). Public-private partnerships, or PPPs, are sometimes offered as a solution to bridging the infrastructure gap. PPPs are relational and typically long-term contracts between a public sponsor and a private partner created to deliver large infrastructure projects across a wide range of economic sectors.<sup>1</sup>

Although PPPs do not generate additional funding for infrastructure (which must come from either users fees or broader tax revenue) *per se*, when properly structured they can enhance on-time and on-cost project delivery, stimulate innovation in project delivery, better allocate risks, and improve project performance.<sup>2</sup> In the United States, the PPP approach stands in contrast to “traditional delivery.” Traditional project delivery refers to the use of design-bid-build (DBB) contracts, under which project design is placed out for bid. The construction of that design is bid out separately, usually to the lowest bidder. The public sector finances the project using tax-exempt municipal bonds. It also operates and maintains the project over its life span. That is, traditional U.S. infrastructure delivery is unbundled in the sense that the main tasks are conducted separately. Traditional delivery also features outdated, rigid procurement laws. Under a PPP approach, tasks such as facility design, construction, financing, operation and maintenance, can be bundled together in various combinations depending on the project to be delivered.<sup>3</sup> This facilitates exploitation of synergies between those functions (Bennett and Iossa, 2006; Martimort and Pouyet, 2008).

PPP laws are widely viewed as important prerequisites for the political and regulatory stability necessary to attract active private participation in infrastructure (World Economic

---

<sup>1</sup> See Albalade, Bel and Geddes (2017: 26) for broad definitions of PPPs in different scholarly fields. With respect to transportation projects, which are our study’s focus, the U.S. Federal Highway Administration, “Public-Private Partnerships (PPPs) are contractual agreements formed between a public agency and private sector entity that allow for greater private sector participation in the delivery and financing of transportation projects.” See U.S. Department of Transportation, Federal Highway Administration, *P3 Defined*, <http://www.fhwa.dot.gov/ipd/p3/defined/index.htm> (accessed May 21, 2015).

<sup>2</sup> For summaries of the benefits of the PPPs, see e.g. Geddes (2011) and the National Surface Transportation Infrastructure Financing Commission (2009).

<sup>3</sup> See U.S. Department of Transportation (2007, pp. 11-17) for a discussion of PPP contract types.

Forum, 2015, p. 11). Commentators stress that this is particularly important for the United States (Fishman, 2009), while others suggest that PPPs in the United States are hindered by a lack of adequate state-level enabling legislation (e.g. Reinhardt, 2011).<sup>4</sup> Indeed, many legislatures state that their purpose in enacting such laws is to attract private infrastructure investment.

PPP enabling laws clarify such contractual issues as the treatment of unsolicited PPP proposals,<sup>5</sup> whether a PPP can be used on existing (referred to as “brownfield”) as well as new (referred to as “greenfield”) transportation facilities, whether agreements can include the sharing of revenue with public sponsors, and whether the agreement may include non-compete clauses, among others.<sup>6</sup> From a potential private partner’s perspective, it is risky to expend time, money, and effort developing infrastructure projects that may ultimately fail to receive the necessary authorization. Enabling legislation provides a framework for contracting that helps reduce such uncertainty while clarifying risk allocation between the public sponsor and the private partner (Iseki *et al*, 2009). Properly structured PPP enabling laws can thus mitigate the substantial transaction costs associated with private infrastructure investment.

Despite their rising popularity, there has been little empirical examination of PPP enabling laws’ effects. We are the first to empirically explore the impact of state-level PPP enabling laws and their provisions on private investment in infrastructure. After controlling for numerous exogenous factors, we find that PPP enabling laws facilitate private investment in infrastructure. Although rising, private investment in U.S. transportation infrastructure remains low by international standards, and controversy surrounding the use of PPPs to finance and operate transportation infrastructure remains.<sup>7</sup> A better understanding of PPP laws’ effect is thus critical.

---

<sup>4</sup> Istrate and Puentes (2011) stress PPP enabling laws as one of their three key recommendations for attracting private investment into U.S. infrastructure.

<sup>5</sup> International standards for managing unsolicited proposals do not yet exist. See Hodges and Dellacha (2017) for an analysis on the introduction of competition and transparency in unsolicited proposals.

<sup>6</sup> A list of key provisions is provided in Table 1 below.

<sup>7</sup> Regarding low U.S. use of private investment in infrastructure, see Istrate and Puentes (2011, p. 4, Figure 1). Critics argue that PPPs do not create net social value, merely hide debt from the government’s balance sheet, raise the social cost of capital, and help protect the interests of private parties who are likely to exploit market power and superior bargaining skills relative to the public sector (e.g. Quiggin 2004, Dannin 2011, Roin 2011). Others argue that PPPs generate net social value through improved incentives to innovate, additional sources of capital, greater contractual transparency, and clearer linking of project returns to performance (e.g. Gilroy 2009, Poole 1993, National Surface Transportation Infrastructure Financing Commission 2009). Our analysis instead focuses on PPP enabling laws’ impact

We assess the effect of simply having a law as well as the impact of varying degrees of legal favorability to private investment. To do so, we develop an enabling-law favorability index that includes thirteen key provisions of each law. Rather than weighting each provision equally, however, we surveyed U.S. PPP experts to assign meaningful weights to the various provisions.

We analyze data on 177 U.S. transportation PPP projects completed between 1998 and 2016 using information gleaned from the *Public Works Financing* monthly newsletter. *Public Works Financing* reports information on all North American PPP projects, allowing a comprehensive analysis of PPP enabling laws' effect on private investment. We consider the 1988 to 2016 period to examine how varying exposure to PPP enabling laws across time – and to their differing elements – impacts the cumulative number of PPPs as well as overall PPP investment in a state. We focus on the proportion of PPP investment relative to total investment in a state's roads and highways in a cross-sectional setting. We describe our data set and empirical methods in detail below.

We find that PPP enabling laws increase the number of PPPs undertaken in a state and that more favorable laws result in more PPP contracts. We find a similar effect on PPP investment per capita and on the proportion of PPP investment relative to total investment in roads and highways.

We proceed as follows. We next discuss the basic structure of PPP enabling laws in the U.S. transportation sector. We describe the dataset, variables and our main predictions regarding the role of PPP enabling laws in facilitating PPP contracts and private investment in Section 3. Section 4 discusses empirical methods used, reports estimates, and offers a discussion. Section 5 concludes.

## **2. Public-Private Partnerships in Transportation**

Private participation via PPP may include the management, operation, and renovation of an existing transportation facility, as well as the design, construction, financing and operation of a new facility. More specifically for the road sector, in which PPPs are more frequent within

---

on private investment, and why states may pass laws explicitly inviting private investment in transportation infrastructure.

transportation infrastructure, Iossa (2015) shows the wide variety of contracts for motorways, depending on the way they are designed.<sup>8</sup>

For both brownfield PPPs, and those greenfield PPPs that include an operational component, the public project sponsor contractually specifies how the facility is to be renovated, maintained and, if necessary, expanded. The contract also specifies the determination of tolls and concession length. Key performance indicators (or KPIs) are typically included, such as safety standards and pavement quality, with clear financial and operational performance incentives. According to *Public Works Financing*, PPPs have been used to help finance and build at least 177 transportation projects for a total of \$115 billion between 1988 and 2016 in the United states.

Although investment in transportation infrastructure via PPPs accounts for about 11 percent of all national capital investment in new highway capacity in 2011, PPP use has increased significantly. Between 2001 and 2010, five states on average started a new transportation PPP each year (Reinhardt 2011). Until 2010, PPP projects accounted for a yearly average of about \$2.4 billion (in constant 2010 dollar terms), while the amount significantly increased between 2011 and 2016, reaching a yearly average of \$7.5 billion.

The failed attempt to lease the Pennsylvania Turnpike illustrates enabling laws' role in attracting investment. In May 2008, Pennsylvania's government announced that a partnership of Citi Infrastructure Investors and the Spanish firm Abertis Infraestructuras was the chosen concessionaire for a 75-year lease of the Pennsylvania Turnpike with a winning bid (i.e. lease payment) of \$12.8 billion. The state's legislature, however, allowed the bid to expire by failing to pass the requisite enabling legislation. The process of generating bids for which there was ultimately no return – even for the winning bidder – was costly.<sup>9</sup> Costs include holding in place

---

<sup>8</sup> Iossa (2015) emphasizes analysis of user tolls, and funding mechanisms generally, because there exists a high correlation between user fees retained by the concessionaire and demand-risk transfer. Even within user-fees schemes, however, the effective transfer of demand risk to the concessionaire depends heavily on the guarantees that the public sector eventually provides in the contract or via general regulations (Bel, Bel-Piñana and Rosell, 2017). Because of this, the Directive 2014/23 of the European Union mandates that awarding a concession requires the effective transfer of operational risk to the concessionaire, and demand risk in particular (see Iosa and Saussier, 2018)

<sup>9</sup> Commentators view such unrecovered bidding costs as a major deterrent to private participation. John Durbin, former executive director of the Pennsylvania Turnpike Commission, noted that “[t]here will not be another consortium that will proceed in any state where they have to put their bids in first and then gain legislative approval to lease the asset” (Pew Center on the States 2009, p.18). The lack of enabling legislation was dispositive for the investors in this case. Samuel (2008) states that, “The Abertis-Citi

commitments on \$12.8 billion in financing as well as direct contracting costs. PPP enabling laws thus help reduce the risk of political uncertainty by granting *ex ante* legislative approval. *Ex post* legislative approval of individual PPP agreements concluded by other units in a state, which can be proscribed by a PPP law, is a major disincentive to private-sector investment (Rall, Reed, & Farber, 2010).<sup>10</sup>

There is anecdotal evidence that PPP laws encourage private investment. Commentators stress that states with the most advanced PPP legislation receive the greatest private-sector attention (Gilroy, 2009). Moreover, sixty percent of all PPP projects between 1989 and 2012 occurred in only six large states. All of those states have PPP enabling legislation.<sup>11</sup> We expect that both passing a law and enacting a more favorable law will increase PPP investment over time.<sup>12</sup>

We utilized the Federal Highway Administration (FHWA) website and other key sources to determine which states have enacted PPP enabling laws.<sup>13</sup> All information was verified through examination of state PPP statutes and traced back to its passage using LexisNexis. Figure 1 displays the evolution of U.S. PPP enabling laws. Since passage of the first modern PPP law in 1988, the number of states with laws increased steadily over time until 2000.<sup>14</sup> From 2000 to 2005, the number of states with laws remained constant. Law adoption restarted in 2006 with

---

current offer of \$12.8 billion for a 75 year lease/concession of the Pennsylvania Turnpike expires next Tuesday Sept 30, and signs are it won't be extended. Last week a senior officer of the two companies was saying that without movement on enabling legislation this month, they were done." See Geddes and Wagner (2013) for further discussion of the importance of PPP enabling laws.

<sup>10</sup> Several states nevertheless have provisions in their enabling legislation requiring legislative approval. Addressing the disincentive to invest created by legislative approval requirements, one commentator claims that, "[i]n those states whose PPP enabling acts required legislative approval of negotiated deals no such deals were ever proposed." Poole (2009).

<sup>11</sup> Those states are Florida, California, Texas, Virginia, North Carolina, and Colorado.

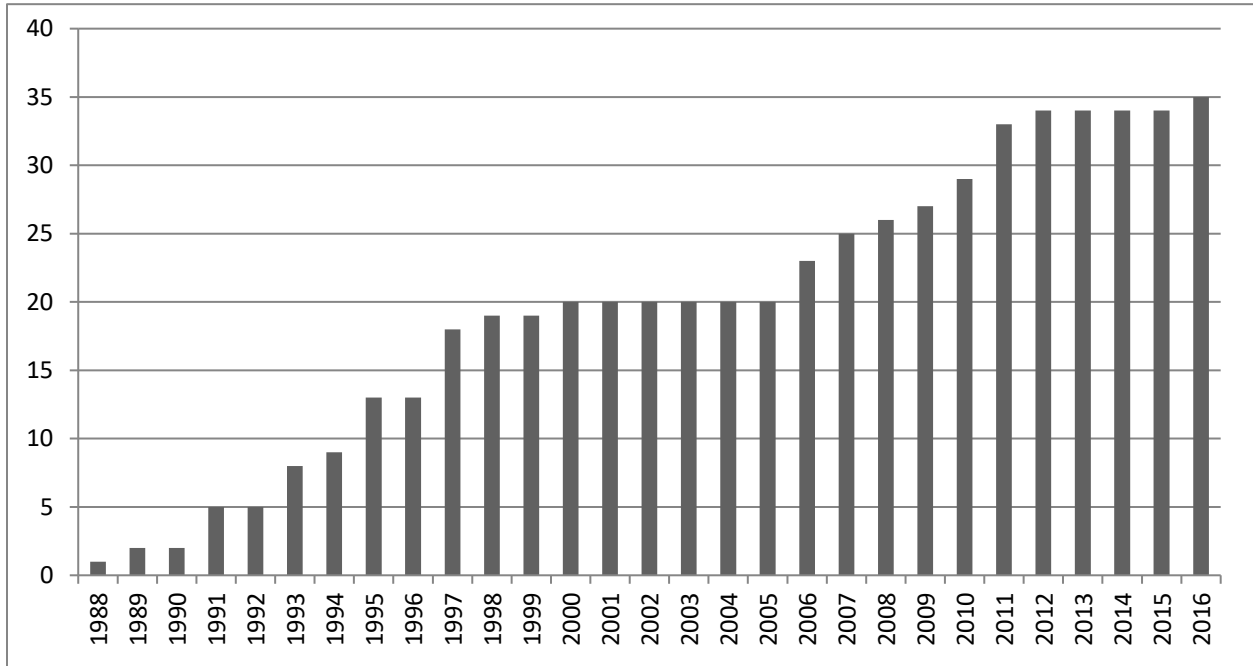
<sup>12</sup> It is possible in the United States to undertake PPPs without enabling legislation. Indeed, extant state-level procurement laws are the baseline with which the effect of enabling laws is compared. Unlike some civil-law jurisdictions, however, U.S. contract law is inherently enabling in the sense that contracts can be undertaken unless explicitly proscribed by law. Nevertheless, Hedlund and Chase (2005) stress that conventional procurement laws are often outdated and ill-suited to the complexities of a PPP, and thus a disincentive to private infrastructure investment. In economic terms, outdated procurement laws raise PPP transaction costs.

<sup>13</sup> Federal Highway Administration, *State P3 Legislation*, (available at: [http://www.fhwa.dot.gov/ipd/p3/state\\_legislation/index.htm](http://www.fhwa.dot.gov/ipd/p3/state_legislation/index.htm), accessed May 21, 2015). Additional sources include Pikiel & Plata (2008); Iseki *et al* (2009); and Rall, Reed & Farber (2010).

<sup>14</sup> Modern PPP legislation began with Virginia's Highway Corporation Act, which was passed in 1988. New Jersey had an enabling law passed by mid 1990s, but it ceased to be in effect as of 2003. The District of Columbia City Council voted unanimously to enact Bill 20-595 on December 2, 2014

the passing of an enabling law in Indiana, followed by several other states. By December 2012 thirty-four states (plus Puerto Rico) had legislation giving explicit authority to an agent of the state (such as the state’s department of transportation), to enter into a PPP agreement. After 2012 the enactment of laws slowed; only Kentucky was added to the list. Figures 2 and 3 show total annual and cumulative PPP investment from 1988 to 2016, respectively.<sup>15</sup>

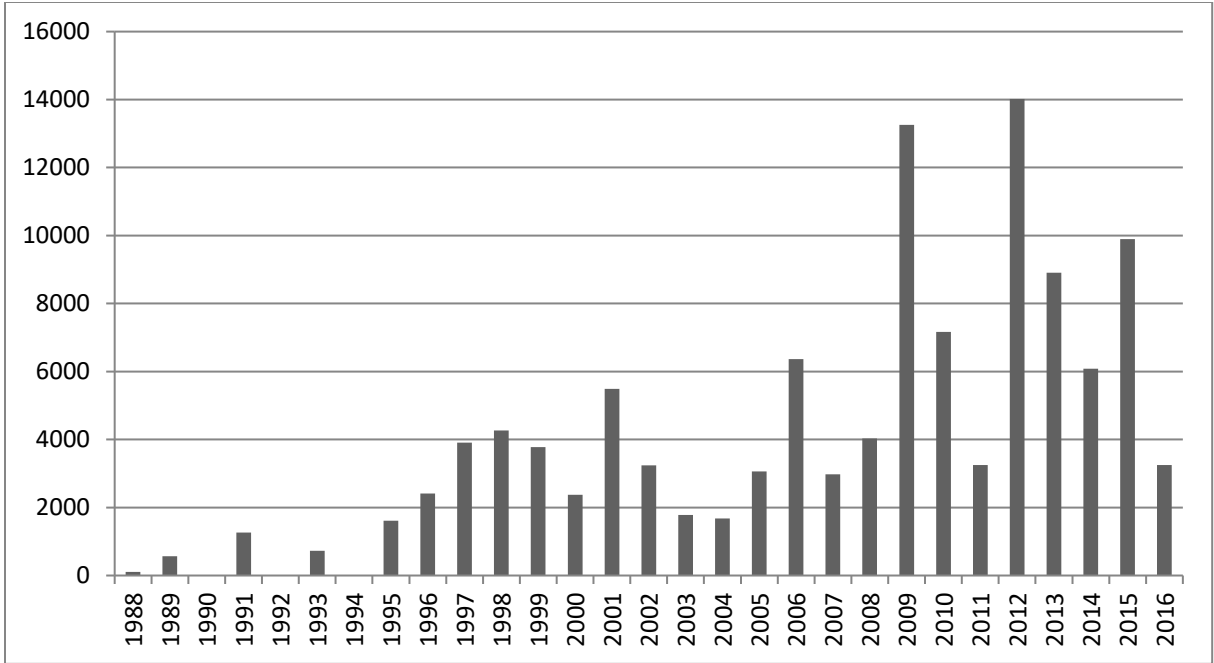
**FIGURE 1. Number of U.S. States with a PPP Enabling Law (1988-2016)**



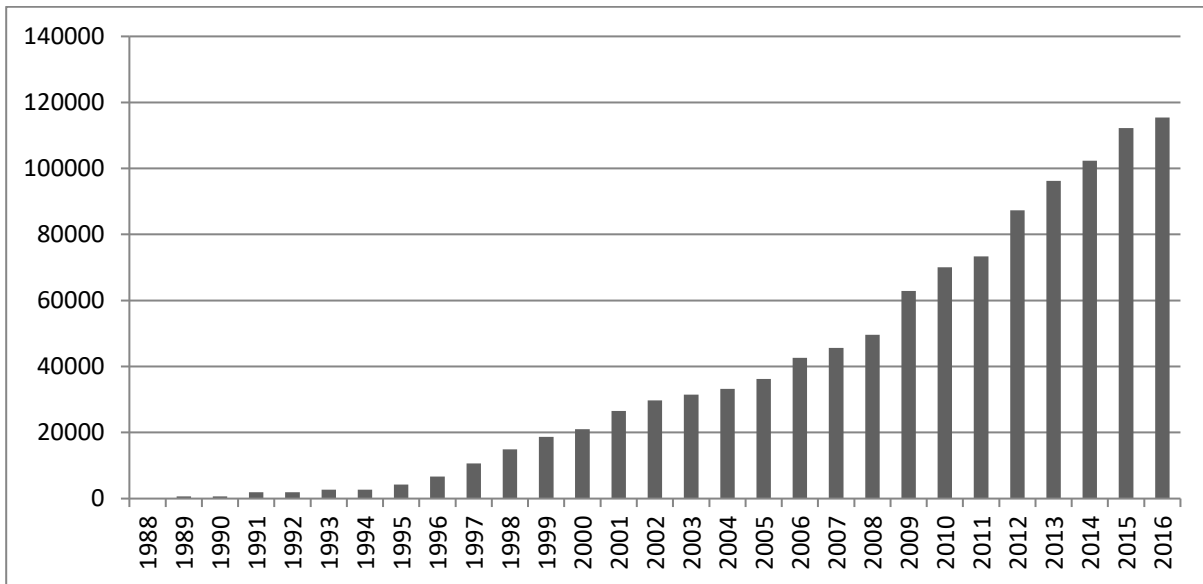
**FIGURE 2. Total Annual PPP Investment in U.S. Roads and Highways (Constant Million US\$ of 2010) (1988-2016)**

<sup>15</sup> Figure 2 displays a sharp drop in 2011. That may be due to the effects of the American Recovery and Reinvestment Act (ARRA) of 2009. Although the ARRA was a complex piece of legislation, it appears that much of the Acts’ effect on public spending was exhausted by 2011, causing state and local governments to pull back on investment. See, e.g. Bivens (2012).





**FIGURE 3. Cumulative PPP Investment in U.S. Roads and Highways (Constant Million US\$ of 2010) (1988-2016)**



### 3. PPP enabling laws and the favorability index

We next describe our data. Our dataset includes an indicator for the year in which a state first passed a PPP enabling law, and the provisions included. Our time frame begins with the passage of the first modern PPP law, Virginia’s Highway Corporation Act of 1988, and ends in 2016, which is the last year for which we have complete independent-variable data. Our data are thus a state-by-year panel from 1988 to 2016 forming a sample of 1,450 observations. In addition to evaluating the effect of having an enabling law (or not) on PPP investment, we address a second empirical question: how important are particular PPP law provisions in attracting private investment?<sup>16</sup>

We first examine the broader literature on state legislation to assess which provisions are generally viewed as important.<sup>17</sup> Poole (1993) and Hedlund and Chase (2005) provided initial guidance.<sup>18</sup> Using those and several additional sources, we identified thirteen enabling law provisions to form our basic PPP law favorability index. We then conducted a survey of PPP experts to assign weights to each provision. We asked respondents to rank each provision on a five-point Likert scale from “very discouraging” to “very encouraging” of private investment.<sup>19</sup> We then assigned each rank an integer value as follows:

- 2 = Very discouraging of private investment
- 1 = Somewhat discouraging of private investment
- 0 = No effect on private investment
- 1 = Somewhat encouraging of private investment
- 2 = Very encouraging of private investment

We calculated the mean value for each provision and divided it by two to produce a favorability score for each provision between -1 and 1. Table 1 reports the resulting “survey-weighted

---

<sup>16</sup> Understanding these effects is of more than academic interests. It may also provide guidance to the remaining states about the most desirable PPP enabling law structure.

<sup>17</sup> This includes the so-called “secondary literature,” which is composed of government reports, working papers, white papers, expert commentary, etc.

<sup>18</sup> See Geddes and Wagner (2013) for a discussion of the development of our PPP enabling law index. Additional sources include Fishman (2009); Iseki et al (2009); and Rall, Reed, & Farber (2010).

<sup>19</sup> Fifteen experts answered the survey. Table A1 in the Appendix reports the distribution of experts across ten major organizational types, such as federal and state government, think tanks and academia. Experts are well-distributed across organizational types, with the exception of law firms and toll road operators. Our survey weightings are thus unlikely to be systematically biased.

enabling score” for each provision relevant to our empirical analysis. A higher score indicates a more encouraging provision.

**TABLE 1. Description of PPP Law Provisions and Enabling Scores**

<b>Concept</b>	<b>Provision</b>	<b>Survey-Weighted Enabling Score</b>
<b>Fundmix</b>	The law allows both public and private sector money to be combined in the financing of a PPP project.	0.90
<b>Eligibility</b>	Road and highways are not eligible for PPPs under the statute	-0.84
<b>Avail</b>	The law explicitly permits the state to make payments to the private entity in lieu of direct user fees (e.g. availability payments, shadow tolls).	0.82
<b>Unlimitedpro</b>	The law does not put a limit on the number of projects that can be developed under the PPP approach.	0.79
<b>Confident</b>	The law protects the confidentiality of proprietary information contained in a private entity's proposal.	0.79
<b>Priorleg</b>	The law does not include a provision that allows the state legislature (or another public body) to reject a PPP agreement.	0.77
<b>Brown</b>	The law allows existing transportation facilities, as well as new transportation facilities, to be PPP-eligible.	0.77
<b>Others</b>	The law explicitly grants authority to entities other than the state DOT (i.e. counties, municipalities) to enter into PPP agreements (assuming that the state DOT also has authority).	0.67
<b>Exemptpro</b>	The statute exempts PPPs from the state's procurement laws.	0.61
<b>Revenue</b>	The law permits revenue sharing in PPP agreements.	0.60
<b>Noncomp</b>	The law allows PPP agreements to contain non-compete clauses or compensation clauses.	0.57
<b>Unsollic</b>	The law allows the responsible public entity to receive both solicited and unsolicited PPP proposals.	0.54
<b>Proptax</b>	The law exempts the private entity from paying property taxes on the land required to operate the facility.	0.47

Source: Authors' compilation

We next catalogued the provisions contained in each state’s enabling law. We then divided the total by 13 (the total number of possible provisions in any given law) to generate an overall favorability index for each state’s law.<sup>20</sup> Some states replaced older PPP laws with newer ones during our study period. We used LexisNexis to track changes in the laws since their inception, which we incorporate into the favorability index. This provides a time-varying favorability score for each state that varies between zero and ten. States without laws received favorability index scores of zero. Scores for each state are reported in Table 2.

<sup>20</sup> We scale the favorability index to be between zero and ten to aid interpretation of regression coefficients.

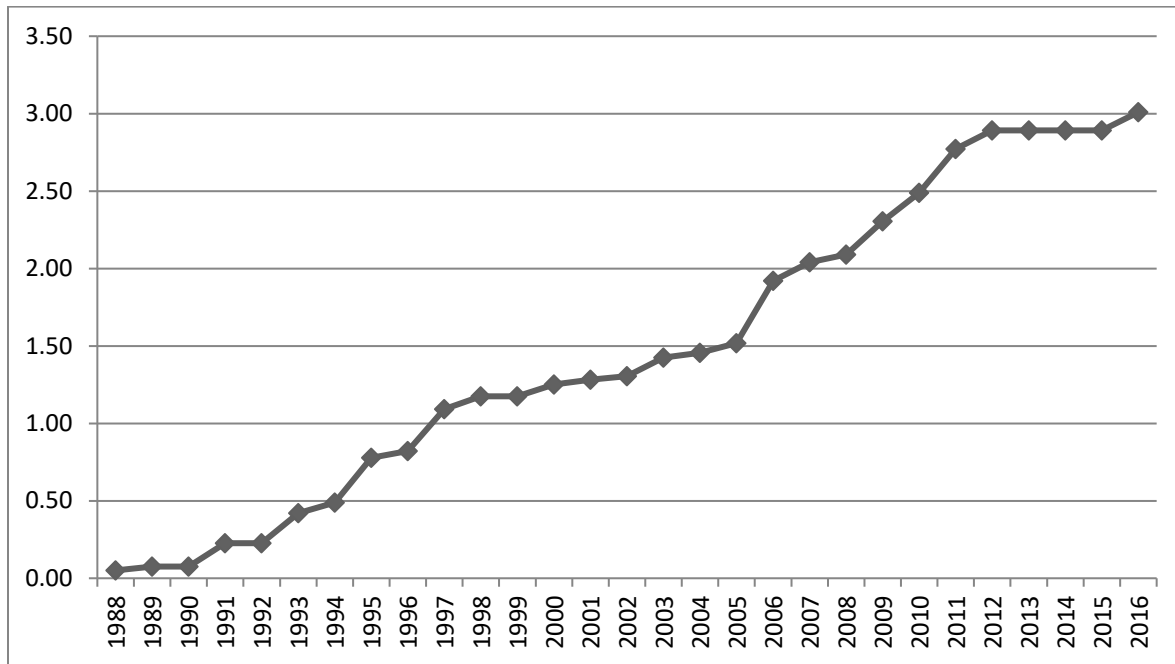
**TABLE 2 - Dates of First Passage of U.S. PPP Laws and Favorability Scores**

State	Year	PPP Index	State	Year	PPP Index
Alabama	1996	4.3	Montana	-	-
Alaska	2006	1.7	Nebraska	-	-
Arizona	1991	5.2	Nevada	2003	2.7
Arkansas	2011	3.4	New Hampshire	-	-
California	1989	3.0	New Jersey	1997	^
Colorado	1995	6.3	New Mexico	-	-
Connecticut	2011	4.1	New York	-	-
Delaware	1995	4.2	North Carolina	2000	3.4
Florida	1991	4.7	North Dakota	1993	4.5
Georgia	1998	6.3	Ohio	2011	5.4
Hawaii	-	-	Oklahoma	-	-
Idaho	-	-	Oregon	1995	6.1
Illinois	2011	4.4	Pennsylvania	2012	4.7
Indiana	2006	4.1	Rhode Island	-	-
Iowa	-	-	South Carolina	1994	3.4
Kansas	-	-	South Dakota	-	-
Kentucky	2016	5.9	Tennessee	2007	1.1
Louisiana	1997	5.7	Texas	1991	5.8
Maine	2010	3.1	Utah	1997	5.2
Maryland	1997	3.1	Vermont	-	-
Massachusetts	2009	5.0	Virginia	1988	6.3
Michigan	2010	5.1	Washington	1993	2.7
Minnesota	1993	2.1	West Virginia	2008	5.0
Mississippi	2007	4.6	Wisconsin	1997	3.4
Missouri	2006	2.4	Wyoming	-	-

Notes: Dash indicates that no law was ever passed. ^: Enabling law in New Jersey expired in 2003.  
Source: Author's compilation.

Amendments have made extant enabling laws more favorable to PPPs over time. Figure 3 indicates that the average value of our favorability index has increased significantly since 1988, reaching its peak in 2012, where it stayed constant until 2016.

**FIGURE 3. Annual Average Value of PPP Index (1988-2016)**



Our index is broadly consistent with commentator views regarding which states are receptive to private investment. For example, Texas, Virginia, Georgia, and Florida are often cited as examples of states with a favorable climate.<sup>21</sup>

#### **4. Empirical Strategies and Estimates**

We next empirically examine PPP enabling laws’ impact on private infrastructure investment. We utilized data on all PPP projects as reported annually in the “U.S. Transportation Projects Scorecard” in *Public Works Financing* to measure PPP investment. We evaluate the effect of enabling laws by considering on the amount of private investment as a share of total road and highway investment in the state. We also examine the laws’ role on PPP project completion.

We next describe both dependent and independent variables. Our main dependent variable is the proportion of PPP expenditure relative to total expenditure on roads and highways in each state. We consider a proportion because states with larger total spending (public and private) may

---

<sup>21</sup> Consistent with our hypothesis that PPP enabling laws in those states facilitate investment, Gilroy (2009, p. 14) notes “States like Texas, Virginia, Georgia, and Florida are generally regarded as offering the best models [of PPP legislation], as evidenced by the fact that they are reaping the most private sector interest and investment.”

receive more PPP investment, thus biasing estimates. To compute the percentage of PPP investments we use data reported in the tables entitled, “Total State Investments in Roads and Highways” from the U.S. Census Bureau’s *Annual Survey of State Government Finances*. In other models we also use the number of projects as the dependent variable to predict if PPP laws facilitated more PPP projects reaching financial close.

Two key independent variables are *PPP Act* and *PPP Index*. Each will display a positive coefficient if enabling laws increase investment and projects. A preliminary analysis based on a two-sample *t*-test for equal variances for both the proportion of PPP investments and the total amount of PPP projects by the presence or not of a PPP law (*PPP Act*) is reported in Table 3 below.

**TABLE 3. Two-sample *t*-test with equal variances by presence of a PPP enabling law**

All States (1450 observations)		
	Percentage of PPP investments	Annual mean Number of Projects
Without PPP Laws (0)	0.0010	0.0203
With PPP Laws (1)	0.0062	0.2814
diff = mean(0) - mean(1)	$t = -5.60^{***}$	$t = -11.67^{***}$
null H0= diff = 0	p-value =0.000	p-value =0.000
Only (Treated) States with PPP law enacted between 1988 and 2016 (1044 observations)		
	Percentage of PPP investments	Annual mean Number of Projects
Without PPP Laws (0)	0.0007	0.0187
With PPP Laws (1)	0.0062	0.2814
diff = mean(0) - mean(1)	$t = -5.09^{***}$	$t = -8.79^{***}$
null H0= diff = 0	p-value =0.000	p-value =0.000

There is a positive association between laws and PPPs as expected. The average percentage of PPP investments and the average annual number of projects are both statistically different and larger for states with a PPP law. The same test only applied to states that enacted a law at some point between 1988 and 2016 confirm that treated states have a larger proportions of private investment and more PPP projects after the enactment of PPP enabling laws.

Our choice of other time-varying regressors for a multivariate analysis was based on a review of both the privatization and contracting-out literatures. Researchers argue that governments utilize private investment in response to constraints on traditional financing sources for public-service provision. Capital constraints, rather than a quest for efficiency, thus drive private-sector participation (e.g. Bel and Fageda, 2007). We thus include proxies for a state’s general fiscal health and its access to traditional sources of infrastructure financing (which we call

“traditional finance”).<sup>22</sup> Those are measured by the state’s debt outstanding per capita (*Real\_Debt\_pc*), gas tax receipts per capita (*Real\_Gastax\_pc*) and federal aid for highways per capita (*Real\_Fedaid\_pc*). All these monetary variables are considered in constant terms (US\$ of 2010) and they are rescaled (per million population) to facilitate the interpretation of coefficients.

Measures of political disposition and pressure groups are typically introduced in PPP empirical analysis. However, Hammami, Ruhashyankiko and Yehoue (2006)<sup>23</sup>, as well as Albalade, Bel and Geddes (2013, 2015), find that political ideology is not relevant. Our attempts to consider the percentage of democrats in the state legislature or the state governor’s political party produce similar results (i.e. lack of significance). Although not included in our final specification as predictors, we use them to instrument our key variable *PPP Act*, as described below. Albalade, Bel and Geddes (2013) find that the relative wage differential between the private and public sectors is a driver of PPP choice in the U.S. water industry. If unions (perhaps to protect salaries and jobs), oppose PPPs in favor of an approach more likely to involve union labor, then the unionization variable will negatively impact PPP utilization. Similarly, if privately operated roadways are more likely to employ electronic tolling, then toll-collector unions may oppose PPPs. We include the unionization rate as a control.

Other basic controls include real per-capita income and the state’s population.<sup>24</sup> It is difficult to predict *ex ante* the impact that either variable will have on the percentage of private investment relative to total investment in roads and highways. Summary statistics for all variables are reported in Table 4 below. We next describe our empirical strategy and estimating equations.

We assess empirically the impact of PPP enabling laws on private investment in U.S. infrastructure by exploiting our data’s panel features. We examine the effect of PPP enabling laws and their favorability on private investment as well as on the number of PPP projects. We

---

<sup>22</sup> We were unable to locate adequate state-by-year data for our time period that measures the condition of transportation infrastructure. Available measures were highly incomplete.

<sup>23</sup> Interestingly, Hammami, Ruhashyankiko and Yehoue (2006) find a weakly positive association between right-wing parties and PPPs in the energy sector, and also a weakly negative association between right-wing parties and PPPs in transportation.

<sup>24</sup> Hammami, Ruhashyankiko and Yehoue (2006) include population and GDP per capita in their model, because PPPs are expected to be higher in larger markets, where demand and purchasing power are higher.

also estimate how exposure to evolving legal frameworks (i.e. different provisions included in a law) impacts investment and number of PPP projects.

#### *Average impact on PPP investments*

Our key dependent variable is the proportion of private investment relative to investment in roads and highways overall. We utilize a differences-in-differences approach to assess the average impact of enabling laws on the percentage of private infrastructure investment. This quasi-experimental strategy evaluates changes in the treatment group (states with enabling laws) with respect to its counterfactual using control group information. We follow the standard application of differences-in-differences to panel data by estimating the two-way fixed effects equation specified in Model (1) below:<sup>25</sup>

$$Percentage_{it} = \alpha + \beta_1 D^{PPP\_Act} + \beta_2 Real\_income\_pc_{it} + \beta_3 Fedaid\_pc_{it} + \beta_4 Debt\_pc_{it} + \beta_5 Pop_{it} + \beta_6 Unionm_{it} + s_i + w_t + \varepsilon_{it} \quad (1)$$

where  $\beta_1$  is the differences-in-differences estimate of the effect of the PPP enabling law on the dependent variable. The dependent variable, *Percentage*, is the percentage of private investment in roads and highways divided by total investment in roads and highways in state  $i$  in year  $t$ . The model includes, in addition to the covariates defined in Table 4, state-specific ( $s_i$ ) and year-specific ( $w_t$ ) fixed effects, and the error term ( $\varepsilon_{it}$ ). We cluster standard errors by state. We also estimate a second model (Model (2)) to account for the importance of PPP enabling-law favorability. The two equations differ only in the use of the binary *PPP Act* indicator (set to one if a PPP enabling law is in effect in the state in that year, zero otherwise) versus the continuous *PPP Index* variable to capture PPP enabling laws' impact. Estimates for both models are reported in Table 5.

$$Percentage_{it} = \alpha + \beta_1 D^{PPP\_Index} + \beta_2 Real\_income\_pc_{it} + \beta_3 Fedaid\_pc_{it} + \beta_4 Debt\_pc_{it} + \beta_5 Pop_{it} + \beta_6 Unionm_{it} + s_i + w_t + \varepsilon_{it} \quad (2)$$

---

<sup>25</sup> We also tested these models with fractional response models in order to capture the proportion or rate nature of our dependent variable. Results are consistent with the ones obtained with the two-way fixed effects panel data models and they are available upon request.



**TABLE 4. Summary Statistics.**

<b>Variables</b>	<b>Description</b>	<b>Source</b>	<b>Mean</b>	<b>Std. Dev.</b>	<b>Min</b>	<b>Max</b>
<i>Percentage</i>	Percentage of PPP investments over Total State Investments (in roads and highways)	See Sections 3 and 4.	0.0030	0.0174	0	0.3184
<i>PPP investments_pc</i>	Total PPP investments in roads and highways per thousand population (Constant \$2010)	See Sections 3 and 4.	0.011	0.07	0	1754
<i>Projects</i>	Number of yearly PPP projects reaching financial Close	See Sections 3 and 4.	0.1220	0.4344	0	5
<i>PPP Act</i>	Binary variable taking value 1 a PPP enabling law is present; 0 Otherwise.	See Section 3	0.3896	0.4878	0	1
<i>PPP Index</i>	PPP favorability index presented describe in Section 3.	See Section 3.	1.435	2.031	0	7
<i>Real Personal Income_pc</i>	State real income per capita (Constant \$2010)	U.S. Census Bureau	36,780	6,970	21,649.5	63,017.8
<i>Real_Federalaid_pc</i>	Federal aid to highways per capita to the state (Constant \$2010)	U.S. Census Bureau	147.23	93.67	13.16	677.91
<i>Real_Gastax_pc</i>	State gasoline tax receipts per capita (Constant \$2010)	FHWA Highway Statistics Series	147.759	41.30	0	276.60
<i>Real_Debt_pc</i>	State's only Debt outstanding per capita (Constant \$2010)	U.S. Census Bureau	3,161	2,201	206.6	20,829.63
<i>Pop</i>	State population (millions)	U.S. Census Bureau	5.708	6.303	0.45	39.25
<i>Unionm</i>	Percent of working population in a union in the state	unionstats.com(from CPS)	12.35	5.92	2	31

**TABLE 5. Panel Data Two way Fixed Effects Estimates on PPP investments**

Covariates	PPP Percentage	PPP Percentage	PPP Investments per capita	PPP Investments per capita
	(1)	(2)	(3)	(4)
<i>PPP Act</i>	0.00429** (0.0019)	-	0.0181** (0.0066)	-
<i>PPP Index</i>	-	0.0011** (0.0005)	-	0.0040** (0.0016)
<i>Real_Income_pc</i>	-0.0696 (0.2149)	-0.0689 (0.2109)	0.8085 (1.094)	0.7692 (1.1477)
<i>Real_Fedaid_pc</i>	-0.1617 (15.414)	-1.203 (15.163)	94.069 (62.253)	89.894 (121.87)
<i>Real_Gastax_pc</i>	3.929 (21.362)	4.456 (20.704)	24.154 (109.35)	24.293 (73.302)
<i>Debtpc</i>	-0.2026 (0.4093)	-0.3011 (0.3972)	-4.882 (2.465)	-5.277 (3.325)
<i>Pop</i>	0.0017** (0.0008)	0.0014* (0.0008)	0.0049** (0.0026)	0.0039* (0.0020)
<i>Unionm</i>	-0.0079 (0.0339)	-0.0069 (0.0334)	0.0412 (0.1514)	0.0407 (0.1365)
State Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
<b>N. Observations</b>	1450	1450	1450	1450
<b>F.Test</b>	52.66***	31.07***	29.22***	25.14***

**Notes:** \*\*\*, \*\*, \* significance levels at 1%, 5% and 10% respectively. In parenthesis standard errors clustered by States. Covariates calculated per capita are rescaled (per million population) in order to facilitate interpretation of coefficients.

Estimates displayed in Table 5 indicate that the *PPP Act* binary variable (model 1) and the favorability index of the state’s legislation (model 2) are both statistically significant determinants of a state’s proportion of PPP investment. Both display a positive, statistically significant impact. That is consistent with predictions regarding the positive role of PPP legislation in attracting private investment. Model (1) allows us to obtain the *differences-in-differences* estimate of the law’s average effect, which is positive and statistically significant at 5%, with an estimated magnitude of 0.004. That coefficient measures the average change in treated states relative to untreated states (i.e., the counterfactual). Some context helps to appreciate its seemingly small magnitude. The average percentage of PPP investment in our sample is 0.0030, slightly higher for treated states (0.0036) and lower for untreated states (0.0013). The effect of 0.004 is larger than those average figures, which suggests the relevance of the estimated effects. Moreover, we find that the average PPP percentage for treated states only in years without a PPP law is just 0.0007. The estimated 0.004 impact represents an almost six-fold increase relative to the average effect prior to the law’s enactment.

We estimate the same two-way fixed-effects model using our favorability index instead of the *PPP Act* variable. Estimates reported in column 2 confirm that higher index values are

associated with higher percentages of PPP investment. A unit increase in the index produces a change in the percentage of 0.001. This is a third of the average percentage of PPP investment in our sample, suggesting its economic significance.

We applied the same models to estimate total PPP investment per capita, obtaining similar results. We report those estimates in Columns 3 and 4.

#### *Impact on PPP project financial close*

We use count data models to predict the annual number of PPP projects reaching financial close. We apply a standard Conditional Fixed Effects Negative binomial model that, unlike Poisson models, account for over-dispersion. We also estimate a Zero-Inflated Negative Binomial model as a robustness check, although it cannot be applied in a panel-data setting. Estimating equations are the same as those presented above. Estimates are reported in columns 5 through 8 of Table 6. Both panel-data fixed-effects negative binomial and zero-inflated negative binomial models indicate that PPP laws and PPP Index are positively related to the number of projects reaching financial close.

It is difficult to interpret coefficients resulting from count data models. We thus transform the coefficients associated with the PPP law ( $\beta_1 = 1.516$ ) into Incidence Rate Ratios.<sup>26</sup> The incidence rate ratio for a binary variable, as our *PPP Act* variable, is simply the ratio of the number of events of one category to the number of events in the other category. We find that the incidence rate ratio of the PPP law is 4.55, which means that states with PPP laws have, on average, 4.5 more PPP projects reaching financial close than states without PPP laws, *ceteris paribus*. The incidence rate ratio of the zero-inflated regression is 5.2.

---

<sup>26</sup> The correct interpretation of coefficients should consider that for a one unit change in the covariates, the difference in the logs of expected counts of the outcome variable is expected to change by the respective regression coefficient, *ceteris paribus*.

**TABLE 6. Estimates of the amount of PPP projects**

Covariates	Negative Binomial Fixed Effects PPP projects (5)	Negative Binomial Fixed Effects PPP projects (6)	Zero inflated Negative Binomial PPP projects (7)	Zero inflated Negative Binomial PPP projects (8)
<i>PPP Act</i>	1.516*** (0.4321)	-	1.655*** (0.3079)	-
<i>PPP Index</i>	-	0.3281*** (0.0913)	-	0.1783*** (0.0620)
<i>Real_Income_pc</i>	10.446 (64.442)	45.829 ( 63.499)	55.062** (21.531)	45.592** (21.865)
<i>Real_Fedaid_pc</i>	-2186.94 ( 6602.04)	-2354.31 ( 6584.53)	-5037.7** (2501.79)	-5534.93 (2643.71)
<i>Real_Gastax_pc</i>	298.64 ( 5817.9)	-336.30 ( 5814.18)	-3908.94 (2658.9)	-2894.17 (2686.41)
<i>Debtpc</i>	-314.53 ( 215.72)	-357.17* ( 211.04)	-29.073 (68.916)	-26.0876 (69.464)
<i>Pop</i>	0.1935** (0.0974)	0.1216 ( 0.0950)	0.0614*** (0.0088)	0.06343*** (0.00875)
<i>Unionm</i>	-10.945 (7.9847)	-11.081 (7.9466)	-6.940*** ( 2.0090)	-4.8416** (2.1524)
<i>Panel Data</i>	Yes	Yes	No	No
<i>Year Fixed Effects</i>	Yes	Yes	Yes	Yes
N. Observations	841	841	1450	1450
loglikelihood	-296.17	-315.14	-401.76	-416.13
Wald-Chi2	65.00***	72.47***	-	-
LR Chi2	-	-	142.82***	113.62***

**Notes:** \*\*\*, \*\*, \* significance levels at 1%, 5% and 10% respectively. Covariates calculated per capita are rescaled (per million population) in order to facilitate interpretation of coefficients.

### *Robustness check on reverse causality*

New PPP laws may be designed and enacted in order to address specific needs and demands. There may be a preexisting interest in PPPs in states where a new law is being considered and discussed. That could affect the causal estimates reported in our empirical analyses above. The causal effect of laws on PPP investments might suffer from reverse causality. Indeed, our PPP law variables may potentially suffer from endogeneity if PPP laws were passed in response to a previously agreed-upon PPP project, or if the state had recently signed a PPP contract that created public concern and engendered legislative action.<sup>27</sup> We use a three-pronged approach to address that concern.

First, we report estimates using a leads and lags analysis, as in Autor (2003). This method replicates the panel-data regression analysis performed above in models presented in Table 5. However, it replaces the law variable *PPP\_Act* with binary variables for specific periods before and after the real treatment to see if there were anticipatory effects (leads). This is also useful to estimate the dynamics of policy impacts over time (lags). Following Autor (2003) we build two leads (two years and one year before the policy is implemented) and four lag variables. The last lag considers not only the fourth year after treatment but also the remaining post-treatment period. This final lag thus captures the average long term effect of the policy (since four years after treatment).

A finding of statistically insignificant lead effects implies rejection of the anticipatory effects hypothesis (i.e., of reverse causality). Such a finding would also confirm the common-trend assumption between the treated and the control groups that underlies our differences-in-differences method. Alternatively, we might expect lags to be statistically significant, which suggests an examination of the effects' time-pattern depending on their statistical significance and magnitude. A lag analysis allows us to distinguish between short-term and long-term impacts. Table 7 reports estimates using various dependent variables

**TABLE 7. Panel Data Leads and Lags Robustness Check**

---

<sup>27</sup> Geddes and Wagner (2013) examine the drivers of a state's decision to adopt a PPP enabling law. They find that states with higher levels of traffic congestion as measured by the travel time index (TTI) are more likely to pass a PPP enabling law. They were sensitive to the possibility that the laws could be endogenous to the amount of investment. However, they were unable to detect an effect of completed private infrastructure investment on the travel time index.

Covariates	Percentage of PPP investments (9)
<i>Lead 2</i>	0.0000 (0.0031)
<i>Lead 1</i>	0.0037 (0.0031)
<i>Adoption</i>	0.0143 (0.0090)
<i>Lag 1</i>	-0.0006 (0.0010 )
<i>Lag 2</i>	0.0044 (0.0038)
<i>Lag 3</i>	0.0007 (0.0014)
<i>Lag 4+</i>	0.0043** (0.0017)
<i>Covariates</i>	Yes
<i>State Fixed Effects</i>	Yes
<i>Year Fixed Effects</i>	Yes
N. Observations	1450
F-Test	471.33***

**Notes:** \*\*\*, \*\*, \* significance levels at 1%, 5% and 10% respectively. We present standard errors in parentheses. Errors are clustered allowing arbitrary correlations by state.

Column 1 in Table 7 reports leads and lags tests for our panel-data model with two-way fixed effects on the percentage of PPP investment relative to total investment in roads and highways. We reject anticipatory effects before treatment and conclude that the effects of such enabling laws do not take place in the short run (i.e., in first three years) but rather in the longer term. Moreover, the effect found since the fourth year is precisely the average treatment effect found in the differences-in-differences estimate obtained in model (1) of Table 5.

As a second robustness check, we estimate a two-stage procedure employing instrumental variables in panel-data models (2SLS). We chose first-stage instruments that determine the adoption of a PPP enabling law. We use *the annual number of laws* enacted by state legislature as a proxy for the state's legislative intensity, which we view as positively correlated with the probability of PPP enactment laws but uncorrelated with PPP investment. Our other instruments come from statistically significant variables reported in Geddes and Wagner (2013), who estimate the determinants of *PPP law passage*. Instruments include *the annual number of vehicle registrations* and the *travel-time index*, as well as some political variables.

We include three political instruments to account for PPP enactment: the ideology of the constituency (proxied by the percentage of votes for democratic candidates in last presidential elections), the percent of democrat representatives in the state legislature, and a dummy variable indicating the governor’s political party (0 democrat, 1 otherwise).

Estimates using this method are reported in Model (10) of Table 8 for the percentage of PPP expenditures relative to total expenditures. The positive and statistically significant impacts of *PPP Act* remain after correcting for possible endogeneity and are slightly larger.<sup>28</sup> 2SLS models rely on the quality of instruments employed. The Hansen *J*-Test checks whether restrictions implied by the existence of more instruments than endogenous regressors are valid (i.e. the exogeneity requirement). Results of this test support our over-identifying restrictions strategy (Chi-sq= 3.87 P-value = 0.57). Alternatively, the Kleibergen-Paap test checks whether instruments are relevant (i.e. relevance requirement), which is also satisfied (Chi-sq = 25.078\*\*\* P-val=0.0003).<sup>29</sup> The first-stage estimation of the model is presented in the appendix (Table A1).

**TABLE 8. Robustness Check: 2SLS estimates.**

Covariates	Panel Data 2SLS PPP percentage (10)
<i>PPP Act</i>	0.0076** (0.0040)
<i>Real_Income_pc</i>	-0.1379 (0.1349)
<i>Real_Fedaid_pc</i>	-5.513 (14.443)
<i>Real_Gastax_pc</i>	11.406 (23.551)
<i>Debtpc</i>	-0.2567 (0.5028)
<i>Pop</i>	0.0016*** (0.0004)
<i>Unionm</i>	0.0041 (0.0276)
N. Observations	1450
F.Test	5.53***

**Notes:** \*\*\*, \*\*, \* significance levels at 1%, 5% and 10% respectively. Standard errors are presented in parentheses. Errors are robust to heteroskedasticity. Covariates calculated per capita are rescaled (per million population) in order to facilitate interpretation of coefficients.

We also use a third strategy to address possible reverse causality. Because PPPs are often large and controversial events covered by the state’s media outlets, we report findings from an

<sup>28</sup> We do not replicate the analysis with the PPP index variable because of collinearity.

<sup>29</sup> The null hypothesis of this test is that the matrix of reduced form coefficients has rank=K1-1 (underidentified). The Kleibergen-Paap Wald rk F can also be used to check whether the equation is weakly identified. This is rejected at 5% in our model.

exhaustive investigation into news reports around the time of law adoption. If legislators adopt a PPP law *in response to* an impending transaction (perhaps due to pressure from investors) that is newsworthy and likely be reported widely.

We searched for media reports of a law passed in response to an impending agreement. That task would be onerous for all thirty-five states with PPP laws. We instead focused on five states that have exhibited high PPP activity: California, Florida, Texas, Virginia, and North Carolina. An exhaustive search into events surrounding *PPP law passage* in each state was conducted.<sup>30</sup> It revealed lobbying by numerous stakeholders prior to the passage of an enabling law, including by state Departments of Transportation, Associated Builders and Contractors, and construction companies, among others. Regarding the importance of the laws for investors (i.e. our maintained hypothesis), there were several instances where private groups lobbied for a stronger PPP law lest they shift investment to a more accommodating state, consistent with our hypothesis.<sup>31</sup> In no case did our investigation reveal that a PPP agreement was concluded prior to the law's passage, offering added comfort regarding possible endogeneity.

#### *Substitution effects on public sector expenditures*

Our estimates suggest that PPP laws encourage a larger presence of private investment in the composition of total state and local road and highways expenditures. However, this could be due to a substitution effect if state and local road expenditures also decrease.

We conduct additional estimates to evaluate if PPP expenditure is substituting for public sector expenditure rather than promoting additional investment. We again use a panel-data two-way fixed effects model to estimate the impact of *PPP laws* on total per capita state and local road expenditure – excluding PPPs – in constant terms (US\$ of 2010). We find that expenditure via PPP increased in those states introducing laws, indicating that expenditures financed by the governments did not concomitantly decrease.

---

<sup>30</sup> We are grateful for Priya Mukherjee for thorough research assistance on this issue. Details of her investigation are available upon request.

<sup>31</sup> Using California's PPP enabling law as an example, Skanska noted that, "The danger for California is that many of its neighbor states not only have legislation in place to allow for PPPs, but have established processes that make these efforts easier for all stakeholders. Should California lag behind these states, private money will go elsewhere." See "To enable its growing economy, California needs to renew its design-build and PPP legislation," September 4, 2013, available at: <http://blog.usa.skanska.com/to-enable-its-growing-economy-california-needs-to-renew-its-design-build-and-ppp-legislation/> (accessed October 18, 2015).



Those estimates are displayed in Table 9. We only report the key PPP variable coefficient, although the three models presented in equations (11), (12) and (13) include the same regressors used in previous models displayed in Table 5.<sup>32</sup> The coefficient associated with *PPP Act* in the first column of Table 9 is not statistically significant. The same result is obtained using *PPP index*. Nonetheless, those variables capture the role of laws and its indirect effect on public expenditures through attracting private expenditure. We use the total amount of PPP expenditures to test if private expenditure substitutes for public expenditure. Those estimates are reported in the third column of Table 9. We again find that the coefficient lacks statistical significance. There is thus no evidence of a substitution effect. We conclude that neither PPP legislation nor PPP expenditure in roads and highways negatively impact public expenditures.

**TABLE 9. Summary of selected least squares estimate results for total public sector investments.**

Covariates	Fixed Effects Total State and Local expenditures without PPP investments (11)	Fixed Effects Total State and Local expenditures without PPP investments (12)	Fixed Effects Total State and Local expenditures without PPP investments (13)
PPP Act	14.42 (19.29)	-	-
PPP Index	-	3.562 (3.731)	-
PPP investments	-	-	-61.90 (40.324)
State Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
N. Observations	1.450	1.450	1.450
F-test	5.97***	5.79***	5.48***

**Notes:** \*\*\*, \*\*, \* significance levels at 1%, 5% and 10% respectively. Standard errors are presented in parentheses. Errors are clustered allowing for arbitrary correlation by state.

#### *The role of PPP law's provisions on PPP outcomes.*

Our analysis suggests the importance of PPP laws and their favorability for private investment in infrastructure. The specific provisions included in the legislation were the ones that determined favorability. We now consider the role of PPP law provisions on the percentage of private investment relative to total road and highway spending between 1988 and 2016. We replicate our panel data models but replace our PPP law key variables (*PPP Act* and *PPP Index*) with binary variables indicating which provisions are included in state's PPP law. The 13 key provisions are described in Table 1.

<sup>32</sup> We did this analysis for federal expenditure on roads and highways in per capita and constant terms. We find the same result that we find in the case of State and Local governments' expenditures.

Model (14) of Table 10 includes all observations, while regression (15) include data from states that enacted a PPP law between 1988 and 2016 only. The dependent variable in both models is the percentage of PPP investment relative to total road and highway expenditures. Models (16) and (17) report estimates with total private investment per capita in roads and highways as the dependent variable.

The effect of various provisions on the private investment percentage is mixed. Some provisions favor PPP investment, while others hamper it. We find that allowing existing transportation facilities as well as new transportation facilities to be eligible for PPPs (*Brown*), and including the protection of confidentiality of proprietary information in the proposal (*Confident*), facilitate PPP investment.<sup>33</sup> Alternatively, our estimates indicate that including revenue sharing agreements (*Revenue*) and unsolicited proposals (*Unsollic*) in a PPP law are not as favorable.<sup>34</sup> Unlike the opinion declared by experts to construct the favorability index, the latter two are found to have a negative correlation instead of a positive correlation. Those results obtain when we restrict our sample to only those states enacting a law in our time span (1988-2016). Furthermore, those estimates are consistent with the change in the outcome variable to the total PPP investments per capita with the exception of one provision. Granting authority to entities other than the state DOT to enter into PPP agreements is negatively correlated with PPP investment per capita.

**TABLE 10. Estimates for the State legislation provisions on PPP investments.**

Provisions	Panel Data FE Percentage of PPP investments (14)	Panel Data FE Percentage of PPP investments (only treated States) (15)	Panel Data FE PPP Investments per capita (16)	Panel Data FE PPP Investments per capita (only treated States) (17)
<i>Eligibility</i>	-0.0028 (0.00252)	-0.003 (0.0026)	-0.0364 (0.0242)	-0.0390 (0.0253)
<i>Brown</i>	0.0043* (0.0024)	0.0046* (0.0026)	0.0256*** (0.0090)	0.0232** (0.0087)
<i>Unsollic</i>	-0.0080**	-0.0077**	-0.0310***	-0.0280**

<sup>33</sup> We realize that a PPP law provision that excludes transportation facilities may be striking since most laws focus on transportation infrastructure. We thus re-estimated our models omitted a PPP law that excludes transportation projects. The effect of that omission on our estimates was minor: Our coefficients diminish from 0.0043 to 0.0038. The statistical significance of that estimates diminishes from 3.5% to 7%, however, implying a reduction from a 5% to a 10% significance level.

<sup>34</sup> A negative sign does not imply that the provision is harmful. Rather, it implies that states with laws containing those provisions have on average lower levels of PPP investments than states without the provision.

	(0.0034)	(0.0034)	(0.0116)	(0.0117)
<i>Exemptpro</i>	0.0044	0.0040	0.0109	0.0091
	(0.0034)	(0.0030)	(0.0114)	(0.0117)
<i>Revenue</i>	-0.0112**	-0.0107**	-0.0567***	-0.0507***
	(0.0046)	(0.0047)	(0.0191)	(0.0179)
<i>Avail</i>	-0.0012	-0.0014	-0.0006	-0.0014
	(0.0029)	(0.0029)	(0.01077)	(0.0113)
<i>Proptax</i>	0.0016	0.0015	0.0072	0.0063
	(0.0024)	(0.0024)	(0.0085)	(0.0090)
<i>Noncomp</i>	-0.0026	-0.0028	-0.0052	-0.0034
	(0.0025)	(0.0024)	(0.0081)	(0.0082)
<i>Fundmix</i>	-0.0017	-0.0015	0.0026	0.0031
	(0.0037)	(0.0041)	(0.0135)	(0.0152)
<i>Confident</i>	0.0070***	0.0069***	0.0225***	0.0212**
	(0.0023)	(0.0023)	(0.0077)	(0.0080)
<i>Priorleg</i>	-0.0017	-0.0021	-0.0014	-0.0022
	(0.0030)	(0.0032)	(0.0131)	(0.0138)
<i>Unlimitedpro</i>	0.0008	0.0010	-0.0022	-0.0009
	(0.0020)	(0.0020)	(0.0093)	(0.0092)
<i>Others</i>	-0.0033	-0.0034	-0.0210*	-0.0226**
	(0.0023)	(0.0022)	(0.0106)	(0.0107)
<i>State Fixed Effects</i>	Yes	Yes	Yes	Yes
<i>Year Fixed Effects</i>	Yes	Yes	Yes	Yes
<b>N. Observations</b>	1450	1047	1450	1044
<b>F-Test</b>	1.81***	1.53**	1.90***	1.67***

**Notes:** \*\*\*, \*\*, \* significance levels at 1%, 5% and 10% respectively. Standard errors are presented in parentheses. Errors are clustered allowing for arbitrary correlation by State.

## 5. Summary and Conclusions

Many U.S. states and localities are facing challenges in financing, maintaining, expanding and renovating their transportation infrastructure. The demand for transportation infrastructure is high, particularly in urban areas. It is, however, often poorly maintained and well past its original design life. Meanwhile, many states and localities lack the resources necessary to ensure adequate operation and maintenance.

One approach that is common globally and used increasingly in the United States is to encourage private participation in infrastructure delivery through PPPs. Thirty-five states plus Puerto Rico had modern PPP enabling laws in force as of late 2016. The laws create the institutional setting to undertake PPPs, thus lowering transaction costs. Enabling laws clarify important contractual issues, such as whether PPPs can be used on both new and existing facilities, whether the state allows the mixing of public- and private-sector financing, whether the

government can share toll revenue, and whether state legislative approval is needed after the PPP agreement is concluded.

In addition to collecting and analyzing data on PPP enabling laws, we surveyed experts from a range of backgrounds to create an expert-weighted index of PPP enabling law favorability. We assigned weights to thirteen critical elements of PPP enabling laws and studied state laws to determine which contain those various provisions. We generated an index of enabling law favorability. More states are passing PPP enabling laws while the average favorability of a U.S. PPP enabling law is rising over time.

Our estimates indicate that the improved legal frameworks offered by PPP enabling laws are successful in attracting private capital to transportation infrastructure projects. We find a strong, positive elasticity of 0.5 for the percentage of PPP investments in roads and highways with respect to PPP Act and of 0.6 for our PPP index variable. We also find a positive association between PPP laws (and their favorability) and the annual number of PPP projects reaching financial close. The higher percentage of PPP investment relative to total state and local investment does not occur due to a crowding-out effect: PPP laws and PPP investment are not associated with lower levels of government investment in highways.

Our estimates suggest several key conclusions regarding the proper structure of PPP enabling laws. Specific-provision estimates reveal that some provisions favor PPP investment in roads and highways while others hamper that investment. The most favorable and consistent findings are associated with exemptions from extant procurement laws and property taxes, and with confidentiality protection. The most problematic are those limiting PPPs to other sectors (i.e. excluding roads and highways) and those allowing for unsolicited proposals. Other provisions show different results depending on whether we include the whole sample, the sample of states with PPP laws, and the sample in years with existing PPP laws.

Our findings are robust to the method of measuring private infrastructure investment via PPPs, and are significant at standard levels of confidence. In addition to extending the current literature, our analysis provides useful guidance to the remaining states and localities wishing to craft PPP enabling laws that encourage additional private investment in infrastructure. It also offers guidance to states wishing to revise their enabling laws in the hope of attracting private investment into infrastructure.

## References

- Albalade, D., Bel, G., & Geddes, R.R. (2013). "Recovery Risk and Labor Costs in Public-Private Partnerships: Contractual Choice in the U.S. Water Industry," *Local Government Studies*, 39(3), 332-351.
- Albalade, D., Bel, G., & Geddes, R.R. (2015). "The Determinants of Public-Private Partnership Contractual Choice in the United States", *Public Money & Management*, 35 (1), 87-94.
- Albalade, D., Bel, G., & Geddes, R.R. (2017). "How Much Vertical Integration? Contractual Choice and Public-Private Partnerships in the United States", *Review of Industrial Organization*, 51 (1), 25-42.
- Bel, G., Bel-Piñana, P. & Rosell, J. (2017). "Myopic PPPs: Risk Allocation and Hidden Liabilities for Taxpayers and Users", *Utilities Policy*, 48, 147-156.
- Bel, G., & Fageda, X. (2007). "Why do local governments privatize public services? A survey of empirical studies," *Local Government Studies*, 33(4), 517-534.
- Bel, G. & X. Fageda, (2009). "Factors explaining local privatization: a meta-regression analysis," *Public Choice*, 139, 105-119.
- Bennett, J. & Iossa, E. (2006). Building and managing facilities for public services. *Journal of Public Economics*, 90(10-11), 2143-2160.
- Bivens, Josh (2012). *Public Investment: The Next 'new thing' for powering economic growth*, Washington, DC: Economic Policy Institute.
- Dannin, E. (2011). "Crumbling Infrastructure, Crumbling Democracy: Infrastructure Privatization Contracts and Their Effects on State and Local Governance," *Northwestern Journal of Law and Social Policy* Vol. 6 (Winter 2011), pp. 47-105.
- Federal Highway Administration. (2009). "Public-Private Partnerships for Highway Infrastructure: Capitalizing on International Experience," International Technology Scanning Program, <http://international.fhwa.dot.gov/pubs/pl09010/pl09010.pdf> (accessed April 1, 2011).
- Fischer, J.W. (2005). "From Interstates to an Uncharted Future: A Short History of the Modern Federal-Aid Highway Program." In W. Cox, A. Pisarski & R.D. Utt (Eds.), *21st Century Highways: Innovative Solutions to America's Transportation Needs* (pp. 9 – 36). Washington, D.C.: The Heritage Foundation.
- Fishman, E. (2009). "Major Legal Issues for Highway Public-Private Partnerships: Legal Research Digest 51," *National Cooperative Highway Research Program*, Washington, D.C.
- Furchtgott-Roth, D. (2010), Mileage Fees Over Gas Taxes? *Real Clear Markets*, May 20, 2010, available at: [http://www.realclearmarkets.com/articles/2010/05/20/mileage\\_fees\\_over\\_gas\\_taxes\\_\\_98477.html](http://www.realclearmarkets.com/articles/2010/05/20/mileage_fees_over_gas_taxes__98477.html) (accessed May 19, 2015).
- Geddes, R.R. (2011). *The Road to Renewal: Private Investment in U.S. Transportation Infrastructure*, Washington, D.C.: The AEI Press.
- Geddes, R.R. and B.L. Wagner (2013). "Why Do States Adopt Public-Private Partnership Enabling Legislation?," *Journal of Urban Economics*, 78, 30-41.
- Geddes, R. and B. Wassink. "Bring Highway Spending Up to Speed," *Wall Street Journal*, June 16, 2014.
- Gelinas, N. (2011). "The Tappan Zee Is Falling Down," *City Journal*, 21(2), [http://www.city-journal.org/2011/21\\_2\\_tappan-zee-bridge.html](http://www.city-journal.org/2011/21_2_tappan-zee-bridge.html) (accessed May 19 2015).

- Gilroy, L. (2009). "Modernizing and Expanding Pennsylvania's Transportation Infrastructure through Public-Private Partnerships." Testimony before the Pennsylvania House Republican Policy Committee, Los Angeles, Calif.: Reason Foundation, [http://reason.org/files/testimony\\_pennsylvania\\_transportation\\_public\\_private\\_partnerships.pdf](http://reason.org/files/testimony_pennsylvania_transportation_public_private_partnerships.pdf) (accessed May 21, 2011).
- Hammami, M., Ruhashyankiko, J-F & Yehou, E.B. (2006). *Determinants of Public-Private Partnerships in Infrastructure*. Washington, DC: International Monetary Fund (IMF).
- Hedlund, K., & Chase, B. (2005). "Overview of Key Elements and Sample Provisions State PPP Enabling Legislation for Highway Projects," Washington, D.C.: Nossaman, Guthner, Knox and Elliott LLP, [http://www.fhwa.dot.gov/ipd/pdfs/legis\\_key\\_elements.pdf](http://www.fhwa.dot.gov/ipd/pdfs/legis_key_elements.pdf) (accessed May 21, 2011).
- Hodges, J.T. & Dellacha, G. (2017). "Unsolicited Infrastructure Proposals. How Some Countries Introduce Competition and Transparency". Washington DC; Public-Private Infrastructure Advisory Facility (PPIAF) working paper series. World Bank.
- Iossa, E. (2018). "Contract and procurement design for PPPs in highways: the road ahead". *Journal of Industrial and Business Economics (Economia e Politica Industriale)*, 42(3), 245-276.
- Iossa, E. & Saussier, S. (2018). "Public Private Partnerships in Europe for Building and Managing Public Infrastructures: An Economic Perspective". *Annals of Public and Cooperative Economics*, 89 (1), 25-42.
- Iseki, H., Eckert, J., Uchida, K., Dunn, R., & Taylor, B.D. (2009). "Task B-2: Status of Legislative Settings to Facilitate Public Private Partnerships in the U.S.," California PATH Research Report UCB-ITS-PRR-2009-32, Berkeley, CA.: Institute of Transportation Studies, University of California, Berkeley.
- Istrate, E. & Puentes, R. (2011). *Moving Forward on Public-Private Partnerships: U.S. and International Experience with PPP Units*, Brookings-Rockefeller Project on State and Metropolitan Innovation (December 2011).
- Lomax, T., Schrank, D., & Eisele, B. (2013). "TTI's 2012 Urban Mobility Report," College Station, Texas: Texas Transportation Institute, <http://http://mobility.tamu.edu/ums/> (accessed May 201, 2015).
- Martimort, D. & Pouyet, J. (2008). "To build or not to build: Normative and positive theories of public-private partnerships". *International Journal of Industrial Organization*, 26(2), 393-411
- National Surface Transportation Infrastructure Financing Commission. (2009). *Paying Our Way: A New Framework for Transportation Finance*. Washington, D.C.: National Surface Transportation Infrastructure Financing Commission.
- Pew Center on the States. (2009). *Driven by Dollars: What States Should Know When Considering Public-Private Partnerships to Fund Transportation*. Washington, D.C., [http://www.pewtrusts.org/~media/legacy/uploadedfiles/wwwpewtrustsorg/reports/state\\_policy/PATurnpikeFINALWEBpdf.pdf](http://www.pewtrusts.org/~media/legacy/uploadedfiles/wwwpewtrustsorg/reports/state_policy/PATurnpikeFINALWEBpdf.pdf) (accessed May 21, 2015).
- Pikiel, M., & Plata, L. (2008). "A Survey of PPP Legislation across the United States," *Global Infrastructure*, 1, 52-65.
- Poole, R.W. (1993). "How to Enable Private Toll Road Development," How-to Guide No. 7, Los Angeles: Reason Foundation, <http://reason.org/files/35ea7f9f3eef937371c6ce7c4db95270.pdf> (accessed May 21, 2015).

- Poole, R.W. (2009). "No Toll Czar: States, Not Feds, Should Protect the Public Interest in Public-Private Partnership Deals," Los Angeles: Reason Foundation, <http://reason.org/blog/show/no-toll-czar-states-not-feds-s> (accessed May 21, 2015).
- Quiggin, J. (2004). "Risk, PPPs, and the Public Sector Comparator," *Australian Accounting Review*, 14(2), 51-61.
- Rall, J., Reed, J. B., & Farber, N. J. (2010). *Public-private partnerships for transportation: A toolkit for legislators*. Washington, D.C.: National Conference of State Legislatures.
- Reinhardt, W. (2011). "The Role of Private Investment in Meeting U.S. Transportation Infrastructure Needs," *Public Works Financing*, Vol. 260, May 2011.
- Roin, J.A. (2011). "Privatization and the Sale of Tax Revenues," *Minnesota Law Review*, 95, 1965-2034.
- Samuel, P. (2008). "Abertis-Citi likely to announce end of bid for Penn Pike early next week – Turnpike Commission wins," *TOLLROADSnews*, September 27, 2008, <http://www.tollroadsnews.com/node/3757> (accessed May 19, 2015).
- Siemiatycki, M. (2007). "What's the Secret? Confidentiality in Planning Infrastructure Using Public/Private Partnerships," *Journal of the American Planning Association*, 73(4), 388-403.
- U.S. Department of Transportation, Federal Highway Administration (2007). *User Guidebook on Implementing Public-Private Partnerships for Transportation Infrastructure Projects in the United States*, (July).
- Wells, J. (2006). "The Role of Transportation in the U.S. Economy." Presentation to the National Surface Transportation Policy and Revenue Study Commission, June 26, 2006.
- Woetzel, Jonathan, Nicklas Garemo, Jan Mischke, Martin Hjerpe, and Robert Palter (2016). *Bridging Global Infrastructure Gaps*, Shanghai: McKinsey Global Institute (June).
- World Economic Forum (2015). *Strategic Infrastructure Mitigation of Political & Regulatory Risk in Infrastructure Projects*. Geneva: World Economic Forum.

## Appendix

Table A1. 2SLS estimates. First stage Ordinary Least squares.

Covariates	First Stage OLS Estimation
<i>Real_Income_pc</i>	5.024* (2.781)
<i>Real_Fedaid_pc</i>	210.45 (230.32)
<i>Real_Gastax_pc</i>	-1449.97*** (378.96)
<i>Debtpc</i>	7.590 (9.379)
<i>Pop</i>	0.0119 (0.0127)
<i>Unionm</i>	-3.248*** (0.5768)
<i>Instruments</i>	
<i>Num_laws</i>	2.49e-06 (0.00003)
<i>Registrations_pc</i>	-0.0743*** (0.0180)
<i>tii_index</i>	2.097*** (.3613)
<i>Democrat_presidentials</i>	-1.58e-08*** (3.68e-09)
<i>State_democrats</i>	2.097*** (-0.9505)
<i>Republican_gov</i>	0.0149 (0.0183)
N. Observations	1450
R-squared	0.39
F.Test	65.21***
First Stage F-stat for instruments	29.59***

**Notes:** \*\*\*, \*\*, \* significance levels at 1%, 5% and 10% respectively. Robust to heteroskedasticity standard errors are presented in parentheses.