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

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ABSTRACT

The use of public-private partnerships, or PPPs, is an important development in U.S. infrastructure delivery. PPPs are contracts between a public-sector project sponsor and a private-sector provider that bundle together key delivery services. PPPs represent an important middle ground between pure-public project delivery and privatization. As of 2016, thirty-five U.S. states had enacted PPP enabling laws. Those laws define the broad institutional framework surrounding a PPP agreement. They address such questions as the mixing of public- and private-sector funds, the treatment of unsolicited PPP proposals, and the need for prior legislative approval of PPP contracts. We provide the first comprehensive empirical assessment of the impact of those 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. A law's average impact represents an almost six-fold increase relative to the average percentage of PPP investment prior to enactment in treated states. We then assess the impact of PPP enabling-law provisions. We find that PPP provisions that empower PPPs, such as exemptions from property taxes and from extant procurement laws, as well as confidentiality protections, attract PPP investment.

1. Introduction

The problem of inadequate infrastructure investment in road infrastructure, and generally across economic sectors, is often decried (Fischer, 2005; Furchtgott-Roth, 2010; Woetzel et al. 2016). By one estimate, the global infrastructure gap – the difference between current investment rates and investment needs – is $350 billion annually (Woetzel et al 2016). Public-private partnerships, or PPPs, are sometimes offered as a solution to bridging the infrastructure gap. PPPs are relational, long-term contracts between a public-project sponsor and a private partner.[1] They are relied upon to deliver critical infrastructure projects across a range of economic sectors.

Although PPPs do not generate infrastructure funding *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.[2] In the United States, PPPs contrast with "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 separately, usually to the lowest bidder. The public sector typically finances the project using tax-exempt municipal bonds. It also operates and maintains the project over its life span. Traditional U.S. infrastructure delivery is unbundled in the sense that the main tasks are conducted separately. Traditional delivery also features relatively rigid state and local procurement laws. Under a PPP approach, tasks such as facility design, construction, financing, operation and maintenance, are bundled together in various combinations depending on the project to be delivered.[3] This facilitates exploitation of synergies between those functions (Bennett and Iossa, 2006; Martimort and Pouyet, 2008).

PPP laws are important prerequisites for the political and regulatory stability necessary to attract active private participation (World Economic Forum, 2015, p. 11). Commentators stress that this is particularly important for the United States (Fishman, 2009), while others suggest that

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[1] See Albalate, Bel and Geddes (2017: 26) for broad definitions of PPPs in different scholarly fields. With respect to transportation projects, which are our focus, the U.S. Federal Highway Administration states that, "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).
[2] For summaries of PPP benefits, see e.g. Geddes (2011) and the National Surface Transportation Infrastructure Financing Commission (2009).
[3] See U.S. Department of Transportation (2007, pp. 11-17) for a discussion of PPP contract types.

PPPs in the United States are hindered by a lack of adequate state-level enabling legislation (e.g. Reinhardt, 2011).[4] Indeed, many legislatures state that their goal in enacting such laws is to attract private infrastructure investment.

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

Despite extensive popular commentary, there has been little empirical examination of PPP enabling laws' effects. We provide the first empirical exploration of the impact of state-level PPP enabling laws and their provisions on private infrastructure investment. 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. Controversy surrounding the use of PPPs to finance and operate transportation infrastructure remains.[7] A better understanding of PPP laws' actual effect is useful.

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

[5] 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.

[6] A list of key provisions is provided in Table 1 below.

[7] Regarding relatively low reliance on private infrastructure investment in the United States, 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 better 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 on private investment, and why states may pass laws explicitly inviting private investment in transportation infrastructure.

We assess the impact of a state having a law as well as the effect 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, we surveyed U.S. PPP experts to assign meaningful weights to various provisions.

We analyze data on 177 U.S. transportation PPP projects completed between 1988 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 number of PPPs as well as overall private 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 find that enabling laws increase the number of PPPs undertaken in a state and that specific empowering provisions in laws result in more PPP contracts. We find a similar effect on PPP investment per capita and on the proportion of private 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 our dataset, variables and main predictions regarding the role of PPP enabling laws in facilitating PPP contracts and private investment in Section 3. We discuss empirical methods used, reports estimates, and offer a discussion in Section 4. Section 5 summarizes and concludes.

2. Public-Private Partnerships in Transportation

Private participation via PPP includes the management, operation, and renovation of an existing transportation facility, as well as the design, construction, financing and operation of a new facility. In the transportation sector (where PPPs are used mainly for roads), Iossa (2015) considers the array of motorway contracts, depending on their design.[8]

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[8] Iossa (2015) emphasizes analysis of user tolls, and funding mechanisms generally, because there is a high correlation between user fees retained by the concessionaire and demand-risk transfer. Even within user-fees schemes, however, effective transfer of demand risk to the concessionaire depends heavily on guarantees the public sector eventually provides in the contract or via general regulations (Bel, Bel-Piñana and Rosell, 2017). Because of this, the European Union's Directive 2014/23 mandates that

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.

As of 2011, investment in transportation infrastructure via PPPs accounted for about 11 percent of all national capital investment in new highway capacity. PPP use has increased over time, however. Between 2001 and 2010, five states on average started a new transportation PPP each year (Reinhardt 2011). Until 2010, PPP projects accounted for an annual average of about $2.4 billion (in constant 2010 dollar terms). That amount significantly increased between 2011 and 2016, reaching an annual average of about $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.[9] Costs include holding in place commitments on $12.8 billion in financing as well as direct contracting costs. PPP enabling laws help reduce the risk of political uncertainty by granting *ex ante* legislative approval. *Ex post*

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awarding a concession requires the effective transfer of operational risk to the concessionaire, and demand risk in particular (see Iossa and Saussier, 2018)

[9] 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 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.

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).[10]

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 had PPP enabling legislation.[11] We expect that both passing a law and enacting a more favorable law will increase PPP investment over time.[12]

We utilized the Federal Highway Administration (FHWA) website and other key sources to determine which states have enacted PPP enabling laws.[13] All information was verified by examining state PPP statutes and traced to its first 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.[14] From 2000 to 2005, the number of states with laws remained constant. Law adoption restarted in 2006 with 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

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[10] 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).

[11] Those are Florida, California, Texas, Virginia, North Carolina, and Colorado.

[12] 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.

[13] Federal Highway Administration, *State P3 Legislation*, (available at: 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).

[14] 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

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.[15]

FIGURE 1. Number of U.S. States with a PPP Enabling Law (1988-2016)
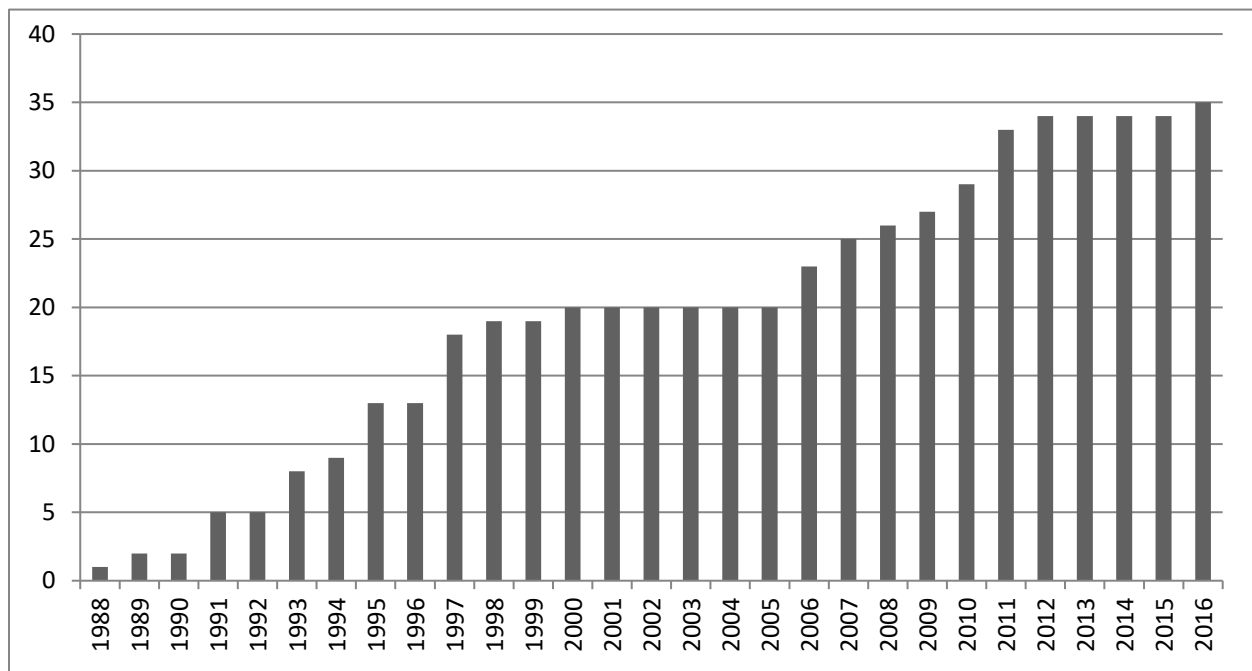
FIGURE 2. Total Annual PPP Investment in U.S. Roads and Highways (Constant Million US$ of 2010) (1988-2016)

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[15] 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 complex, 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).
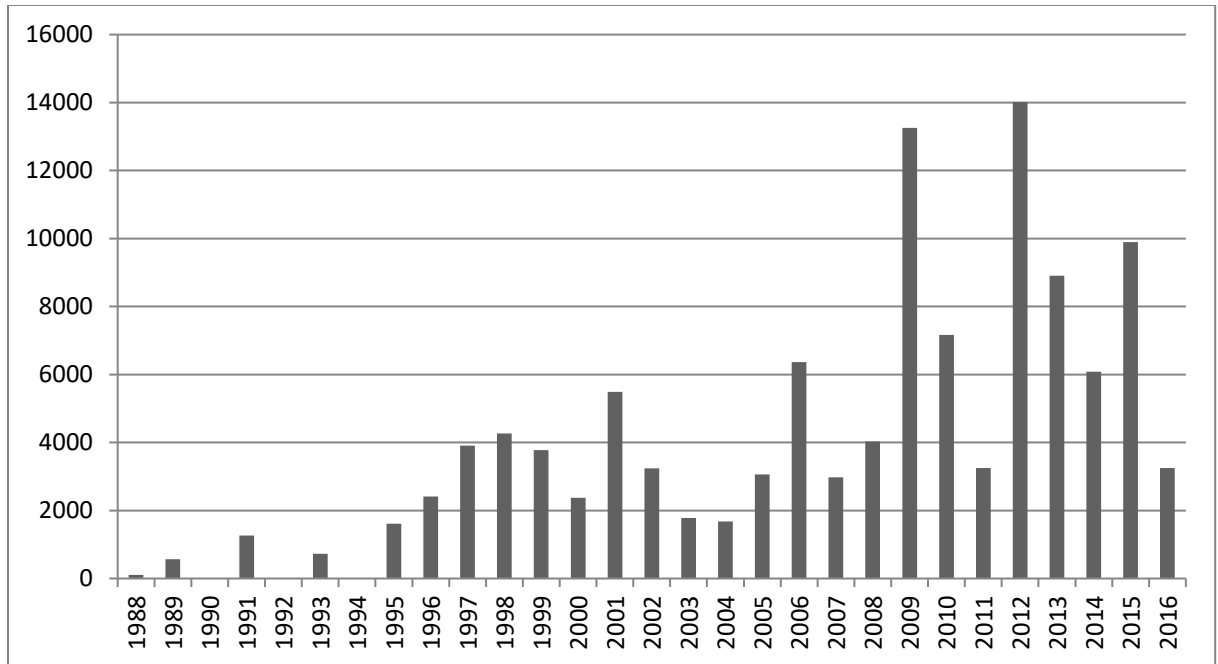
FIGURE 3. Cumulative PPP Investment in U.S. Roads and Highways (Constant Million US$ of 2010) (1988-2016)
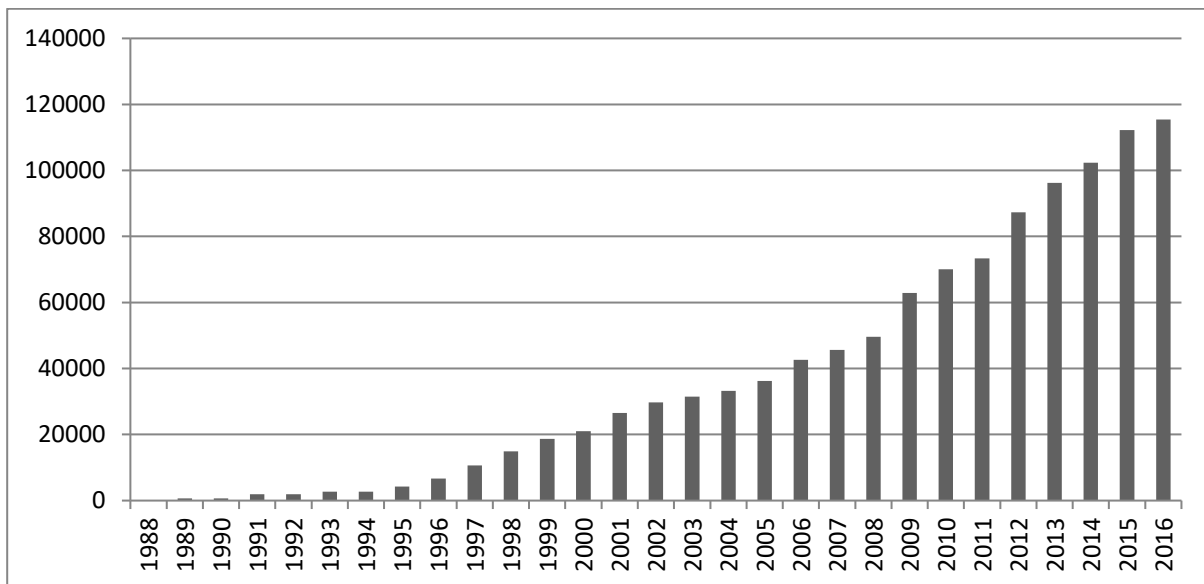
3. PPP enabling laws and the favorability index

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?[16]

We first examine the broader literature on state legislation to determine which provisions are generally viewed as important.[17] Poole (1993) and Hedlund and Chase (2005) provided initial guidance.[18] Using those and several additional sources, we identified thirteen enabling-law provisions that 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.[19] 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

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[16] Understanding these effects is of more than academic interest. It may also provide guidance to the remaining states about the most desirable PPP enabling law structure.

[17] This includes the so-called "secondary literature," which is composed of government reports, working papers, white papers, expert commentary, etc.

[18] 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).

[19] 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

Concept	Provision	Survey-Weighted Enabling Score
Fundmix	The law allows both public- and private-sector money to be combined in PPP project financing.	0.90
Eligibility	Road and highways are eligible for PPPs under the law.	0.84
Avail	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
Unlimitedpro	The law puts no limit on the number of projects that can be developed under a PPP contract.	0.79
Confident	The law protects the confidentiality of proprietary information contained in a private entity's proposal.	0.79
Priorleg	The law does not include a provision that allows the state legislature (or another public body) to reject a PPP agreement.	0.77
Brown	The law allows existing transportation facilities, as well as new transportation facilities, to be PPP-eligible.	0.77
Others	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
Exemptpro	The statute exempts PPPs from the state's procurement laws.	0.61
Revenue	The law permits revenue sharing in PPP agreements.	0.60
Noncomp	The law allows PPP agreements to contain non-compete clauses or compensation clauses.	0.57
Unsolic	The law allows the responsible public entity to receive both solicited and unsolicited PPP proposals.	0.54
Proptax	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.[20] 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.

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[20] 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 existing 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)
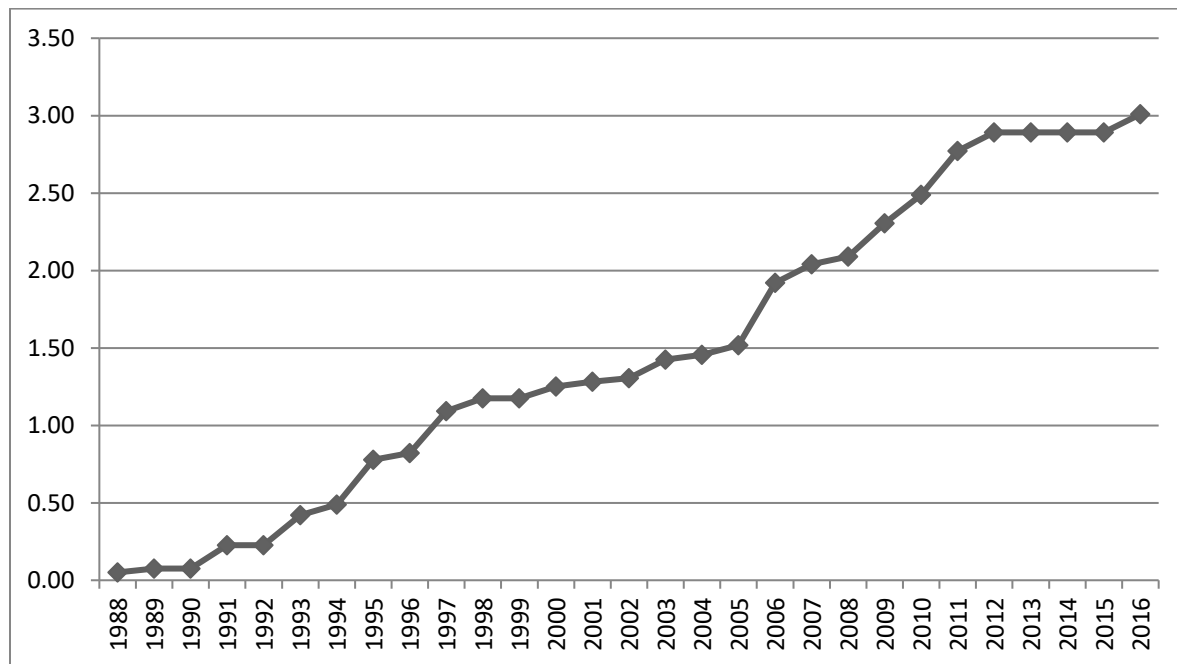
Our index is broadly consistent with commentary regarding which states are receptive to private investment. For example, Texas, Virginia, Georgia, and Florida are often cited as examples of states with a favorable climate.[21]

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 the amount of private investment as a share of total road and highway investment in the state. We also examine the laws' impact 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

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[21] 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 investment 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*. Other models incorporate the number of projects as the dependent variable to test if PPP laws encourage more projects to reach 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. Two-sample *t*-tests 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*) are 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 1988-2016 (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

Note: ** $p < 0.01$.

Table 3 reveals the expected positive association between laws and PPPs. The average percentage of PPP investment and the average annual number of projects are both statistically different and larger for states with a PPP law. The same test applied only to states that enacted a law at some point between 1988 and 2016 confirm that treated states have larger proportions of private investment and more PPP projects after enabling-law enactment.

We based our choice of time-varying regressors for a multivariate analysis on a review of the privatization and contracting-out literatures. Commentators 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, 2009). 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").[22] 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 monetary variables are in constant 2010 U.S. dollars. They are rescaled (per million population) to facilitate coefficient interpretation.

Measures of political disposition and pressure groups are often included in PPP empirical analysis. However, Hammami, Ruhashyankiko and Yehoue (2006), and Albalate, Bel and Geddes (2013, 2015) find that political ideology is irrelevant.[23] Percentage of democrats in the state legislature and the state governor's political party are also insignificant. Although not included as predictors in our final specification, we use them to instrument our key *PPP Act* variable. Albalate, Bel and Geddes (2013) find that the relative wage differential between the public and private 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 unionization rate as a control.

Other basic controls include real per-capita income and state population.[24] It is difficult to predict *ex ante* the impact that either variable will have on the percentage of private 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 estimate 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 to private investment as well as on the number of PPP projects. We also estimate how exposure to evolving legal frameworks (i.e. different provisions included in a law) impacts investment and the number of PPP projects.

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[22] We were unable to locate adequate state-by-year data for our time period measuring the condition of transportation infrastructure. Available measures were highly incomplete.

[23] Hammami, Ruhashyankiko and Yehoue (2006) find a weak positive association between right-wing parties and PPPs in the energy sector, and a weak negative association between right-wing parties and PPPs in transportation.

[24] Hammami, Ruhashyankiko and Yehoue (2006) include population and GDP per capita in their model. PPP use is expected to be higher in larger markets, where demand and purchasing power are greater.

Average impact on PPP investments

Our key dependent variable is private investment relative to overall investment in roads and highways. We utilize a difference-in-difference 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 (i.e states with enabling laws) with respect to its counterfactual using control group information. We follow a standard application of difference-in-difference to panel data by estimating the two-way fixed effects equation specified in Model (1) below:[25]

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

where 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. β_1 is the difference-in-difference estimate of the PPP enabling law's effect on the dependent variable. 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 (ε_{it}). We cluster standard errors by state.

We estimate a second model (Model (2) below) 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. Both model estimates are reported in Table 5.

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

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[25] We also estimate these models using fractional response models to capture the proportion or rate nature of our dependent variable. Estimates (available upon request) are consistent with those obtained with two-way fixed effects panel data models.

TABLE 4. Summary Statistics.

Variables	Description	Source	Mean	Std. Dev.	Min	Max
Percentage	Percentage of PPP investment over Total State Investment (roads & highways)	See Sections 3 and 4.	0.0030	0.0174	0	0.3184
PPP investments_pc	Total PPP investment in roads and highways (Constant $2010 millions) per thousand population.	See Sections 3 and 4.	0.011	0.07	0	1754
Projects	Number of yearly PPP projects reaching financial Close	See Sections 3 and 4.	0.1220	0.4344	0	5
PPP Act	Binary variable set equal to one if a PPP enabling law is present; 0 Otherwise.	See Section 3	0.3896	0.4878	0	1
PPP Index	PPP favorability index as described in Section 3.	See Section 3.	1.435	2.031	0	7
Real Personal Income_pc	State real income per capita (Constant $2010)	U.S. Census Bureau	36,780	6,970	21,649.5	63,017.8
Real_Federalaid_pc	Federal aid to highways per capita to the state (Constant $2010)	U.S. Census Bureau	147.23	93.67	13.16	677.91
Real_Gastax_pc	State gasoline tax receipts per capita (Constant $2010)	FHWA Highway Statistics	147.759	41.30	0	276.60
Real_Debt_pc	State's only Debt outstanding per capita (Constant $2010)	U.S. Census Bureau	3,161	2,201	206.6	20,829.63
Pop	State population (millions)	U.S. Census Bureau	5.708	6.303	0.45	39.25
Unionm	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 of PPP Investment in U.S. Transportation Infrastructure

Covariates	PPP Percentage	PPP Percentage Bootstrapping	PPP Percentage	PPP Investments per capita	PPP Investments per capita Bootstrapping	PPP Investments per capita	PPP percentage PPP Act=1	PPP Investments per capita PPP Act=1
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
PPP Act	0.00429*	0.00429*	-	0.0181*	0.0181*	-	-	-
	(0.0019)	(0.0020)		(0.0066)	(0.0016)			
PPP Index	-	-	0.0011*	-	-	0.0040*	0.00039	0.0021
			(0.0005)			(0.0016)	(0.0010)	(0.0070)
Real_Income_pc	-0.0696	-0.0696	-0.0689	0.8085	0.8085	0.7692	0.0964	1.108
	(0.2149)	(0.2347)	(0.2109)	(1.094)	(1.345)	(1.1477)	(0.4975)	(2.774)
Real_Fedaid_pc	-0.1617	-0.1617	-1.203	94.069	94.069	89.894	101.64 [+]	1517.05**
	(15.414)	(22.352)	(15.163)	(62.253)	(152.879)	(121.87)	(58.79)	(311.98)
Real_Gastax_pc	3.929	3.929	4.456	24.154	24.154	24.293	-4.387	-8.883
	(21.362)	(21.953)	(20.704)	(109.35)	(81.924)	(73.302)	(44.008)	(321.09)
Debtpc	-0.2026	-0.2026	-0.3011	-4.882	-4.882	-5.277	-3.806**	-21.175 [+]
	(0.4093)	(0.5273)	(0.3972)	(2.465)	(3.839)	(3.325)	(1.368)	(11.899)
Pop	0.0017*	0.0017 [+]	0.0014 [+]	0.0049*	0.0049 [+]	0.0039 [+]	0.0021	0.0086
	(0.0008)	(0.0009)	(0.0008)	(0.0026)	(0.0029)	(0.0020)	(0.0013)	(0.0086)
Unionm	-0.0079	-0.0079	-0.0069	0.0412	0.0412	0.0407	0.0073	0.1483
	(0.0339)	(0.0335)	(0.0334)	(0.1514)	(0.1413)	(0.1365)	(0.0574)	(0.4159)
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N. Observations	1450	1450	1450	1450	1450	1450	565	565
F.Test / Wald Test(bootstrapping)	52.66**	83.48**	31.07**	29.22**	67.02**	25.14**	0.77	1.45*

Notes: Standard errors clustered by states are in parenthesis. Covariates calculated per capita are rescaled (per million population) in order to facilitate interpretation of coefficients. Estimates including bootstrapping with 2.000 replications are reported in columns 2 and 4.

+ $p < 0.10$.
* $p < 0.05$.
** $p < 0.01$.

Table 5 indicates that the *PPP Act* binary variable (Model 1) and the favorability index of the state's legislation (Model 3) are statistically significant determinants of a state's proportion of PPP investment. Both display a positive and statistically significant impact.[26] That is consistent with predictions regarding the positive role of PPP laws in attracting private investment. Model (1) allows us to obtain the difference-in-difference coefficient estimate of the law's average effect, which is positive and statistically significant at the 5 percent level. Its estimated magnitude is 0.004 (See column 1), which measures the average change in treated states relative to untreated states (i.e., the counterfactual).

Added context helps to interpret 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, underscoring the estimated effect's relevance. 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 thus represents an almost six-fold increase relative to the average effect prior to the law's enactment.

Our dependent variable's distribution is skewed toward zero. That implies a non-normal distribution of errors, raising concerns about statistical significance and confidence intervals. Importantly, the estimator remains unbiased, but loses efficiency.

Bootstrapping offers a useful tool for estimating *p*-values and confidence intervals when standard assumptions, such as normality of errors are not satisfied. As a robustness check, we use bootstrapping with 2,000 replications to estimate standard errors and to confirm that the coefficient attached to the *PPP_Act* variable remains statistically significant at 5% level (See Model 2).[27]

We estimate the same two-way fixed-effects model using our favorability index instead of the *PPP Act* variable. Estimates reported in column 3 confirm that higher index values are

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[26] Our main finding of a positive effect on private investment seems unsurprising given the laws' stated intent. However, a long tradition in law and economics empirically examines the actual (versus intended) effects of numerous laws and regulations. See Stigler and Friedland (1962), Peltzman (1973), Peltzman (1975) *et seq.* A finding that PPP laws had their intended effect is thus more valuable than initially thought.

[27] We applied bootstrapping with 2,000 replications (bootstrap samples), following the suggestion by Davison and Hinkley (1997), who state that the number should be between 1000 and 2000 for 95% confidence intervals.

associated with higher percentages of PPP investment. A unit increase in the index produces a change in the percentage of 0.0011. This represents a third of the average percentage of PPP investment in our sample, suggesting economic significance.

We also estimate total PPP investment per capita, obtaining similar results. Those estimates appear in Columns 4, 5 and 6. Estimates indicate that, on average, a PPP law increases PPP investment by about 18 dollars per person. We estimate that a unit and per-score increase in the favorability index increases per capita PPP investment by about 4 dollars (both in terms of constant 2010 U.S. dollars).

The last two columns explore the effect of unit changes in the PPP law favorability index for states and years with a PPP act. We assess whether it is the mere existence of a law itself or a change in a law's favorability index that drives column 3 and 6 estimates. Coefficient estimates for the PPP index in columns 7 and 8 lack statistical significance. We view this as evidence that the existence of a PPP law in a state is more useful in attracting private investment than a unit increase in the law's favorability index. We also considered the effects of low values versus high index values which, given the standard deviations, revealed no statistically significant results for the favorability index once we restrict the sample to PPP acts available. The relatively low number of observations (565) should also be kept in mind when interpreting model estimates.

Impact on PPP project financial close

We next 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 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 above. Estimates are reported in columns 9 through 12 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 count-data-model coefficients however. We thus transform the coefficients associated with *PPP law* ($\beta_1 = 1.516$) into incidence-rate ratios.[28] The incidence-rate ratio for a binary variable (i.e. *PPP Act*), is the ratio of the number of one category of event to that

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[28] For a one-unit change in covariates, the difference in log of expected counts of the outcome variable will change by the respective regression coefficient, *ceteris paribus*.

in another category. We find that the incidence-rate ratio of the PPP law is 4.55. That means states with PPP laws have, on average, 4.5 more PPP projects reaching financial close than those without such laws, *ceteris paribus*. The incidence-rate ratio for the zero-inflated regression is 5.2.

We next evaluate the effects of unit changes in the favorability index once a law is passed. We report estimates using the same model for states and years with a PPP act in column 13. They are consistent with our conclusions regarding PPP investment. Unit changes in the favorability-score index are not statistically significant and the incidence-rate ratio is only 1.13. We again suggest caution in interpreting estimates due to the low number of observations.

TABLE 6. Estimates of the amount of PPP projects

Covariates	Negative Binomial Fixed Effects PPP projects (9)	Negative Binomial Fixed Effects PPP projects (10)	Zero inflated Negative Binomial PPP projects (11)	Zero inflated Negative Binomial PPP projects (12)	Negative Binomial Fixed Effects PPP projects. Restricted Sample PPP Act =1 (13)
PPP Act	1.516**	-	1.655**	-	-
	(0.4321)		(0.3079)		
PPP Index	-	0.3281**	-	0.1783**	0.1224
		(0.0913)		(0.0620)	(0.1467)
Real_Income_pc	10.446	45.829	55.062*	45.592*	36.964
	(64.442)	(63.499)	(21.531)	(21.865)	(81.714)
Real_Fedaid_pc	-2186.94	-2354.31	-5037.7*	-5534.93	3314.92
	(6602.04)	(6584.53)	(2501.79)	(2643.71)	(11643.6)
Real_Gastax_pc	298.64	-336.30	-3908.94	-2894.17	-562.61
	(5817.9)	(5814.18)	(2658.9)	(2686.41)	(6483.35)
Debtpc	-314.53	-357.17 [+]	-29.073	-26.0876	-697.07*
	(215.72)	(211.04)	(68.916)	(69.464)	(288.47)
Pop	0.1935*	0.1216	0.0614**	0.06343**	0.1515
	(0.0974)	(0.0950)	(0.0088)	(0.00875)	(0.1162)
Unionm	-10.945	-11.081	-6.940**	-4.8416*	-5.254
	(7.9847)	(7.9466)	(2.0090)	(2.1524)	(10.079)
Panel Data	Yes	Yes	No	No	
Year Fixed Effects	Yes	Yes	Yes	Yes	
N. Observations	841	841	1450	1450	420
loglikelihood	-296.17	-315.14	-401.76	-416.13	-235.43
Wald-Chi2	65.00**	72.47**	-	-	40.93
LR Chi2	-	-	142.82**	113.62**	-

Notes: Covariates calculated per capita are rescaled (per million population) in order to facilitate interpretation of coefficients.

+ $p < 0.10$.

* $p < 0.05$.

** $p < 0.01$.

Robustness checks for reverse causality

There may be a preexisting interest in PPPs in states where a law is being considered and discussed, raising concerns about reverse causality. PPP law variables may suffer from endogeneity if PPP laws were passed in response to an agreed-upon project, or if the state had signed a PPP contract that created public concern and engendered legislative action.[29] We use a three-pronged approach to address such concerns.

We first report estimates using leads-and-lags analysis (Autor 2003). This approach replicates the panel-data regression analysis performed above using models presented in Table 5. It replaces the law variable *PPP_Act* with binary variables for specific periods before and after the same-year treatment to reveal 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 policy implementation) 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 (through four years after treatment).

Insignificant lead effects implies rejection of the anticipatory-effects hypothesis (i.e., of reverse causality). It also confirms the common-trend assumption between treated and control groups underlying our difference-in-difference method. Alternatively, we might expect lags to be statistically significant, suggesting exploration of the effects' time-pattern depending on statistical significance and magnitude. A lag analysis allows us to distinguish between short-term and long-term impacts.

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[29] 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 consider the possibility that the laws may be endogenous to the amount of investment. They were however unable to detect an effect of completed private infrastructure investment on the travel-time index.

TABLE 7. Panel Data Leads and Lags Robustness Check

Covariates	Percentage of PPP investments (14)
Lead 2	0.0000
	(0.0031)
Lead 1	0.0037
	(0.0031)
Adoption	0.0143
	(0.0090)
Lag 1	-0.0006
	(0.0010)
Lag 2	0.0044
	(0.0038)
Lag 3	0.0007
	(0.0014)
Lag 4+	0.0043*
	(0.0017)
Covariates	Yes
State Fixed Effects	Yes
Year Fixed Effects	Yes
N. Observations	1450
F-Test	471.33**

Notes: We present standard errors in parentheses. Errors are clustered allowing arbitrary correlations by state.
+ $p < 0.10$.
* $p < 0.05$.
** $p < 0.01$.

Table 7 reports leads and lags tests for our panel-data model with two-way fixed effects on PPP investment relative to total investment in roads and highways. We reject anticipatory effects before treatment and conclude that PPP enabling-law effects do not manifest in the short run (i.e., in first three years) but rather in the longer term. Moreover, the effect found through the fourth year is the average treatment effect found in the difference-in-difference 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 passed by the state legislature as a proxy for the state's legislative intensity. That is likely to be positively correlated with the probability of enacting a PPP law but uncorrelated with PPP investment. 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 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 the prior

presidential election), the percent of democrat representatives in the state legislature, and an indicator variable for the governor's political party (0 democrat, 1 otherwise).

Those estimates are reported in Model (15) 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.[30] 2SLS models rely on instrument quality 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 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).[31] First-stage estimation is reported in Appendix Table A1.

TABLE 8. Robustness Check: 2SLS estimates.

Covariates	Panel Data 2SLS PPP percentage (15)
PPP Act	0.0076*
	(0.0040)
Real_Income_pc	-0.1379
	(0.1349)
Real_Fedaid_pc	-5.513
	(14.443)
Real_Gastax_pc	11.406
	(23.551)
Debtpc	-0.2567
	(0.5028)
Pop	0.0016**
	(0.0004)
Unionm	0.0041
	(0.0276)
N. Observations	1450
F.Test	5.53**

Notes: 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.
+ $p < 0.10$.
* $p < 0.05$.
** $p < 0.01$.

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 exhaustive investigation into news reports around the time of law adoption. If legislators adopt a

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[30] We do not replicate the analysis with the *PPP index* variable due to collinearity.
[31] 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% for our model.

PPP law *in response to* an impending transaction (perhaps due to pressure from investors) that is newsworthy and likely be reported.

We searched media reports for evidence of laws passed in response to an impending agreement. That task is onerous for all thirty-five states with laws. We instead focus on five states exhibiting high PPP activity: California, Florida, Texas, Virginia, and North Carolina and conduct an exhaustive search of events surrounding PPP law passage in each.[32] 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.[33] Our investigation did not reveal any PPP agreement that 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 fraction of private investment in the composition of total state and local road and highway expenditures. However, that could be due to a substitution effect if state and local road expenditures also decrease.

We examined whether 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. We find that expenditure via PPP increased in those states introducing laws, indicating that expenditures financed by government did not concomitantly decrease.

Those estimates are reported in Table 9. We only report the key PPP variable coefficient, although the three models presented in equations (16), (17) and (18) include the same

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[32] We are grateful for Priya Mukherjee for thorough research assistance on this issue. Details of her investigation are available upon request.

[33] 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).

regressors as in Table 5.[34] The coefficient associated with *PPP Act* in the first column of Table 9 is insignificant. The same result is obtained using *PPP index.* Nonetheless, those variables capture the role of laws and their indirect effect on public expenditures by attracting private expenditure.

We use total PPP expenditures to test if private expenditure substitutes for public. Those estimates are reported in the third column of Table 9. The key coefficient is insignificant, suggesting a substitution effect. Neither PPP legislation nor PPP expenditure on roads and highways negatively impacts 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 (16)	Fixed Effects Total State and Local expenditures without PPP investments (17)	Fixed Effects Total State and Local expenditures without PPP investments (18)
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: Standard errors are presented in parentheses. Errors are clustered allowing for arbitrary correlation by state.
+ $p < 0.10$.
* $p < 0.05$.
** $p < 0.01$.

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

Our analysis underscores the importance of PPP laws and their favorability for encouraging private infrastructure investment. Favorability was determined by specific provisions included in the laws. We next consider the effect of PPP-law provisions on the percentage of private investment relative to total road and highway spending. We group the 13 key provisions described in Table 1 into three broad categories: (*i*) provisions related to the regulatory and contractual framework; (*ii*) provisions related to project funding and financing; and (*iii*) provisions designed to empower PPP participation.[35]

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[34] 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.
[35] We are grateful to Ed Glaeser for suggesting this grouping.

Assignment of provisions across those three categories appears in Table 10. Category 1 includes provisions that clarify and create the contractual setting for PPPs. Basic contractual issues clarified by category 1 provisions include possible limits on the number of PPP projects allowed under the law, how unsolicited PPP proposals will be treated, whether brownfield PPPs are allowed, and whether non-compete clauses are allowed in the PPP contract, among others. Such considerations may have been poorly defined, or undefined, in a state's extant procurement laws. The need for states to clarify such issues arose from the growing use of the PPP approach.

Category 2 provisions define the framework for PPP project funding and financing. They include whether or not private and public funds can be co-mingled to complete the project, whether or not availability payments (essentially performance payments based on the "availability" of the infrastructure) are allowed to fund the project, and whether or not the public and private sectors can share project revenue, as from tolls. Clarifying such issues is critical for estimating the likely funding available (i.e., the underling dollars needed to pay for the project) as well as the anticipated financing (i.e. the size of the upfront payment for project design and construction generated by the financial markets given the expected funding).

Category 3 provisions empower PPPs. We view those as moving beyond simply defining contractual terms and toward affirmatively attracting private investment into the state's infrastructure. They include the protection of confidential business information, exemption from the state's old (and likely outdated for PPPs) procurement laws, and exemptions from property taxes. Such provisions may actively incentivize firms to enter into PPP agreements.

Table 10. Assignment of PPP Law Provisions into Categories.

Regulatory and contractual	Funding and Financing	Empowering PPPs
Eligibility	Fundmix	Confident
Unlimitedpro	Avail	Exemptpro
Priorleg	Revenue	Proptaxes
Brown		
Others		
Noncomp		
Unsolic		

Note: Descriptions of provisions available in Table 1.

We replicate our panel-data models but replace key PPP law variables (*PPP Act* and *PPP Index*) with our three category variables. We evaluate how adding or subtracting one provision impacts investment on average. Selected estimates reported in Table 11 indicate that

empowering PPPs is the only statistically significant category. The effect is also economically significant. A unit change (i.e. the addition of one of these kind of provisions), increases the percentage of PPP investments by 0.004. The average percentage of PPP investments is 0.003. Thus, including more provisions of that type substantially increases the amount of private investment relative to the average (to 0.007 for one additional provision). However, the small percentage that represents relative to total investment should be kept in mind. We find that the empowering PPPs provisions induces a per capita increase of about 14 dollars per clause (in 2010 U.S. dollars). For the other categories, having more or fewer provisions has no statistically significant effect.

TABLE 11. Estimates for the State legislation provisions on PPP investments.

Category	Panel Data FE Percentage of PPP investments		Panel Data FE PPP Investments per capita	
	(19)		(20)	
Regulatory/Contractual	-0.0007		-0.0015	
	(0.0006)		(0.0024)	
Financial conditions	-0.0008		-0.0038	
	(0.0022)		(0.0088)	
Empowering PPPs	0.0044*		0.0138 $^+$	
	(0.0021)		(0.0075)	
State Fixed Effects	Yes		Yes	
Year Fixed Effects	Yes		Yes	
N. Observations		1450	1450	
F-Test		83.24**	29.10**	

Notes: Standard errors are presented in parentheses. Errors are clustered allowing for arbitrary correlation by State. The model includes the rest of covariates of models presented in Table 5 except PPP Act and PPP Index.
+ $p < 0.10$.
* $p < 0.05$.
** $p < 0.01$.

Our analysis offers guidance to states wishing to encourage private investment in transportation infrastructure. First, simply having a PPP law itself helps attract investment. A law's mere existence signals a state's overall posture toward private investment. The effect of adding or subtracting specific provisions is modest relative to passing a law.

However, when we group law provisions into three broader categories, they become very important. Our analysis does not suggest that provisions clarifying the regulatory and contractual setting, or those relating to project funding and financing, are unimportant. However, we find that the lion's share of a law's effect comes from provisions affirmatively empowering PPPs.

Those include clauses protecting the confidentiality of private-partner information, those exempting the PPP from a state's old (and perhaps outdated), procurement laws, and those exempting the private partner from paying property taxes. Although each is individually important, including such provisions further signals a state's acceptance of private investment in infrastructure.

5. Summary and Conclusions

PPPs are contracts that bundle together the design, construction, financing, operation and maintenance of large civil and social infrastructure projects. They shift many project risks to the private partner while encouraging a long-term relationship between the public-sector project sponsor and the private partner. The PPPs approach to infrastructure delivery is increasingly common in the United States and abroad.

As of late 2016, thirty-five states plus Puerto Rico had passed modern PPP enabling laws. Those laws clarify the set of institutional arrangements that underpin a PPPs. They thus mitigate uncertainty while lowering transaction costs. Enabling laws address 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.

We provide the first comprehensive empirical assessment of the laws' impact on a state's utilization of private infrastructure investment. In addition to collecting and analyzing detailed data on PPP enabling laws, we surveyed experts from a range of backgrounds to create an expert-weighted index of enabling-law favorability. We assigned weights to thirteen critical elements of PPP enabling laws and studied state laws to determine which contain various provisions. We generated an index of enabling law favorability.

Our estimates indicate that the improved legal frameworks offered by PPP enabling laws are successful in attracting private capital into transportation projects. The most insight comes from grouping the thirteen provisions into three categories, including regulatory and contractual, funding and financing, and PPP-empowering provisions. Although the effects associated with adding specific provisions are limited, we find strong effects associated with provisions that empower PPPs. Those are provisions exempting the PPP from extant procurement laws as well as property taxes while protecting the private partner's confidential business information. Our

findings provide clear guidance to states wishing to pass laws that attract private investment. They also offer guidance to states wishing to revise PPP enabling laws in the hope of attracting more private investment.

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 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 findings are robust to the method of measuring private infrastructure investment via PPPs, and are significant at standard levels of confidence.

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Appendix

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

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

Notes: Robust-to-heteroskedasticity standard errors are presented in parentheses.

+ $p < 0.10$.
* $p < 0.05$.
** $p < 0.01$.