Do Public-Private-Partnership-Enabling Laws Increase Private Investment in Transportation Infrastructure?

Daniel Albalate  
*University of Barcelona*

Germà Bel  
*University of Barcelona*

R. Richard Geddes  
*Cornell University*

Abstract

The use of public-private partnerships (PPPs) is an important development in infrastructure delivery. These contracts between a public-sector owner and a private provider bundle delivery services and provide a middle ground between traditional delivery and privatization. As of 2016, 35 states had enacted PPP-enabling laws that address such questions as the mixing of public- and private-sector funds, the treatment of unsolicited PPP proposals, and the need for prior legislative contract approval. We provide the first comprehensive empirical assessment of the laws’ impact on the utilization of private investment. We analyze the effect of a state having a PPP-enabling law and a law’s average impact. We also assess the impact of PPP-enabling-law provisions. We find that provisions that empower PPPs, such as exemptions from property taxes, exemptions from extant procurement laws, and confidentiality protections, attract private investment.

1. Introduction

The problem of inadequate 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 by providing relational, long-term contracts between a public project sponsor and a private partner (see Albalate, Bel, and Geddes [2017, p. 26] for broad definitions). They are relied on 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 (see, for example, Geddes 2011; National Surface Transportation Infrastructure Financing Commission 2009). In the United States, PPPs contrast with traditional delivery. Traditional project delivery refers to the use of design-bid-build contracts, under which project design is placed out for bid. The construction of the design is bid separately and usually awarded 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 US 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 in various combinations depending on the project to be delivered (see US Department of Transportation 2007, pp. 11–17). This facilitates exploitation of synergies among those functions (Bennett and Iossa 2006; Martimort and Pouyet 2008).

Public-private-partnership 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 PPPs in the United States are hindered by a lack of adequate state-level enabling legislation (for example, Reinhardt 2011).

Indeed, many legislatures state that their goal in enacting such laws is to attract private infrastructure investment. Laws enabling PPPs clarify such key contractual issues as the treatment of unsolicited PPP proposals, whether a PPP can be used on existing transportation facilities (known as brownfields) and new ones (known as greenfields), whether agreements can include the sharing of revenue with public sponsors, and whether the agreement may include noncompete clauses, among others. 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

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1 With respect to transportation projects, which are our focus, the Federal Highway Administration states that “Public-Private Partnerships (PPPs) are contractual agreements between a public agency and a private entity that allow for greater private participation in the delivery of transportation projects” (US Department of Transportation 2015, p. 1).

2 Istrate and Puentes (2011) stress laws enabling public-private partnerships (PPPs) as one of their three key recommendations for attracting private investment in US infrastructure.

3 International standards for managing unsolicited proposals do not yet exist. See Hodges and Dellacha (2017) for an analysis of the introduction of competition and transparency in unsolicited proposals.

4 A list of key provisions is provided in Table 1.
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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 US transportation infrastructure remains low by international standards. Controversy surrounding the use of PPPs to finance and operate transportation infrastructure remains. A better understanding of PPP laws’ effect is useful.

We assess the impact of a state having a law and the effect of varying degrees of legal favorability to private investment. To do so, we develop an enabling-law favorability index that includes 13 key provisions of each law. Instead of weighting each provision equally, we surveyed US PPP experts to assign meaningful weights to various provisions.

We analyze data on 177 US 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, which allows a comprehensive analysis of PPP-enabling laws’ effect on private investment. We consider the 1988–2016 period to examine how varying exposure to PPP-enabling laws across time—and to their differing elements—impacts the number of PPPs and 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. Section 2 discusses the basic structure of PPP-enabling laws in the US transportation sector. We describe our data set, 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, report estimates, and offer a discussion in Section 4. Section 5 summarizes and concludes.

5 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 that are likely to exploit market power and superior bargaining skills relative to the public sector (for example, 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 (for example, 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.
2. Public-Private Partnerships in Transportation

Private participation via PPPs includes the management, operation, and renovation of an existing transportation facility and 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.\

For both brownfield PPPs and the 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, such as safety standards and pavement quality, are typically included, with clear financial and operational performance incentives. According to Public Works Financing, PPPs were 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. Use of PPPs 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 dollars). 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 (that is, 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. Costs in-

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6 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, European Union Council Directive 2014/23 (2014 O.J. [L 94] 1) mandates that awarding a concession requires the effective transfer of operational risk to the concessionaire and demand risk in particular (see Iossa and Saussier 2018).

7 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 that case. Samuel (2008) states, “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.
clude holding in place commitments on $12.8 billion in financing and direct contracting costs. Enabling laws help reduce the risk of political uncertainty by granting ex ante legislative approval for PPPs. 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, and Farber 2010).8

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, 60 percent of all PPP projects between 1989 and 2012 occurred in only six large states, all of which had PPP-enabling legislation.9 We expect that both passing a law and enacting a more favorable law will increase PPP investment over time.10

We utilize the Federal Highway Administration website and other key sources to determine which states enacted PPP-enabling laws.11 All information was verified by examining state PPP statutes and tracing to their first passage using LexisNexis. Figure 1 shows the evolution of US PPP-enabling laws. Since passage of the first modern PPP law in 1988, the number of states with laws increased steadily over time until 2000.12 From 2000 to 2005, the number of states with laws remained constant. Adoption of the laws restarted in 2006 with the passing of an enabling law in Indiana, followed by several other states. By December 2012, 34 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.13

8 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 “in those states whose PPP enabling acts required legislative approval of negotiated deals[,] no such deals were ever proposed” (Poole 2009).

9 The states are Florida, California, Texas, Virginia, North Carolina, and Colorado.

10 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, US 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 are a disincentive to private infrastructure investment. In economic terms, outdated procurement laws increase PPP transaction costs.

11 US Department of Transportation, Federal Highway Administration, State P3 Legislation (https://www.fhwa.dot.gov/ipd/p3/legislation/). Additional sources include Pikel and Plata (2008), Iseki et al. (2009), and Rall, Reed, and Farber (2010).

12 Modern PPP legislation began with Virginia’s Highway Corporation Act, which was passed in 1988. New Jersey had an enabling law passed by the 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.

13 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 act’s effect on public spending was exhausted by 2011, which caused state and local governments to pull back on investment. See, for example, Bivens (2012).
Figure 1. States with a public-private-partnership enabling law

Figure 2. Total annual public-private-partnership investment in US roads and highways

Figure 3. Cumulative public-private-partnership investment in US roads and highways
3. Enabling Laws and the Favorability Index

Our data set 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-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-enabling-law provisions in attracting private investment?14

We first examined the broader literature on state legislation to determine which provisions are generally viewed as important.15 Poole (1993) and Hedlund and Chase (2005) provide initial guidance.16 Using those and several additional sources, we identified 13 enabling-law provisions that form our basic PPP-law favorability index. We then conducted a survey of PPP experts to assign weights to the provisions. We asked respondents to rank each provision on a 5-point Likert scale from “very discouraging” to “very encouraging” of private investment.17 We then assigned each rank an integer value as follows: −2 is very discouraging, −1 is somewhat discouraging, 0 is no effect, 1 is somewhat encouraging, and 2 is very encouraging. We calculated the mean value for each provision and divided it by 2 to produce a favorability score between −1 and 1. Table 1 reports a list of the key provisions and their survey-weighted enabling scores. A higher score indicates a more encouraging provision.

We next catalogued the provisions contained in each state’s enabling law and divided the total by 13 (the number of possible provisions in any given law) to generate an overall favorability index for each state’s law.18 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 that varies between 0 and 10 for each state. States without laws receive favorability index scores of 0. Scores are reported in Table 2.

Amendments have made existing enabling laws more favorable to PPPs over time. Figure 4 indicates that the average value in our favorability index has in-

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14 Understanding these effects is of more than academic interest. It may also provide guidance to the remaining states about the most desirable structure for PPP-enabling laws.
15 This includes the secondary literature, which is composed of government reports, working papers, white papers, expert commentary, and the like.
16 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, and Farber (2010).
17 Fifteen experts answered the survey. Those experts were distributed across 10 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.
18 We scale the favorability index to be between 0 and 10 to aid interpretation of regression coefficients.
| Term          | Provision                                                                 | Score |
|--------------|---------------------------------------------------------------------------|-------|
| Fundmix      | Both public- and private-sector money may be combined in projects financed | .90   |
|              | by public-private partnerships (PPPs)                                     |       |
| Eligibility  | Roads and highways are eligible for PPPs                                  | .84   |
| Avail        | The state is explicitly permitted to make payments to the private entity  | .82   |
|              | in lieu of direct user fees (for example, availability payments or shadow |
|              | tolls)                                                                    |       |
| Unlimitedpro | There is no limit on the number of projects that can be developed under  | .79   |
|              | a PPP contract                                                             |       |
| Confident    | The confidentiality of proprietary information contained in a private    | .79   |
|              | entity’s proposal is protected                                              |       |
| Priorleg     | A provision that allows the state legislature (or another public body)    | .77   |
|              | to reject a PPP agreement is not included                                 |       |
| Brown        | Existing and new transportation facilities are PPP eligible               | .77   |
| Others       | Authority is granted to entities other than the state department of      | .67   |
|              | transportation (that is, counties, municipalities) to enter into PPP       |       |
|              | agreements (assuming that the department also has authority)             |       |
| Exemptpro    | Public-private partnerships are exempt from the state’s procurement laws  | .61   |
| Revenue      | Revenue sharing in PPP agreements is permitted                            | .60   |
| Noncomp      | Public-private-partnership agreements may contain noncompete and            | .57   |
|              | compensation clauses                                                       |       |
| Unsolic      | Responsible public entities may receive both solicited and unsolicited   | .54   |
|              | PPP proposals                                                              |       |
| Proptax      | Private entities are exempt from paying property taxes on land required    | .47   |
|              | to operate the facility                                                   |       |
creased significantly since 1988, reaching its peak in 2012, where it stayed constant until 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.\textsuperscript{19}

4. Empirical Strategies and Estimates

We empirically examine PPP-enabling laws’ impact on private infrastructure investment. We utilize data on all PPP projects as reported annually in the US Transportation Projects Scorecard in \textit{Public Works Financing} for 1998–2016 to measure PPP investment.\textsuperscript{20} 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.

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

\textsuperscript{19} 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.”

\textsuperscript{20} For the underlying source of these data, see US Census Bureau, Annual Survey of State and Local Government Finances (https://www.census.gov/programs-surveys/gov-finances.html). For easy access and manipulation of those data, see Urban Institute, State and Local Finance Initiative, Data Query System (https://slfdqs.taxpolicycenter.org/index.cfm).
because states with greater total spending (public and private) may receive more PPP investment, which may bias 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 US Census Bureau’s Annual Survey of State Government Finances for 1988–2016. 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 displays a positive coefficient if enabling laws increase investment and projects. Two-sample t-tests for equal variances for the proportion of PPP investments and the total number of PPP projects by the presence or absence of a PPP law (PPP Act) are reported in Table 3.

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 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 confirms 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 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. In that view, capital constraints, rather than a quest for efficiency, thus drive private-sector participation (see, for example, Bel and Fageda 2007, 2009). We thus include proxies for a state’s general fiscal health and its access to traditional sources of infrastructure

![Figure 4. Annual average value of the public-private-partnership index](image-url)
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They are measured by the state’s debt outstanding per capita (Real Debt Per Capita), gas tax receipts per capita (Real Gas Tax Per Capita), and federal aid for highways per capita (Real Federal Aid Per Capita). All monetary variables are in constant 2010 US dollars. They are rescaled (per million people) to facilitate interpretation of coefficients.

Measures of political disposition and pressure groups are often included in PPP empirical analysis. However, elsewhere we (Albalate, Bel, and Geddes 2013, 2015) and Hammami, Ruhashyankiko, and Yehoue (2006) find that political ideology is irrelevant. The 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 variable PPP Act. We (Albalate, Bel, and Geddes 2013) show elsewhere that the relative wage differential between the public and private sectors is a driver of PPP choice in the US 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 rate variable (Union) 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. 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.

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Table 3
Two-Sample t-Test Results

|                      | Percentage of Investments | Annual Mean Projects |
|----------------------|---------------------------|----------------------|
| All states (N = 1,450): |                           |                      |
| Without laws         | .0010                     | .0203                |
| With laws            | .0062                     | .2814                |
| Difference (t-statistic) | −5.60**               | −11.67**             |
| Treated states (N = 1,044): |                       |                      |
| Without laws         | .0007                     | .0187                |
| With laws            | .0062                     | .2814                |
| Difference (t-statistic) | −5.09**               | −8.79**              |

Note. For tests of the null hypothesis, $p = .000$ for all regressions.

** $p < .01$.  

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

22 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.

23 Hammami, Ruhashyankiko, and Yehoue (2006) include population and gross domestic product per capita in their model. Use of PPPs is expected to be greater in larger markets, where demand and purchasing power are greater.
We estimate the impact of PPP-enabling laws on private investment in US infrastructure by exploiting our data’s panel features. We examine their favorability to private investment and their effect on the number of PPP projects. We also estimate how exposure to evolving legal frameworks (that is, different provisions included in a law) affects investment and the number of PPP projects.

4.1. Average Impact on 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 (that is, states with enabling laws) with respect to the counterfactual using control-group information. We follow a standard application of a difference-in-difference strategy to panel data by estimating the two-way fixed-effects model specified in equation (1):24

\[
\text{Percentage}_{it} = \alpha + \beta_1 D^{PPP\text{ Act}}_{it} + \beta_2 \text{Real Income Per Capita}_{it} + \beta_3 \text{Federal Aid Per Capita}_{it} + \beta_4 \text{Debt Per Capita}_{it} + \beta_5 \text{Population}_{it} + \beta_6 \text{Union}_{it} + s_i + w_t + \epsilon_{it},
\]

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 \(t\), and \(\beta_1\) 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 an error term \((\epsilon_{it})\). We cluster standard errors by state.

We estimate a second model (equation [2]) to account for the importance of PPP-enabling-law favorability:

\[
\text{Percentage}_{it} = \alpha + \beta_1 D^{PPP\text{ Index}}_{it} + \beta_2 \text{Real Income Per Capita}_{it} + \beta_3 \text{Federal Aid Per Capita}_{it} + \beta_4 \text{Debt Per Capita}_{it} + \beta_5 \text{Population}_{it} + \beta_6 \text{Union}_{it} + s_i + w_t + \epsilon_{it},
\]

The two equations differ only in the use of the binary PPP Act indicator (which equals one if a PPP-enabling law is in effect in the state in that year and zero otherwise) versus the continuous PPP Index variable. Estimates for both models are reported in Table 5.

Table 5 indicates that the binary variable PPP Act (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

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24 We also estimate these models using fractional response models to capture the proportion or rate nature of our dependent variable. Estimates (available from the authors on request) are consistent with those obtained with two-way fixed-effects panel data models.
## Table 4
### Summary Statistics

| Variable                  | Description                                                                 | Mean   | SD    | Min  | Max  |
|---------------------------|------------------------------------------------------------------------------|--------|-------|------|------|
| Percentage                | Percentage of investment from public-private partnerships (PPP) over total state investment (roads and highways) | .0030  | .0174 | 0    | .3184|
| PPP Investments Per Capita| Total PPP investment in roads and highways ($ millions) per thousand residents | .011   | .07   | 0    | 1754 |
| Projects                  | Number of yearly PPP projects reaching financial close                        | .1220  | .4344 | 0    | 5    |
| PPP Act                   | Binary variable that equals one if a PPP-enabling law is present and zero otherwise | .3896  | .4878 | 0    | 1    |
| PPP Index                 | Public-private-partnership favorability index                                 | 1.435  | 2.031 | 0    | 7    |
| Real Personal Income Per Capita | State real income per capita                                                 | 36,780 | 6,970 | 21,649.5 | 63,017.8 |
| Real Federal Aid Per Capita | Federal aid for highways to the state per capita                             | 147.23 | 93.67 | 13.16 | 677.91 |
| Real Gas Tax Per Capita   | State gasoline tax receipts per capita                                        | 147.759| 41.30 | 0    | 276.60|
| Real Debt Per Capita      | State's only debt outstanding per capita                                      | 3,161  | 2,201 | 206.6 | 20,829.63 |
| Population                | State population (millions)                                                  | 5.708  | 6.303 | .45  | 39.25 |
| Union                     | Percentage of working residents in a union in the state                       | 12.35  | 5.92  | 2    | 31   |

**Sources.** For Real Personal Income Per Capita and Real Debt Per Capita: US Census Bureau (1988–2016); for Real Federal Aid Per Capita and Real Gas Tax Per Capita: US Department of Transportation (1988–2016); for Union: US Bureau of Labor Statistics (1988–2016, table 1).

**Note.** All monetary amounts are in constant 2010 dollars.
|                          | Percentage | Percentage with Bootstrapping | PPP Investments Per Capita | PPP Investments Per Capita with Bootstrapping | PPP Investments Per Capita and PPP Act | Percentage and PPP Act | PPP Investments Per Capita and PPP Act |
|--------------------------|------------|-------------------------------|---------------------------|-----------------------------------------------|----------------------------------------|------------------------|----------------------------------------|
| PPP Act                  | .00429*    | .00429*                       | .0181*                    | .0181*                                        | .0040*                                 | .00039                 | .0021                                  |
|                          | (.0019)    | (.0020)                       | (.0066)                   | (.0016)                                       | (.0016)                                | (.0010)                | (.0070)                                |
| PPP Index                |            |                               |                           |                                               |                                        |                        |                                        |
|                          | (.0011*)   | .0011*                        |                           |                                               |                                        |                        |                                        |
|                          | (.0005)    |                               |                           |                                               |                                        |                        |                                        |
| Real Income Per Capita   | −.0696     | −.0696                        | −.0689                    | .8085                                         | .8085                                  | .7692                  | .964                                  | 1.108                                  |
|                          | (.2149)    | (.2347)                       | (.2109)                   | (1.094)                                       | (1.345)                                | (1.1477)               | (.4975)                               | (2.774)                                |
| Real Federal Aid Per Capita | −.1617   | −.1617                        | −1.203                    | 94.069                                        | 94.069                                 | 89.894                 | 101.64**                              | 1.517.05**                             |
|                          | (15.414)   | (22.352)                      | (15.163)                  | (62.253)                                      | (152.879)                             | (121.87)               | (58.79)                               | (311.98)                               |
| Real Gas Tax Per Capita  | 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)                               |
| Debt Per Capita          | −.2026     | −.2026                        | −.3011                    | −4.882                                        | −4.882                                 | −5.277                 | −3.806**                              | −21.175**                              |
|                          | (.4093)    | (.5273)                       | (.3972)                   | (2.465)                                       | (3.839)                                | (3.325)                | (1.368)                               | (11.899)                               |
| Population               | .0017*     | .0017*                        | .0014*                    | .0049*                                        | .0049*                                 | .0039*                 | .0021                                 | .0086                                  |
|                          | (.0008)    | (.0009)                       | (.0008)                   | (.0026)                                       | (.0029)                                | (.0020)                | (.0013)                               | (.0086)                                |
| Union                    | −.0079     | −.0079                        | −.0069                    | .0412                                         | .0412                                  | .0407                  | .0073                                 | .1483                                  |
|                          | (.0339)    | (.0335)                       | (.0334)                   | (.1514)                                       | (.1413)                                | (.1365)                | (.0574)                               | (.4159)                                |
| N                        | 1,450      | 1,450                         | 1,450                     | 1,450                                         | 1,450                                  | 1,450                  | 565                                   | 565                                     |
| F-test/Wald test (bootstrapping) | 52.66**  | 83.48**                       | 31.07**                   | 29.22**                                       | 67.02**                                | 25.14**                | .77                                   | 1.45*                                  |

**Note.** Standard errors clustered by states are in parentheses. Covariates calculated per capita are rescaled (per million in the population) to facilitate interpretation of coefficients. Estimates in columns 2 and 5 include bootstrapping with 2,000 replications. All regressions include state and year fixed effects.  
**+ p < .10.**  
**∗ p < .05.**  
**∗∗ p < .01.**
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statistically significant impact.\(^{25}\) 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 .004, which measures the average change in treated states relative to untreated states (that is, the counterfactual).

Added context helps to interpret its seemingly small magnitude. The average percentage of PPP investment in our sample is .0030, slightly higher for treated states (.0036) and lower for untreated states (.0013). The effect of .004 is larger than those average figures, which underscores the estimated effect’s relevance. Moreover, we find that the average PPP percentage (for treated states) in years without a PPP law is just .0007. The estimated impact of .004 thus represents an almost sixfold increase relative to the average effect prior to the law’s enactment.

Our dependent variable’s distribution is skewed toward 0. That implies a non-normal distribution of errors, which raises 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 on PPP Act remains statistically significant at the 5 percent level (see model 2).\(^{26}\)

We estimate the same two-way fixed-effects model using our favorability index instead of PPP Act. Estimates reported in column 3 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 .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. The estimates indicate that, on average, a PPP law increases PPP investment by about $18 per person. We estimate that a unit and per-score increase in the favorability index increases per capita PPP investment by about $4 (both in constant 2010 US dollars).

Columns 7 and 8 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 existence of a law or a change in a law’s favorability index that drives the estimates in columns 3 and 6. 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

\(^{25}\) 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) and Peltzman (1973, 1975). A finding that PPP laws had their intended effect is thus more valuable than initially thought.

\(^{26}\) We apply bootstrapping with 2,000 replications (bootstrap samples), following the suggestion by Davison and Hinkley (1997), who state that the number should be between 1,000 and 2,000 for 95 percent confidence intervals.
is more useful in attracting private investment than a unit increase in the law’s favorability index. We also considered the effects of low index values versus high index values. That analysis, given the standard deviations, reveals no statistically significant results for the favorability index once we restrict the sample to the PPP acts available. The relatively low number of observations (565) should also be kept in mind when interpreting estimates.

4.2. Impact on Projects’ 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, accounts for overdispersion. 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 Table 6. Both models indicate that PPP Act and PPP Index are positively related to the number of projects reaching financial close.

It is however difficult to interpret count data model coefficients. We thus transform the coefficients associated with PPP Act ($β_1 = 1.516$) into incidence-rate ratios. The incidence-rate ratio for a binary variable (PPP Act) is the ratio of the number of one category of event to that in another category. We find that the incidence-rate ratio of PPP Act is 4.55, which means that 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 law in column 5. 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 because of the low number of observations.

4.3. Robustness Checks for Reverse Causality

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

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27 For a 1-unit change in covariates, the difference in log of expected counts of the outcome variable will change by the respective regression coefficient, ceteris paribus.

28 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 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 are however unable to detect an effect of completed private infrastructure investment on the travel-time index.
Table 6
Estimates of the Number of Public-Private-Partnership Projects

|                        | Negative Binomial Model | Zero-Inflated Model | PPP Act (5) |
|------------------------|-------------------------|---------------------|-------------|
|                        | (1)                     | (2)                 |             |
| PPP Act                | 1.516**                 |                     |             |
|                        | (.4321)                 |                     |             |
| PPP Index              | .3281**                 | .1783**             | .1224       |
|                        | (.0913)                 | (.0620)             | (.1467)     |
| Real Income Per Capita | 10.446                  | 55.062*             | 36.964      |
|                        | (64.442)                | (21.531)            | (81.714)    |
| Real Federal Aid Per Capita | −2,186.94             | −5,037.7*           | 3,314.92    |
|                        | (6,602.04)              | (2,501.79)          | (11,643.6)  |
| Real Gas Tax Per Capita | 298.64                  | −3,908.94           | −562.61     |
|                        | (5,817.9)               | (2,658.9)           | (6,483.35)  |
| Debt Per Capita        | −314.53                 | −29.073             | −697.07*    |
|                        | (215.72)                | (68.916)            | (288.47)    |
| Population             | .1935*                  | .0614**             | .1515       |
|                        | (.0974)                 | (.0088)             | (.1162)     |
| Union                  | −10.945                 | −6.940**            | −5.254      |
|                        | (7.9847)                | (2.0090)            | (10.079)    |
| Panel data             | Yes                     | No                  | Yes         |
| N                      | 841                     | 1,450               | 420         |
| Log likelihood         | −296.17                 | −401.76             | −235.43     |
| Wald χ²                | 65.00**                 | 72.47**             | 40.93       |
| Likelihood-ratio χ²    |                         | 142.82**            | 113.62**    |

Note. Covariates calculated per capita are rescaled (per million in the population) to facilitate interpretation of coefficients. All regressions include state and year fixed effects.

* p < .10.
* p < .05.
** p < .01.
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 PPP Act with binary variables for 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 lead variables (2 years and 1 year before policy implementation) and four lag variables. The last lag considers not only the fourth year after treatment but also the remaining posttreatment period. The lag thus captures the average long-term effect of the policy (through 4 years after treatment).

Insignificant lead effects imply rejection of the anticipatory-effects hypothesis (that is, of reverse causality). It also confirms the common-trends assumption between treated and control groups underlying our difference-in-difference method. Alternatively, we might expect lags to be statistically significant, which suggests 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.

Table 7 reports lead-and-lag 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 and conclude that the effects of PPP-enabling laws do not manifest in the short run (that is, in the first 3 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. 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 laws’ passage. Instruments include the annual number of vehicle registrations, the travel-time index, and 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 percentage of Democratic representatives in the state legislature, and an indicator variable for the governor’s political party (zero for Democrat, one otherwise).

Those estimates are reported in 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. Two-stage least squares models rely on the instrument quality employed. The Hansen J-test checks whether restrictions implied by the existence of more instru-

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29 We do not replicate the analysis with PPP Index because of collinearity.
ments than endogenous regressors are valid (that is, the exogeneity requirement). Results support our overidentifying-restrictions strategy \((\chi^2 = 3.87; p = .57)\). Alternatively, the Kleibergen-Paap test checks whether instruments are relevant (that is, the relevance requirement), which is also satisfied \((\chi^2 = 25.078, \text{ significant at the .001 level}; p = .0003)\). First-stage estimation is reported in Table A1.

We also use a third strategy to address possible reverse causality. Because PPPs are often large and controversial events covered by the media outlets in a state, we report findings from an exhaustive investigation into news reports around the time of a law’s adoption. If legislators adopt a PPP law in response to an impending transaction (perhaps because of pressure from investors), that is newsworthy and likely to be reported.

We searched media reports for evidence of laws passed in response to an impending agreement. That task would be onerous for all 35 states with laws, so we instead focused on five states exhibiting high PPP activity—California, Florida, Texas, Virginia, and North Carolina—and conducted an exhaustive search of events surrounding PPP laws’ passage in each. \(^{31}\) It revealed lobbying by numerous stakeholders prior to the passage of an enabling law, including by state

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**Table 7**

Panel-Data Lead and Lag Robustness Check

|                | Percentage |       |       |
|----------------|------------|-------|-------|
| Lead 2         | 0.0000     | (.0031)|       |
| Lead 1         | 0.0037     | (.0031)|       |
| Adoption       | 0.0143     | (.0090)|       |
| Lag 1          | -0.0006    | (.0010)|       |
| Lag 2          | 0.0044     | (.0038)|       |
| Lag 3          | 0.0007     | (.0014)|       |
| Lag 4+         | 0.0043*    | (.0017)|       |
| *p < .05       |            |       |       |
| **p < .01      |            |       |       |
| F-test         | 471.33**   |       |       |

Note. Standard errors are in parentheses. Errors are clustered allowing for arbitrary correlation by state. All regressions include covariates and state and year fixed effects. \(N = 1,450\).

\(^{30}\) The null hypothesis of this test is that the matrix of reduced-form coefficients has a rank of \(K-1\) (underidentified). The Kleibergen-Paap Wald rk \(F\)-statistic can also be used to check whether the equation is weakly identified. This is rejected at the 5 percent level for our model.

\(^{31}\) We are grateful to Priya Mukherjee for thorough research assistance on this issue. Details of her investigation are available from the authors on request.
departments of transportation, Associated Builders and Contractors, and construction companies, among others. Regarding the importance of the laws for investors (our maintained hypothesis), there were several instances in which private groups lobbied for stronger PPP laws lest they shift investment to a more accommodating state, consistent with our hypothesis. Our investigation did not reveal any PPP agreement that was concluded prior to the law’s passage, which offers added comfort regarding possible endogeneity.

### 4.4. 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 examine 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 Act on total per capita state and local road expenditures, excluding PPPs. We find that expenditure via PPP increased in states introducing laws, which indicates that expenditures financed by government did not concomitantly decrease.

Those estimates are reported in Table 9. We report only the key PPP variable

### Table 8

| Percentage | PPP Act | (.0076)* |
| Real Income Per Capita | −.1379 | (.1349) |
| Real Federal Aid Per Capita | −5.513 | (14.443) |
| Real Gas Tax Per Capita | 11.406 | (23.551) |
| Debt Per Capita | −.2567 | (.5028) |
| Population | .0016** | (.0004) |
| Union | .0041 | (.0276) |

F-test 5.53**

**Note.** Standard errors are in parentheses. Errors are robust to heteroskedasticity. Covariates calculated per capita are rescaled (per million in the population) to facilitate interpretation of coefficients. N = 1,450.

* p < .05.

** p < .01.
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4.5. The Role of the Law’s Provisions on Outcomes

Our analysis underscores the importance of PPP laws and their favorability in encouraging private infrastructure investment, where favorability is determined by the provisions included in the laws. We next consider the effect of PPP-enabling-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.33

Category 1 includes provisions that clarify and create the regulatory and contractual setting for PPPs: Eligibility, Unlimitedpro, Priorleg, Brown, Others, Noncomp, and Unsolic. 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 are treated, whether brownfield PPPs are allowed, and whether noncompete 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.

32 We performed this analysis for federal expenditure on roads and highways in per capita and constant terms. That reveals the same finding as in the case of state and local governments’ expenditures.

33 We are grateful to Ed Glaeser for suggesting this grouping.
Category 2 provisions define the framework for PPP project funding and financing: Fundmix, Avail, and Revenue. They include whether private and public funds can be commingled to complete the project, whether availability payments (essentially performance payments based on the availability of the infrastructure) are allowed to fund the project, and whether the public and private sectors can share project revenue, as from tolls. Clarifying such issues is critical for estimating the likely funding available (that is, the underlying dollars needed to pay for the project) and the anticipated financing (that is, the size of the up-front payment for project design and construction generated by the financial markets given the expected funding).

Category 3 provisions are designed to empower participation in PPPs: Confidential, Exemptpro, and Proptax. We view them 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.

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 10 indicate that provisions empowering PPPs is the only statistically significant category. The effect is economically significant. A unit change (that is, the addition of one provision), increases the percentage of PPP investment by .004. The average percentage of PPP investment is .003. Thus, including more provisions of that type substantially increases the amount of private investment relative to the average (to .007 for one additional provision). However, the small percentage that represents relative to total investment should be kept in mind. We find that empowering PPP provisions induce a per capita increase of about $14 per clause (in 2010 US dollars). For the other categories, having more or fewer provisions has no statistically significant effect.

Our analysis offers guidance to states wishing to encourage private investment in transportation infrastructure. First, simply having a PPP law helps attract investment: a law’s 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 the 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 partners’ information, exempting the PPP from a state’s old (and perhaps outdated) procurement laws, and exempting the private partner from paying property taxes. Although each is individually im-
important, including such provisions further signals a state’s acceptance of private investment in infrastructure.

5. Summary and Conclusions

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

As of late 2016, 35 states and Puerto Rico had passed modern PPP-enabling laws. The laws clarify the set of institutional arrangements that underpin PPBs. They thus mitigate uncertainty while lowering transaction costs. Enabling laws address important contractual issues, such as whether PPBs can be used for 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 a 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 13 critical elements of PPP-enabling laws and studied state laws to determine which contain various provisions. We generated an index of favorability toward enabling laws.

Our estimates indicate that the improved legal frameworks offered by PPP-enabling laws are successful in attracting private capital to transportation proj-
The greatest insight comes from grouping the 13 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 exempting the PPP from extant procurement laws and 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 because of 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 measuring private infrastructure investment via PPPs and are significant at standard levels of confidence.
Appendix

Additional Table

Table A1
First-Stage Estimates

|                                      | Estimate     |
|--------------------------------------|--------------|
| Real Income Per Capita               | 5.024*       |
|                                       | (2.781)      |
| Real Federal Aid Per Capita           | 210.45       |
|                                       | (230.32)     |
| Real Gas Tax Per Capita               | -1,449.97**  |
|                                       | (378.96)     |
| Debt Per Capita                       | 7.590        |
|                                       | (9.379)      |
| Population                            | .0119        |
|                                       | (.0127)      |
| Union                                 | -3.248**     |
|                                       | (.5768)      |
| Instruments:                          |              |
| Num_Laws                              | 2.49e−06     |
|                                       | (.00003)     |
| Registrations_PC                      | -.0743**     |
|                                       | (.0180)      |
| TTI_Index                             | 2.097**      |
|                                       | (.3613)      |
| Democrat_Presidential                 | -1.58e−08**  |
|                                       | (3.68e−09)   |
| State_Democrats                       | 2.097**      |
|                                       | (−.9505)     |
| Republican_Gov                       | .0149        |
|                                       | (.0183)      |
| $R^2$                                 | .39          |
| $F$ test                              | 65.21**      |
| First-stage $F$-statistic for instruments | 29.59**     |

**Note.** Robust-to-heteroskedasticity standard errors are in parentheses. $N = 1,450$.

* $p < .10$.
** $p < .01$.

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