ABSTRACT: Public-private partnerships (PPPs) have become an important tool for investing in and developing public infrastructure and services. However, many developing countries have failed to attract sufficient private investment from the PPP market. This article uses data from 4,484 PPP projects across 130 developing countries to investigate if and how distinct types of government support can attract more private investment. Results showed that capital, revenue, and in-kind subsidies directly provided from governments attract more private capital, while indirect supports through government guarantee policies do not. The institutional quality of a country enhances the positive relationship between direct government support and private PPP investments. Further, risk allocation plays a mediating role between government supports and private investment.

INTRODUCTION

Public-private partnerships (PPPs) have been used as an important tool to supply public infrastructure over the past three decades. Although PPP can be defined in various ways, a common concept and assumption can be identified based on core concepts like risk sharing and the nature of the contract relationship. In this
article, a PPP is a form of cooperation between public and private sectors for the development of infrastructural facilities, where the governing contract covers the allocation of resources, risks, and rewards among partners (Wang, Chen, et al. 2018). Undeniably, PPPs in developed countries such as the United Kingdom, Australia, Canada, and the Netherlands have matured in their institutional environment and market conditions, and private investors have full confidence in those countries’ markets. Thus, those developed countries have received a rapid increase in private-investment commitments over the past decades (Osei-Kyei and Chan 2017).

However, in the aftermath of the 2008 global financial crisis, developing countries have struggled to attract more private investment, even while their governments have enthusiastically pursued a PPP program. For example, from 2005 to 2008, private participation in funding programs for roads was strong in developing countries, only to retract after 2008 (Queiroz, Vajdic, and Mladenovic 2013). Since 2014, while China's central and local governments made many efforts to promote PPPs for infrastructure development projects, private investments and private contractors continue to diminish their participation in the PPP market. In most developing countries, government investments have proven insufficient to expand access to modern infrastructure in rural areas (Sovacool 2013). Private investment is important in developing countries, as otherwise they would struggle to meet rising demand for infrastructure improvements. To attract private investments to PPP markets, governments in developing countries often provide programs that offer different forms of direct and indirect support for PPP investments. An important question is whether these programs influence the degree of private investment in the developing countries’ PPP projects.

To identify whether governments’ direct and indirect support programs influence PPP investments, we use a large sample dataset of PPP projects in developing countries. The results indicate that direct support programs have a significant positive impact on private investment in developing countries’ PPPs. High levels of institutional quality of a country (e.g., obeying rule of law, high level of government effectiveness, and control of corruption) enhance the positive effect of direct support programs on private investment, and the risk assumed by private partners plays a mediating role between direct supports and private investment.

In the following sections, after a brief literature review, we outline our hypothesis and general framework. We then identify variables and data for the empirical analysis. Next, we use Tobit regression analysis to examine the influence of government support policies on private investment. Finally, we discuss the results of statistical analysis and their implications.

LITERATURE REVIEW

Much of the academic literature on the relationship between government support policies and PPPs focuses on two central dimensions. First, many studies show that government support programs influence both PPP project performance and the level of private investment (Osei-Kyei and Chan 2017; Takshima, Yagi,
and Takamori 2010), with much of the focus on which elements of government policies improve PPP outcomes. For example, Armada, Pereira, and Rodrigues (2012) analyze how government subsidies and guarantees in PPPs should be arranged to promote immediate private investment. Mauldin (2012) examines whether loans and loan guarantees to business owners influenced organizational structures of PPPs. Soumare and Lai (2016) compared government loan guarantees and direct investment through PPPs in reducing project-borrowing costs.

Although this literature has been enlightening in many ways, the studies are not without some limitations. First, the research designs are narrow, with most using single PPP case studies or economic modeling techniques to evaluate the effect of different government-incentive arrangements. Few studies use larger samples. Insights from case studies and economic models can be illuminating, but their generalizability or practicality for policymaking may be limited (Wang 2016). In addition, extant studies only described whether government supports affected private investment theoretically; the topic needs further consideration to discern how different incentive arrangements affect private investments. To address these limitations, this article uses a large sample dataset of PPP projects in developing countries to address whether distinct types of government support attract private investment differently.

THEORIES AND HYPOTHESIS

Diverse Forms of Government Support and Private Investment

Local governments often use diverse direct and indirect support policies to encourage and attract private investment in PPPs. With direct support policies, governments provide capital subsidies, revenue subsidies, or in-kind (i.e., land) subsidies to cover project costs, with payments made in installments or all at once. Capital subsidies are cash grants for capital investments to cover the costs of physical assets during construction. Revenue subsidies are grants as revenue support to help private investors recuperate investment during the operational phase of the project.2

Indirect support means that a government uses various policies to support private investors’ investment and reduce risk. With government indirect supports, governments provide private investors with guarantees (e.g., revenue, payment, construction cost, exchange rate, debate, tariff rate, and loan guarantees) and tax deductions. Indirect government supports are either contingent liabilities (liabilities that may not actually occur, as they are contingent on a predetermined event) or government policies that support private investment.2

Direct and indirect supports can improve the financial viability of PPP projects, enabling them to realize economic benefits and thereby attract private investment. In addition, diverse forms of government incentive arrangements affect the transfer of risk and benefit from the public sector to private investors. An appropriate valuation and comparison of the effect of these government supports on PPP development is crucial for PPP policymakers.

Government support programs may differ in their ability to attract private investment to PPPs. Direct support programs directly cover project-investment
costs and increase the value of underlying cash flows, thereby promoting immediate private investment (Armada, Pereira, and Rodrigues 2012). Indirect support programs do not directly reduce investment costs but can reduce underlying uncertainties and risk. Indirect support programs can be especially crucial in developing economies where market financial markets are immature (Yang, Hou, and Wang 2013). Infrastructure projects typically entail long-term time horizons for construction and operation, which often require large startup investments. Therefore, private investors need to consider the investment cycle before entering the PPP market (Albalate, Bel, and Geddes 2015).

In general, private investors aim to recover investment costs and make profits as soon as possible (Brown, Potoski, and Van Slyke 2016). Direct support programs offer investors minimal investment risk. Conversely, indirect support programs offer some political uncertainty and risk because infrastructure investment and operation may be long-term. In light of these arguments, we first investigate whether distinct types of government support attract private investment differently.

Hypothesis 1a (H1a): Indirect and direct government support programs increase private investment in PPPs.

Hypothesis 1b (H1b): Compared to indirect support programs, direct support programs attract more private investment in PPPs.

The Moderating Role of Institutional Quality

A country’s institutional quality can moderate the effects of government support programs on private investment in PPP projects. We use the term “institution” to refer to rules, norms, and strategies of a game, as defined by the actors’ context (Ostrom 1990; North 1991; Brown, Potoski, and Van Slyke 2006). Institutions provide enforcement mechanisms for agreements, penalties for defection, and rewards for effective implementation, thereby affecting individual action (Hall and Taylor 1996). A high level of institutional quality indicates that the government has good governance, such as abiding by rules of law, contract enforcement, and judicial independence (Kaufmann, Kraay, and Zoido-Lobaton 1999; Kaufmann, Kraay, and Mastruzzi 2011). According to the definition of institution and good governance, in this article the institution of a country is reflected by obeying the rule of law, government effectiveness, and control of corruption.

A government-support program may be more successful in attracting private investment when the country has higher-quality institutions for PPP development. This can occur for several reasons. First, rule of law is the extent to which agents have confidence in and abide by the rules of society, including the quality of contract enforcement, property rights, and judicial independence (Kaufmann, Kraay, and Mastruzzi 2011). If a society has a higher level of obeying rule of law, private investors would believe its government to be more reliable. Second, governments’ effectiveness also reflects the quality of policy formulation and implementation,
and the credibility of a government's commitment to such policies (Kaufmann, Kraay, and Mastruzzi 2011). A government with a higher level of effectiveness is likewise more reliable for private investors. Third, the control of corruption is the extent to which governments exercise public power for private gain, including the capture of state elites and private interests (Kaufmann, Kraay, and Mastruzzi 2011). Private companies and state-owned enterprises receive equal treatment in countries with low corruption levels. Private companies may be more interested in investing in low-corruption countries.

The rule of law, government effectiveness, and control of corruption are relevant to institutions because they can measure the extent to which the government is able to govern economic and social interaction rules among partners, change the rules of interactions to its advantage, and fairly implement rules. These three facets have the advantage of measuring different dimensions of institutional quality, allowing us to study whether some dimensions of the institution matter for private investment, while others do not (Daude and Stein 2007).

The effects of direct and indirect support policies on PPP investments may differ, depending on a country's institutional quality. Poor institutions (e.g., those that fail to comply with the law, have low levels of government effectiveness, and high levels of corruption) create uncertainty about whether the government will adhere to past promises, such as those in indirect support programs. As rational investors, private-sector investors would prefer immediate cash or in-kind direct payments from governments, a preference better met through direct support programs. When institutions are higher quality (e.g., obeying the rule of law, high level of government effectiveness, and low level of corruption), private investors can have more trust in governments to meet their future obligations promised in indirect support programs. Therefore, we propose the following hypotheses:

Hypothesis 2a (H2a): Investors are more willing to accept indirect support programs from governments in countries with a strong degree of rule of law than in those with a weak rule of law. Conversely, investors are more responsive to direct supports in countries with a weak degree of rule of law.

Hypothesis 2b (H2b): Investors are more willing to accept indirect support programs from governments in countries with high levels of government effectiveness than in those with low levels of government effectiveness. Conversely, investors are more responsive to direct support programs in countries with low levels of government effectiveness.

Hypothesis 2c (H2c): Investors are more willing to accept indirect support programs from governments in countries with low levels of corruption than in those with high levels of corruption. Conversely, investors are more responsive to direct support programs in countries with high levels of corruption.
The Mediating Role of Risk Assumed by Private Partners

Risk sharing is a major consideration for public and private sectors seeking cooperation (Hodge and Greve 2007). PPP projects have many kinds of risk, including project-level risks (e.g., design, construction, finance, and ownership risks), market-level risks (e.g., demand and investment-environment risk), and country-level risks (e.g., political risk) (Wang, Xiong, et al. 2018). Risk allocation between public and private sectors is a potential mediator in the relationship between government support programs and private investment in PPPs.

First, government direct and indirect support programs may reduce private investors’ risk. The larger the government’s direct and indirect support programs in the PPP, the less risk private sectors assume. However, different kinds of government support can reduce different kinds of risk. An investment subsidy reduces private investors’ financial and construction risks. A revenue subsidy reduces private investors’ demand risk. Government debt guarantees significantly reduce lenders’ risk premiums associated with a loan and can increase the financial viability of a PPP project.

Second, the nature of risk allocation between the government and investors can affect the private sector’s investment choices. Private investors are less motivated to invest in an environment where PPP projects have many uncertainties and institutional (e.g., political instability and corruption) and sector risks (e.g., water) (Ameyaw, Chan, and Owusu-Manu 2017). For instance, when corruption or political instability is high in a country, private investors must assume more risk to do business with governments. Under this condition, private investors pursue profit maximization over public needs, which lower investments (Pusok 2016).

In financial terms, the certainty of government-support programs can decrease private sector risks, thereby enhancing investment (Urpelainen and Yang 2017). For example, toll-road PPP projects may have demand risk; thus, the government needs to provide a minimum-traffic guarantee to induce potential private investors to participate. In 2004, Brazil allowed the government to provide project incentives such as financial subsidies and return-of-investment guarantees to reduce the private sector’s risk and increase the attractiveness of the project to the private investor (Brandao et al. 2012). On this basis, we hypothesize:

Hypothesis 3 (H3): The risk assumed by private investors mediates the relationship between government support programs and private investments.

Considering each of these factors, Figure 1 depicts our analytical framework.

DATA AND METHOD

Dependent Variable: Private Investment in PPP Projects

This article explores the impact of government supports on private investment in PPP markets. The level of private investment is measured as the percentage of a Special Purpose Vehicle (SPV) owned by private investors (percentage private) (Panayides,
Parola, and Lam 2015). The SPV is a legal entity created by public and private sectors to fulfill specific or temporary objectives. A higher percentage of an SPV owned by private investors means higher degrees of private investment. The data for the dependent variable (percentage private) are from the World Bank’s Private Participation in Infrastructure (PPI) Database. The value of percentage private ranges from 0 to 100%.

**Independent Variables**

*Government Support Programs*

The entry for each PPP project in the PPI database shows whether the project had direct government supports (e.g., revenue subsidy, capital subsidy, and in-kind) or indirect government supports (e.g., debt guarantee, payment guarantee, and other guarantees). In the PPI database, if a government provided support for a PPP project (direct or indirect), the value of support was assigned 1; 0 otherwise. If a PPP project had government direct support, the value of direct was 1; 0 otherwise. If a PPP project had indirect supports in a PPP project, the value of indirect was 1; 0 otherwise.

*Moderating Variable: Institutional Quality*

The moderating variables in the analyses include rule of law (law), government effectiveness (effectiveness), and control of corruption (corruption), all drawn from the World Bank's Worldwide Governance Indicators (WGI). The WGI was developed by Kaufmann, Kraay, and Zoido-Lobaton (1999) to measure the institutional quality of a country (Daude and Stein 2007; Percoco 2014; Panayides, Parola, and Lam 2015; Baker 2016). The WGI data sources include surveys of firms and households, as well as subjective assessments of a variety of commercial business information providers, non-governmental organizations, a number of multilateral organizations, and other public sectors (Kaufmann, Kraay, and Mastruzzi 2011). Scores of subjective assessment range from 0 to 100. High scores mean high
levels of institutional quality. Therefore, scores accrued for the three dimensions of institution in each country are from the WGI database.

**Mediating Variable: Risk Assumed by Private Investors**

The mediating variable is the risk assumed by private investors \((risk)\). Risk allocation can be shown in contracts, and contracts have defined residual control rights. Residual control rights indicate control of ownership, which determines risk allocation (Hefetz and Warner 2012). For example, if a private investor gets more residual control rights, it will assume more risk.

PPP contracts can be classified into 10 subtypes and grouped into three categories (see Appendix Table A1 and Table 1) in the PPI database. Previous research assigned the value of \(risk\) from 1 to 10 (Percoco 2014; Zhang 2014). Following previous research, we assign a subjective ranking of risk assumed by private partners across types of PPPs. A higher value indicates a higher degree of risk transfer from public to private partners. For management and lease contracts, the values of \(risk\) are 1 and 2, respectively. Governments have the ownership of the facilities. Private investors mainly assume operation and maintenance of risk over a short time (e.g., three to five years). For rehabilitate-operate-transfer (ROT), rehabilitate-lease/rent-transfer (RLT), and build-rehabilitate-operate-transfer (BROT), values of \(risk\) are 3, 4, and 5, respectively. Governments have the ownership of the facilities, and private investors mainly assume construction, operating, and maintenance of risks over a long period (e.g., 20 to 30 years). For build-lease-transfer (BLT), build-operate-transfer (BOT), build-own-operate (BOO), merchant, and rental, values are 6, 7, 8, 9, and 10, respectively.

\[
\begin{array}{|c|c|c|}
\hline
\text{Type} & \text{Subtype} & \text{Value of risk assumed by private partners} \\
\hline
\text{Operations and maintenance (public ownership of facilities)} & \text{Management contract} & 1 \\
& \text{Lease contract} & 2 \\
\text{Concessions (public ownership of facilities)} & \text{Rehabilitate-operate-transfer (ROT)} & 3 \\
& \text{Rehabilitate-lease/rent-transfer (RLT)} & 4 \\
& \text{Build-rehabilitate-operate-transfer (BROT)} & 5 \\
\text{Greenfield projects (private ownership of facilities)} & \text{Build-lease-transfer (BLT)} & 6 \\
& \text{Build-operate-transfer (BOT)} & 7 \\
& \text{Build-own-operate (BOO)} & 8 \\
& \text{Merchant} & 9 \\
& \text{Rental} & 10 \\
\hline
\end{array}
\]

*Source: Adapted from Percoco (2014) and Zhang (2014).*
respectively. Private investors own facilities over a specified period (e.g., 20 to 30 years). During the specified period, a private investor builds a new facility at its own risk and owns and operates the facility at its own risk.

Control Variables

We selected control variables to control for potential influences on private investment in PPP markets. Control variables include project-specific (concession duration, number of sponsors, multilateral lenders, PPP experience, and sectors) and country-specific (economic growth, country’s income, and country’s region) variables.

Concession duration (period). This variable measures the length of the PPP contract. Longer PPP contracts may allow investors to control the infrastructure asset for a longer period of time. However, Wang, Chen, et al. (2018) showed a negative significant correlation between length of contract and innovativeness, and an insignificant correlation between length of contract and private investment. A possible reason is that if a project has a long contract period, it may take greater private investment and a longer time to recover investment costs. In addition, a long period of concession needs operators to bear potential political and demand risk. Thus, a long period of concession may hinder private investment. The entry for each PPP project in the PPI database shows the contract period of the project.

Number of sponsors (sponsors). This control variable measures the number of private investors in a PPP (Galilea and Medda 2010). A company or a consortium formed by several investors can set up an SPV. A large number of investors means the project is bigger and more complex. Furthermore, sponsors may be foreign companies (foreign). Investments from foreign companies indicate that the domestic market environment is more open. A bigger project and a more open market will attract private investment. If a project has a foreign investor, the value of foreign is 1; 0 otherwise. The entry of each PPP project in the PPI database shows the number of sponsors, the names of the sponsors, and whether they are foreign companies.

Multilateral lenders (multi-lenders). This control variable measures the extent of multilateral lenders (e.g., the World Bank and Asian Bank) in the PPP. If a project has multilateral lenders, the value of multi-lenders is 1; 0 otherwise. The entry for each PPP project in the PPI database shows whether multilateral banks support the project.

PPP experience (success and failure). A country may have successful PPP projects or failed PPP projects in the past. Past PPP experience may affect private investors’ decisions. In the PPI database, success counts the number of projects "concluded" in the country of the PPP at the moment of the PPP’s financial closure; failure counts the number of projects “canceled/distressed” in the country of the PPP at the moment of the PPP’s financial closure. If a country has no prior experience, the variable is set to 0 (Galilea and Medda 2010). The entry for each PPP project in the PPI database shows the project status, including active, canceled, concluded, and distressed.
Sectors. PPP projects in developing countries occur in four economic sectors: energy, telecommunication, transport, and water. Different sectors may have different government supports for attracting private investment. In this article, sector is a dummy variable. We created three dummy variables. Energy is 1 if the PPP project is in the energy sector; 0 otherwise. Water is 1 if the PPP project is in the water sector; 0 otherwise. Transport is 1 if the PPP project is in the transport sector; 0 otherwise. PPP projects in the telecommunication sector are taken as the base case, represented when the three dummy variables become 0. The entry for each PPP project in the PPI database shows to which sectors the project belongs.

Economic growth (GDP growth). This variable measures a country’s economic growth as average annual GDP growth one year before financial closure of the PPP contract. If GDP growth is negative, its value is 0. If GDP growth is between 0 and less than 3%, its value is 1; between 3% and 6%, its value is 2; if it is more than or equal to 6%, its value is 3 (Galilea and Medda 2010). Higher levels of economic growth may increase investor confidence. We collected the GDP growth of every country in every year from the World Bank’s World Development Indicators (WDI) database.

Country income (income). If a government has sufficient financial resources, it would prefer to use the traditional approach to investing in infrastructures, because the PPP refers to a more complex contractual arrangement than traditional governmental procurement (Albalate, Bel, and Geddes 2015). In this sense, PPPs need governments to have higher contract management ability. If a government is not short of finances, it would more likely choose a simpler way to deliver infrastructure. Therefore, a richer country may reduce the opportunity for private investors to participate in infrastructure. Developing countries can be classified into three groups, based on per capita income: low-income, lower-middle-income, and upper-middle-income. Country’s income is a dummy variable. The upper-middle-income variable is 1 if the PPP project is in an upper-middle-income country; 0 otherwise. The entry for each PPP project in the PPI database shows in which country the project located, and the income level of the country.

Country region (Asia, Africa, and Latin). The analyses control for PPPs’ region, to address the fact that countries in the same region may behave similarly. For instance, the Latin American region has more experience using private capital than Asia and Africa. Therefore, the Latin American region may be more attractive to private investment. Three dummy variables classify the region in which a PPP project was executed (Galilea and Medda 2010). Asia is 1 if the PPP project is in southern Asia, eastern Asia, and the Pacific region; 0 otherwise. Africa is 1 if the PPP project is in Sub-Saharan Africa, the Middle East, or northern Africa regions; 0 otherwise. Latin is 1 if the PPP project is in Latin America and the Caribbean region; 0 otherwise. PPP projects in Europe and Central Asia are taken as the base case, represented when the three dummy variables become 0. The entry for each PPP project in the PPI database shows in which region the project located.
Data Sources and Estimation Strategy

Data are drawn from three sources: the dependent and variable and the project-specific independent variables (concession duration, number of sponsors, multilateral lenders, PPP experience and sectors) and country-specific (country’s income and country region) control variables from the PPI database. We collected moderating variables from the WGI database. We collected economic growth (a country-specific control variable) from the WDI database. In addition, we adapted the mediating variable from Percoco (2014) and Zhang (2014).

The cross-sectional data include PPP projects in 130 developing countries from 2002 to 2015. These developing countries are in Africa, Asia, Latin America, and the Middle East regions. The project’s year refers to the date of PPP financial closure, representing the amount of private investment stated in the final contract (Panayides, Parola, and Lam 2015). The control variable of economic growth (GDP growth) indicates the year preceding financial closure of the PPP contract, ranging from 2001 to 2014. Other variables are from 2002 to 2015. Descriptive statistics of all variables appear in Table 2. The value of the dependent variable ranges from 0 to 100%. The appropriate statistical model is the Tobit regression model.

The PPI data system is the most comprehensive catalog of PPP projects available in developing countries, and represents the best efforts of the World Bank to compile publicly available information on those projects. Every project record includes country, region, financial closure year, primary sector, project status, type of private participation, private sponsors, private ownership, total investment, direct government support, indirect government support, award method (e.g., tendering and negotiation), contract period, multilateral lenders, and so on. Publicly available longitudinal and horizontal data on countries’ PPP projects are quite limited; thus, the PPI database provides a remarkable window into PPP projects around the world. Like all datasets, the PPI data system has flaws. Some projects (particularly those involving local and small-scale operators) tend to be omitted because they are usually not reported by major news sources; thus, their records are incomplete. We only drew PPP projects with complete records.

The PPI database contains more than 6,400 projects from 1984 to 2016. Among them are partial and full privatization projects, which are not PPP projects per our definition. When excluding those non-PPP projects and projects with missing information for dependent variables, independent variables, and control variables, we identified as many as 4,780 PPP projects. In our article, the PPP project samples are from 2002 to 2015, mainly because we worked to match the PPI and the WGI databases. The data in the WGI are from 2002 to 2015. For these reasons, the actual sample size for PPP projects is 4,484 located in 130 developing countries.

RESULTS

Empirical Findings

Table 3 shows baseline results, which regress when distinct types of government support affect private investment. Model 1a reports the results of the Tobit
| Variable                          | Observation | Mean   | S.D.   | Min   | Max   | Data source                                                                 |
|----------------------------------|-------------|--------|--------|-------|-------|----------------------------------------------------------------------------|
| **Dependent variable**           |             |        |        |       |       |                                                                            |
| Percentage private               | 4,484       | 0.924  | 0.183  | 0.050 | 1     | PPI                                                                        |
| **Independent variables**        |             |        |        |       |       |                                                                            |
| Support                          | 4,484       | 0.315  | 0.465  | 0     | 1     | PPI                                                                        |
| Direct                           | 4,484       | 0.149  | 0.356  | 0     | 1     | PPI                                                                        |
| Indirect                         | 4,484       | 0.168  | 0.373  | 0     | 1     | PPI                                                                        |
| **Moderating variables**         |             |        |        |       |       |                                                                            |
| Law                              | 4,482       | 44.607 | 15.035 | 0     | 89.474| WGI                                                                        |
| Effectiveness                    | 4,482       | 51.515 | 14.787 | 0     | 87.805| WGI                                                                        |
| Control of corruption            | 4,482       | 42.250 | 16.290 | 0     | 91.707| WGI                                                                        |
| **Mediating variable**           |             |        |        |       |       |                                                                            |
| Risk                             | 4,484       | 6.748  | 2.092  | 1     | 10    | Percoco (2014); Zhang (2014)                                              |
| **Control variables (project specific)** |         |        |        |       |       |                                                                            |
| Period                           | 4,484       | 22.870 | 9.454  | 1     | 99    | PPI                                                                        |
| Sponsors                         | 4,480       | 1.332  | 0.705  | 0     | 9     | PPI                                                                        |
| Foreign                          | 4,480       | 0.395  | 0.489  | 0     | 1     | PPI                                                                        |
| Multi-lenders                    | 4,484       | 0.107  | 0.310  | 0     | 1     | PPI                                                                        |
| Success                          | 4,484       | 338.769| 328.552| 0     | 1,213 | PPI                                                                        |
| Failure                          | 4,484       | 15.247 | 13.892 | 0     | 42    | PPI                                                                        |
| **Control variables (country specific)** |         |        |        |       |       |                                                                            |
| GDP growth                       | 4,483       | 2.393  | 0.835  | 0     | 3     | WDI                                                                        |
| Income                           | 4,484       | 0.374  | 0.484  | 0     | 1     | PPI                                                                        |
| Asia                             | 4,484       | 0.521  | 0.500  | 0     | 1     | PPI                                                                        |
| Africa                           | 4,484       | 0.105  | 0.307  | 0     | 1     | PPI                                                                        |
| Latin                            | 4,484       | 0.273  | 0.446  | 0     | 1     | PPI                                                                        |
### TABLE 3
Marginal Effect of Government Supports on Private Investment: Basic Relationship (Tobit Model)

| Variables  | Model 1a     | Model 1b     | Model 1c     | Model 1d     |
|------------|--------------|--------------|--------------|--------------|
| Support    | 0.199***     | 0.472***     | 0.047        | 0.476***     |
|            | (0.036)      | (0.059)      | (0.042)      | (0.059)      |
| Direct     |              |              | 0.476        |              |
|            |              |              | (0.059)      |              |
| Indirect   | -0.011***    | -0.010***    | -0.011**     | -0.010***    |
|            | (0.001)      | (0.002)      | (0.002)      | (0.002)      |
| Period     | 0.006**      | 0.006***     | 0.010**      | 0.005**      |
|            | (0.002)      | (0.002)      | (0.002)      | (0.002)      |
| Sponsors   | 0.153***     | 0.145***     | 0.162***     | 0.145***     |
|            | (0.030)      | (0.030)      | (0.030)      | (0.030)      |
| Foreign    | 0.017*       | 0.005**      | 0.006**      | 0.007***     |
|            | (0.005)      | (0.004)      | (0.005)      | (0.004)      |
| Multi-lenders |          |              |              |              |
| Success    | 0.001        | 0.001        | 0.001        |              |
|            | (0.002)      | (0.002)      | (0.002)      |              |
| Failure    | -0.0002**    | -0.0002**    | -0.0002**    | -0.0003***   |
|            | (0.0001)     | (0.0001)     | (0.0001)     | (0.0001)     |
| GDP growth | 0.064**      | 0.070**      | 0.069**      | 0.070**      |
|            | (0.020)      | (0.020)      | (0.020)      | (0.020)      |
| Income     | 0.136***     | 0.118***     | 0.121***     | 0.119***     |
|            | (0.043)      | (0.042)      | (0.043)      | (0.042)      |
| Asia       | 0.041        | 0.086        | 0.090        | 0.082        |
|            | (0.061)      | (0.060)      | (0.061)      | (0.061)      |
| Africa     | -0.091       | -0.063       | -0.073       | -0.065       |
|            | (0.059)      | (0.059)      | (0.060)      | (0.059)      |
| Latin      | 0.257***     | 0.277***     | 0.267***     | 0.276***     |
|            | (0.052)      | (0.052)      | (0.053)      | (0.052)      |
| Energy     | -0.181***    | -0.152**     | -0.150**     | -0.155**     |
|            | (0.064)      | (0.063)      | (0.065)      | (0.064)      |
| Transport  | 0.018        | 0.004        | 0.048        | 0.003        |
|            | (0.068)      | (0.068)      | (0.069)      | (0.068)      |
| Water      | -0.0002      | 0.018        | 0.038        | 0.016        |
|            | (0.078)      | (0.071)      | (0.072)      | (0.092)      |
| Trend      | 0.049***     | 0.055***     | 0.061***     | 0.054***     |
|            | (0.005)      | (0.005)      | (0.005)      | (0.005)      |
| Cons       | 1.669***     | 1.624***     | 1.630***     | 1.627***     |
|            | (0.093)      | (0.091)      | (0.093)      | (0.092)      |
| Observations | 4,479       | 4,479        | 4,479        | 4,479        |
| Pseudo R-squared | 0.330      | 0.341        | 0.323        | 0.34         |

Standard errors are in parenthesis below the coefficient. *, **, and *** denote 10%, 5%, and 1% levels of significance, respectively.
regression between government support (support) and private investment (percentage private). Government support has a positive impact on private investment ($\beta = 0.199, p < 0.01$). Thus, H1a is supported. In models 1b and 1c, the independent variable is replaced by government direct supports (direct) and indirect supports (indirect), respectively. In Model 1d, the independent variables are direct and indirect. Compared to the insignificant effect of government indirect supports on private investment ($\beta = 0.019, p > 0.01$), government direct supports have a stronger positive relationship with private investment ($\beta = 0.476, p < 0.01$). Therefore, H1b is supported. Government direct supports have a greater degree of attractiveness for private investment than indirect supports in developing countries.

For project-specific control variables, contract period ($\beta = -0.010, p < 0.01$), failure experiences ($\beta = -0.0003, p < 0.01$), and energy sector ($\beta = -0.155, p < 0.1$) have negative impacts on private investment. Number of sponsors ($\beta = 0.005, p < 0.1$), foreign sponsor ($\beta = 0.145, p < 0.01$), and multi-lenders ($\beta = 0.007, p < 0.01$) have positive impacts on private investment. It is interesting that investors care about failure experiences rather than success experiences. This finding shows that investors are generally risk averse. In addition, compared to the telecommunication sector, private investors do not prefer to select the energy sector.

For country-specific control variables, economic growth ($\beta = 0.070, p < 0.05$) and a country’s income ($\beta = 0.119, p < 0.01$) favor private investment because these developing countries have a large demand for infrastructure and governments have sufficient financial resources to support private investment. The Latin variable is significant ($\beta = 0.276, p < 0.01$). One possible reason is that this region has more experience attracting private investment. For instance, the Latin region received 50% of worldwide private capital flows to infrastructure sectors during the 1990s (Galilea and Medda 2010).

Table 4 shows Tobit regression results of the moderating effect between institutions (law, effectiveness, and control of corruption) and supports (support, direct, and indirect) on private investment (percentage private). The moderating effects show which factors enhance or hinder the positive relationships between government supports and private investment. In models 2a, 2b, and 2c, rule of law (law) is the moderating variable. In models 2d, 2e, and 2f, government effectiveness (effectiveness) is the moderating variable. In models 2g, 2h, and 2i, control of corruption is the moderating variable.

In models 2a, 2d, and 2g, law ($\beta = 0.003, p < 0.01$), effectiveness ($\beta = 0.009, p < 0.01$), and control of corruption ($\beta = 0.005, p < 0.01$) can enhance the positive relationship between government supports and private investment. In models 2b, 2e, and 2h, law ($\beta = 0.005, p < 0.01$), effectiveness ($\beta = 0.004, p < 0.01$), and control of corruption ($\beta = 0.003, p < 0.01$) can also enhance a positive relationship between government direct supports and private investment. However, in models 2c, 2f, and 2i, the moderating effects of law ($\beta = 0.002, p > 0.1$), effectiveness ($\beta = 0.004, p > 0.1$), and control of corruption ($\beta = 0.001, p > 0.1$) on private investment are
TABLE 4
Moderating Effect of Institutional Quality and Government Supports on Private Investment

| Variables       | Model 2a | Model 2b | Model 2c | Variables | Model 2d | Model 2e | Model 2f | Variables | Model 2g | Model 2h | Model 2i |
|-----------------|----------|----------|----------|-----------|----------|----------|----------|-----------|----------|----------|----------|
| Law             | 0.005*** | 0.005*** | 0.004*** | Effectiveness | 0.005*** | 0.006*** | 0.006*** | Control   | 0.006*** | 0.006*** | 0.006*** |
|                 | (0.001)  | (0.001)  | (0.001)  |            | (0.001)  | (0.001)  | (0.001)  | of corruption | (0.001)  | (0.001)  | (0.001)  |
| Support         | 0.071**  |          |          | Support    | 0.024**  |          |          | Support   | 0.131*   |          |          |
|                 | (0.012)  |          |          |            | (0.013)  |          |          |           | (0.101)  |          |          |
| Support * law   | 0.003*** |          |          | Support *  | 0.009*** |          |          | Support * | 0.005*** |          |          |
|                 | (0.003)  |          |          | effectiveness | (0.002)  |          |          | control of corruption | (0.002)  |          |          |
| Direct          |          | 0.495**  |          | Direct     | 0.364*** |          |          | Direct    | 0.447**  |          |          |
|                 |          | (0.253)  |          |            | (0.129)  |          |          |           | (0.235)  |          |          |
| Direct * law    | 0.005*** |          |          | Direct *   | 0.004*** |          |          | Direct *  | 0.003*** |          |          |
|                 | (0.005)  |          |          | effectiveness | (0.0005) |          |          | control of corruption | (0.0002) |          |          |
| Indirect        | 0.127    |          |          | Indirect   | 0.051    |          |          | Indirect  | 0.023    |          |          |
|                 | (0.129)  |          |          |            | (0.137)  |          |          |           | (0.107)  |          |          |
| Indirect * law  | 0.002    |          |          | Indirect * | 0.004    |          |          | Indirect* | 0.001    |          |          |
|                 | (0.003)  |          |          | effectiveness | (0.003) |          |          | control of corruption | (0.002) |          |          |
| Controls (project specific) | Yes | Yes | Yes | Controls (project specific) | Yes | Yes | Yes | Controls (project specific) | Yes | Yes | Yes |
| Controls (country specific) | Yes | Yes | Yes | Controls (country specific) | Yes | Yes | Yes | Controls (country specific) | Yes | Yes | Yes |
| Trend           | 0.046*** | 0.052**  | 0.058*** | Trend      | 0.048*** | 0.053*** | 0.058*** | Trend     | 0.049*** | 0.055*** | 0.062*** |
|                 | (0.005)  | (0.005)  | (0.005)  |            | (0.005)  | (0.005)  | (0.005)  |            | (0.005)  | (0.005)  | (0.005)  |
| Cons            | 1.490*** | 1.440*** | 1.463*** | Cons       | 1.407*** | 1.349*** | 1.345*** | Cons      | 1.403*** | 1.380*** | 1.362*** |
|                 | (0.010)  | (0.009)  | (0.010)  |            | (0.010)  | (0.010)  | (0.010)  |            | (0.010)  | (0.010)  | (0.010)  |
| Observations    | 4,477    | 4,477    | 4,477    | Observations | 4,477    | 4,477    | 4,477    | Observations | 4,477    | 4,477    | 4,477    |
| Pseudo R-squared | 0.335 | 0.346 | 0.327 | Pseudo R-squared | 0.341 | 0.348 | 0.331 | Pseudo R-squared | 0.337 | 0.347 | 0.330 |

Standard errors are in parenthesis below the coefficient. *, **, and *** denote 10%, 5%, and 1% levels of significance, respectively.
insignificant. Therefore, H2a, H2b, and H2c are unsupported, which means that investors are more willing to accept direct supports from governments in countries with strong institutions than in those with weak institutions.

Furthermore, we computed the size of the interaction effect between law and support in Model 2a (see Table 4). If we consider the moderating role of law, the marginal effect of government supports on private investment is 0.206, which is higher than the coefficient of support ($\beta = 0.1999$) in Model 1a. Likewise, the marginal effect of government direct supports on private investment in Model 2b is 0.720, which is higher than the coefficient of direct support ($\beta = 0.472$) in Model 1b. If we consider the moderating role of effectiveness, the marginal effect of government supports on private investment in Model 2d is 0.488, which is higher than the coefficient of support ($\beta = 0.199$) in Model 1a. The marginal effect of government direct supports on private investment in Model 2e is 0.570, which is higher than the coefficient of direct support ($\beta = 0.472$) in Model 1b. If we consider the moderating role of control of corruption, the marginal effect of government supports on private investment in Model 2g is 0.341, which is higher than the coefficient of support ($\beta = 0.199$) in Model 1a. The marginal effect of government direct supports on private investment in Model 2h is 0.573, which is higher than the coefficient of direct support ($\beta = 0.472$) in Model 1b.

In short, moderating effect means that a higher degree of institutional involvement would attract much more private investment.

Figure 2. Marginal effect of direct supports on private investment at different levels of institutional quality.
# TABLE 5
Mediating Effect of Risk Assumed by Private Partners

| Dependent variable | Model 3a | Model 3b | Model 3c | Model 3d | Model 3e | Model 3f | Model 3g | Model 3h | Model 3i |
|--------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
|                    | percentage private | risk | percentage private | risk | percentage private | risk | percentage private | risk | percentage private | risk |
| Support            | 0.199*** (0.036) | -0.205*** (0.063) | 0.171*** (0.035) | 0.472*** (0.059) | -0.697*** (0.081) | 0.411*** (0.057) | 0.047 (0.042) | -0.369** (0.081) | 0.035 (0.041) |
| Direct             | -0.090*** (0.008) | 0.472*** (0.059) | -0.697*** (0.081) | 0.411*** (0.057) | 0.047 (0.042) | -0.369** (0.081) | 0.035 (0.041) |
| Indirect           | 0.411*** (0.057) | 0.047 (0.042) | -0.369** (0.081) | 0.035 (0.041) |
| Risk               |                   |                   |                   |                   |                   |                   |                   |
| Controls (project specific) | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Controls (country specific) | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Trend              | 0.049*** (0.005) | 0.075*** (0.010) | 0.053*** (0.005) | 0.055*** (0.005) | 0.072*** (0.009) | 0.058*** (0.005) | 0.061*** (0.005) | 0.055*** (0.009) | 0.063*** (0.005) |
| Cons               | 1.669*** (0.093) | 2.511*** (0.124) | 1.624*** (0.091) | 2.439*** (0.123) | 1.630*** (0.093) | 2.499*** (0.125) |
| Observations       | 4,479 | 4,479 | 4,479 | 4,479 | 4,479 | 4,479 | 4,479 | 4,479 | 4,479 |
| Pseudo R-squared   | 0.330 | 0.387 | 0.364 | 0.341 | 0.391 | 0.373 | 0.323 | 0.388 | 0.358 |

Standard errors are in parenthesis below the coefficient. *, **, and *** denote 10%, 5%, and 1% levels of significance, respectively.
We also graphed the expected marginal effect of direct supports on private investment at different levels of rule of law, government effectiveness, and control of corruption (Figure 2). We did not graph the marginal effect of indirect supports on private investment because the interaction between indirect support programs and the institution is not significant (see models 2c, 2f, and 2i). The horizontal axis represents the range of institution levels, whereas the vertical axis captures the magnitude of the marginal effect. The solid sloping line shows the value of the estimated effect of direct supports on private investment across the different levels of institutional quality.

Table 5 shows regression results of the mediating effect. Risk assumed by private partners (risk) is the mediating variable. The mediating effect can indicate how government supports attract private investment. In Model 3a, government supports have a positive impact on private investment ($\beta = 0.199, p < 0.01$) when we do not consider the mediating effect. Model 3b shows that government supports can reduce private sector risk ($\beta = -0.205, p < 0.01$). In Model 3c, both support ($\beta = 0.171, p < 0.01$) and risk ($\beta = -0.090, p < 0.01$) have a significant impact on private investment when we consider the mediating effect. According to the three models (3a, 3b, and 3c), we can infer that risk assumed by private sectors plays a mediating role between government supports and private investment. Furthermore, we find that the size of the mediating effect is about 2.8% ($0.199 - 0.171 = 0.028$), which means that the risk-mediated effect accounts for 14.1% ($0.028/0.199 = 0.141$) of the total effect. Therefore, H3 is supported. Also, in Models 3d, 3e, and 3f, the results showed that risk assumed by private sectors plays a mediating role between government direct supports and private investment. The size of the mediating effect is about 0.061 ($0.472 - 0.411 = 0.061$), which means the risk-mediated effect accounts for 12.9% ($0.061/0.472 = 0.129$) of the total effect. However, in Model 3i, the relationship between indirect support and private investment is not significant ($\beta = 0.035, p > 0.1$), which means that risk assumed by private partners cannot provide a mediating role between government indirect supports and private investment, possibly because the risk may not actually occur.

Robustness Checks

Results for the relationship between government supports and private investment need to be assessed for consistency. For parsimony, Tables A2 and A3 report the full results of specification checks, which are summarized in the following. We checked robustness in two ways. First, we changed the regression method. Because the dependent variable (percentage private) ranges from 0 to 100%, we again ran the regression, adopting the generalized linear model (GLM) proposed by Papke and Wooldridge (1996). Comparing the results in Table A2 to results in Table 3, significant consistency emerges. Second, we changed the data of the dependent variable and the regression method simultaneously. In the PPI database, percentage private is a percentage variable ranging from 0 to 100%. In the model of robustness check, we converted the percentage variable into a dichotomous variable. If percentage private was less than 50%, the variable was set to 0; if it was between 50 and 100%, the value was 1. Because the new dependent variable was dichotomous,
we again ran Models 1a, 1b, 1c, and 1d with a Probit regression. Again, the results shown in Table A3 are consistent with findings disclosed in Table 3.

**DISCUSSION AND CONCLUSION**

In this study, we analyzed the effect of government support programs on private investment in PPP projects in developing countries. The results show that government direct support programs are powerful attractors of private capital. The main reason is that direct supports can directly reduce costs to private investors. In addition, statistical analyses indicate that increased institutional quality of a country (e.g., obeying rule of law, high level of government effectiveness, and control of corruption) can enhance the positive relationship between government supports and private investment, especially for government direct supports. If investors do not believe that the government is trustworthy (e.g., fails to comply with law, has low level of government effectiveness, and has high levels of corruption), neither direct nor indirect support policies can attract private investment. In this sense, governments can improve their institutional quality to inspire the confidence of private investors and thus attract investment (Yang, Hou, and Wang 2013).

The analyses further show that the risk assumed by private partners plays a mediating role between government supports and private investment, especially for government direct support programs. From the investors’ perspective, direct support policies reduce investor risk, and reducing risk is one important factor in encouraging private participation because the risk to private participation centers on cost recovery (Albalate, Bel, and Geddes 2013). From the perspective of governments, direct support policies can incentivize and help private partners focus on lifecycle management of PPP projects by reducing cost risk rather than optimizing short-term profit (Carpintero and Petersen 2016).

This article makes a number of contributions to the extant literature. First, previous studies examined the effect of government supports on PPP performance or examined the effect of government supports on private investment through policy simulation. This empirical study employed a large dataset from 130 developing countries. Second, outcomes showed that government direct support programs are more effective than indirect supports to attract private investment in developing countries. These findings shed light on issues that require systematic comparisons of government support policies in attracting private investment.

The results also provide insightful managerial implications for policymakers. Policymakers in developing countries wishing to increase private investment should comply with the law, abide by the PPP contract and private property, improve the quality of public services and the effectiveness of policy implementation, and implement anticorruption campaigns to control corruption.

Like all empirical studies, this study would benefit from further scholarly work. First, this article focused on data in developing countries. Testing the hypotheses with data from developed countries would enhance the generalizability of the findings. For example, the relationship between indirect supports and private
investment is insignificant in developing countries. If we test private investment in developed countries with better institutional quality, the findings may be different. Also, this article only focused on how government support programs influence private investment. In the future, we aim to discuss how the combination of agovernment direct and indirect support programs affect private investment in the PPP market. In addition, the data on government supports in the PPI database only show if governments provide supports; the database does not show the extent of supports. Future work may seek to discuss the relationship between the amount of government supports and private investment with large-N samples.

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NOTES

1. http://www.bridata.com/charts/month/firm
2. https://ppi.worldbank.org/methodology/glossary
3. https://data.worldbank.org/data-catalog/worldwide-governance-indicators
4. http://data.worldbank.org/data-catalog/world-development-indicators
5. Marginal effects in models 1a and 2a (see Tables 3 and 4):

\[
\text{Private investment} = \beta_1 \times \text{Support} + \epsilon \\
\text{Private investment} = \alpha_2 \times \text{Law} + \beta_2 \times \text{Support} + \gamma_2 \times (\text{Law} \times \text{Support}) + \epsilon \\
A = \beta_2 + \gamma_2 \times \hat{x} \\
\]

where \( \beta_1 \) means the marginal effect of government supports on private investment in the basic models (see Model 1a in Table 3). \( \beta_2 \) means the marginal effect of government supports on private investment with no consideration of institutional quality in Model 2a. \( \gamma_2 \) is the coefficient of the interaction between law and support in Model 2a. \( \hat{x} \) means the mean value of law (see Table 2). A means the marginal effect of government supports on private investment when considering the rule of law.

Thus, \( A = 0.071 + 0.003 \times 45 = 0.206 \)

REFERENCES

Ameyaw, E. E., A. P. C. Chan, and D. G. Owusu-Manu. 2017. “A Survey of Critical Success Factors for Attracting Private Sector Participation in Water Supply Projects in Developing Countries.” Journal of Facilities Management 15(1):35–61.
Albalate, D., G. Bel, and R. R. Geddes. 2013. “Recovery Risk and Labor Costs in Public-Private Partnerships: contractual Choice in the US Water Industry.” Local Government Studies 39(3):332–51.

Albalate, D., G. Bel, and R. R. Geddes. 2015. “The Determinants of Contractual Choice for Private Involvement in Infrastructure Projects.” Public Money & Management 35(1):87–94.

Armada, M. J. R., P. J. Pereira, and A. Rodrigues. 2012. “Optimal Subsidies and Guarantees in Public-Private Partnerships.” The European Journal of Finance 18(5):469–95.

Baker, N. B. 2016. “Transaction Costs in Public-Private Partnerships.” Public Performance & Management Review 40(2):431–55.

Brandao, L. E., C. Bastian-Pinto, L. L. Gomes, and M. Labes. 2012. “Government Supports in Public-Private Partnership Contracts: Metro Line 4 of the Sao Paulo Subway System.” Journal of Infrastructure Systems 18(3):218–25.

Brown, T. L., M. Potoski, and D. Van Slyke. 2006. “Managing Public Service Contracts: Aligning Values, Institutions, and Markets.” Public Administration Review 66(3):323–31.

Brown, T. L., M. Potoski, and D. Van Slyke. 2016. “Managing Complex Contracts: A Theoretical Approach.” Journal of Public Administration Research and Theory 26(2):294–308.

Carpintero, S., and O. H. Petersen. 2016. “Public-Private Partnerships (PPPs) in Local Services: Risk-Sharing and Private Delivery of Water Services in Spain.” Local Government Studies 42(6):958–76.

Daude, C., and E. Stein. 2007. “The Quality of Institutions and Foreign Direct Investment.” Economics & Politics 19(3):317–44.

Galilea, P., and F. Medda. 2010. “Does the Political and Economic Context Influence the Success of a Transport Project? An Analysis of Transport Public-Private Partnerships.” Research in Transportation Economics 30(1):102–9.

Hall, P. A., and R. C. R. Taylor. 1996. “Political Science and the Three New Institutionalisms.” Political Studies 44(5):936–57.

Hodge, G. A., and C. Greve. 2007. “Public-Private Partnerships: An International Performance Review.” Public Administration Review 67(3):545–58.

Hefetz, A., and M. Warner. 2012. “Contracting or Public Delivery? The Importance of Service, Market and Management Characteristics.” Journal of Public Administration Research and Theory 22(2):289–317.

Kaufmann, D., A. Kraay, and P. Zoido-Lobaton. 1999. “Governance Matters. World Bank policy Research Working Paper 2196.” Washington, DC.

Kaufmann, D., A. Kraay, and M. Mastruzzi. 2011. “The Worldwide Governance Indicators: Methodology and Analytical Issues.” Hague Journal on the Rule of Law 3(2):220–46.

Mauldin, M. D. 2012. “A New Governance Explanation for the Creation of a Minority Economic Development Public-Private Partnership in Florida.” Public Performance & Management Review 35(4):679–95.

North, D. C. 1991. “Institutions.” Journal of Economic Perspectives 5(1):97–112.

Osei-Kyey, R., and A. P. C. Chan. 2017. “Factors Attracting Private Sector Investments in Public-Private Partnerships in Developing Countries.” Journal of Financial Management of Property and Construction 22(1):92–111.

Ostrom, E. 1990. Governing the Commons: The Evolution of Institutions for Collective Action. New York: Cambridge University.
Panayides, P. M., F. Parola, and J. S. L. Lam. 2015. “The Effect of Institutional Factors on Public-Private Partnership Success in Ports.” *Transportation Research Part A* 71: 110–27.

Papke, L. E., and J. M. Wooldridge. 1996. “Econometric Methods for Fractional Response Variables with an Application to 401(k) Plan Participation Rates.” *Journal of Applied Econometrics* 11(6):619–32.

Percoco, M. 2014. “Quality of Institutions and Private Participation in Transport Infrastructure Investment.” *Transportation Research Part A* 70:50–8.

Pusok, K. 2016. “Public-Private Partnerships and Corruption in the Water and Sanitation Sectors in Developing Countries.” *Political Research Quarterly* 69(4):678–91.

Queiroz, C., N. Vajdic, and G. Mladenovic. 2013. “Public-Private Partnerships in Roads and Government Support: Trends in Transition and Developing Economies.” *Transportation Planning and Technology* 36(3):231–43.

Soumare, I., and V. S. Lai. 2016. “An Analysis of Government Loan Guarantees and Direct Investment through Public-Private Partnership.” *Economic Modelling* 59:508–19.

Sovacool, B. K. 2013. “Expanding Renewable Energy Access with Pro-Poor Public Private Partnerships in the Developing World.” *Energy Strategy Reviews* 1(3):181–92.

Takashima, R., K. Yagi, and H. Takamori. 2010. “Government Guarantees and Risk Sharing in Public-Private Partnerships.” *Review of Financial Economics* 19(2):78–83.

Urpelainen, J., and J. Yang. 2017. “Policy Reform and the Problem of Private Investment: Evidence from the Power Sector.” *Journal of Policy Analysis and Management* 36(1):38–64.

Wang, H., B. Chen, W. Xiong, and G. Wu. 2018. “Commercial Investment in Public-Private Partnerships: The Impact of Contract Characteristics.” *Policy & Politics* 46(4):589–606.

Wang, H., W. Xiong, G. Wu, and D. Zhu. 2018. “Public-Private Partnership in Public Administration Discipline: A Literature Review.” *Public Management Review* 20(2):293–316.

Yang, Y., Y. Hou, and Y. Wang. 2013. “On the Development of Public-Private Partnerships in Transitional Economies.” *Public Administration Review* 73(2):301–10.

Zhang, Y. 2014. “From State to Market: Private Participation in China's Urban Infrastructure Sectors, 1992–2008.” *World Development* 64:473–86.

**ABOUT THE AUTHORS**

**Huanming Wang** (whm715@163.com) is an associate professor in the Department of Public Administration of Dalian University of Technology in China. His research interests include public-private partnerships, collaborative governance, and urban development. His recent work has appeared in *Public Management Review, Policy & Politics, Urban Policy and Research, Review of Managerial Sciences, Annals of Public and Cooperative Economics, and Australian Journal of Public Administration.*

**Yuhai Liu** (liuyuhai2449@dlut.edu.cn) is an associate professor in the Faculty of Management and Economics of Dalian University of Technology in China. His research interests include public-private partnerships and industrial economics.
His recent work has appeared in *China Economic Quarterly, China Industrial Economics, Modern Economic Science*, and *Journal of International Trade*.

**Wei Xiong** (kevinxiong@tongji.edu.cn) is an assistant professor in the Department of Public Administration of Tongji University in China. His current research interests are in the areas of public private partnerships, governance, and sustainability. His recent work has appeared in *Australian Journal of Public Administration, Journal of Computing in Civil Engineering, Journal of Construction Engineering and Management, Journal of Civil Engineering and Management, Public Management Review*, and *Policy & Politics*.

**Dajian Zhu** (dajianzhu@263.net) is a professor in the Department of Public Administration of Tongji University in China. His research interests are sustainability, PPP, collaborative governance, and urban development. His recent work has appeared in *Journal of Cleaner Production, Land Use Policy, Habitat International, Public Management Review*, and *Australian Journal of Public Administration*.

### APPENDIX

#### TABLE A1

| Type                        | Subtype                                                                 |
|-----------------------------|-------------------------------------------------------------------------|
| Management and lease contracts | *Management contract*: transfer responsibility for managing a utility to a private operator, often for three to five years. |
|                             | *Lease contracts*: an operator is responsible for operating and maintaining the business, but not for financing investment. |
| Brownfields                 | • *Rehabilitate-operate-transfer* (*ROT*): a private sponsor rehabilitates an existing facility, then operates and maintains the facility at its own risk for the contract period. |
|                             | • *Rehabilitate-lease/rent-transfer* (*RLT*): a private sponsor rehabilitates an existing facility at its own risk, leases or rents the facility from the government owner, then operates and maintains the facility at its own risk for the contract period. |
|                             | • *Build-rehabilitate-operate-transfer* (*BROT*): a private developer builds an add-on to an existing facility or completes a partially built facility and rehabilitates existing assets, then operates and maintains the facility at its own risk for the contract period. |

(continued)
TABLE A1
Continued

| Type            | Subtype                                      |
|-----------------|----------------------------------------------|
| Greenfield projects | Build-lease-transfer (BLT): a private sponsor builds a new facility largely at its own risk, transfers ownership to the government, leases the facility from the government and operates it at its own risk, then receives full ownership of the facility at the end of the concession period. |
|                 | Build-operate-transfer (BOT): a private sponsor builds a new facility at its own risk, owns and operates the facility at its own risk, then transfers the facility to the government at the end of the contract period. |
|                 | Build-own-operate (BOO): a private sponsor builds a new facility at its own risk, then owns and operates the facility at its own risk. |
|                 | Merchant: a private sponsor builds a new facility in a liberalized market in which the government provides no revenue or payment guarantees. The private developer assumes construction, operating, and market risk for the project. |
|                 | Rental: a private sponsor places a new facility at its own risk, and owns and operates the facility at its own risk. |

Source: World Bank.

TABLE A2
Marginal Effect of Government Supports on Private Investment (GLM Model)

| Variables         | Model 4a    | Model 4b    | Model 4c    | Model 4d    |
|-------------------|-------------|-------------|-------------|-------------|
| Support           | 0.032***    | 0.054***    | 0.056***    |             |
|                   | (0.006)     | (0.008)     | (0.008)     |             |
| Direct            |             |             |             |             |
|                   |             | 0.003       | 0.009       |             |
|                   |             | (0.008)     | (0.008)     |             |
| Indirect          | 0.934***    | 0.927***    | 0.930***    | 0.929***    |
|                   | (0.018)     | (0.018)     | (0.018)     | (0.018)     |
| Cons              |             |             |             |             |
|                   |             |             |             |             |
| Controls (project specific) | Yes | Yes | Yes | Yes |
| Controls (country specific) | Yes | Yes | Yes | Yes |
| Observations      | 4,479       | 4,479       | 4,479       | 44,79       |
| Log likelihood    | 1,498.55    | 1,508.04    | 1,484.50    | 1,508.78    |

Standard errors are in parenthesis below the coefficient. *, **, and *** denote 10%, 5%, and 1% levels of significance, respectively.
### TABLE A3
Effect of Government Supports on Private Investment (Probit Model)

| Variables          | Model 5a       | Model 5b       | Model 5c       | Model 5d       |
|--------------------|----------------|----------------|----------------|----------------|
| Support            | 0.248***       |                |                |                |
|                    | (0.096)        |                |                |                |
| Direct             |                | 0.609***       |                | 0.600***       |
|                    | (0.149)        |                | (0.151)        |                |
| Indirect           |                |                | 0.142          | 0.047          |
|                    |                |                | (0.114)        | (0.115)        |
| Cons               | 1.395***       | 1.338***       | 1.327***       | 1.329***       |
|                    | (0.266)        | (0.265)        | (0.266)        | (0.266)        |
| Controls (project specific) | Yes       | Yes            | Yes            | Yes            |
| Controls (country specific) | Yes       | Yes            | Yes            | Yes            |
| Observations       | 4,479          | 4,479          | 4,479          | 4,479          |
| Pseudo R-squared   | 0.319          | 0.327          | 0.316          | 0.327          |

Standard errors are in parenthesis below the coefficient. *, **, and *** denote 10%, 5%, and 1% levels of significance, respectively.